RESPONSE OF VENEZUELAN OUTPUT TO MONETARY POLICY, DEFICIT SPENDING, AND CURRENCY DEPRECIATION: A VAR MODEL

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RESUMEN

Este estudio aplica el modelo VAR para hallar posibles respuestas del PIB real a variables macroeconómicas seleccionadas en Venezuela. Basado en una muestra anual de 1961-2001, el autor encuentra que el PIB real responde positivamente a choques en el M2 real, al déficit del gobierno, a la depreciación de la tasa de cambio y al producto rezagado, y negativamente a choques en la inflación durante algunos períodos de tiempo. Excepto por el producto rezagado, el déficit del gobierno y la inflación son las variables que tienen mayor influencia en el primer año. El M2 real y la tasa de cambio real son las que más influyen y tienen impactos de más largo plazo después del primer año.

Palabras clave: Modelos VAR, política monetaria, déficit.
Clasificación JEL: E52, E62, F41.

ABSTRACT

This study applies the VAR model to find possible responses of real GDP to selected macroeconomic variables in Venezuela. Based on an annual sample during 1961-2001, the author finds that real GDP responds positively to a shock to real M2, government deficit spending, exchange rate depreciation, and the lagged output and negatively to a shock to the inflation rate during some of the time periods. Except for the lagged output, government deficit spending and the inflation rate are the most influential variable in the first year, and real M2 and the real exchange rate are more influential and have longer-term impacts after the first year.

Keywords: VAR model, monetary policy, deficit spending.
JEL Classification: E52, E62, F41.

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I. INTRODUCTION

The Venezuelan economy is characterized by the significant role of the petroleum sector. Its output was close to 28% of the GDP, 80% of exports, and 50% of government spending. It was the U.S. largest oil supplier and the world's fourth largest oil exporter turning out around 3 million barrels per day. In recent years, Venezuelan households and firms experienced relatively high inflation rates, the depreciation of the bolivar, and slow economic growth.

Up to 1986, inflation rates in Venezuela were relatively low. Beginning in 1987, inflation rates rose rapidly reaching a high of 99.88% in 1996, gradually decreased to 12.54% in 2001, and then went up again to 31.19% in 2003. The high inflation rate was mainly attributable to very high growth rate of the money supply that reached a record of 68.89% in 1994, the dramatic depreciation of the bolivar, and the budget deficit equivalent to 5.1% of the GDP in 2002. The bolivar depreciated from 8.08 per U.S. dollar in 1986 to 14.5 in 1987 or 79.5%. It continued to depreciate by 60.4% in 2002 and by 38.4% in 2003, reaching 1,606.96 per U.S. dollar. The considerable depreciation raised import and domestic prices substantially to cause high inflation rates. The decline of money growth rates after 1997 has reduced the inflationary pressure to some extent.

Up to 1983, the central bank pursued a fixed exchange rate policy effectively and allowed the bolivar to vary within a tightly controlled band. During 1984-1988, the central bank allowed the bolivar to depreciate to some extent. After 1988, the central bank could not effectively control the bolivar exchange rate. To defend the value of the bolivar and reduce inflationary pressure, the central bank raised the discount rate to as high as 71.25% in 1993 to keep investors from buying U.S. dollars and spent billions of U.S. dollars in international reserves without success. In February 2003, the central bank announced that it adopted a free-floating exchange rate in order to stimulate exports, ease the pressure on limited international reserves, and allow the over-valued bolivar to reach a fair market value. The depreciation of the bolivar helped the export sector as the Venezuelan-made products were much cheaper but hurt consumers as approximately 60% of what it consumed was imported.

During 1984-2002, Venezuela experienced economic slowdowns in 5 out of 19 years due to the collapse of world oil prices, the financial crisis, and other related reasons. Its economic growth rate was below 3.5% in 10 out of the 19 years. Real GDP in 2002 was less than the 1995 level. The unemployment rate rose from 13.2% in 2001 to 15.8% in 2002. One of the major reasons was the very high lending rate, which reached 36.58% in 2002 and then declined to 25.19% in 2003. The high interest rate policy was adopted in the late 1980s to support the bolivar exchange rate, attract international capital, and contain inflation. However, the high cost of borrowing hurt household and business spending. These and other issues suggest that a further study of the interrelationships among these macroeconomic variables is needed in order to provide the Venezuelan government with some findings which may be useful in conducting macroeconomic policies.

This paper attempts to determine whether a shock to real M2, government deficit spending, the depreciation of the bolivar, or the inflation rate would affect real GDP for Venezuela. The paper has several unique aspects. First, its theoretical foundation is based on the IS-LM model in that both the goods/services and money markets are considered. Second, several exogenous variables are considered, and the endogenous variables are separated from the exogenous variables in empirical work. Third, the VAR model is applied, and the impulse response and variance decomposition functions for real GDP are estimated and presented. The impulse response function describes any response of real output to a shock to one of the endogenous variables, and the variance decomposition for real output illustrates the relative influence of each of the endogenous variables on output variance.

II. LITERATURE SURVEY

Mishkin (1995) and Kuttner and Mosser (2002) summarized the articles on the monetary transmission mechanisms and indicated that monetary policy could influence an economy via several channels such as the wealth effect, the exchange rate channel, the interest rate channel, the monetarist channel, Tobin's q theory, and the credit channels including the bank lending channel and the balance-sheet channel. Taylor (1993, 1995), Jorgenson (1963), and others emphasized the significant impact of the interest rate channel whereas Bernanke and Gertler (1995) stressed the significance of the credit channel. Stiglitz and Greenwald (1993), Eichenbaum (1994), Bernanke and Gertler (1995) argued that the elasticity of the interest rate is not significant, that the effect of the cost-of-capital is weak, and that monetary policy influences short-term interest rates whereas businesses and households consider long-term rates in their decisions to purchase long-term assets. Estrella (2002) and Boivin and Giannoni (2002) showed that since the 1980s, the response of real output to the interest rate has decreased. In view of these different views, it is appropriate to further examine the potential effect of real interest rates on real output.

According to the conventional view, an increase in the budget deficit would shift the IS curve to the right and raise real output in the short run. In the long run, increased government debt to pay for the increased deficits would drive up the interest rate and crowd out private spending. The Ricardian equivalence theory (Barro, 1989) suggests that deficit-financed government spending would have a neutral effect in the long run because taxpayers figure out a tax cut today would be matched by a tax increase in the future. The Ricardian Equivalence hypothesis was challenged by Blanchard (1985) and Bernheim (1989). Smyth and Hsing (1995) reported that economic growth and the debt ratio exhibited a bell-shape relationship and that economic growth would slow down if the debt ratio is too high.

Edwards (1986) found that the effect of currency depreciation is negative in the first period, positive in the second period, and neutral in the long term. Morley (1992) showed that currency depreciation harms output. Moreno (1999) reported that currency depreciation causes output to decline in the OLS regression and does not affect output in the instrumental variable regression. Upadhyaya (1999) showed that

the impact of currency depreciation is negative for Pakistan and Thailand and neutral for Malaysia, India, Sri Lanka, and the Philippines over the long term.

Vaez-Zadeh (1989) revealed that Venezuelan oil reserves generate a "confident effect" on anticipated future income that would influence spending behaviors. This effect also has an impact on inflation, money demand, and payment balance. Garcia-Herrero (1997) examined banking problems and lessons for three nations including Venezuela. Countries responding to banking crises fast with comprehensive and consistent policy would have smaller negative impacts. Countries with a high degree of dollarization and a large share of foreign and government banks experienced a stable deposit pattern at least in the short term. The largest impact can be found when both banking crises and macroeconomic problems occurred together. Soydemir (2002) found that an increase in the U.S. interest rate has a sluggish and varying impact on the equity market in Argentina, Brazil, Colombia, Mexico, and Venezuela and does not have any impact on Chile's equity market. He indicated that monetary policy in the U.S. may affect the economic stability in these countries.

Edwards (1993) examined exchange rates, inflation rates and disinflation for four Latin American nations including Venezuela. During the period of fixed exchange rates, these countries observed the rule in conducting domestic monetary and credit policies. However, after pursuing a flexible exchange rate regime, some of these countries overlooked the constraints and experienced losses of international reserves and high inflation. Holmes (2002) reported that seven out of thirteen Latin American countries exhibit nonlinear exchange rate patterns and that Venezuela and Colombia show the steepest change between low and high exchange rates. Based on the generalized error correction model, Anoruo, Braha and Ahmad (2002) found that the purchasing power parity (PPP) hypothesis is valid for 11 countries including Venezuela in the long run and that the PPP does not hold if the traditional unit root method is employed to test the hypothesis.

III. THEORETICAL MODEL

This paper applies the IS-LM model to find the equilibrium output (Gali, 1992; Dubey and Greanakoplos, 2000; Dohmen, 2002). Suppose that household consumption spending is a function of disposable income and the real interest rate, that business investment spending is determined by the real interest rate and output, that net exports are influenced by the real exchange rate and world output. When aggregate supply and aggregate demand are in equilibrium, we can write

$$Y = C(Y-T, RR) + I(RR, Y) + G + NX(EX, WY) \quad (1)$$

where

Y = real GDP for Venezuela,
C = the consumption function,
T = real government taxes,
RR = the real interest rate,
I = the investment function,

G = real government spending,
NX = the next exports function,
EX = the real exchange rate,
WY = world output.

The equilibrium condition in the money market suggests that

$$M/P = f(NR, Y) \quad (2)$$

where
M = the quantity of money,
NR = the nominal interest rate, and
P = the price level.

Solving for the equilibrium values simultaneously, we have

$$Y^* = f(RM, G, T, EX, PC) \quad (3)$$

where

RM = M/P,
PC = the inflation rate, and
NR = RR + PC.

Combining G and T to become government deficit DE, we can rewrite equation (3) as

$$Y^* = f(RM, DE, EX, PC) \quad (4)$$

Applying the VAR model and including exogenous variables, we can express the estimated model as

$$X = \theta_1 X_{t-1} + \ldots + \theta_m X_{t-m} + \beta_t Z_t + \varepsilon_t \quad (5)$$

where

X = a k-vector containing the endogenous variables [Y, RM, DE, EX, PC],
Z = a d-vector of the exogenous variables [OIL, WY],
θ, β = parameter matrices to be estimated,
OIL = world crude oil price per barrel, and
ε = white-noise error term.

We expect that real output Y would respond positively to a shock to RM and DE because an increase in real quantity of money would shift the LM curve to the right, causing the nominal interest rate to decline and real output to rise and because an increase in government deficit either due to an increase in government spending or a decrease in taxes would shift the IS curve to the right, causing the equilibrium nominal interest rate and real output to rise.

The response of real output to a shock to EX is unclear. Currency depreciation would bring some positive effects such as increased exports and decreased imports and negative impacts such as a potential increase in import and domestic prices, decrease in real income and wealth, and decrease in the net flow of international investment. The impact of the inflation rate on output is ambiguous. On the one hand, an increase in the inflation rate would reduce the real interest rate paid by borrowers due to the Fisher effect. On the other hand, a rising inflation rate would cause inconvenience, inefficiency, misallocation of resources, and other costs, which would harm real output. In the VAR model, because all the right-hand side variables are identical and lagged, OLS is as good as GLS, and the simultaneity bias would not be a concern. A recent application of the VAR model to a Latin American country can be found in Hsing (2003).

IV. DATA AND EMPIRICAL RESULTS

Because quarterly data for some of the variables is not available, we use the sample of annual data during 1957-2001. The data for government deficit spending in 2002 has not been published at the time of writing this paper. Depending upon the lag length in the VAR model, several observations will be lost. All the data for Venezuela and world crude oil prices were taken from the *International Financial Statistics* published by the International Monetary Fund. The real exchange rate is equal to the nominal exchange rate in terms of the bolivares per U.S. dollar times the relative price levels in the U.S. and Venezuela. Due to the strong influence of U.S. real output on Venezuela's economy, it is employed as a proxy for world output and was obtained from the Bureau of Economic Analysis, U.S. Department of Commerce. Y, RM, and DE are expressed in billions of bolivares. WY is measured in billions of U.S. dollars.

Let's first test unit roots. The critical values are -3.59, -2.93, and -2.60 at the 1%, 5%, and 10% levels, respectively. We find that in levels Y, RM, EX, PC and OIL have unit roots and DE and WY are stationary at the 5% level and that in difference all the variables are stationary at the 1% level. The Johansen cointegration test is employed to test the null hypothesis that these variables have zero cointegrating relationship against the alternative hypothesis that there is one cointegrating relationship among these variables. The value of the trace statistic is estimated to be 113.78 compared with the critical value of 76.07 at the 1% level. Therefore, real GDP and the right-hand side variables are cointegrated and have a stable long-term relationship.

Based on Akaike information criterion, the final prediction error, and the Hannan-Quinn information criterion, a lag length of 3 is chosen in estimating the VAR regressions and parameters. Figure 1 presents the impulse response function of real GDP. As shown, real GDP responds positively to a shock to real M2, real government deficits, the real exchange rate, or the lagged real GDP and negatively to a shock to the inflation rate during some of the periods. Therefore, an expansionary monetary policy by increasing the quantity of real money supply would raise real output. An expansionary fiscal policy by increasing the government deficit would increase real GDP. However, the effect lasts

only for one year and vanishes after the first year. It may suggest that an expansionary fiscal policy may not be relied upon to pursue long-term economic growth. It is interesting to note that the depreciation of the bolivar would help raise real GDP. However, there is a lag of one year before the response takes effect. The impact lasts three years and vanishes after the fourth year. The negative response of real output to a shock to the inflation rate implies that the costs of inflation are greater than its benefits. Table 1 presents the same impulse response function of real GDP in numerical values.

Table 2 reports the variance decomposition function of real GDP. Each figure represents the percent of the variation in real GDP that can be explained by a variable in a year. An analysis of the results indicates that RM, DE, EX, PC, and the lagged Y can explain up to 39.9%, 24.7%, 35.2%, 24.5%, and 48.3% of output variance, respectively. Hence, we may rank relative influence in order as the lagged output, real M2, the real exchange rate, government deficit, and the inflation rate. Impacts of real government deficit and the inflation rate are short-term and last only for one year, whereas real M2, the real exchange rate, and the lagged output have impacts lasting at least three years.

V. SUMMARY AND CONCLUSIONS

This study has applied the IS-LM theory and the VAR model to examine how real output would respond to a shock to a major macroeconomic variable. Empirical results can be summarized as follows. Real output has a significant positive response to a shock to real M2, government deficit, the real exchange rate, and the lagged real output and has a significant negative response to a shock to the inflation rate during some of the time periods. However, the duration of some responses varies. The response of real output to government deficit or the inflation rate lasts just one year whereas the response of real GDP to each of the other three variables lasts at least three years. In the first year, the lagged output, government deficit and the inflation rate, in that order, are more influential as they can explain a greater percentage of output variance. In the long run, real M2 and the exchange rate are more influential.

There are several policy implications. First, the government of Venezuela may need to note that deficit-financed government spending may not have long-term impacts as government officials would expect. Therefore, the government needs to rely upon other programs or measures to enhance long-term economic growth. Second, although an increase in the inflation rate would reduce the level of the real interest rate and stimulate investment activities, it seems that the costs of inflation outweigh the benefits. Hence, the government needs to pursue price stability and contain inflation so that the value of the bolivar can be maintained. Third, according to empirical outcomes, it seems that the depreciation of the bolivar would be expansionary. However, the currency depreciation should be gradual and smooth in order to reduce large fluctuations that would be harmful to some of the sectors in the economy.

There may be areas for future research. If the data is available, stock market performance may be included as an additional endogenous variable in order to consider the wealth effect on household consumption spending and Tobin's q theory for firms'

decision to increase investment spending. Different definitions of the quantity of money may be considered to determine which monetary aggregate would yield a better impulse-response relationship for real output. We may consider a model which could treat the interest rate as a monetary policy instrument.

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APPENDIX

Figure 1
Impulse Response Function of Real GDP

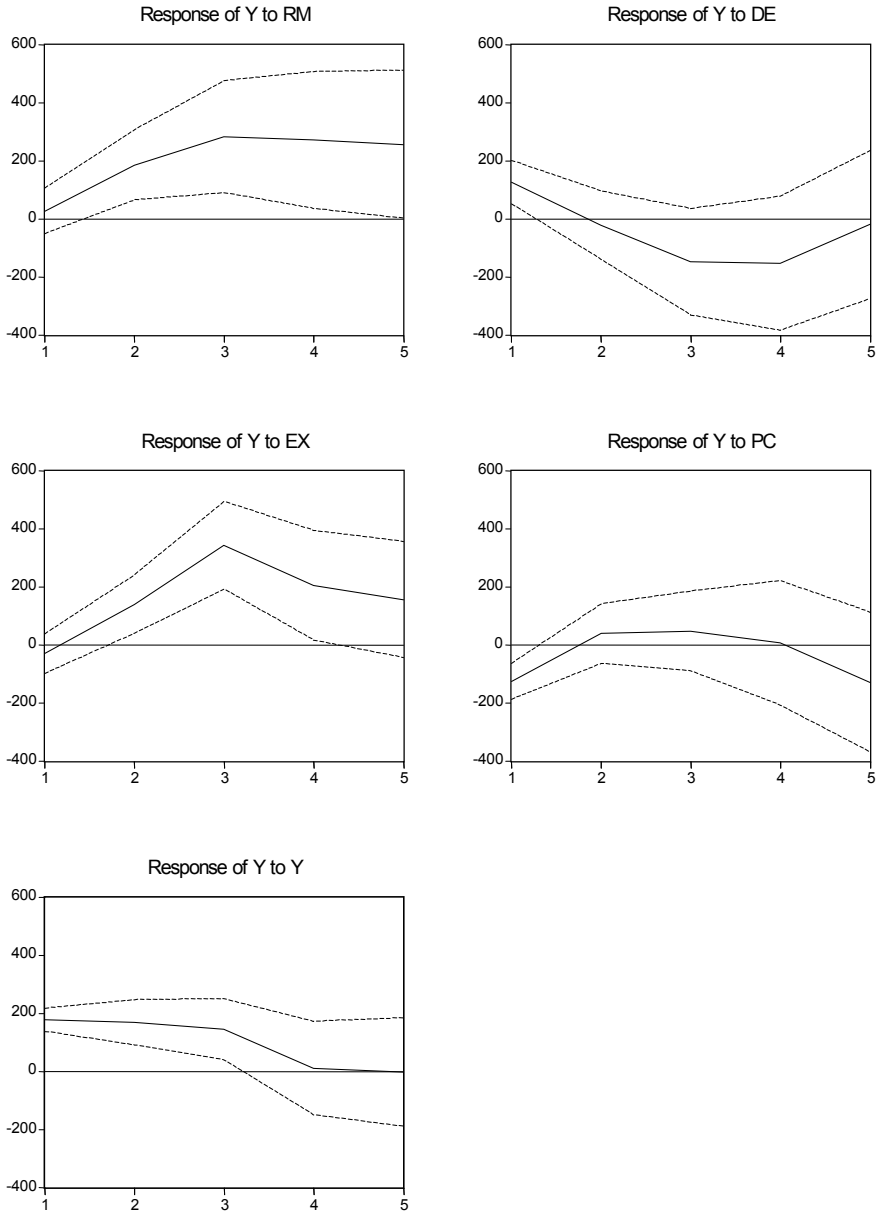

Table 1
Impulse Response Function of Real GDP

Period	RM	DE	EX	PC	Y
1	27.175	126.710	-30.121	-126.185	177.284
	(39.720)	(37.052)	(34.147)	(30.996)	(19.578)
2	185.009	-22.710	139.769	38.329	167.903
	(60.341)	(58.988)	(50.287)	(51.019)	(39.050)
3	283.313	-148.273	342.466	46.860	144.118
	(96.483)	(91.992)	(75.296)	(68.672)	(52.727)
4	271.224	-154.300	204.644	6.397	10.6867
	(117.853)	(115.384)	(94.141)	(107.156)	(80.587)
5	255.775	-19.501	155.906	-129.795	-3.232
	(127.623)	(127.902)	(100.2)	(120.418)	(93.573)

Cholesky Ordering: RM DE EX PC Y
Standard Errors: Analytic

Table 2
Variance Decomposition of Real GDP

Period	S.E.	RM	DE	EX	PC	Y
1	311.914	1.135	24.680	1.395	24.476	48.314
2	566.147	23.469	11.122	13.721	11.673	40.016
3	695.616	29.434	9.848	35.180	5.003	20.535
4	800.521	35.561	11.747	33.830	3.697	15.164
5	918.730	39.854	9.837	31.968	5.718	12.623

Cholesky Ordering: RM DE EX PC Y