Relative importance of foreign and domestic shocks in the Venezuelan economy

Importancia relativa de los shocks extranjeros y nacionales en la economía venezolana

José U. Mora[*]

Abstract

This paper uses a Cholesky Factorization in a VAR analysis to investigate the relative importance of foreign and domestic shocks in the Venezuelan economy during the 1960:i-2004:ii period. The economy is assumed to be driven by foreign (U. S. GDP and oil prices) and domestic (exchange rate, fiscal, monetary, inflation, and output) orthogonal shocks. As shown by the empirical evidence foreign shocks tend to be relatively more important than domestic shocks. Precisely, oil price and U. S. GDP shocks tend to have permanent effects on the main macroeconomic aggregates. Monetary policy only has temporary effects on output and the nominal exchange rate.

Key words: Time-series models, business fluctuations, latin american economies.

Resumen

Este artículo utiliza la factorizacón Cholesky en un análisis VAR para investigar la importancia relativa de los shocks extranjeros y nacionales en la economía venezolana durante el periodo 1960:i-2004:ii. Se supone que la economía está afectada por choques ortogonales extranjeros (PIB estadounidense y precios petroleros) y nacionales (tipo de cambio, política fiscal, política monetaria, inflación y producción). Tal como se muestra por la evidencia empírica, los choques extranjeros tienden a ser relativamente más importantes que los nacionales. Precisamente, el precio del petróleo y los shocks del PIB estadounidense tienden a tener efectos permanentes sobre los agregados macreconómicos más importantes. La política monetaria sólo tiene efectos temporales sobre la producción y sobre el tipo de cambio nominal.

Palabras clave: Modelos de series de tiempo, fluctuaciones de negocios, economías latinoamericanas.

* Department of Economics, University of Vermont. Departamento de Economía, Universidad de Los Andes, e-mail: jumora@ula.ve

1. Introduction

Despite the sustained economic growth experienced during 1920-1970s, since early 1980s the Venezuelan economy has experienced a profound economic crisis characterized by severe macroeconomic disequilibria, particularly high and sustained inflation rates, exchange rate instability, unemployment, and a poor economic growth. Since early 1990s, this puzzle has constituted a great debate among Venezuelan macroeconomists.

The most recent empirical works in the VAR literature for the case of Venezuela found that approximately 70% of non-oil GDP total variability is due to domestic shocks, more precisely from the supply side, while domestic nominal shocks account for more than 50% of inflation total variability (Arreaza and Dorta; 2004).[1] Mora (2002), using quarterly data for 1960 -2000, found in a structural VAR model that oil prices and U.S. shocks are the main source of balance of payment deficits, inflation, and exchange rate instability in Venezuela. Their effects tend to be highly persistent while domestic policy innovations have only temporary effects. Pagliacci and Ruda (2004) made use of a VAR model with weekly data from April 2002-January 2004 and found that monetary policy tends to have persistent effects on inflation and real economic activity if monetary authorities make simultaneous decisions in the same direction. The channel through which monetary policy works is the reduction in the overnight rate. Guerra (2002) used a VEC for quarterly data from 1984 until 1994 for the CPI, fiscal, monetary and costs variables. He found that inflation is explained fundamentally by inflationary inertia, government deficit, and salary indexation. However, not all works related to macroeconomic fluctuations in Venezuela are found in the VAR literature. For instance, Saez and Puch (2004) use a stochastic general equilibrium model for the 1950-1995 period under the assumptions that Venezuela is a small open economy under imperfect capital mobility and produces a single commodity (oil). They assume that the economy is exposed to multifactor productivity and terms of trade shocks. Their results suggest that both types of shocks play a very important role in explaining the business cycles in Venezuela.

As seen, there is a significant disagreement amongst macroeconomists about the sources of inflation, exchange rate fluctuations and, in general, macroeconomic fluctuations in Venezuela.

This paper investigates the relative importance of foreign and domestic shocks on the Venezuelan economy and how these have obstructed the channels through which monetary and fiscal policy works. The fact that Venezuela is an oil producing and exporting country, where GDP from its oil industry accounts for more than 40% of total GDP, makes Venezuela a very rigid and fragile economy. In other words, it is an economy exposed to shocks in the world oil market. To accomplish this task, this paper assumes that the Venezuelan economy is driven by seven innovations and uses the Cholesky factorization to recover the shocks. As it will be shown, foreign shocks and supply shocks tend to be very important in explaining the macroeconomic fluctuations in Venezuela.

This paper is organized as follows. Stylized facts about the performance of the Venezuelan economy are presented in section 2. Section 3 focuses on the VAR methodology. In section 4 the data and the empirical results are discussed and section 5 concludes.

2. Stylized Facts

The modern economic history of Venezuela begins around early 1920s. With the birth and development of its oil industry, the Venezuelan economy began to experience profound changes in its economic structure. In the 1920s, Venezuela exhibited a poor economic performance. A high percentage of its population lived in rural areas, its main exporting products were coffee and cocoa and GDP grow was low. During the first 30 years of its oil industry development, the economy expanded very rapidly and even after the 1950s continued growing until the end of 1970s. Tables 1 and 2 below show that, between 1960 and 1980, per capita GDP remained around 7,800 dollars per annum. The average GDP growth rate was approximately 6.8%. Prices increased at a rate around 5% per year in the context of a fixed exchange rate regime. This was a

period of sustained investment not only in the oil sector but also in the other sectors of the economy, particularly the manufacturing sector due to the imports substitution model implemented during the decade of 1960s and early 1970s as the average investment share of 32.1 indicates. Nevertheless, after this superb economic performance the Venezuelan economy began to face severe macroeconomic problems. As shown, during the last twenty four years the economic growth almost came to a halt since per capita GDP diminished to approximately 6,400 dollars. Economic growth has been called a disaster because of its negative growth rate of -1.04%, the Bolívar has depreciated significantly and the exchange market has been very unstable, inflation rose to an annual average of 27% and investment has slowed down. As seen, the modern economic history of Venezuela could be divided into two different periods of economic performance, before and after 1980.

Table 1. Per Capita GDP and Investment

Years	Per capita GDP(a)	Investment Share %
1960	7751	32.6
1980	7905	20.8
2000	6420	13.5
1960 - 1980	0.01%	32.1
1980 - 2000	-1.04%	15.2

Source: Penn World Tables 6.1 (a) Constant International Prices of 1996.

Table 2. Styled facts about the Venezuelan economy

1962 – 1980				1980 – 2004		
Exchange Rate (Bs/$)	Inflation %	GDP %		Exchange Rate (Bs/$)	Inflation %	GDP %
4.4	5.2	6.8	Average	389.2	27.1	1.2
0.1	5.3	9.5	Standard Deviation	688.6	16.9	6.3
4.5	21.6	41.5	Maximum	3015.7	76.2	17.3
4.3	1.2	-4.6	Minimum	4.3	5.6	-9.4

Source: International Financial Statistics. Banco Central de Venezuela. www.bcv.org.ve. Exchange rate is the free market rate

3. Methodology

The methodology used here is a "near- VAR", a slight modification of the unrestricted VAR technique proposed by Sims (1980). Sims proposed that the orthogonalized innovations of the estimated VAR could be interpreted as the structural shocks. This orthogonalization was achieved by ordering the variables in a way such that they show their contemporaneous relationships. Although this atheoretical method has been criticized because of the incredible restrictions (Cooley and LeRoy, 1985), recent research has shown how this methodology can be modified to take into account identifying restrictions that are derived from economic theory and therefore defensible, which have emphasized the identification through long run restrictions (see, Blanchard and Watson, 1986; Blanchard and Quah, 1989; Shapiro and Watson, 1988; Cecchetti and Karras, 1991). This paper uses a slight modification of Sims (1980, 1986) models by considering the fact that Venezuela is an oil producing and exporting country and trades mostly with the U.S.[2] These two phenomena are considered the main sources of foreign innovations. Next, to achieve identification this work uses the Cholesky decomposition for the rest of the variables in the system.

The variables whose behavior is examined in this paper are oil prices (PP), U. S. real GDP (YF), the ratio of government deficit to expenditures (D), the money supply (M), the nominal exchange rate (E), inflation (PI), and the Index of Economic Activity (EA) whose construction is explained in the appendix. Suppose that, except D, all variables are in logs and the model is given by:

$$x_t = \sum_{i=0}^{n} A(L)x_{t-i} + u_t \tag{1}$$

where A(L) is a matrix in the lag operator L, $\mathbf{x_t}$ = (YF$_t$, PP$_t$, E$_t$, D$_t$, M$_t$, P$_t$, EA$_t$)' and $\mathbf{u_t}$ = (u$_t^{YF}$, u$_t^{PP}$, u$_t^{E}$, u$_t^{D}$, u$_t^{M}$, u$_t^{P}$, u$_t^{EA}$)' is the vector containing the seven orthogonal shocks. These innovations are assumed not to be serially correlated nor serially correlated with one another. In other words, E$\mathbf{u_t u_s}$ = $\mathbf{D}$ for t = s and E$\mathbf{u_t u_s}$ = $\mathbf{0}$ for t ≠ s, where $\mathbf{D}$ is a diagonal matrix. Reordering equation (1) we obtain

$$x_t = \sum_{i=1}^{n} (I - A_0)^{-1} A_i x_{t-i} + (I - A_0)^{-1} u_t \qquad (2)$$

where $\mathbf{A_0}$ is the matrix of contemporaneous effects. Equation (2) can be written as:

$$x_t = \sum_{i=1}^{n} B_i x_{t-i} + e_t \qquad (3)$$

where $\mathbf{B_i} = (\mathbf{I} - \mathbf{A_0})^{-1}\mathbf{A_i}$. Equation (3) is the reduced form of the VAR model and $\mathbf{e_t} = (\mathbf{I} - \mathbf{A_0})^{-1}\mathbf{u_t}$ is the vector of estimated residuals that can be correlated. Given that the first element of the right hand side of (3) can be consistently estimated with OLS and 2SLS, the next step is to impose restrictions on the second element $\mathbf{e_t}$ in order to recover the moving average representation. The fact that the estimated residuals can be correlated implies that:

$$e_t = (I - A_0)^{-1} u_t \qquad (4)$$

By means of the Cholesky recursive system of decomposition the structural innovations $\mathbf{u_t}$ are recovered from the estimated residuals as follows:

(1.1) $\quad e^{YF}_t = u^{YF}_t$

(1.2) $\quad e^{PP}_t = \alpha_{21} e^{YF}_t + u^{PP}_t$

(1.3) $\quad e^{e}_t = \alpha_{31} e^{YF}_t + \alpha_{32} e^{PP}_t + u^{E}_t$

(1.4) $\quad e^{D}_t = \alpha_{41} e^{YF}_t + \alpha_{42} e^{PP}_t + \alpha_{43} e^{E}_t + u^{D}_t$

(1.5) $\quad e^{m}_t = \alpha_{51} e^{YF}_t + \alpha_{52} e^{PP}_t + \alpha_{53} e^{E}_t + \alpha_{54} e^{D}_t + u^{m}_t$

(1.6) $\quad e^{P}_t = \alpha_{61} e^{YF}_t + \alpha_{62} e^{PP}_t + \alpha_{63} e^{E}_t + \alpha_{64} e^{D}_t + \alpha_{65} e^{m}_t + u^{P}_t$

(1.7) $\quad e^{AE}_t = \alpha_{71} e^{YF}_t + \alpha_{72} e^{PP}_t + \alpha_{73} e^{E}_t + \alpha_{74} e^{D}_t + \alpha_{75} e^{m}_t + \alpha_{76} e^{p}_t + u^{AE}_t$

From this system of equations, equation (4.1) shows that the contemporaneous effects on YF are produced by U.S. own innovations. Inclusion of YF is justified by the fact that the U. S. is Venezuela's main trading partner. Equation (4.2) presents the fact that, first, oil price shocks

are affected by its own innovations and, second, by U. S. innovations as well. Although in the literature, oil prices are important for output and inflation (Hamilton, 1983; Karras, 1993), in this paper oil prices might affect both the demand and the supply side of the economy because of the nature of the economic structure of Venezuela. Additionally, it is important to emphasize the fact that the U.S. economy shocks might affect indirectly the economy through oil prices innovations. As equation (4.3) shows, the exchange rate is used here to reflect the fact that this variable has been used more frequently as a policy variable rather than as an endogenous variable. In other words, between 1960 and 2004 the exchange has not been fixed during very short periods of time, particularly during 1989-1994 and 1997-2003 and has remained under fixed or multiple fixed exchange rate regimes the rest of the time. Additionally, due to the importance of trade in oil with the U.S., it has been assumed that PP and YF shocks contemporaneously affect the nominal exchange rate.[3] Equations (4.4) and (4.5) are the domestic fiscal and monetary policy variables. The reasons for the domestic policy variables to follow this ordering rest on the fact that, first, in order to finance its own deficit, the government frequently has devalued the domestic currency and second, monetary authorities has financed government expending by means of a monetization of fiscal deficit. Subsequently, in equation (4.6), inflation might be produced not only by domestic price innovations but also by monetary, fiscal, exchange rate, oil prices and foreign GDP innovations as well. Finally, the index of economic activity, in equation (4.7), is the most endogenous variable of them all and has been assumed to the contemporaneously affected by all other variables in the system.

4. Estimation

The quarterly series were extracted from the International Financial Statistics of the IMF and the Central Bank of Venezuela's web page[4] for the period 1960:i-2004:ii. The time series include: the logarithm of the average Brent oil price, PP, the logarithm of the average Bolívar/dollar

exchange rate, E, the logarithm of nominal M2[5], the ratio of government deficit to expenditures, D, the logarithm of the consumer price index, P (1995 = 100), the logarithm of the real GDP for the U. S., and finally, the logarithm of the index of economic activity (AE) computed as shown in the appendix. Although it would be desirable to have data on domestic real GDP, the series are not fully available for the entire period. There are estimations for 1968:i-1977:iv (Rosas, 1979) and for 1990:i-2004:i which can be found at Central Bank of Venezuela's web page.

Stationarity tests were carried out by means of the Dickey-Fuller "τ" and Phillips-Perron "z(t)" tests. The results of the unit root tests using the Dickey-Fuller tests are shown in table 3. The null hypothesis is that the first differences of the log level of the series are non-stationary or that they exhibit a unit root process. Results indicate that the null hypothesis is rejected in all cases, meaning that the series first differences, excepting D, are stationary or that the series are integrated or order 1, I(1). Accordingly, D is stationary or more formally D is I(0).[6]

Table 3. Unit Root Tests. Series First Seasonal Difference: $(1-L)x_t$

Series[a]	DF	ADF(4)	ADFT(4)
D[b]	-13.6***	-5.5***	-5.7***
E	-4.0***	-3.5***	-5.0***
PI	-4.5***	-3.2**	-5.1***
M2	-1.8*	-3.4**	-4.0***
YF	-2.1**	-3.8***	-4.4***
PP	-4.9***	-4.3***	-5.3***
AE	-5.5***	-4.9***	-5.8***

(a) All series are in logs, except D. (b) D is in the levels. Statistical significance levels: *** 1% ** 5%

Given the fact that the series are I(1), Engle and Granger (1987) suggested that it might be possible that the series are cointegrated. If so, they suggest that the appropriate way to estimate a VAR model would be to include a vector error correction with all series in their first differences. Another equivalent approach would be to estimate the

VAR model with the level of the series since differencing is not needed (Fuller, (1974) cited in RATS User's Guide). This paper follows this last approach because not all series are I(1), in other words, if the series are cointegrated, then the VAR model will be estimated in the levels of the series.

Table 4 shows the cointegration tests based on the trace statistics for the I(1) series and the initial null hypothesis is that there is not a cointegrating equation. Results indicate that when a linear deterministic trend is included, there exists a cointegrating equation since the null hypothesis is rejected at standard significance levels.

Table 4. Cointegration Test

No. of CE(s)	Eigenvalue	Trace Statistic
No deterministic trend (restricted constant)		
None	0.177	101.31***
At most 1	0.145	67.73***
At most 2	0.113	40.76**
Linear deterministic trend		
None *	0.145	73.98**
At most 1	0.118	47.00*

***, **, *: 1%, 5%, 10% significance levels

Consequently, the empirical findings that follow are based on a six lags model for the log levels of the series.[7] More precisely, YF was estimated having as independent variables only the lags of YF. The PP equation was estimated with the lags of YF and PP as the independent variables. The rest of the equations in the system were estimated using the lags of the seven variables.

5. Empirical Results

Table 5 shows the variance decompositions for the five variables of interests: E, D, M2, PI, and AE. The numbers reported represent the percentage of the forecast error in each variable that can be attributed to each of the orthogonal innovations at different horizons. These results are reported for only four horizons: 1 and 4 quarters ahead (short run), 20 quarters ahead (medium run), and 40 quarters ahead (long run). PP and YF variance decompositions are not reported because by construction YF and PP are only affected by YF own innovations and also by oil price innovations, respectively.

Exchange rate shocks explain more than 94% of its total variability in the short run whereas oil prices and U. S. GDP innovations increase their impact in the medium and long run. Nevertheless, it is important to emphasize the persistence observed in the exchange rate. Its own innovations explain more than 40% of its total variability even after the 20 quarter horizon. This has been noted by Mora (2002), Karras (1993), Engel and Hamilton (1990), and Dornbusch (1987).

The deficit total variability at all horizons is explained mostly by its own and by oil price innovations, meaning that the government finances its deficit by means of government bonds and by tax revenue from the oil company. Money supply disturbances have the greatest impact on M2 in the short run; however oil prices and exchange rate tend to dominate in the medium and long run. Additionally, there is no significant evidence in favor of monetization of the government deficit by the central bank. Furthermore, the inflation rate is dominated by inflation innovations in the short run but in the medium and long run oil prices, the exchange rate, and U.S. real GDP have the greatest impact among all shocks. Monetary innovations do not play an important role for inflation in the long run since the money supply tends to change with changes in foreign variables due to the fact that the exchange rate has been fixed for most of the time of the period under study.

Finally, economic activity innovations have the greatest impact among all shocks on output at all horizons while YF and PP innovations increase overtime but are not large enough to compensate the economic

Table 5. Variance Decomposition

	Percentage of Exchange explained by shocks to						
Horizon	YF	PP	E	D	M2	PI	AE
1	0.04	2.23	97.72	0.00	0.00	0.00	0.00
4	0.07	1.82	94.15	1.89	0.41	1.27	0.41
20	24.69	31.04	41.23	1.80	0.38	0.62	0.25
40	39.39	40.98	18.22	0.85	0.15	0.29	0.13
	Percentage of Deficit explained by shocks to						
Horizon	YF	PP	E	D	M2	PI	AE
1	1.78	0.56	1.60	96.07	0.00	0.00	0.00
4	6.58	40.76	3.04	44.97	0.26	3.97	0.41
20	6.20	37.76	4.40	40.40	1.47	4.11	5.67
40	6.25	37.65	4.44	40.28	1.58	4.11	5.70
	Percentage of Money explained by shocks to						
Horizon	YF	PP	E	D	M2	PI	AE
1	0.01	5.43	0.07	3.11	91.38	0.00	0.00
4	1.11	14.09	10.65	1.93	70.92	0.66	0.65
20	6.66	18.11	47.40	5.00	17.59	1.54	3.72
40	24.62	31.21	27.56	3.49	8.70	1.11	3.30
	Percentage of Inflation explained by shocks to						
Horizon	YF	PP	E	D	M2	PI	AE
1	0.80	1.51	14.29	0.12	0.86	82.42	0.00
4	2.05	0.96	50.17	3.04	1.71	39.19	2.89
20	12.11	37.22	21.37	2.98	6.08	11.25	9.00
40	12.42	38.49	24.51	2.03	6.22	7.55	8.78
	Percentage of Output explained by shocks to						
Horizon	YF	PP	E	D	M2	PI	AE
1	2.50	0.01	0.01	1.50	0.00	0.31	95.67
4	1.23	0.68	2.72	0.93	2.44	5.68	86.32
20	20.23	10.54	2.89	2.17	4.42	2.98	56.77
40	27.30	11.84	5.27	1.88	3.69	2.50	47.51

activity shocks. It is puzzling that AE variance decomposition does not show fiscal, monetary, or exchange rate innovations dominating in the short run.

Another way to look at the results, and help clarify some of the findings that are still puzzling, is by means of the impulse response functions. These functions present the responses over time of each variable to innovations in each disturbance. The impulse response functions for (the log level of) economic activity, inflation, and the exchange rate are shown in figures 1, 2, and 3, respectively. These figures also plot confidence bands of two standard deviations, computed by Monte Carlo simulations.

As the impulse response functions in figure 1 show, innovations on the economic activity are important in the short run and die out in the medium and long run. U. S. shocks have permanent effects on output, although in the long run these effects tend to diminish. Oil price innovations only have temporary effects on output. Output shows significant instability in the short run when there is a depreciation/devaluation of the domestic currency; moreover, the medium and long run effects of a depreciation/devaluation tend to be permanent. Economic policy variables produce temporary effects on output. These results are consistent with economic theory. Particularly, the response of output to monetary innovations has the expected hump-shaped with a peak around 6 quarters. Finally, inflation shocks produce a short recession around the third quarter. Afterwards, the economy goes back again to the same level of economic activity.

Regarding inflation (see figure 2), foreign (U. S. GDP and oil price) innovations produce a deflation, especially in the short and medium run. Their long run effects are rather negligible. The exchange rate shock produces significant instability on the rate of inflation, particularly in the short run while its long run effect tends to be quite small. Contrary to economic theory, rather than having long run effects, monetary policy innovations produce inflation mostly during the short run. Finally, economic activity innovations have positive effects on inflation during the short and medium run while its long run effects eventually die out.
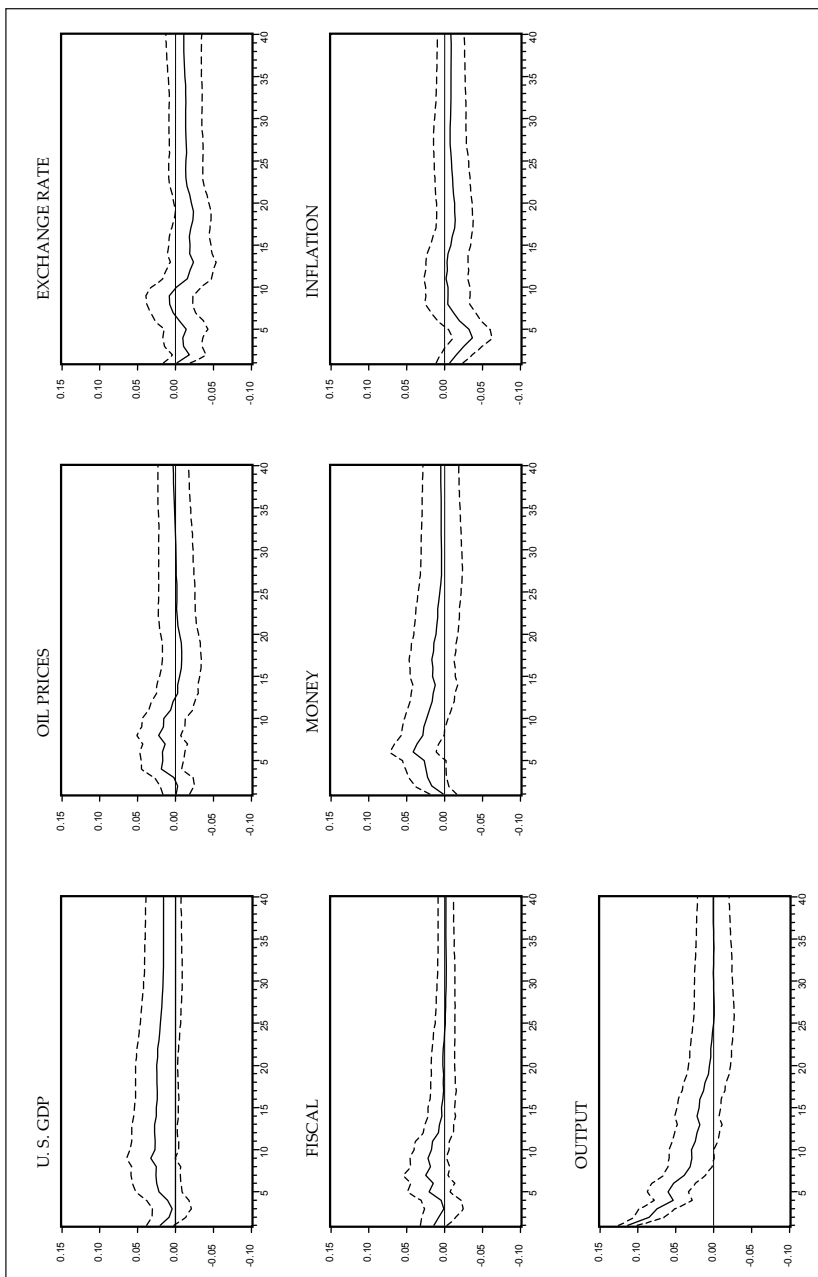
Figure 1. Responses of output to Innovations in: Shocks are equivalent to one S. D. +/- 2 S. E.
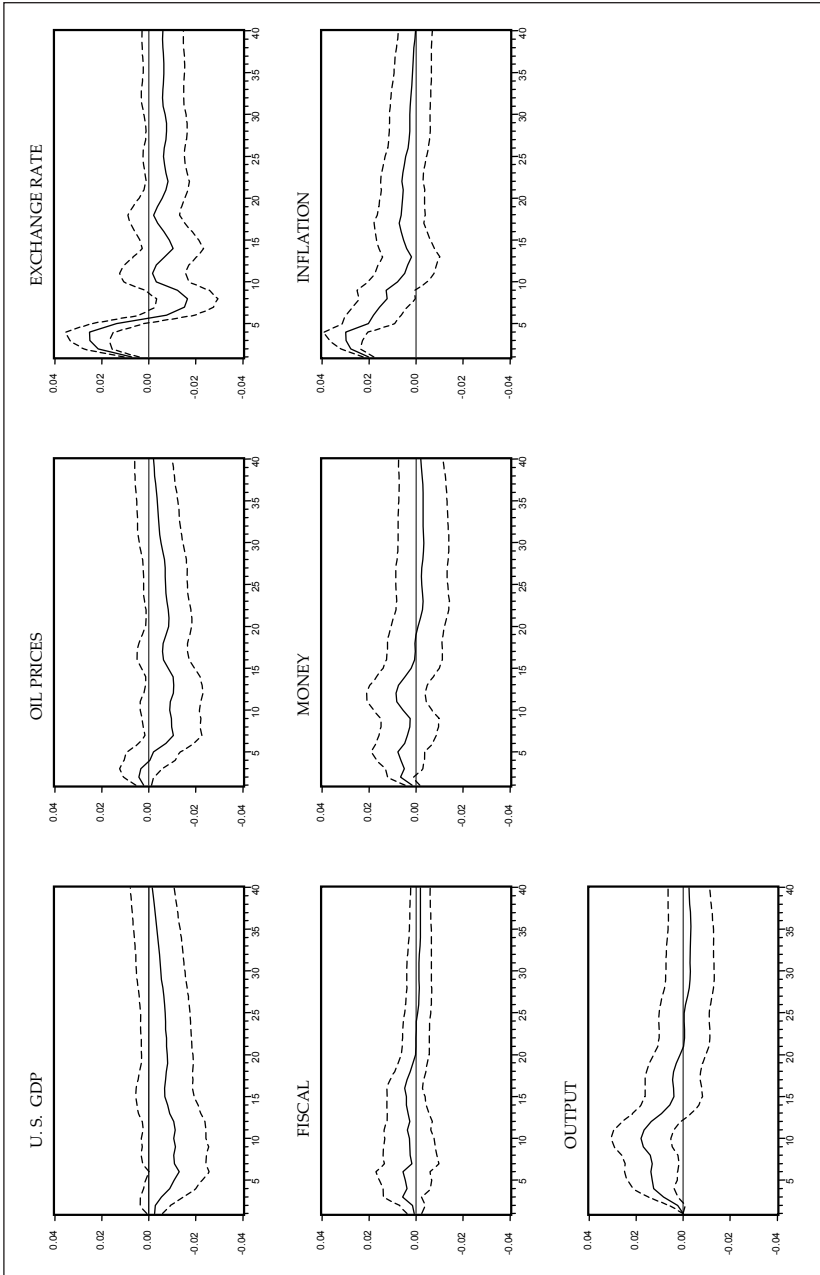
Figure 2. Responses of inflation to Innovations in: Shocks are equivalent to one S. D. +/- 2 S. E.

According to the impulse response functions from figure 3, the responses of the exchange rate to the different innovations show that U.S. and oil price shocks have permanent effects on the exchange rate. The domestic currency tends to appreciate. Also, monetary innovations produce a similar result. On the contrary, inflation shocks produce a depreciation of the Bolívar.

6. Robustness

Since the model was estimated with the series in their levels, this section tries to determine how robust the estimated results are. First, recall that some of the series are I(1) and cointegrated and D is I(0). Second, an error correction vector was not introduced in the var model. And third, from the impulse response functions and variance decompositions the effects of the system seem to be quite high and persistent. Then, it is important to study the properties of the var estimated residuals.

The ordering proposed to perform the Cholesky decomposition, YF → PP → D → M2 → PI → E → AE, considers the fact that during the last 25 years, the exchange rate has been very unstable and, therefore, has been placed next to the last endogenous variable. A summary of the variance decomposition and the corresponding impulse response functions are presented in table 7 and figures 4 to 6, respectively. Inspection of this table shows that although quantitatively results are slightly different from the ones reported in table 5, qualitatively those results are not very different when compared to one another. Furthermore, the main findings displayed in figures 1 to 3 are also supported by the impulse response functions reported in figures 4 to 6. In other words, the main findings reported in table 5 and the impulse response functions from figures 1 to 3 are very robust to changes in the ordering.

Table 7. Variance Decomposition Alternative Ordering

| Horizon	Percentage of Deficit Explained by shocks to						
	YF	PP	D	M2	PI	E	AE
1	1.78	0.56	97.67	0.00	0.00	0.00	0.00
4	6.58	40.76	45.75	0.26	5.41	0.83	0.41
8	6.20	38.65	42.21	1.36	5.17	2.15	4.27
20	6.20	37.76	41.01	1.47	5.35	2.55	5.67
40	6.25	37.65	40.89	1.58	5.33	2.60	5.70
Horizon	Percentage of Money Explained by shocks to						
	YF	PP	D	M2	PI	E	AE
1	0.01	5.43	3.18	91.38	0.00	0.00	0.00
4	1.11	14.09	2.74	70.78	0.53	10.11	0.65
8	0.68	27.23	4.70	39.81	6.20	20.56	0.83
20	6.66	18.11	9.46	17.48	12.40	32.18	3.72
40	24.62	31.21	6.27	8.64	7.74	18.22	3.30
Horizon	Percentage of Inflation Explained by shocks to						
	YF	PP	D	M2	PI	E	AE
1	0.80	1.51	0.68	0.83	96.17	0.00	0.00
4	2.05	0.96	6.74	1.64	68.01	17.72	2.89
8	7.37	15.50	8.40	1.95	42.92	17.20	6.66
20	12.11	37.22	3.61	6.11	17.49	14.47	9.00
40	12.42	38.49	2.47	6.28	12.34	19.22	8.78
Horizont	Percentage of Exchange Explained by shocks to						
	YF	PP	D	M2	PI	E	AE
1	0.04	2.23	1.60	0.00	13.75	82.38	0.00
4	0.07	1.82	6.20	0.38	19.57	71.56	0.41
8	2.59	7.23	8.18	0.95	18.39	62.27	0.40
20	24.69	31.04	4.42	0.39	9.09	30.13	0.25
40	39.39	40.98	2.05	0.15	4.06	13.24	0.13
Horizon	Percentage of Output Explained by shocks to						
	YF	PP	D	M2	PI	E	AE
1	2.50	0.01	1.46	0.00	0.36	0.00	95.67
4	1.23	0.68	0.71	2.46	7.93	0.68	86.32
8	6.52	4.97	1.48	5.82	6.47	1.23	73.52
20	20.23	10.54	1.86	4.44	4.66	1.50	56.77
40	27.30	11.84	1.77	3.71	4.42	3.46	47.51
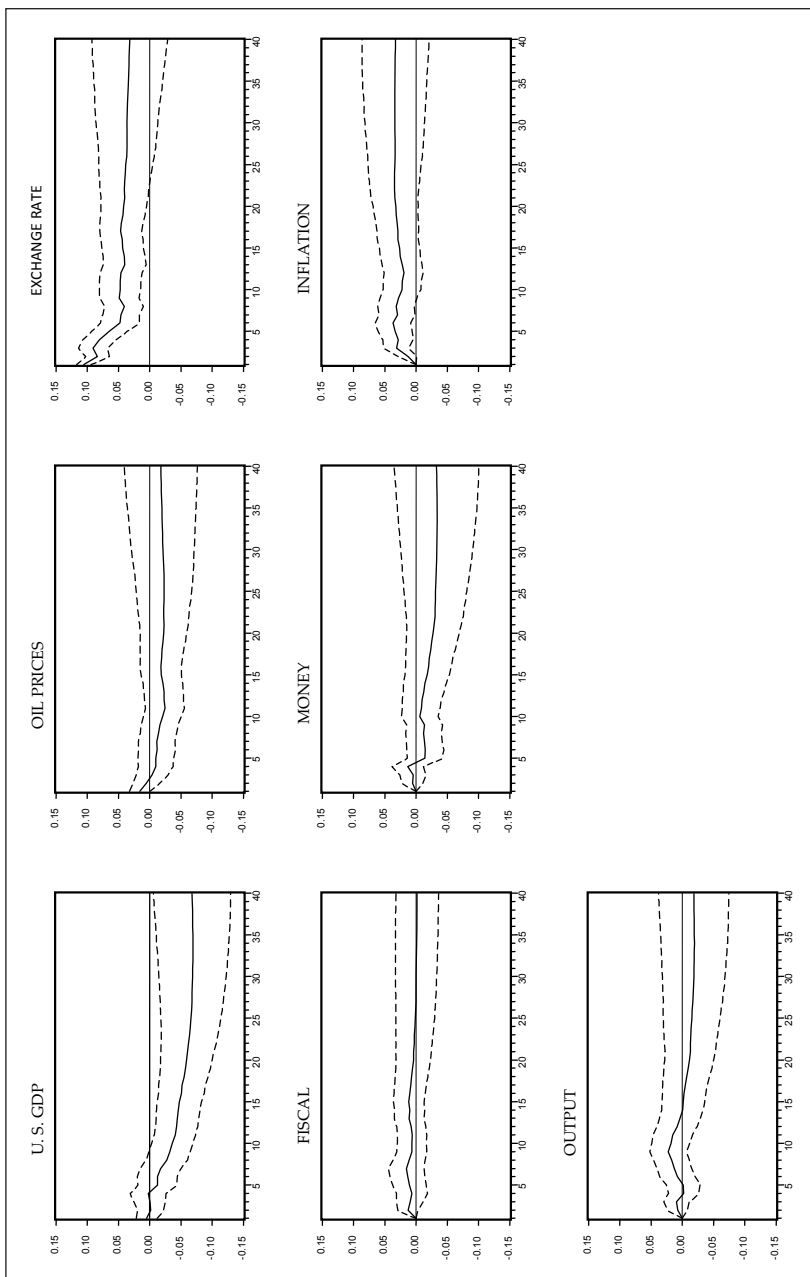
Figure 3. Responses of the exchange rate to Innovations in: Shocks are equivalent to one S. D. +/- 2 S. E.
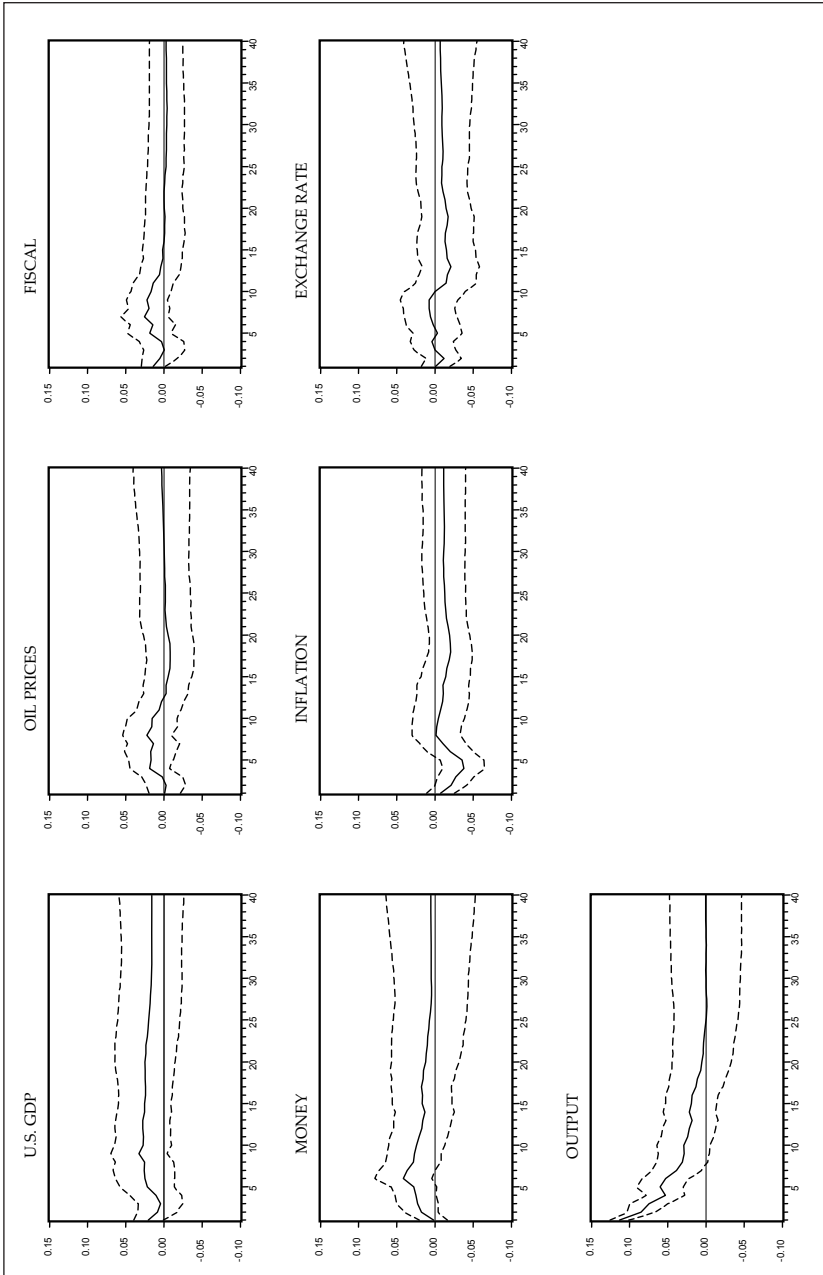
Figure 4. Responses of OUTPUT to innovations in: Shocks are equivalent to one S. D. +/- 2 S. E.
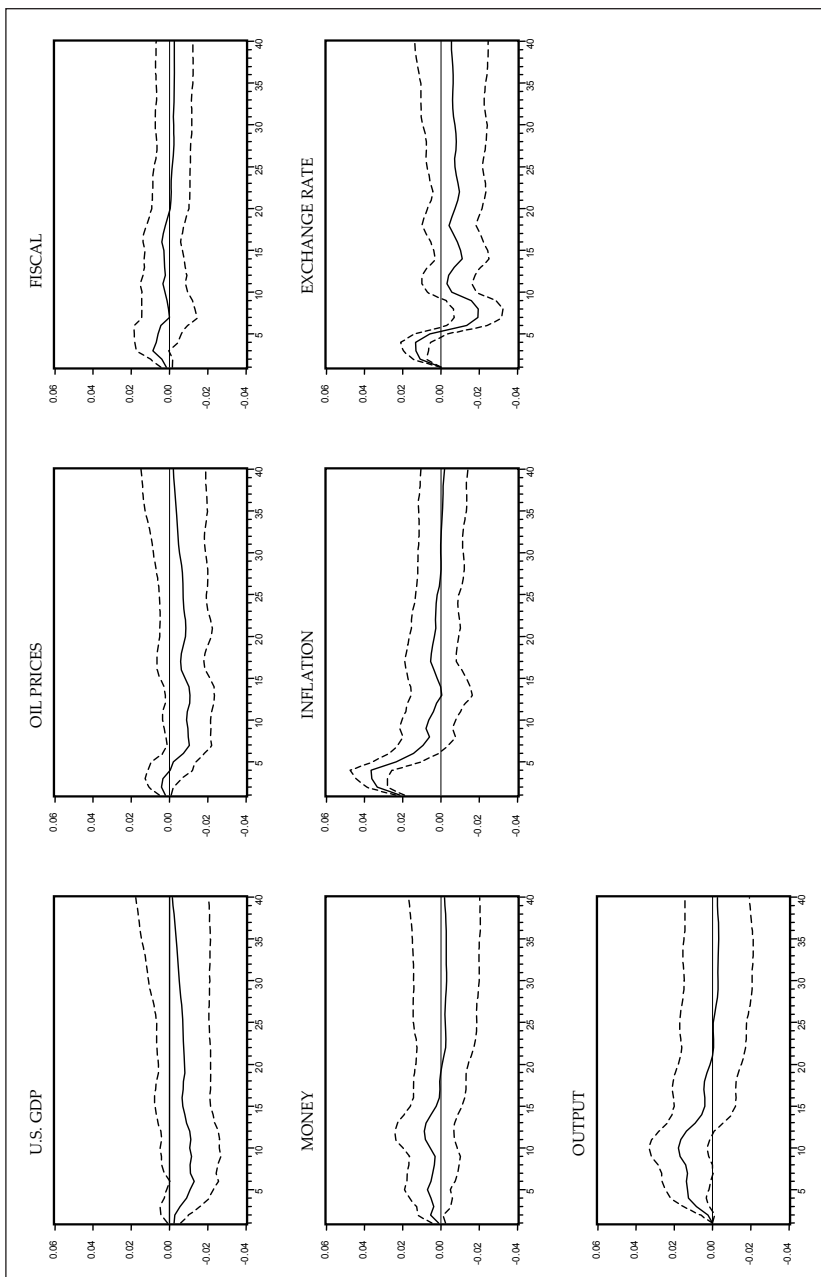
Figure 5. Responses of INFLATION to innovations in: Shocks are equivalent to one S. D. +/- 2 S. E.
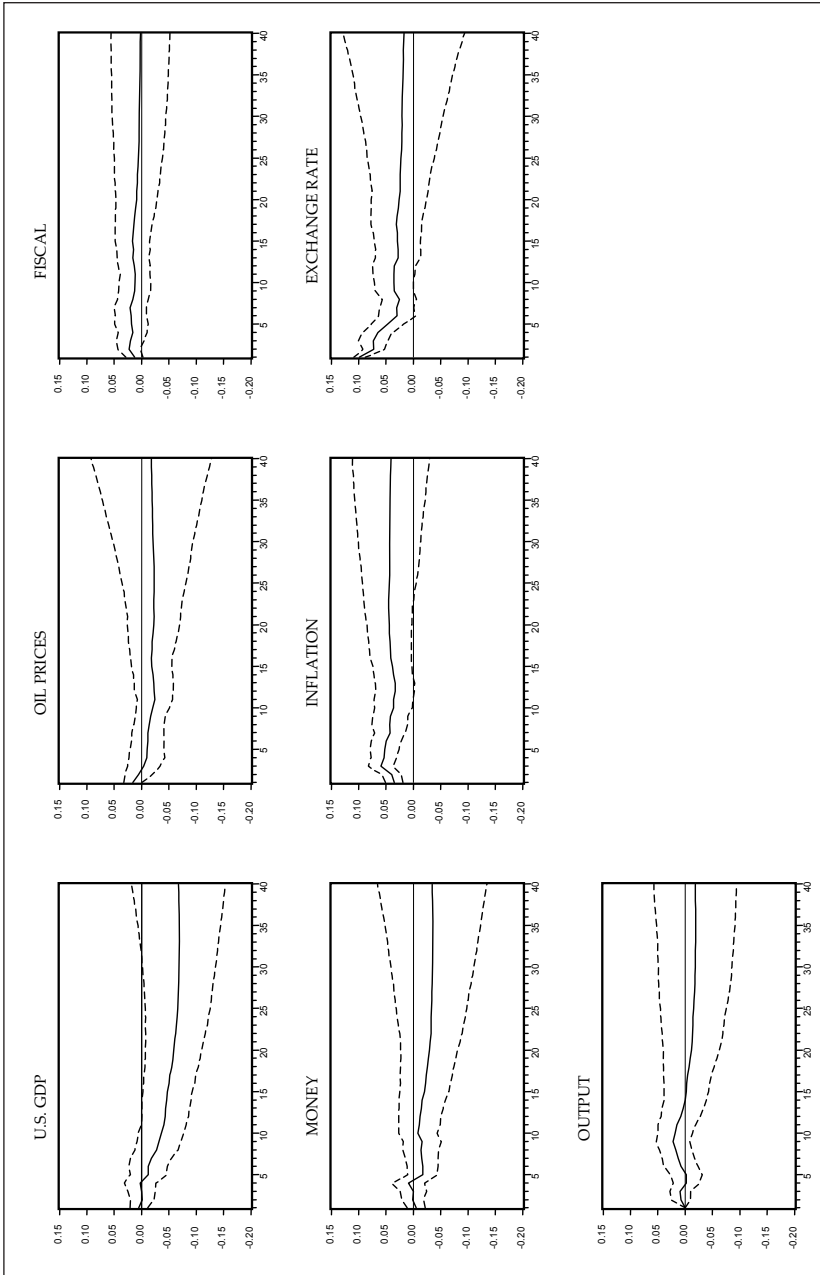
Figure 6. Responses of EXCHANGE RATE to innovations in: Shocks are equivalent to one S. D. +/- 2 S. E

7. Policy Implications

Although, empirically, the exchange rate has not been always used as a policy variable, in this paper it has been assumed that the exchange rate has been and is, up to some extent, more exogenous than fiscal and monetary policy. This implies that in this paper, the exchange rate is used more as a policy variable than as an endogenous variable. Therefore, this section discusses the implications of fiscal, monetary, and exchange rate policy in order to understand how they could be used in the particular context of the Venezuelan economy.

A devaluation of the domestic currency depreciates even more the Bolívar, particularly during the first six quarters with insignificant effects in the medium and long run. Additionally, the costs associated with a devaluation of the Bolívar can be better seen through the effects on the inflation rate, which substantially rises in the short run. The effects on output are negligible. These results imply that a devaluation of the domestic currency has only temporary effects on the exchange and inflation rates.

An expansionary fiscal policy has important effects in the short run. It produces a substantial increase in the price level and a depreciation of the domestic currency. Additionally, fiscal policy creates a temporary economic expansion but unimportant effects in the long run. In other words, the cost of an expansionary fiscal policy that increases domestic real GDP, at least temporarily, produces elevated inflation rates and a Bolívar depreciation.

Finally, as predicted by the theory, monetary policy can only produce a momentarily economic expansion, which vanishes after two years, approximately. However, the price level exhibits a different behavior from the theory. The price level slowly rises during the first two years and more rapidly after two years but these effects tend to die out in the long run when the inflation rate eventually decreases.

In summary, according to the results, economic policy variables tend to have only temporary effects on the variables on the system. Output increases particularly in the short run with monetary and fiscal policies with no effects in the long run. Inflation and the exchange rate

also increase as a result of domestic policy. Finally, results also imply that foreign shocks tend to be more important than domestic shocks in the long run.

6. Concluding Remarks

This paper used the Cholesky factorization VAR approach to investigate the relative importance of foreign and domestic shocks in the Venezuelan economy during the 1960:i-2004:ii period. The economy was assumed to be driven by two different sets and seven different innovations: foreign (U. S. GDP and oil prices) and domestic (exchange rate, fiscal, monetary, inflation, and output) innovations. As shown by the impulse response functions and variance decompositions, foreign shocks tend to be relatively more important than domestic shocks. Precisely, oil price and U. S. shocks tend to have permanent effects on the exchange rate, inflation, and output. Economic activity innovations have the greatest impact on output at all horizons, followed by U. S. and oil price shocks. Monetary innovations have only temporary effects on output. Regarding inflation, exchange rate innovations introduce significant instability on the rate of inflation, especially in the short and medium run. Contrary to what economic theory predicts, monetary policy do not play a major role on the inflation rate. Its effects tend to be larger in the short run than in the long run. Finally, the exchange rate tends to appreciate with oil prices, U. S., and monetary shocks at all horizons while inflation produces a depreciation of the Bolívar.

7. Notes

1   They used quarterly data for the period 1984-2003
2   Venezuela is a small country whose main trading partners are the U.S., with more than 40%, and Colombia, with less than 7% of overall trade. This paper considers the fact that Venezuela is amongst the five largest oil producers and the sixth energy producers in the world.

3   Rather than using economic theory, the fact that according to the Constitution of Venezuela, the property and administration of oil and its derivatives corresponds to the Venezuelan government was used. Thus, for every dollar that PDVSA (Government owned oil company) sells in oil, the government collets more than 60% of its profits through taxes and royalties.

4   www.bcv.org.ve

5   Also M1 was tried but results were not better than the ones reported in this work.

6   Although not shown, APP and APPT tests also indicate that all series, except D, are I(1). D is I(0).

7   Other lag structures were tried but the AIC and Loglikelihood ratio showed six lags as the most appropriate lag structure.

8. References

Arreaza, A. y Dorta, M. (2004). *Sources of Macroeconomic Fluctuations in Venezuela.* Caracas: Banco Central de Venezuela (Serie documentos de trabajo 56).

Blanchard, O. J. y Watson, M. W. (1986). "Are business cycles all alike?" En *The American Business Cycle*, ed. R. J. Gordon, pp. 123-179. Chicago: University of Chicago Press.

Blanchard, O. J. y Quah, D. (1989). "The dynamic effects of aggregate demand and supply disturbances." *American Economic Review*, 79, pp. 655-673.

Cecchetti, S. G. y Karras, G. (1992). "Sources of output fluctuations during the interwar period: Further evidence on the causes of the great depression." National Bureau of Economic Research, Working Paper 4049.

Cooley, T. F. y LeRoy, S. F. (1985). "Atheoretical macroeconometrics: A critique." *Journal of Monetary Economics*, 16, pp. 283-308.

Engle, R. E. y Granger, C. W. J. (1987). "Cointegration and error-correction: Representation, estimation, and testing." *Econometrica*, 55, pp. 251-276.

Engel, R. E. y Hamilton, J. (1990). "Long Swings in the Dollar: Are they in the data and do markets know it?" *American Economic Review*, 80, pp. 689-713.

Guerra, J., Olivo, V. y Sánchez., E. (2002). "El proceso inflacionario en Venezuela: Un estudio con vectores autoregresivos" (1997). En *Estudios Sobre la Inflación en Venezuela*. J. Guerra (Comp). Caracas: Banco Central de Venezuela (Colección Económico Financiera).

Hamilton, J. D. (1983). "Oil and the macroeconomy since World War II." *Journal of Political Economy,* 91, pp. 228-248.

Hamilton, J. D. (1994). *Time Series Analysis*. Princeton: Princeton University Press.

International Monetary Fund. *International Financial Statistics*.

Karras, G. (1993). "Sources of U.S. macroeconomic fluctuations: 1973-1989." *Journal of Macroeconomics*, 15, 47-68.

Karras, G. (1992). "Nominal effects of fiscal and monetary policy in Greece." *Kredit und Kapital*, 3, pp. 416-427.

Mora, J. U. (2002). *Inflation, Exchange Rate Instability and Balance of Payment Deficits in Venezuela: A VAR Approach.* Ph. D. Dissertation. Chicago: University of Illinois at Chicago.

Pagliacci, C. y Ruda, M. (2004). *¿Tienen Efectos las Acciones de Política Monetaria? Un Análisis de Intencionalidad.* Caracas: Banco Central de Venezuela (Serie documentos de trabajo 67).

ESTIMA (2000). *RATS User's Guide*. Versión 5. Evanston, IL.

Rosas-Bravo, P.(1983). *Metodología para la Trimestralización del Producto Territorial Bruto de Venezuela. Con Aplicaciones para el Periodo 1968-1977.* Caracas: Banco Central de Venezuela.

Saez F. J. y Puch, L. A. (2004). *Shocks Externos y Fluctuaciones en una Economia Petrolera.* Caracas: Banco Central de Venezuela (Serie documentos de trabajo 59).

Shapiro, M. D. y Watson, M. W. (1988). Sources of business cycles fluctuations. En Stanley Fisher (ed.), *National Bureau of Economic Research Macroeconomics Annual*. Cambridge: MIT Press.

Sims, C. A. (1980). "Macroeconomics and reality." *Econometrica*, 48, pp. 1-48.

Sims, C. A.(1986). "Are forecasting models usable for policy analysis?" *Federal Reserve Bank of Minneapolis Quarterly Review*. Winter, pp. 2-16.

9. Appendix

Since the database built for the present work lacks information about quarterly real GDP, an index of economic activity may serve as a proxy for the behavior of real GDP in the Venezuelan economy. To build such an index, this work assumes that real imports and real income are positively correlated; then, real imports might serve as a base to build such index. More specifically, if, at annual frequency, real imports and real GDP are positively correlated it would be reasonable to assume that these two series would also be positively correlated at a higher frequency. Additionally, there is data available on imports on a quarterly base. Hence, the methodology employed in the construction of the index of economic activity involves the test for cointegration. In other words, if both series are I(1) and cointegrated, then it is possible to conclude that the series are moving together and therefore the construction of such an index is feasible. Next, I proceeded as follows:

–   I used annual data from 1950 to 2003 from real imports and real GDP. Both series were logged (LRM and LRGDP).
–   I tested both series for unit roots and, as expected, the logs of real imports and real GDP were found to be integrated of first order or I(1).
–   Since the series were found to be I(1), I proceeded to test for cointegration. These results are shown in table A1.

Table A1. Cointegration Tests for LRM and LRGDP

Normalizing Series	Single Unit Root	Augmented Dickey-Fuller t-test for Lags				Augmented Phillips-Perron t-test for Lags			
		1	2	3	4	1	2	3	4
LRM [a]	-3.1**	-2.9**	-2.8*	-2.3	-2.4	-3.2**	-3.2**	-3.2**	-3.1**
LRM [b]	-3.2**	-2.9**	-2.7*	-2.4	-2.7*	-3.3**	-3.3**	-3.3**	-3.3**

Significance Levels: **5%, *10%. a. Model with Constant but no TREND in the cointegrating vector. The statistics for the ADFT and APPT tests (not shown separately) are, after rounded, the same as for ADF and APP. b. Model with Constant and TREND in the cointegrating vector.

1. Since the Phillips-Perron is more flexible than the Dickey-Fuller procedure, then, it is possible to conclude that LRM and LRGDP are cointegrated.
2. The index of economic activity was built using the average value of quarterly real imports for 1995 as a base. Thus, this index is just a rough approximation to a real index of economic activity, which despite measuring problems would be much better.