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Rodrigo A. Cerda[*]
Hermann González
Luis Felipe Lagos

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[*] Economics Department, Pontificia Universidad Católica de Chile, Casilla 76, Correo 17, Santiago, Chile. Phone: 56-2-3547101, Fax: 56-2-5532377, e-mail: rcerda@faceapuc.cl, flagos@faceapuc.cl, hgonzalb@bcentral.cl

CONTENTS

1. MOTIVATION

Standard Keynesian theory states that fiscal expenditure should impact positively output in the short run. However, there is some evidence concerning developed economies that reports non keynesian results for fiscal policy in the short run, i.e. expansionary fiscal contractions (Giavazzi and Pagano 1990,1995).

The literature on the expectational effect of fiscal policy (for example Bertola and Drazen 1993 and Sutherland 1995) can explain this result. In this view, a credible fiscal contraction will change expectations about the future of fiscal policy. In effect, a permanent reduction of government consumption to GDP will anticipate a future reduction in taxes and government debt that increases permanent income, consumption and output in the short run. In this scenario, fiscal deficit may act as a signal which determines private expenditure and output.

This study presents further evidence about the lack of effectiveness of fiscal policy over GDP as developed in the traditional keynesian framework. We use a structural VAR approach, a widely used econometric tool in the literature on the dynamic effects of fiscal policy, but generally carried out for developed economies. This study analyzes the case of an emerging economy.

2. THE DATA

As a case of fiscal policy changes in emerging economies, we study Chile, using annual data for fiscal policy and national accounts from 1833 to 2000[1]. This study considers three variables: government expenditure, tax revenue and GDP.

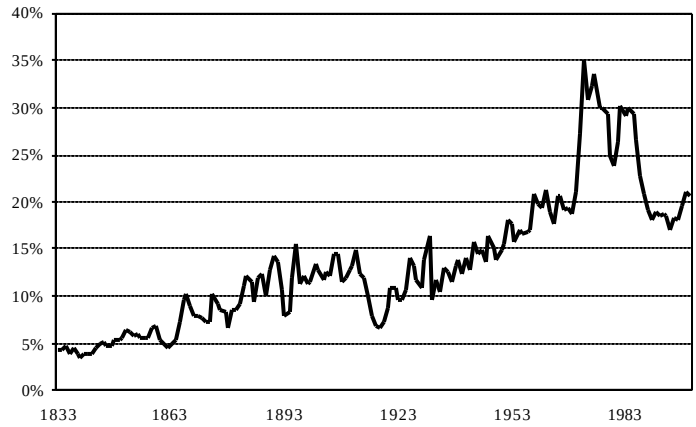
The sample used allows us to address a number of episodes related to the Chilean fiscal policy. In particular, this sample covers a period involving tax reforms, changes in tax incomes driven by the economic cycle and changes in the government size, measured

[1] Source Jofré et al (2000).

by government expenditure over GDP. For instance, data represented in figure 1A show that the ratio government expenditure to GDP reached levels close to 20% only in late 1960s, rising up to 35% in early 1970s and declining afterwards, given the change in both the political and economic regimes. This scenario is partially reversed from early 1990s, when a new political regime takes place.

In turn, figure 1B shows both fiscal expenditure and tax revenue in the last four decades, being clearly displayed effects coming from tax reforms and economic crises over fiscal incomes. This figure shows positive fiscal balances from mid-1970s, despite the sharp increase in government expenditure from early 1990s. This outlook was only reversed by the impact of both the early 1980s and late 1990s crises, mainly because of their negative impact over tax incomes.

1A. Fiscal Spending (% GDP)



1B. Taxes and Fiscal Spending (million Ch$, 1996 constant prices)

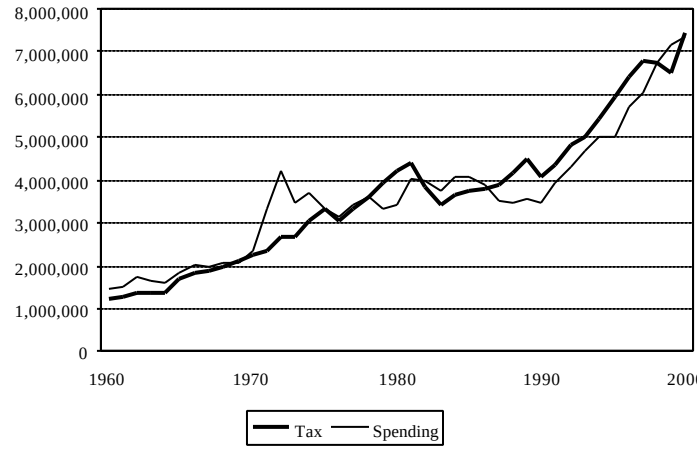


Table 1 shows the unit root tests (ADF, PP, DF-GLS) for each series. To choose the lags on the ADF y DF-GLS tests, we use the Akaike criteria. In the tests, when the variables are in levels, we include a constant and a time trend, while when the variables are in first differences, we include only a constant. The results indicate that in general, the series are integrated of order one.

TABLE 1: UNIT ROOT TESTS, 1833-2000

	Critical values	Test values	Serie	Critical values	Test values	Serie	Critical values	Test values	Serie
	Log (GDP)			Log (Fiscal Spending)			Log (Tax)		
ADF	1%, -4.01	-2.98	I(1)	1%, -4.01	-3.40	I(1)	1%, -4.01	-5.05	I(0)
	5%, -3.44			5%, -3.44			5%, -3.44		
PP	1%, -4.01	-2.46	I(1)	1%, -4.01	-3.20	I(1)	1%, -4.01	-4.97	I(0)
	5%, -3.44			5%, -3.44			5%, -3.44		
DF-GLS	1%, -3.50	-2.36	I(1)	1%, -3.50	-3.11	I(0)	1%, -3.50	-4.69	I(0)
	5%, -2.97			5%, -2.96			5%, -2.96		
	D(log (GDP))			Log (Fiscal Spending)			D(log (Tax))		
ADF	1%, -3.47	-9.08	I(0)	1%, -3.47	-8.42	I(0)	1%, -3.47	-9.21	I(0)
	5%, -2.88			5%, -2.88			5%, -2.88		
PP	1%, -3.47	-12.52	I(0)	1%, -3.47	-15.40	I(0)	1%, -3.47	-26.47	I(0)
	5%, -2.88			5%, -2.88			5%, -2.88		
DF-GLS	1%, -2.58	-8.88	I(0)	1%, -2.58	-13.09	I(0)	1%, -2.58	-14.33	I(0)
	5%, -1.94			5%, -1.94			5%, -1.94		

3. THE STRUCTURAL VAR

Our goal is to identify the impact on GDP of an exogenous and unexpected change in fiscal policy. To do so, we estimate a SVAR with annual data. We carefully identify exogenous and unexpected fiscal policy changes on the residuals of the SVAR. The reasons to focus on this methodology are twofold:

1. It seems possible to identify fiscal shocks. In fact, the movements of government spending are determined by policy decisions, among which the stabilization of the GDP is less predominant (interest rate is the instrument most widely used to stabilize GDP). From this point of view, exogenous fiscal shocks with respect to the movement of GDP exist and could be identified.
2. The lags of fiscal policy suggest that there is a weak or null response of current fiscal policy to unexpected movements of economic activity. This will allow us to identify the fiscal shocks.

3.1. The system

Let X_t be a vector of endogenous variables including GDP (Y_t), government spending (G_t) and government revenue (T_t). Hence we write the following reduced form for the VAR system:

$$(1) \qquad X_t = \sum_{j=1}^{K} A_{t-j} X_{t-j} + U_t$$

Where t indexes time, $X_t \equiv [\ \Delta G_t \quad \Delta Y_t \ \Delta T_t\ ]'$ and U_t is residual vector defined as $U_t \equiv [g_t\ y_t\ t_t]'$, ($g_t\ y_t\ t_t$) being the residuals of the above system. The number of lags, K, was set equal to 2, by means of the Akaike criteria.

We hypothesize that the government revenue residuals and government spending residuals (t_t,g_t) depends on three factors:

1. Automatic response to the economy's shocks, captured by the residuals of the GDP equation.
2. Response to unexpected government spending shocks, denoted as e_t^g
3. Exogenous and unexpected changes in government revenue, denoted as e_t^t

Thus, we will assume the following structure determining the government revenue and spending residuals:

$$(2a) \qquad t_t = a_1 y_t + a_2 e_t^g + e_t^t$$

$$(2b) \qquad g_t = b_1 y_t + b_2 e_t^t + e_t^g$$

Next, we assume that the GDP shock will depend on an exogenous supply shock, e_t^y, in addition to the fiscal shocks, as in:

$$(2c) \qquad y_t = c_1 t_t + c_2 g_t + e_t^y$$

3.2. Identification of the system

Finally, to obtain the impact of an exogenous change on fiscal policy we need to identify (e_t^g, e_t^t, e_t^y) plus the associated coefficients (a_1, b_1, c_1, a_2, b_2, c_2). The system of equations (2a)-(2c) might be identified by noting that from the estimation of (1) we have available the variables (g_t y_t t_t). The steps are the following:

1. To identify a_1 or b_1 we will run 2SLS on (2a) and (2b) using changes on terms of trade as an instrument for y_t. Denote those estimators as $\hat{a}_1, \hat{b}_1$. We choose terms of trade because it is a variable that generally impacts GDP in an open economy like Chile and it does not depend on exogenous changes in fiscal policy.
2. We next define $\tilde{t}_t = t_t - \hat{a}_1 y_t$, $\tilde{g}_t = g_t - \tilde{b}_1 y_t$. Using those definitions and (2a), (2b), we get $\tilde{g}_t = b_2 \tilde{t}_t + e_t^g (1 - a_2 b_2)$. As $\tilde{t}_t, \tilde{g}_t$ are constructed and known variables, we identify this equation by running 2SLS, using as instrument for $\tilde{t}_t$ the timing of tax reform in Chile.
3. The residual obtained in step 2, $\hat{e}_t^g$, is used as a proxy of e_t^g in equation (2a), which is rewritten as in $\tilde{t}_t = t_t - \hat{a}_1 y_t = a_2 \hat{e}_t^g + e_t^t$. We will run this equation by OLS to obtain the estimates $(\hat{a}_2, \hat{e}_t^t)$.
4. Finally, to identify (c_1, c_2), we will run equation (2c) by 2SLS using $(\hat{e}_t^g, \hat{e}_t^t)$ as instruments for (t_t, g_t).

The results of this procedure are shown in table 2. Notice that equations (2a)-(2c) can be written as:

$$U_t = \begin{bmatrix} t_t \\ g_t \\ y_t \end{bmatrix}_t = C \begin{bmatrix} e_t^t \\ e_t^g \\ e_t^y \end{bmatrix}$$

where

$$C = \begin{bmatrix} \left(\frac{a_1[c_1 + c_2 b_2]}{[1 - c_1 a_1 - c_2 b_1]} + 1\right) & \left(\frac{a_1[c_2 + c_1 a_2]}{[1 - c_1 a_1 - c_2 b_1]} + a_2\right) & \frac{a_1}{[1 - c_1 a_1 - c_2 b_1]} \\ \left(\frac{b_1[c_1 + c_2 b_2]}{[1 - c_1 a_1 - c_2 b_1]} + b_2\right) & \left(\frac{b_1[c_2 + c_1 a_2]}{[1 - c_1 a_1 - c_2 b_1]} + 1\right) & \frac{b_1}{[1 - c_1 a_1 - c_2 b_1]} \\ \frac{[c_1 + c_2 b_2]}{[1 - c_1 a_1 - c_2 b_1]} & \frac{[c_2 + c_1 a_2]}{[1 - c_1 a_1 - c_2 b_1]} & \frac{1}{[1 - c_1 a_1 - c_2 b_1]} \end{bmatrix} = \begin{bmatrix} 0.797 & 0.204 & 1.633 \\ -0.316 & 0.629 & 1.109 \\ -0.062 & -0.167 & 0.499 \end{bmatrix}$$

TABLE 2: ESTIMATION OF (a_1, b_1, c_1, a_2, b_2, c_2)

Parameter	a_1	a_2	b_1	b_2	c_1	c_2
Value	3.27**	0.75**	2.22**	-0.18	-0.16**	-0.21**
(Standard Deviation)	(0.37)	(0.06)	(0.31)	(0.18)	(0.02)	(0.02)

** Indicates parameter is significant at 5% confidence.

From these results, it follows that a 1% exogenous shock to fiscal expenditure produces a –0.17% current decrease on GDP, while a 1% shock on tax revenue produces a -0.06% current decrease on GDP.

3.3. Impulse-Response functions and confidence intervals

To obtain the impulse-response functions, we write the SVAR as in:

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + \ldots + A_8 X_{t-8} + C e_t \text{ ,....dónde....} e_t = \begin{bmatrix} e_t^t \\ e_t^g \\ e_t^y \end{bmatrix}$$

$$\begin{bmatrix} X_t \\ X_{t-1} \\ \dots \\ X_{t-7} \end{bmatrix} = \begin{bmatrix} A_1 & A_2 & \dots & A_8 \\ I & 0 & \dots & 0 \\ 0 & I & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & \dots & I & 0 \end{bmatrix} \begin{bmatrix} X_{t-1} \\ X_{t-2} \\ \dots \\ X_{t-8} \end{bmatrix} + \begin{bmatrix} C \\ 0 \end{bmatrix} e_t$$

$$\Rightarrow x_t = F\, x_{t-1} + Q e_t$$

dónde

$$x_t = \begin{bmatrix} X_t \\ X_{t-1} \\ \dots \\ X_{t-7} \end{bmatrix}, F = \begin{bmatrix} A_1 & A_2 & \dots & A_8 \\ I & 0 & \dots & 0 \\ 0 & I & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & \dots & I & 0 \end{bmatrix}, Q = \begin{bmatrix} C \\ 0 \end{bmatrix}$$

This is a useful representation, as we can easily obtain the impulse-response functions, IR_t, as in:

(4) $$IR_t = F^{t-1} Q$$

To calculate the confidence intervals, we follow Runkle (1987), by using a boostrapping approach. The procedure is to run our SVAR and to obtain the fitted residuals, $\{\hat{e}_1, \hat{e}_2, ..., \hat{e}_T\}$ and the estimated coefficients $\left(\hat{F}, \hat{Q}\right)$, where T is the sample size. Next, we draw a random sample of size T from our fitted residuals, where for each observation of our random sample each residual has a (1/T) chance of being chosen. We then use this residual random sample to construct an artificial sample as in:

$$\hat{x}_t^{\,i} = \hat{F}\, \hat{x}^i_{t-1} + \hat{Q} u_t^i$$

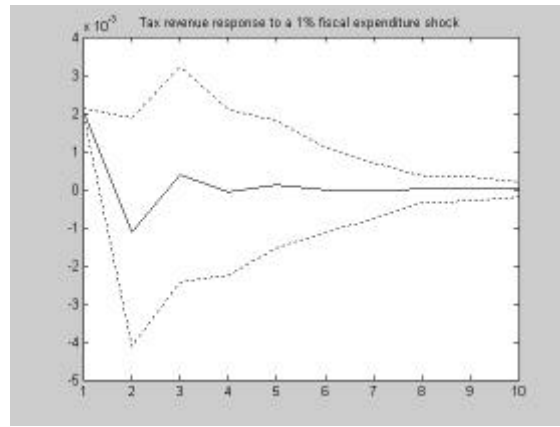
where u_t^i is the residual random sample and $\hat{x}_t^{\,i}$ is the artificial simple. We next re-estimate the SVAR to obtain a new impulse-response function, $\hat{IR}_t^i$. We repeat this

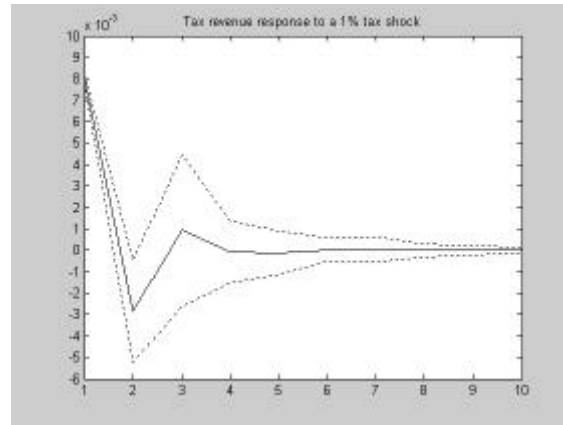
procedure 10.000 times, which allows us to calculate the standard deviation, and thus, the confidence intervals of the impulse-response function.

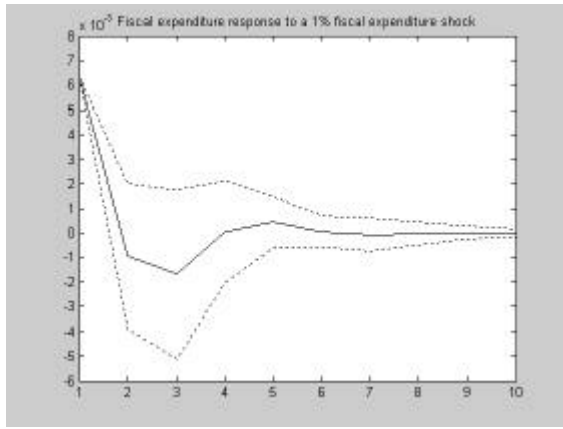
4. RESULTS AND INTERPRETATION

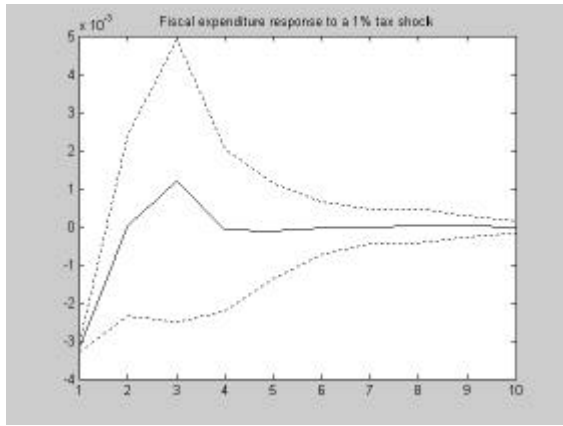
Figures 3 to 8 show the response in a 10-year horizon to fiscal expenditure and tax revenue shocks. The three figure on the left show the response to the expenditure shock while the three figure on the right show the response to a tax revenue shock. The confidence intervals rely upon a 5% confidence.

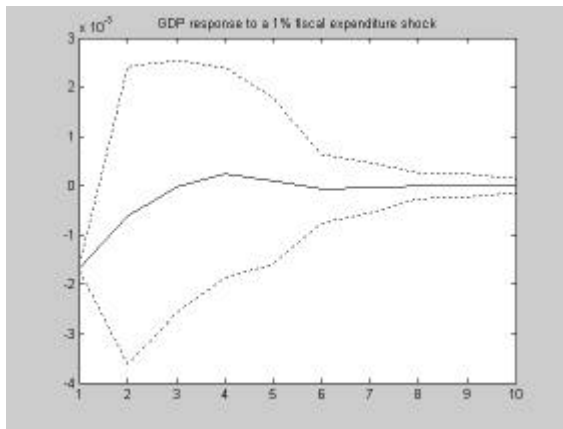
FIGURES 3-8: RESPONSE OF ENDOGENOUS VARIABLES TO EXOGENOUS SHOCKS IN FISCAL POLICY

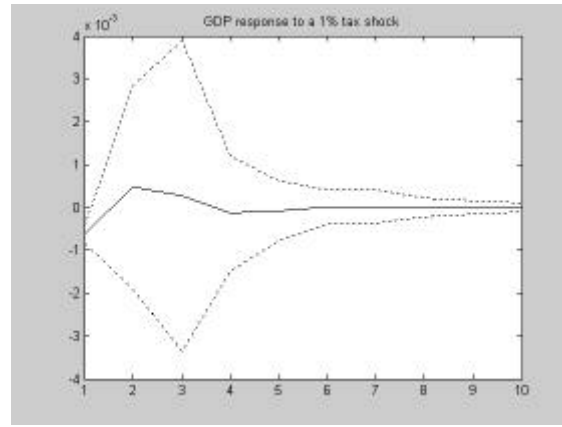





x 10^-3 Fiscal expenditure response to a 1% fiscal expenditure shock
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1
2
3
4
5
6
7
8
9
10


x 10^-3
Fiscal expenditure response to a 1% tax shock
5
4
3
2
1
0
-1
-2
-3
-4
1
2
3
4
5
6
7
8
9
10


x 10^-3
GDP response to a 1% fiscal expenditure shock
3
2
1
0
-1
-2
-3
-4
1
2
3
4
5
6
7
8
9
10



The figures show that a 1% fiscal expenditure shock produces a negative impact on GDP on the first year of approximately -0.2%. The latter impacts are non significant. Similarly, a 1% tax revenue shock is associated with a decline of -0.1% on GDP on the first year, while there are no latter significant impacts.

These results contradict the expected impacts of fiscal variables on GDP from standard Keynesian theory. Recent literature has stressed the possibility of a negative impact of fiscal shocks on economic activity. In fact, Blanchard and Perotti (1999) and Perotti (2002) report negative multiplier effects on OECD countries in the period post-1980. Our study reports further evidence on an emerging economy. These results are in line with the literature that focus on the impact of fiscal policy on individual´s expectations, which may produce non Keynesian effects (Bertola y Drazen 1993, Giavazzi y Pagano 1990 y 1995, Giavazzi, Jappelli y Pagano 2000). In fact, if a fiscal adjustment affects individual´s expectations about future fiscal policy, the current fiscal adjustment may positively impact individual´s expenditure and thus GDP, while if there is an increase on fiscal expenditure, individuals may anticipate larger taxes on the future, reducing permanent income and thus, private expenditure and GDP.

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