

Budget Deficit and Macroeconomics Fundamentals: The case of Azerbaijan

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Abstract

In recent years, the emergence of rising budget deficit is the main reason forcing economists to investigate the reasons for changes in fiscal balances. The purpose of the paper is to investigate the relationship between budget deficit and macroeconomic fundamentals using data from Azerbaijan. The empirical analysis applies ARDL Cointegration methodology in conjunction with Granger causality tests to provide evidence for both the long and short run dynamics between the variables involved in the analysis. Using the Error Correction specification, there was found evidence of long-run causality running from current account, real interest rate, GDP, inflation and exchange rate to budget deficit. There was also found evidence of short-run Granger causal effects running from current account and real interest rate towards budget deficit and a rather weak causal effect from inflation to budget deficit. However, there is no short – run causality running from interest rate to budget deficit.

Key words: Budget deficit, Fiscal policy, Cointegration methodology, Error correction model

JEL classification: E62, H62, C22

1. Introduction

Azerbaijan became an independent state in October 1991, following the dissolution of the USSR. The Azeri economy, geared to the demands of the Soviet GOSPLAN (*the state planning commission of the former Soviet Union or any of its constituent republics: it was responsible for coordination and development of the economy, social services, etc*) and part of CMEA (*Council for Mutual Economic Assistance*), faced external shocks with the demise of these structures, and by the onset of regional conflict over Nagorno – Karabakh. The break-up of trading links and payment mechanisms within the CMEA bloc, and more particularly within the Soviet Union was exacerbated by the deterioration in terms of trade for Azerbaijan as the formerly planned economies began to move towards transition at different speeds and with different rates of price adjustment. The start of the stabilization process was possible following the cessation of conflict Garabag in 1994. During this year

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a 30-year contract was signed between the State Oil Company of Azerbaijan Republic (SOCAR) and 13 oil companies, among them Amoco, BP, ExxonMobil, Lukoil.

In 1995, the Azeri authorities undertook an IMF-backed stabilisation plan. Both monetary and fiscal policies were tightened. These led to a sharp reduction in domestic inflation to 84,5 per cent in 1995 and to 4 per cent in 1997. Azerbaijan's high economic growth during 2006-08 was attributable to large and growing oil exports. GDP grew 41.7% in the first quarter of 2007, possibly the highest of any nation worldwide. Such rates cannot be sustained, however, despite reaching 26.4% in 2005, and over 36.6% (world highest) in 2006, they dropped to 11.6% in 2008. In 2009, economic growth dropped back to around 3% as oil prices moderated and growth in the construction sector cooled. The current global economic slowdown presents some challenges for the Azerbaijani economy as oil prices remain below their recent highs in mid-2008, highlighting Azerbaijan's reliance on energy exports and the ongoing difficulty diversifying its economy. In 2009, the government increasingly relied on financial transfers from the State Oil Fund to bridge its budget shortfalls. It should also be noted that besides important oil reserves Azerbaijan also has significant agronomic potential based on a wide variety of climatic zones.

On 18 June 2010, Azerbaijan's parliament, the Milli Majlis, has passed a bill amending the 2010 state budget. The amendments increase the revenue side of the budget by AZN 1.49bn (\$1.855bn), bringing total revenue to AZN 11.505bn (\$14.322bn). Expenditure is increased by AZN 1.11bn (\$1.259bn), bringing it to AZN 12.275bn (\$15.281bn). The increased revenue will be met by increased contributions from the State Oil Fund, which will go up by AZN 1bn to AZN 5.915bn, and from the Ministry of Taxes, which will contribute an additional AZN 490m, taking their total contribution to AZN 4.47bn. The amendments mean a reduction in the budget deficit from AZN 1.249bn to AZN 770.3m, or from 3.9% of GDP to 2.3%.

The main question is why such a country emerging as an important exporter of oil and natural gas and as a transport corridor between Europe and central Asia has budget deficit. Are fiscal deficits explained by a set of economic variables or do political factors bias fiscal policy towards deficit spending? In particular, do political systems and institutions have an inherent bias towards fiscal deficits or are these the result of the decisions of policymakers?

2. Theoretical Underpinnings

Theories of budget deficits run in two general directions. Some theories look on the effect of fiscal deficits on economic variables. Others look on the reverse direction, that is, what macroeconomic and fiscal variables (including budget rules and institutions) affect and determine fiscal deficits. This section gives a brief review of the theories of both –the effect of fiscal deficit on economic variables and the effect of macroeconomic variables on fiscal deficit.

2.1 Effect of Persistent Deficits on the Economy

How do persistent budget deficits and large government debt affect the economy?

Macroeconomic theory has divergent hypotheses regarding the implications of government deficits and debt on the economy. One strand of the literature contends that government debt reduces national saving which, in turn, crowds out capital accumulation. Thus, government debt hinders economic growth. Another strand of the literature implies the opposite: public debt does not influence national saving or capital accumulation. This view is based on the Ricardian equivalence theorem which asserts that it is only the quantity of government purchases, not whether such purchases are financed through between taxation or borrowing, which affects the economy. This implies that economic agents are indifferent between governments borrowing now or to a tax increase in the future. It has been shown empirically that this is not the case in the real world. In addition, when the permanent income hypothesis and the effect on consumption are considered, the Ricardian equivalence may not hold.

Barro's tax-smoothing theory states that what determines the deficit is the desire of the government to minimize distortions associated with raising taxes. The model implies that deficits and surpluses arise when the ratio of government purchases to output is expected to change. War and recession are times when the expected future ratio of government purchases to output is less than the current ratio. Consistent with the tax smoothing model, it has been observed that governments usually run deficits during these times. This implies that when national income is low, or government purchases are large, governments run deficits.

Roubini and Sachs (1988) find only partial evidence to support tax-smoothing, wherein tax rates are set over time to minimize the excess burden of taxation. They found a tendency for larger deficits in countries characterized by a short average tenure of government, the presence of many political parties in a ruling coalition and higher tax collection cost.

2.2 Effect of Macroeconomic Variables on Fiscal Balance

Inflation may affect budget deficits through various ways. The first way is through real tax revenues - inflationary conditions reduce the real tax revenues collected by government, thus, pushing towards budget deficits. The second way is via the effect on nominal interest rates. Inflation increases the nominal interest rates and consequently debt servicing, thus increasing the budget deficit. With these two factors in mind, it may be expected that inflation negatively affects fiscal balances.

However, inflation may positively affect fiscal stance by raising revenues via income tax 'bracket creep.' The US experience in the late 1970s was high federal tax receipts as a percentage of GDP in the face of high inflation rates (of approximately 10%). The explanation given by Saez (1999) and Auerbach (2000) was that the US income tax system at the time was not indexed for inflation (i.e. fixed in nominal terms), resulting in taxpayers near the top-end of a bracket to creep to the next bracket even if real income remained

the same. Furthermore, if the tax system is designed to be elastic to changes in economic activity, it may be possible to have increased revenues with a boom and thus a positive influence on fiscal balance.

Easterly and Schmidt-Hebbel (1994) estimated the relationship between inflation and fiscal deficits. Across countries, the decision to print money to finance deficits (i.e. seignorage) would depend on the extent to which other means of financing are available. In their cross section estimation, they found no simple relationship between fiscal deficits leading to inflation. For case studies using time series data, revenue-maximizing inflation rates seem to rise with actual average inflation. In addition, money demand and inflation are nonlinearly related. It was found that money demand has decreasing semi-elasticity with respect to inflation. This implies that as inflation rises, money demand becomes less semi-elastic. They concluded that seignorage is unimportant as a steady state phenomenon, but it can be important as a temporary source of revenue in times of crisis. Furthermore, large surges of money creation are not closely linked to accelerated inflation. Though Easterly and Schmidt-Hebbel (1994) looked at how budget deficits affect inflation via seignorage, the opposite direction of this study, it is evident that the relationship of inflation and fiscal stance is not a simple one. The effect of inflation may be through various routes, thus making the actual relationship dependent on empirical evidence.

The level of development of the **financial market** is also believed to be related to fiscal performance. A more developed financial market would have more readily available forms of money to buy goods and services without incurring costs. The World Bank suggests that a more developed financial sector has increased flexibility in adjusting to macroeconomic shocks to prevent banking or financial crises. A measure of financial depth used by the World Bank is the ratio of liquid liabilities (i.e. broad money or M3) to GDP.

Another aspect of a financially deep economy is the link between banking openness and economic growth. Bayraktar and Wang (2006) found empirical evidence that banking sector openness may directly affect growth by improving the access to financial services and indirectly by improving the efficiency of financial intermediaries, both of which reduce the cost of financing and in turn, stimulate capital accumulation. Increased investments lead to economic growth and an improved fiscal performance, implying a positive relationship.

The literature on financial openness has also hinted at a positive relationship between financial depth and fiscal balance. Financial repression, as indicated by a less liquid banking sector, is practised by government either to finance its budget deficits or to direct its access of cheap credit to select industries, or both. Restrictive financial policy can be implemented in various ways: (1) imposing high nominal interest rate ceilings; (2) money creation (i.e. seignorage); and (3) imposing high reserve requirements. Denizer, Desai and Gueorguiev (1998) found evidence that the post-Communist governments in their study inhibit the development of financial institutions to ensure adequate flows of external capital to enterprise sectors rather than to finance deficits.

Other empirical evidence, however, has shown a negative relationship between fiscal deficit and financial market development. Woo (2001) examined the effect of financial depth on consolidated public sector deficit in developing countries. He found that an increase in

financial depth is negatively associated with fiscal stance. He explained that a more liquid banking system can more easily finance fiscal deficits by issuing bonds without having to resort to inflationary finance. Aizenman and Noy (2003) found similar evidence that a budget surplus has a negative impact on financial openness for developing countries. That is, a bigger budget deficit will increase *de facto* financial openness. This was explained by evidence that developing economy engage in procyclical, rather than counter-cyclical, policy. In developing economies, financial crises tend to lead to recessions that in turn result in lower budget deficits because government reduces its spending. In addition, if the tax system is relatively inelastic to economic activity, an economic recession would lead to relatively higher tax revenues.

Turning to the open economy, most of the literature and studies about fiscal deficits and **exchange rates** have used fiscal stance as the independent variable. Easterly and Schimdt-Hebbel (1994) found robust relationships between the fiscal deficit, the trade deficit, and the real exchange rate. The fiscal deficit and the real exchange rate have a two-step relationship: the fiscal deficit and other determinants of investment and saving behaviour determine the external deficit, which then determines the real exchange rate consistent with clearing of the domestic goods market.

Long-term interest rate. A high interest rate worsens the overall budget balance via increasing interest expenditure on newly issued debt and on rolling debt. On the other hand, higher interest rates signal higher opportunity costs of bond market financing, possibly urging governments to improve the fiscal balance. Overall, however, the first effect is expected to dominate, thus producing a negative correlation between interest rates and budget balances.

An alternative measure could be interest expenditures as a percentage of GDP, on the ground that effects of high interest rates on fiscal policies depend on the prevailing debt level (e.g. Volkerink and De Haan, 2001 and Eschenbach and Schuknecht, 2002).

Short-term interest rate. In setting fiscal policy, the monetary policy stance may be an argument. The expected reaction, however, is ambiguous. High short-term interest rates to reduce inflationary pressures could be supported by fiscal policy or it could be countered, depending on policy preferences, views on the operation of the economy, and the allocation of tasks among policymakers. Modelling monetary policy by an interest rate, moreover, may capture other elements such as the cost of government financing, as described above when discussing long-term interest rates. This may be of particular importance in case of predominantly short-term financing or in case there is a strong link between short-term and long-term interest rates.

3. Methodological Issues

3.1 Concept of Stationarity

A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance between the two time periods and not on the actual time at which the covariance

is computed (Gujarati, 2003). When time series data are not stationary and are used in an econometric equation, there is the problem of spurious regression, which leads to unreliable results. In order to avoid this problem, it is necessary to investigate the time series data for their stationary properties.

The ADF test consists of estimating the following regression:

$$\Delta y_i = \beta_1 + \delta y_{i-1} + \sum_{j=1}^{p-1} a_j \Delta y_{i-j} + u_i \quad (3.1)$$

Where u_i is a pure white noise error term, $\Delta y_{i-1} = y_{i-1} - y_{i-2}$, and p is the class of autoregression. We test whether $\delta = 0$ (null hypothesis).

The ADF test with trend variable consists of estimating the following regression

$$\Delta y_i = \beta_1 + \beta_2 t + \delta y_{i-1} + \sum_{j=1}^{p-1} a_j \Delta y_{i-j} + u_i \quad (3.2)$$

Where t is the time or trend variable. The null hypothesis is $\delta = 0$ and if it is rejected, y_i is stationary around a deterministic trend.

The ADF test statistic is a modified t statistic. It has developed by Dickey and Fuller in cases where serial correlation exists and is conducted by adding the lagged values of the dependent variable Δy_i . The ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used. The power of the test to reject the null hypothesis decreases when the number of lags is increased. The rejection of the null hypothesis entails that the examined variable is stationary (Gujarati, 2003).

The testing procedure requires the estimation of the testing model and computes the t -value for the estimated coefficient β . Then we compare the calculated t ratio with the critical value τ from the Dickey - Fuller tables. If $t > \tau$, then the null hypothesis is rejected. If $t < \tau$, then the null hypothesis is accepted. In case the variables are found to be non-stationary we repeat the test using as depended variable the second difference $\Delta^2 y_{i-1}$ and so on, till we come to a stationary transformation of the original variable (Lazaridis, 2005).

3.2 The Concept of Cointegration

Many economic time series tend to change over time. However, this change may occur in: a) a stable or predictable way, in which case the mean and variance will be well defined, or b) in an unstable way, entailing that the mean and the variance will change over time. Unstable or non-stationary series can often be made stable or stationary if differentiated (d) one or more times, and are called integrated series of order d , $[I(d)]$. Cointegration extends the univariate concept of integration to two or more series. Even in the case of two non-stationary variables, if a linear transformation of the variables is stationary, they are said to be cointegrated (more than two variables can generate more than one cointegrating vector). If cointegration is detected, the cointegrating equation defines the long-run relationship of the variables, but also, an error-correction model will exist to define both the short-run and long run behaviour of the variables.

If a long-run equilibrium relationship exists for a set of variables X , then it must be true that a cointegrating vector γ can be defined such that $Z_t = X_t\gamma \sim I(0)$.

That is, Z_t (the error term) is white noise representing random disturbances from a long-run equilibrium position; with the system again adjusting to the equilibrium. A direct test proposed for cointegration by Engle and Granger (1987) consists of a two-stage approach. First, each variable series is tested for stationary. In case the variables are found non stationary of the same order of integration, we proceed with the second stage. Next, the cointegrating vector is formed and then a test, that the errors (Z_t) are integrated of order zero, is performed. The Engle-Granger procedure has an advantage in the application of the least squares to identify and estimate a cointegrating vector. On the other hand, it has the disadvantage that it is efficient only for two variables. However, the Dickey-Fuller statistic used in testing has low power in distinguishing between unit roots and near unit roots. An alternative procedure for cointegration testing is the one of Johansen and Juselius (1990) which is more reliable for multivariate analysis. Nonetheless, large samples are needed for this test. The data are divided into a differentiated part and a levels' part. Under the assumption of $I(1)$ processes, the differentiated data are stationary. The technique of canonical correlations is used to find linear combinations of the data in levels. It is inferred that these linear combinations must be stationary. This procedure has the advantage of being able to identify more than one cointegrating vector. Finally, a relatively new approach used for cointegration testing is the ARDL cointegration - a single equation technique.

3.3 The Autoregressive Distributed Lag (ARDL) Cointegration Approach

The autoregressive distributed lag (ARDL) approach to cointegration, which has been chosen in this paper, is a relatively new technique for detecting possible long-run relationships among economic variables. The ARDL approach is considered to be a more efficient technique in determining cointegrating relationships in small samples, compared to the previously mentioned conventional techniques. An additional advantage of the ARDL approach is that it can be applied irrespective of the regressors' order of integration; therefore, it can be applied regardless of the stationary properties of the variables in the sample, thus allowing for statistical inferences on long-run estimates which are not possible under alternative cointegration techniques. Consequently, we are not concerned whether the applied series are $I(0)$ or $I(1)$.

More particularly, in the first step the following unrestricted error correction (EC) version of the ARDL model is estimated for each of the examined variables:

$$DY_t = \alpha_0 + \sum_{i=1}^p b_i DY_{t-i} + \sum_{i=0}^p c_i DX_{t-i} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + e_t \quad (3.3)$$

Where Y and X are the endogenous variables of the model; and D denotes first difference.

On the basis of equation (3.3), we perform bounds test for the presence of a long-run relationship between the variables. Actually, F-test is applied for the joint null hypothesis that the coefficients on the level variables are jointly equal to zero. According to the

traditional approach and given that the testing statistic displays a non-standard distribution, we would have to take under consideration whether the variables are individually $I(0)$ or $I(1)$, the number of regressors and the existence of an intercept and/or a trend. Instead of the conventional F critical values, we may use two sets of critical value bounds for all classifications of the regressors into purely $I(1)$, purely $I(0)$ or mutually cointegrated. If the test statistic exceeds their respective upper critical values, it may be argued that there is evidence of a long-run equilibrium relationship. If the test statistic falls below the lower critical values, we cannot reject the null hypothesis of no cointegration. Finally, if the test statistic lies between the two bounds, then the test becomes inconclusive (Pesaran and Shin, 1999; Pesaran, et al., 2001).

The conditional long-run models can be extracted from the reduced form solution of equation (3.3), when the first-differenced variables jointly equal zero. The long-run coefficients of the EC models are estimated through the ARDL approach to cointegration and the use of OLS. The lag structure for the ARDL specification of the short-run dynamics, in this thesis, is determined by the Akaike's Information Criterion (AIC), in conjunction with the autocorrelation test. The corresponding EC specification is based on the implied ARDL specification, through a simple linear transformation (Pesaran and Pesaran, 1997).

The ARDL is based on a single-equation estimation method and requires the estimation of a fairly smaller number of parameters. Consequently, in case of small data samples, ARDL is considered a rather more suitable cointegration technique. In addition, the ARDL method avoids the problem of pre-testing for the order of integration of the individual variables which might be of crucial importance. Therefore, after the confirmation of a long run relationship between the variables, the derived from the ARDL analysis Error Correction (EC) model can be used to test for Granger-type causality. An advantage of using an EC specification to test for causality is that, on the one hand, it allows the testing of short-run causality through the lagged differenced explanatory variables and, on the other hand, the testing of long-run causality through the lagged EC term. A significant EC term confirms long-run causality from the explanatory variables to the dependent variable.

4. Data and Empirical Results

4.1 Data

The econometric method that is adopted to examine the relationship among the variables under examination is the ARDL cointegration technique in conjunction with Granger-Causality testing.

The data employed for the empirical analysis are annually covering the period 1992 to 2009 and are collected from the International Financial Statistics Yearbook (2000/2006) and World Bank database. Actually, the following variables are used: i) Interest Rate (we deduct inflation rate and used Real Interest Rate, denoted by RIR.) ii) Exchange Rate, denoted by ER. iii) Gross Domestic Product, denoted by Y iv) Inflation, denoted by P v) Current Account as a percentage of GDP, denoted by CA vi) Budget Deficit as a percentage

of GDP denoted by BD. In this analysis ER and Y are used in logarithmic form and are denoted by LER and LY respectively.

The econometric analysis uses Microfit 4.0 developed by Pesaran and Pesaran (Pesaran and Pesaran, 1997).

4.2 Empirical Results

Before proceeding with the econometric estimations, it is required to investigate the integration properties of the used variables in order to avoid the problem of spurious regression. Consequently, the variables for their stationary properties are examined by means of the conventional Augmented Dickey-Fuller (ADF) test while the optimal ADF specification is determined by means of Akaike Information Criterion (AIC), the Schwarz Bayesian Criterion (SBC). The tests for all the variables in levels (BD, CA, P, LY, RIR and LER) as well as in first differences are presented in Tables 1 and 2. The results suggest that, all variables are non stationary in levels and stationary when tested in first difference form.

Table 1: ADF unit root test in levels

VARIABLE	LEVELS			
	Lag	With Intercept	Lag	With Intercept and Trend
BD	2	-2.4265	1	-1.2686
CA	0	-.94752	0	-1.8424
RIR	3	-2.8892	3	-1.5990
P	3	-2.3197	3	-1.2879
LY	0	-1.7757	0	-3.4704
LER	2	-2.3751	3	-1.5071

Note: 95% critical value for the augmented Dickey-Fuller statistic = -3.1004

Table 2: ADF unit root test in first differences

VARIABLE	FIRST DIFFERENCES			
	Lag	With Intercept	Lag	With Intercept and Trend
DBD	0	-4.9924	0	-5.3422
DCA	3	-6.6876	3	-7.5619
DRIR	2	-5.9034	2	-5.3513
DP	2	-5.0282	2	-4.3578
DLY	0	-5.7253	0	-5.4908
DLER	2	-1.9661	3	-4.1459

Note: 95% critical value for the augmented Dickey-Fuller statistic = -3.7921

Although the results provide evidence that all examined variables are integrated of order one I (1), we should accept this finding with caution given the limited number of available data. Following, the application of the ARDL Cointegration methodology proceeds in order to examine the dynamics of the investigated relationships. It is believed that this methodology is probably the most appropriate for the needs and limitations of the empirical analysis because of the following reasons:

1-While other methods require non-stationary variables of integration order I(1), like the traditional methodology proposed by Johansen, the ARDL method proposed by Pesaran has the advantage to avoid the problem of pre-testing for the order of integration of the individual series.

2-In addition, it is a single equation estimation technique and requires the estimation of a fairly smaller number of parameters compared to the Johansen's method. Consequently, ARDL proves to be more efficient when small data samples are available and thus, this method is adopted for the needs of the given empirical research.

In the first step, we proceed with the examination of the joint integration properties of the series using the ARDL cointegration methodology proposed by Pesaran and Shin (1999). Actually, we estimate the unrestricted error correction (EC) model (3.3) above, with DBD as the dependent variable and one of the other variables each time as independent and apply a F test on the group of the lagged level variables.

The F test results on the group of the lagged level variables are depicted in Table 3, below.

Table 3: Testing the existence of a long run relationship between variables

Dependent / Independent Variable	F-statistic	Intercept	Trend	Conclusion
BD/CA	22.4255	Yes	No	cointegration
BD/RIR	5.8721	Yes	No	Cointegration
BD/LY	8.2234	Yes	Yes	Cointegration
BD/P	5.6730	Yes	No	Cointegration
BD/LER	10.4014	Yes	No	Cointegration

Note: Critical values have been obtained from Pearan & Pesaran and are: 1) with constant 9.934 and 5.764 at the 95% level of significance and 2) with constant and trend 6.606 and 7.423 at the 95% level of significance.

We observe that the value of F-statistic exceeds the upper bound of the critical value bounds in all cases and consequently the tests suggests that there exist long-run equilibrium relationships between the BD and each one of the examined determinants CA, RIR, LY, P and LER with long-run causality running towards BD.

Having confirmed the existence of cointegration among the budget deficit variable and the tested determinants in a bi-variate framework, we proceed with the estimation of the appropriate ARDL models. Among a number of estimated alternative models, the most appropriate are selected according to the Akaike Information Criterion (AIC).

Next, the long-run coefficients from the implied ARDL model are estimated and are depicted in Table 4, below. All the independent variables (CA, RIR, LY, P, LER) bear statistically significant causal impacts on the dependent variable BD, in the long-run time horizon.

Table 4: Estimates of the long-run coefficients based on ARDL model

Estimated Long Run Coefficients using the ARDL Approach
selected based on Akaike Information Criterion.

Dependent variable is BD

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CA	4.2601	1.1607	3.6704[.004]
C	3.9477	1.0817	3.6495[.004]

RIR	-.0085576	.0035478	-2.4121[.031]
C	3.6593	1.6207	2.2578[.042]

LY	-3.5743	2.7225	-1.3128[.214]
C	-3.3194	5.3816	-.61681[.549]
t	1.2010	.79775	1.5055[.158]

P	.0075571	.0033579	2.2506[.042]
C	3.6098	1.6570	2.1785[.048]

ER	-22.2797	7.9950	-2.7867[.015]
C	-23.1119	6.8514	3.3733[.005]

More particularly, we can extract the following long-run econometric relationships:

$$\widehat{BD}_t = 3.947 + 4.2601 CA_t \quad (4.1)$$

$$\widehat{BD}_t = 3.6593 - 0.00856 RIR_t \quad (4.2)$$

$$\widehat{BD}_t = -3.3194 - 3.5743 LY_t \quad (4.3)$$

$$\widehat{BD}_t = 3.6098 - 0.00756 P_t \quad (4.4)$$

$$\widehat{BD}_t = 23.112 - 22.2797 LER_t \quad (4.5)$$

In particular, according to the equations above, an increase in current account by 1%, increases budget deficit by 4.2%, increase in interest rate by 1% decreases budget deficit 0.008%, an increase in GDP by 1%, decreases budget deficit 3.6%, increase in inflation by 1% increases budget deficit 0.007% and increase in exchange rate by 1% decreases budget deficit 22.2%.

The stability of the coefficients of the EC models is tested by means of the CUSUM test. Figures 1, 2, and 3 below, confirm long-run structural stability for the model's coefficients.

Figure 1: Plot of cumulative sum of recursive residuals for BD on CA and RIR

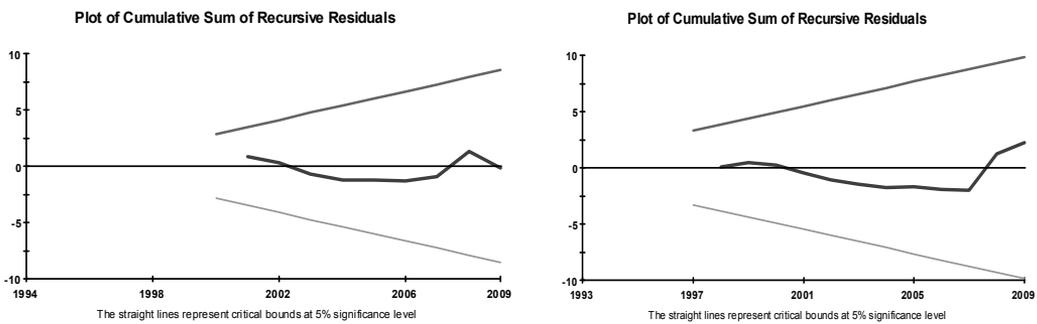


Figure 2: Plot of cumulative sum of squares of recursive residuals for BD on LY and P

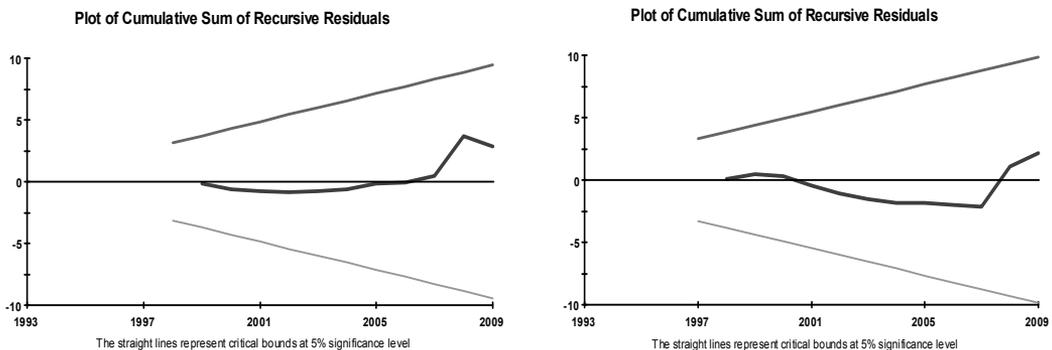
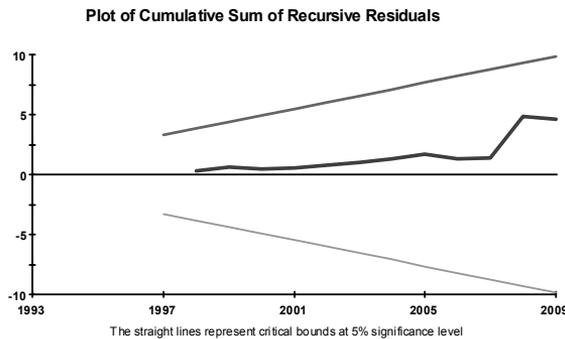


Figure 3: Plot of cumulative sum of squares of recursive residuals for BD on ER



Next, we proceed with the estimation of the corresponding Error Correction Models (ECM). The results are presented analytically in Table 5. The estimations are obtained from the following general form of equation:

$$DY_t = c + \sum a_j DY_{t-j} + \sum b_k DX_{t-k} + \delta ECM_{t-1} + \varepsilon_t \quad (4.6)$$

As we can notice in Table 5 below, the coefficients of the error correction terms in all estimated models were found negative and statistically significant at the 5% significance level. The larger the error correction coefficient (in absolute values), the faster the return to equilibrium, once shocked. Therefore, there is a statistically significant long-run impact from CA, RIR, LY, P and LER on BD.

Table 5: Causality test based on the Error correction Representation

Model	Wald statistic (lagged differences)	Coefficient of the error-correction term. (t-statistic/p-value)	Conclusion
CA → BD	59.0344(0.000)	-.59676 (- 4.6943 /0.001)	Both short and long run causality
RIR → BD	3.8706 (0.049)	-.94812 (- 3.4256 /0.004)	Both short and long-run causality
LY → BD	0.0014 (0.969)	-.84969 (- 3.2122 /0.005)	Long-run causality
P → BD	3.1142 (0.078)	-.95554 (- 3.3997 /0.009)	Long-run causality and weak short-run causality
LER → BD	2.3386 (0.126)	-.86592 (-3.6249 /0.003)	Long-run causality

In order to investigate the short-run dynamics among CA, RIR, LY, P and LER, Wald tests are performed. The results are depicted also in Table 5. We can see that for Current Account (CA) Wald statistics yields a value $\chi^2 = 59.0344$ (p- value 0.000), hence the above regressors are jointly statistically significant. Consequently, there is a short-run causal impact CA on BD. Regarding Real Interest Rate (RIR), the test gives a value $\chi^2 = 3.8706$ (p- value 0.049), that is statistically significant and indicates a short- run causal effect on BD. GDP (LY) has no short –run causal effect on BD since $\chi^2 = 0.0014$ (p – value 0.969). Wald statistic test yields a value $\chi^2 = 3.1142$ (p-value 0.078) for Inflation (P) and it shows that Inflation has a rather weak short-run effect on BD. Finally, for the Exchange Rate (LER), we can extract from the Table 5 above, the value $\chi^2 = 2.3386$ (p-value 0.126) which is statistically insignificant, therefore, we conclude that there is no short-run causal impact from ER on BD.

Since the results were derived from bivariate relationships using a rather limited data sample we provide further evidence from variance decomposition analysis (Table 6), based on the above estimated error-correction models. The analysis traces the dynamics of a shock in any of the involved determinants of budget deficit over time. Actually, table 6 reports the percentage of the variance of the t-year ahead forecast that is attributable to each of the shocks for T=1, 3 and 5. One year ahead could be interpreted as the short-run, three years ahead as the medium-run and five years ahead as the long-run.

Table 6: Variance Decomposition Analysis

Period	CA	RIR	LY	P	LER
1	0.22	0.37	0.11	0.51	0.24
3	0.43	0.44	0.23	0.57	0.33
5	0.48	0.45	0.28	0.58	0.36

The reported results reveal that in the short-run, P with 51% and RIR with 37%, dominate in explaining the behaviour of budget deficits. However, in the medium and long-run horizon all determinants become very significant with LY to be rather weaker. Summarizing, the results are in line with the evidence obtained from the error-correction estimates and causality tests.

Bearing in mind the overall evidence, we can argue that an increase in current account, interest rate and inflation, cause Budget Deficit to increase as well and this should be carefully considered from the economic policy authorities. However, it should be mentioned that except the macro fundamentals referred above, there are other factors which may have an impact on budget deficit as well and are not considered in the present research.

Conclusions

In this paper, there was an attempt to investigate the determinants of budget deficit by developing an econometric model that would relate budget deficit in Azerbaijan (BD) to macroeconomic factors of the economy, namely, inflation (P), interest rates (RIR), current account as a percent of GDP (CA), exchange rate (LER), and Gross domestic Product (LY). First, unit root tests (ADF) were applied, in order to avoid any spurious regression and to ensure the reliability of the derived results. Next, the ARDL cointegrating technique was applied, being the most suitable for the given empirical analysis due to the limited number of the available data. Finally, the EC models were estimated in order to be examined for long-run and short-run Granger type causality running from the independent variables on the dependent ones. In sum, the application of the above mentioned techniques revealed that:

- ❖ Stationarity tests results suggest that, all variables are non stationary in levels and stationary when tested in first difference form
- ❖ Based on the ARDL method, it can be observed that the value of F-statistic exceeds the upper bound of the critical value bounds in all cases and consequently the tests suggest that there exist long-run equilibrium relationships between the BD and each one of the examined determinants CA, RIR, LY, P and LER with long-run causality running towards BD.
- ❖ The long-run ARDL estimates revealed the following: an increase in current account by 1% increases budget deficit 4.2%, an increase in interest rate by 1% decreases budget deficit by 0.008%, an increase in GDP by 1% decreases budget deficit by 3.6%, an increase in inflation by 1% increases budget deficit by 0.007% and an increase in exchange rate by 1% decreases budget deficit by 22.2%.
- ❖ Regarding the Error Correction specification, evidence of long-run causality running from CA, RIR, LY, P and ER to BD was found. There were also found evidence of short-run Granger causal effects running from CA and RIR towards BD and a rather weak causal effect from P to BD. However, there is no short – run causality running from LER on BD.

Nevertheless, there is a weak point in the present approach, along the paper, as there are other factors which may have an impact on budget deficit as well and are not considered in the given research. These factors may be macroeconomic factors like unemployment, money reserve, and government policy factors. Besides, the empirical analysis should be in a multivariate framework, but due to the limited number of available data it is not possible.

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