

Twin Deficits

An empirical analysis on the relationship between budget deficits and trade deficits in Argentina

Brian Ng
The College of New Jersey

Abstract: The majority of existing literature on the twin deficits hypothesis focuses on its effects in economies already well developed. The theory suggests that there is a causal relationship between the budget deficit and trade deficit of a nation, a claim often debated in the economic community. This paper attempts to supplement existing literature by examining the causal relationship between budget deficit and trade deficit for a nation whose economy is earlier on the developmental timeline. Using data for Argentina from 1976:Q1 through 2010:Q3, the relationship is investigated in the framework of Granger's test for causality.

I. Introduction

As governments and societies grow, it becomes necessary to taken on a certain amount of debt to spur growth in the economy. The problem in doing so lies in maintaining control over these deficits and being able to use them to aid growth instead of letting them become idle liabilities the government must take care of. The two deficits that are the most crucial to understand are the budget and trade deficits.

Though there is plenty of evidence to support the relationship between both the budget and trade deficits, there is no consensus as to the directionality of the relationship between the two. Most of the previous investigations into this relationship have focused on developed nations like the United States and its trading countries and have produced a mixed bag of results. Not many have attempted to analyze empirically the deficit relationships in developing countries, where the results of an analysis are more crucial and are more likely to have implications that can affect budgetary policy. Additionally, the type testing done for each country is not standardized, making it difficult to compare the usefulness of one test to another in determining the success of the Twin Deficits Theory. Furthermore, analysis of some countries seems confirm alternative theories, (i.e. Ricardian Equivalence Hypothesis) or even causality in the direction opposite that which Twin Deficits Theory suggests. That is to say, causality runs from trade deficit to budget deficit instead.

The purpose of this paper is to empirically examine the causal relationship between trade and budget deficits for Argentina. The remainder of this paper will proceed as follows. In the following section, there will be a review of literature on budget and trade deficit and

the causal relationship between them. The third section will outline the methodology behind the testing. The fourth section will detail the empirical results and derive a conclusion according to the empirical findings. Lastly, Section V will outline possible future research opportunities.

II. Literature Review

Most of the analyses of these two deficits have tests in one of few frameworks. The first is that budget deficit has a considerable impact on current account deficits. This is the Twin Deficits Theory. Smith and Hsing (1995) tested this and came to the conclusion that trade deficits are caused by budget deficits because increasing the budget deficit increases interest rates. This in turn increases the currency exchange rate, which enlarges the trade deficit.

The alternative to this is the Ricardian Equivalence Hypothesis. When applied to budget deficits (Barro 1989) this hypothesis argues that movement between taxes and budget deficits have no affect on the real interest rate or the current account balance. In other words, there is no relationship between the two deficits.

Finally, most closely related to this paper is the argument that claims there is causality between the two deficits, but that it is directional and runs from current account deficit to budget deficit. This argument is most important to this paper because it is this theory that has been tested specifically in Brazil, a country that resides in the same region as Argentina and therefore can be used to in testing Argentina. The analysis of Brazil's twin deficits is in an article written by M. Fazul Islam. He wrote an empirical analysis of Brazil's

twin deficits from 1973:Q1 to 1991:Q4 to determine the direction of causality between the budget and trade deficits. Framed around the Granger Causality test, the analysis determined causality between trade deficits and budget deficits was bilateral. (Islam 1998) There are, however, several other relevant tests performed with developing nations with interesting conclusions.

Khalid and Guan (1999) tested a combination of developing countries by using cointegration. The study tested Egypt, India, Indonesia, Mexico, and Pakistan, using data from 1955 to 1993, and found a higher correlation for these developing nations compared to the developed nations they also tested. (Australia, Canada, England, France, and the United States)

In 2000, Alkswani analyzed the same relationship in Saudi Arabia, using annual time series data from 1970 – 1999. Using cointegration regression and an error correction model he determined there was a long-run relationship between trade deficit and budget deficit, causality from the former to the latter.

Kulkarni and Erickson (2001) tested for empirical evidence of a correlation between trade deficit and budget deficit. Revisiting the cases of India, Mexico, and Pakistan, they came to conclusions for each nation that differed from what Khalid and Guan found just two years prior. These countries had been selected according to similarities between them. In the time period tested (1969 – 1996) “[they were] all developing countries, all have adopted a continuously expansionary fiscal policy in the period under study, and all have experienced trade deficits of different magnitude in this time period.” In India, they concluded there was strong supportive evidence for the Twin Deficits hypothesis. In Mexico, there was no

evidence of causality running either to or from trade deficit to budget deficit at all. As for Pakistan, evidence suggested a causal relationship where trade deficits affect budget deficits. They conclude that “[with] three country cases showing different evidences, the twin deficit idea has little or no value in this time period.”

Another pair of researchers performed a test for Turkey similar to the test that was performed by Alkswani for Saudi Arabia. Utilizing data from years 1987 – 2001, Akbostanci and Tunc (2002) also tested using cointegration and included an error correction model. Upon completion of their testing, they determined that the Twin Deficits Theory holds. That is to say, that budget deficit has a considerable impact on current account deficits.

In 2003, Saleh performed a study for Lebanon. Testing within the unrestricted error correction model (UECM) framework, he used a bounds test to establish whether or not the Lebanese trade and budget deficits were cointegrated. The author concluded that there was a weak unidirectional linkage between trade deficit and budget deficit and that the direction of said causality is to the budget deficit from the trade deficit. He goes on to say that the “‘twin deficit problem’ can be managed effectively if the economic environment is conducive to sustain growth, i.e., stable social and political environment and sound supply and demand side policies.”

Kouassi, Mougoue, and Kymn (2004) performed tests on both developed and developing nations using Granger causality tests and came to two distinct conclusions. It is only for a handful of the developing nations tested that the Granger causality tests are conclusive. Israel has unidirectional causality from budget deficits to current account deficits. Korea’s unidirectional causality runs in the other direction, from current account

deficits to budget deficits and a “feedback relation” between the deficits for Thailand. All other developing nations that were sampled lacked evidence conclusive enough to determine a causal relationship between the deficits. As for the developed nations that were tested, “the evidence for any causal link between BD and CAD is less convincing...[the] lone exception is Italy where causality runs uni-directionally from CAD to BD.” Kouassi et al. conclude that the findings for the developing countries “tends to suggest that economies that are relatively more open and in which trade plays a relatively more important role are probably more likely to have their domestic developments dictated by the foreign balance to a certain extent.

Most, if not all, of the literature reviewed has made abundantly clear that it is difficult to fully confirm or disprove the Twin Deficit Theory. If one thing is certain, it is the fact that in order to further our understanding of how these two deficits relate to each other, it must be done on a case by case basis, taking into account how the policies enacted in each nation could skew the results.

Daniel G Arce M. (1999) wrote of interpreting budget deficits in Latin America with application specifically to Argentina. His investigation revolves around understanding the inflation endogeneity of the budget in Argentina from 1970 to 1990. This can then serve as a guideline for how to interpret the budget deficit when the causality of the deficits is tested.

Daniel G et al. suggest that the Latin American deficits can be interpreted three ways:

First, there is the conventional wisdom that populism and special interest pressure are the underlying forces that perpetuate fiscal imbalance. A second interpretation contends that, while populism plays a small role, the true source of Latin American deficits is the failure of developmentalist policies during the 1970s to generate long term growth. A third view is that

budget deficit is primarily due to structural causes – deficits are overly sensitive to business cycles and external shocks, and this produces movements in the budget that are out of the government’s control. The proper interpretation of budget deficits is important because fiscal adjustment is often the centerpiece of stabilization policy.

There are three key conclusions the author draws from his testing that he suggests need to be taken into considering when interpreting the Argentinian budget deficit. First, there is a significant amount of inflation endogeneity that is within the budget. As a result, the discretionary deficit is much smaller than previously estimated, implying that “a significant portion of Latin American deficits are due to structural causes. Second is that Argentinian budget policy is poorly managed. More specifically, that it is not effectively used as a Keynesian “counter-cyclical stabilization device in periods of recession.” His last point addresses how to interpret the Argentinian budget policy, the initial question that was proposed. He states that “[his] findings support the populist interpretation of fiscal policy during the debt crisis years and the developmentalist view for the prior decade.” These conclusions lead the author to believe that “Latin American countries must incorporate their policy targets and sources of budget endogeneity when evaluating fiscal policy.”

III. Data & Methods

The model being used for the study is a vector autoregressive (VAR) model that is based upon a Keynesian Open economy model. In an open economy, gross domestic product, Y , is the sum of private consumption expenditures, C , gross private domestic investment expenditures, I , government expenditures and net exports, NX :

$$Y = C + I + G + NX$$

Additionally, GDP can be alternatively defined as the sum of private consumption expenditures, C, private domestic savings, S, and taxes, T:

$$Y = C + S + T.$$

Combining the two equations we get:

$$C + I + G + NX = C + S + T.$$

This can subsequently be simplified to show:

$$(S - I) = (G - T) + NX$$

where net private savings ($S - I$) equal public savings ($G - T$) and net exports (NX). This can be further expressed as $S_p + S_{pub} - I = NX$, where S_p is the private saving and S_{pub} is the public saving (or Budget surplus). The final equation proposes domestic savings equal private domestic investment expenditures assuming that there is a balanced fiscal budget ($G - T = 0$) and a balance of trade ($NX = 0$). This model shows there is an implicit relationship between the budget deficit and trade deficit. They move together and in the same direction. However, in the context of an open economy where international financial markets are available for investment, the relationship *may not* necessarily exist, even if it exists, they may not move together and in the same direction. This model is the basis for attempting to understand the relationship between these twin deficits and how they may affect each other. (Islam 1998)

The proposed analysis uses trade deficit data and budget deficit data in order to determine if there is directional causality between the two. The data used in this study are national accounts data for the country of Argentina and have been retrieved solely from the

International Monetary Fund (IMF). They are quarterly observations that begin in quarter one of 1976 all the way through to quarter three of 2010 and have been expressed in millions of US dollars. Trade deficit data was taken directly from the IMF database. Budget deficit data, however, was not directly available for the country. As a result, budget deficit data was supplemented by available Financial Accounts N.I.E. data. Financial Accounts N.I.E. data was supplemented because it provided the most apt reflection of the budget balance of the country among all the data available for Argentina. It is an apt reflection because this data does “not include exceptional financing.” As defined by the IMF, said exceptional financing includes “debt forgiveness, debt-for-equity swaps, and other types of transactions related to debt reorganizations,” which are typically related to transactions associated with the IMF itself. An additional independent variable was necessary in order to support whatever relationship might be derived between the two deficits by testing for the cointegration of the deficits. Inflation data, derived from Consumer Price data for the country, was that additional independent variable. One hundred and thirty eight data points were used in the analysis.

Based on previous literature, the method used in this analysis for testing causality was based on the vector autoregressive model defined below:

$$X_{1t} = \beta_0 + \sum \beta_j X_{1t-j} + \sum \alpha_i X_{2t-i} + u_{1t} ,$$

and

$$X_{2t} = \beta_0 + \sum \beta_j X_{1t-j} + \sum \alpha_i X_{2t-i} + u_{2t}$$

More specifically, Granger causality tests within the vector autoregressive model determine whether one variable (X_1) is predictable by the other (X_2) if the inclusion of past

observations of X_2 (lag of X_2) reduces the prediction error of X_1 and X_2 , as compared to a model which includes only previous observations of X_1 . (Seth 2009)

The Durbin-Watson test was used to detect the presence of autocorrelation. If autocorrelation was present, it would violate the ordinary least squares (OLS) assumption that the error terms are uncorrelated. This would make the results of the Granger causality test insignificant because the test uses a vector autoregressive model that is dependent on OLS assumptions. The Durbin-Watson test was set up in the following manner:

$$d = \frac{\sum_{t=2}^T (e_t - e_{t-1})^2}{\sum_{t=1}^T e_t^2},$$

Where e_t is the residual associated with time t and T is the number of observations.

A Dickey-Fuller test was used to determine the stationarity of the data used in the analysis. i.e. whether or not there is a unit root present in the data. If a unit root is present, the data is non-stationary, meaning that the data is integrated and changes in values over the time series occur. The Dickey-Fuller Test was set up in the following manner:

$$\nabla y_t = (\rho - 1)y_{t-1} + u_t = \delta y_{t-1} + u_t$$

Where ∇ is the first difference operator and $\delta = \rho - 1$, the null hypothesis is that the data is not stationary and a unit root exists ($H_0: \delta = 0$), and the alternative hypothesis is that the data are stationary ($H_a: \delta < 0$). The model was estimated and tested for a unit root, the equivalent of testing $\delta = 0$. Since the test was conducted over the difference term instead of the raw data, standard t-distribution could not be used to provide critical values. Rather, this test is simply known as the Dickey-Fuller statistic and is denoted by Tau (τ).

The Chow test tests against a model in which the pooled data are not interactive to determine the presence of a structural break in the data. If a structural break is present, it will throw off the analysis of the data because there is a recognizable change in the mean of the data at a point in time. The implications of its presence would mean that if the data was broken down into subintervals, there would be better modeling than the combined regression over the entire data series.

IV. Results

For the regressions that tested for Granger Causality, two different models were tested. First Granger causality was tested to determine if Budget Deficit could be used to accurately predict Trade Deficit (Test 1, Table 1). The second model was to test if Granger causality existed in the reverse direction, i.e. if Trade Deficit was Granger-causal to Budget Deficit. (Test 2, Table 1.) The results of the Test 1 concluded that $\chi^2 = 0.64$, with $p = 0.4220$. Test 2 determined that $\chi^2 = 0.93$, with $p = 0.3338$. Therefore, it can be concluded that at a 5% significance level, there is no causal relationship between trade and budget deficit in either direction of the relationship.

The Durbin-Watson test for autocorrelation used Yule-Walker estimates for the ARIMA (1,0) model and resulted in a d value where $d = 2.4687$. Consequently, there is no serial correlation in the data. (Table 2)

The findings of the Dickey-Fuller test are presented in Table 3. It determined that budget balance data was always stationary at a 5% significance level. Trade balance data,

however, was determined to always be non-stationary at a 5% significance level. Thus the estimated relationship between these two variables is suspect.

Additionally, Chow tests for structural change in the data are displayed in Table 4. The null hypothesis for the Chow test is that there is no structural break in the regression model (VAR) model relationship between the variables Trade Balance and the Budget Balance, its alternative is that there exist structural breaks. The results of the Chow test are shown in Table 4. It shows that show that at a 5% significance level, there is reason to reject the null hypothesis, affirming that there is a general structural break among the relationship between these two variables. The model was tested at data points 20, 28 and 30. These point breaks correspond with data at Q4 1980, Q4 1982, and Q2 1983.

Because of the existence of such structural breaks it is difficult to estimate the causality relationship between these two variables. It suggests that further and better modeling would be necessary. Possibly, the data was broken down into several subintervals instead of combined regression.

V. Conclusions

The analysis was done between quarter one of 1976 to quarter three of 2010 to determine if there was a causal relationship between budget deficit and trade deficit in Argentina. Other tests were conducted to determine the presence of autocorrelation, if the data was stationary, and if there are structural breaks in the data.

Testing showed that the relationship between the two data sets were not Granger-causal in either direction, denoting one value could not be used as a predictor for the other.

To confirm this result, it was determined that there was no serial correlation in the data. The budget balance data was found to be stationary; however, trade balance data was not stationary. According to Chow test results, there is reason to believe that there is a model that better fits the data than a combined regression analysis.

To finalize, there was no determinable Granger-causal relationship between budget data and trade deficit data. There are implications that signal further study is necessary to confirm the conclusion due to the imperfect nature of the data used and that there is evidence that a better fitting model can be made.

VI. Appendix

Table 1 Granger-Causality Wald Test

Test	DF	Chi-Square	Pr > ChiSq
1	1	0.64	0.4220
2	1	0.93	0.3338
Test 1: Group 1 Variables : Budget Balance Group 2 Variables : Trade Balance			
Test 2: Group 1 Variables: Trade Balance Group 2 Variables: Budget Balance			

Table 2 Yule-Walker Estimates of the Autoregressive Model

SSE	110147520	DFE	134
MSE	821996	Root MSE	906.64018
SBC	2287.95424	AIC	2276.24522

MAE	643.387908	AICC	2276.54597
MAPE	154.687919	Regress R-Square	0.0070
Durbin-Watson	2.4687	Total R-Square	0.7311

Table 3 Dickey-Fuller Unit Root Tests

Variable	Type	Rho	Pr < Rho	Tau	Pr < Tau
Budget Balance	Zero Mean	-406.73	0.0001	-14.16	<.0001
	Single Mean	-406.73	0.0001	-14.10	<.0001
	Trend	-406.73	0.0001	-14.05	<.0001
Trade Balance	Zero Mean	-3.52	0.1961	-1.02	0.2752
	Single Mean	-7.83	0.2191	-1.77	0.3949
	Trend	-15.21	0.1625	-2.68	0.2474

Table 4 Chow Test for Structural Change

Point Break	Numerator DF	Denominator DF	F Value	Probability < F
22	3	132	3.03	0.03160
28	3	132	3.92	0.0101
30	3	132	3.97	0.0096

VII. References

- Arce M., Daniel G. "Interpreting Budget Deficits in Latin America: Methods with Application to Argentina." *Cambridge Journal of Economics* 23.1 (1999): 21-32. Print.
- Akbostanci, E., and Tunc. "Turkish Twin Deficits: An Error Correction Model of Trade Balance." *ERC Working Paper no: 01/06*, 2002.
- Alkswani, M. A. "The Twin Deficits Phenomenon in Petroleum Economy: Evidence from Saudi Arabia." Paper presented at the *Seventh Annual Conference, Economic Research Forum (ERF)*, Amman, Jordan, 2000.
- Barro, Robert J. "The Ricardian Approach to Budget Deficits." *Journal of Economic Perspectives* 3 (1989): 37-54.
- Islam, M. F. "Brazil's Twin Deficits: An Empirical Examination." *Atlantic Economic Journal* 26, no. 2 (1998): 121-28.
- Fleegler, Ethan. "Duke University | Economics: Symposium Edition 2006." *Duke University | Economics: Home*. 2006. Web. 29 Sept. 2010. <<http://econ.duke.edu/dje/symposium-edition-2006>>.
- Khalid, A. M., and W. G. Teo. "Causality Tests of Budget and Current Account Deficits: Cross-Country Comparisons." *Empirical Economics* 24 (1999): 389-402.
- Kouassi, Eugene, Mbodja Mougou, and Kern O. Kymn. "Causality Tests of the Relationship between the Twin Deficits." *Empirical Economics* 29.3 (2004). Print.
- Kulkarni, Kishore, and Erick Erickson. "Twin Deficits Revisited: Evidence from India, Pakistan, and Mexico." *The Journal of Applied Business Research* 17.2 (2001). Print.
- Latif-Zaman, Nazma. "The Budget Deficit and Trade Deficit: Insights into This Relationship." *JSTOR*. Oct. 1990. Web. 26 Sept. 2010. <<http://www.jstor.org/stable/40325309>>.

Saleh, Ali Salman. "Long-run Linkage between Budget Deficit and Trade Deficit in Lebanon: Results from UECM and Bounds Tests." *IJUM Journal of Economics and Management* 14.1 (2006) 29-48.

Seth, Anil. "A MATLAB toolbox for Granger causal connectivity analysis." *Journal of Neuroscience Methods* 186 (2009): 263. Elsevier. Web. 24 Sept. 2010.

Smyth, D., and Y. Hsing. "In Search of an Optimal Debt Ratio for Economic Growth." *Contemporary Economic Policy* 13, no. 4 (1995): 51-9.