An economic growth model: Evaluating the interaction of market consumption with GDP growth rate in Afghanistan

Azimi, Mohammad Naim

Department of Industrial Economics, Rana University

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An Economic Growth Model: Evaluating the Interaction of Market Consumption with GDP Growth Rate in Afghanistan

Mohammad Naim Azimi[1]

[1]Vice Chancellor and Professor, Industrial Economics Faculty, Department of Business Administration
Rana University, Kabul – Afghanistan Tel: +93 7900 600 73 Email: vc@ru.edu.af

Abstract: In this paper, we argue that the market consumption is one of the major and significant elements of Gross Domestic Product driver in Afghanistan for which the competeting null hypothesis that consumption drives the GDP growth is tested. The statistical analysis based on Semi-long regression economic growth model shows a significant corresponding probability value of 0.000 which shows that consumption drives GDP growth while the coefficient exhibits 0.1534 or 15.34% growth of GDP driven by consumption throughout the period 2001 to 2014. Further statistical analysis obtained from the Breusch-Godfrey and Breusch – Pegan-Godfrey LM tests for investigating the existence of any serial correlation within the series support us to reject the null hypothesis that there is no serial correlation within the series. On the other hand, the Jarque-Bera test of normality shows a p-value of 0.3099 which is significant and further documents that the residuals are random and normally distributed within the series.

Keyword: Market Consumption; GDP; Homoskedasticity; Heteroskedasticity; Economic Growth

1. INTRODUCTION

From the basic economic theory, we know that shift in the level of market consumption which includes increase or decrease both in the households and organizations' level of consumption for economic commodities affect the overall GDP growth rate either upward or downward overtime. According to Mofrad (2012) one of the major objective of each country is to achieve a relatively desirable economic growth rate. The improvement in the rate of economic growth depends upon the improvement in the degree of market consumption which improves the productivity, demand and supply in a particular country. Theoretically, growth in GDP is one of major indicator of growth in overall economy of a country (Munir & Mansur, 2009) which has several drivers and one of which is the level of market consumption that leads to overall economic growth in a country. Barro (1991) empirically studies the GDP growth drivers panel in 98 countries and finds that countries with higher human capital and population rolling the market consumption and increases its level of consumption which leads the economy to grow overtime. Bergh (2009) shows that GDP growth is far from a robust indicator of social welfare but the influence of GDP information on economic decisions by firms, consumers, investors and governments is a matter of further consideration. Huang et.al., (2008) argue that some types of market consumption like higher portion of energy has negative impact over the economic growth (see also, Mo, 2001; Mozumder & Marathe, 2007; Ciarreta & Zarraga, 2010; Apergis & Payne, 2010; Stern, 2011). Eris & Ulasan (2013) state that one of the economic driver is the openness of a country's market to international consumption and this has robust correlation with GDP growth in long run. On the other hand, Cooper (1997) shows that for a given starting level of GDP, the growth rate is enhanced by higher initial schooling and life expectancy, lower fertility, lower government consumption, better maintenance of the rule of law, lower inflation, and improvements in the terms of trade in a particular country. Krausmann et al., (2009) argue that emerging industrial metabolism is a major element of economic growth both in national and international context. Specifically, Afghanistan has come a long way since emerging from major conflict in late 2001 and the economy has recovered strongly, growing by nearly 50% cumulatively in the last two years (Bank, 2005). The GDP growth driven by exceptional harvest constituting local market consumption and export throughout the year 2012 has increased by 11.8% which shows a growth rate of 4.5% within 4 years only (Joya & Nassif, 2013). The reason for immediate GDP growth in the country within the stated period can also be the repatriation and return of more than one million citizen from abroad (Coleman, 2014). In this paper, we study to investigate the economic growth by considering two economic variables GDP (Gross Domestic Product) and Market Consumption for 14 years from 2001 to 2014. The intention is to rationally estimate and evidentially determine the percentage (refers to as 'rate') of growth in the country's GDP throughout the aforementioned period by considering the market consumption only as a significant GDP growth driver, though, there are many other drivers that are intentionally overlooked in this paper.

The remainder of the paper is organized as follow: section 2 discusses about the data and estimation alternative and testing procedures, section 3 presents the data analysis, research findings and discussion, section 4 concludes the paper followed by author's acknowledgement and list of references.

2. METHODOLOGY

2.1 Data

To study for interaction of two economic variables such as gross domestic product and market consumption for investigating the economic growth in Afghanistan, a set of time series data on Gross Domestic Product (GDP) and the Market Consumption (Consumption) is retrieved from the official website of World Development Indicator (WDI: 2015) covering the period 2001 to 2014 arranged by annual basis.

2.2 Estimation Alternative

For testing the competing hypothesis of economic growth in the country, the following procedure is followed that a brief discussion of which is given below.

2.2.1 Economic Growth Model

The initial step to determine the growth of economic throughout the stated period by considering the GDP as dependent variable and the consumption as the independent variable, we fit following equation:

$$log(gdp) = C_1 + C_2(t) + \varepsilon_t \qquad (1)$$

where log(gdp) is the GDP which is converted into natural log, t represents the time period from 2001 to 2014 and ε_t is the error terms or the residual. The equation 1 represents a semi-log model as there is only one variable which is converted into natural logarithm.

2.2.2 Breusch – Godfrey LM Test

Estimation of growth by applying the equation (1) can only be valid if the residuals are not serially correlated. To check this, we apply the Breusch-Godfrey LM test that the equation of which fits with our data can be expressed as:

$$e_t = X_t\gamma + \left(\sum_{\varepsilon=1}^{k} \alpha_\varepsilon e_{t-\varepsilon}\right) + \nu_t \qquad (2)$$

The statistic value for observed R-Squared is major Breusch-Godfrey LM test and this is asymptotically distributed as $X^2(p)$. The acceptance of null hypothesis that there is no serial correlation in the residual must be followed by testing the normal distribution of the residual within the series (see also, Rois et.al., 2012).

2.2.3 Jarque-Bera Test

The Jarque-Bera test developed by Jarque & Bera (1980) is used to test whether the residuals are normally distributed within the series. By this we test the null hypothesis of normal distribution that the equation of which is written as:

$$JB = \frac{N}{6}\left(S^2 + \frac{(k-3)}{4}\right) \qquad (3)$$

Where JB is the abbreviation form of Jarque-Bera, S is the Skewness and K is the Kurtosis expressed in this equation (see, Koizumi et.al., 2009).

2.2.4 Q-Statistics Corrologram

We use the Q-Statistic test to check whether the residual distribution is white noise for the purpose of which, we fit the following equation for Q-Statistic as:

$$Q_{LB} = T(T+2)\sum_{j=1}^{k} \frac{\tau_j^2}{T-J} \qquad (4)$$

where k is the number of lags, τ_j is the *j-th* serial correlation and T stands for the number observation included in the test. The practical problem in selecting the appropriate number of lags remains in but to minimize this problem to an acceptable low level, we compute the test on 10 lags to achieve an optimum result.

2.2.5 Breusch – Pegan – Godfrey Test

As the last step in our testing procedure, we apply the Breusch-Pegan-Godfrey test. We test the null hypothesis that the residuals are homoscedastic against the alternative hypothesis being the residuals are heteroskedastic (see, Breusch & Pagan, 1979). To do so, we fit the following equation:

$$y_t = b_1 + b_2x_t + b_3z_t + e_t \qquad (5)$$

where e is the residual and b are the estimated parameters in the equation. The residuals are further tested for checking the heteroskedasticity of the residuals if there is any. The acceptance of the null hypothesis that there is no serial correlation (autocorrelation) documents that the semi-log model is valid and results obtained are of sufficient validity (see, Breusch & Pagan, 1979; Koenker, 1981).

3. RESULTS AND DISCUSSION

In this section, we present the statistical analysis and research findings obtained by applying the testing alternatives specified in section 2.

Table 1: Semi-log Least Square Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.542527	0.181072	19.56420	0.0000***
Cons	0.153437	0.011613	13.21304	0.0000***
R-squared	0.935686	Mean dependent var		5.877613
Adjusted R-squared	0.930326	S.D. dependent var		0.558982
S.E. of regression	0.147548	Akaike info criterion		-0.857769
Sum squared resid	0.261243	Schwarz criterion		-0.766475
Log likelihood	8.004381	Hannan-Quinn criter.		-0.866220
F-statistic	174.5845	Durbin-Watson stat		1.429374
Prob(F-statistic)	0.000000			

***Significant if p-value ≤ 0.05
Sample: 2001 to 2014
Total observation: 14

Table 1 shows that the corresponding probability value of Consumption (Cons) is 0.0000 which is significant while the value for coefficient is 0.1534 meaning that significance of consumption results the GDP to grow by 15.34% throughout the years 2001 to 2014. The statistical value for R-Squared is almost close to 1.0000 which shows the stability of the regression in addition that this is much lower than the Durbin – Watson statistics which exhibits that the model is spurious – free.

Table 2: Breusch – Godfrey Correlation LM Test

F-statistic	0.033125	Prob. F(2,10)	0.9675***
Obs*R-squared	0.092138	Prob. Chi-Square(2)	0.9550***

***Significant if p-value is ≥ 0.05

The Breusch – Godfrey Correlation Lagrange Multiplier test exhibits probability values of 0.9675 and 0.9550 for F-statistics and observed R-Squared that are significant to accept the null hypothesis that there is no autocorrelation in the residuals generated from the regression model. By this we understand that the test is valid because it is not victimized by serial correlation throughout the series.

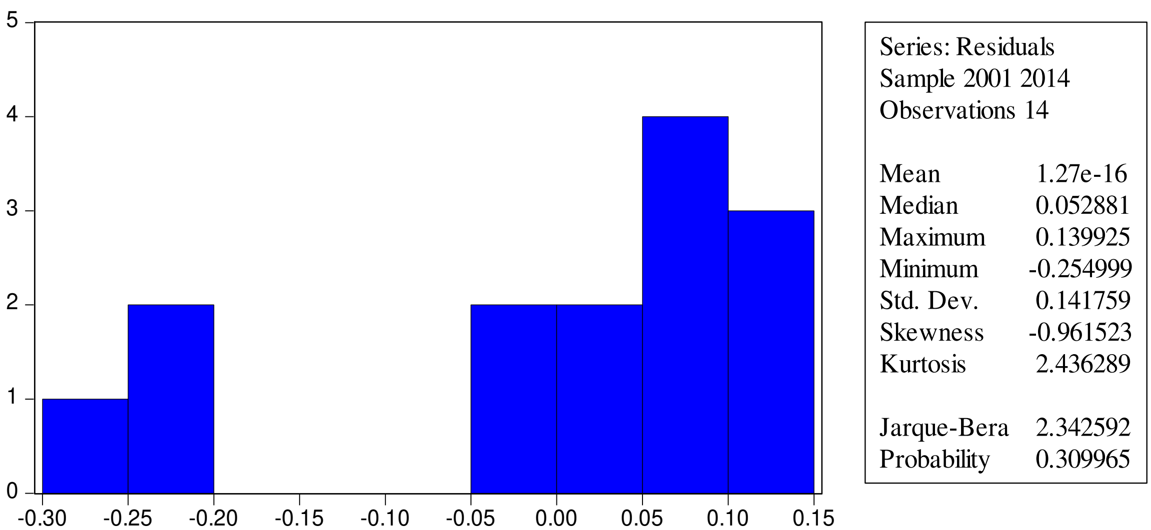

Figure 1: Test of Normality
***Significant if p-value of ≥ 0.05

The Jarque-Bera exhibits a corresponding probability value of 0.309965 which is more than ∂ 0.05 at 95% confidence interval on the basis of which, we fail to reject the null hypothesis rather we accept it and state that the residual is random and it is normally distributed within the series provided that the residual is stationary. To check the stationarity of the residual, we plot it as below:

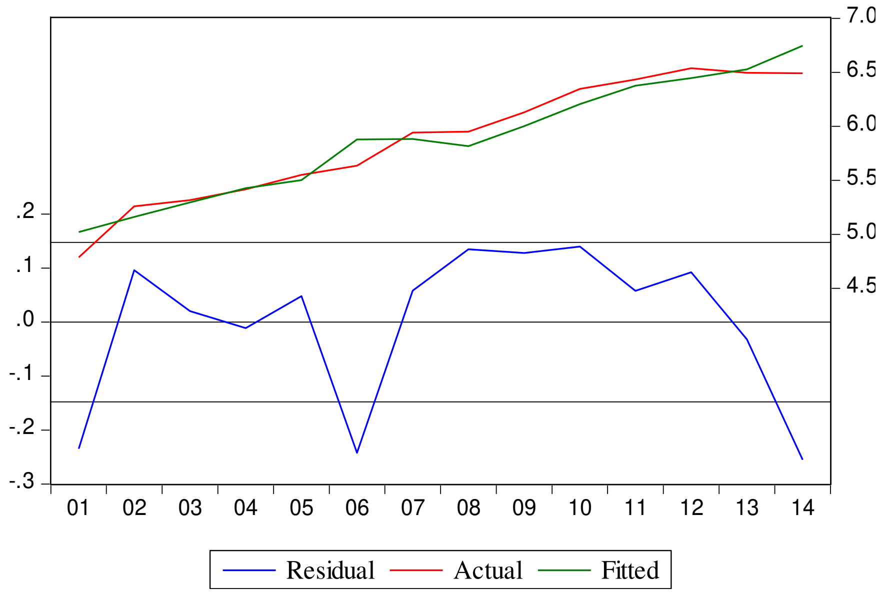

Figure 2: Residual's Stationarity

In the figure above, there are three lines. The red line shows the nonstationarity of the variable which moves alongside the green line which is called the fitted line and both of them have upward trend. On the side, we see the blue line that shows the stationarity of the residual and that is desirable for our test since, this supports the normal distribution of the residuals with a p-value of 0.31 extracted from the Jarque-Bera test in figure 1. To further ensure the validity of this test, we continue to check the Q-statistics of corrologram as below:

Table 3: Q-Statistic Corrologram

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.055	0.055	0.0530	0.818***
. | . |	. | . |	2	-0.041	-0.044	0.0848	0.958***
. | . |	. | . |	3	-0.055	-0.050	0.1462	0.986***
. **| . |	. **| . |	4	-0.332	-0.330	2.6079	0.625***
. |* . |	. |* . |	5	0.096	0.138	2.8351	0.725***
. **| . |	. **| . |	6	-0.212	-0.300	4.0990	0.663***
. *| . |	. | . |	7	-0.076	-0.051	4.2816	0.747***
. |* . |	. | . |	8	0.168	0.042	5.3303	0.722***
. *| . |	. *| . |	9	-0.143	-0.152	6.2463	0.715***
. | . |	. *| . |	10	-0.010	-0.189	6.2515	0.794***

***Significant if p-value ≥ 0.05
Variable: Residual

The residual is further tested by Q-Statistics Corrologram at 10 lags. The probability value of Q-statistics at all 10 lags are more than ∂ 0.05 and from this we understand that if the p-value is more than 0.05, we cannot reject the null hypothesis that 1) the residuals are stationary and does not follow unit root and 2) the residual is not autocorrelated (see, Mujica et.al., 2008). The statistical values for autocorrelation function (ACF) and partial correlation function (PACF) also indicate stationarity of the residual at all 10 lags. But still we have test for the heteroskedasticity of the residuals for which the following hypothesis must be tested:

Null: The residual is homoscedastic within the series Vs. Alternative: The residual is heteroskedastic

Table 4: Heteroskedasticity test of Breusch – Pegan – Godfrey

F-statistic	0.117603	Prob. F(1,12)	0.7376***
Obs*R-squared	0.135872	Prob. Chi-Square(1)	0.7124***
Scaled explained SS	0.071688	Prob. Chi-Square(1)	0.7889

***Significant if p-value is ≥ 0.05
Variable: Residual

The corresponding p-values for F-statistics and the observed R-Squared are 0.7376 and 0.7124 respectively that are $> \partial$ 0.05 on the basis of which we cannot reject the null hypothesis rather we accept it against the alternative one and we conclude that the residual is homoscedastic (see, Zaman, 2000; Herwartz, 2006).

4. CONCLUSION

Estimation and evidenced based determination of GDP growth rate driven by Consumption can be of high assistance to the policy makers, investors and the consumers of a particular economic market. In this paper, the market consumption as a major driver of GDP growth in Afghanistan is investigated that as a direct consequence of the statistical analysis of a set of data representing the period 2001 to 2014, it is found that market consumption has a direct affect and it is one of the significant element to drive an economic growth in Afghanistan. The semi-log model exhibits a corresponding probability value of 0.000 which is significant while the coefficient presents 15.34% GDP growth driven by market consumption throughout the period under study. Further statistical analysis obtained from the Breusch-Godfrey and Breusch – Pegan-Godfrey LM tests for investigating the existence of any serial correlation within the series support us to reject the null hypothesis that there is no serial correlation within the series. On the other hand, the Jarque-Bera test of normality shows a p-value of 0.3099 which is significant and further documents that the residuals are random and normally distributed within the series.

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REFERENCES

Apergis, N., & Payne, J. E. (2010). The causal dynamics between coal consumption and growth: Evidence from emerging market economies. *Applied Energy*, *87*(6), 1972–1977. http://doi.org/10.1016/j.apenergy.2009.11.035

Bank, W. (2005). *Afghanistan—State Building, Sustaining Growth, and Reducing Poverty*. *The world Bank*. Retrieved from http://siteresources.worldbank.org/INTAFGHANISTAN/Resources/0821360957_Afghanistan--State_Building.pdf

Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, *106*(2), 407. http://doi.org/10.2307/2937943

Bergh, J. C. J. M. Van Den. (2009). The GDP paradox. *Journal of Economic Psychology*, *30*(2), 117–135. http://doi.org/10.1016/j.joep.2008.12.001

Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. *Econometrica: Journal of the Econometric Society*. Retrieved from http://www.jstor.org/stable/1911963\npapers://62b5880a-9dca-4c73-a7b5-68e18ca4833e/Paper/p27832

Ciarreta, a., & Zarraga, a. (2010). Economic growth-electricity consumption causality in 12 European countries: A dynamic panel data approach. *Energy Policy*, *38*(7), 3790–3796. http://doi.org/10.1016/j.enpol.2010.02.058

Coleman, D. Y. (2014). Afghanistan. *Afghanistan Country Review*, 2–406.

Cooper, R. N. (1997). Determinants of Economic Growth: A Cross-Country Empirical Study. *Foreign Affairs*, *76*(6), 154.

Eris, M. N., & Ulasan, B. (2013). Trade openness and economic growth: Bayesian model averaging estimate of cross-country growth regressions. *Economic Modelling*, *33*, 867–883. http://doi.org/10.1016/j.econmod.2013.05.014

Herwartz, H. (2006). Testing for random effects in panel data under cross sectional error correlation - A bootstrap approach to the Breusch Pagan test. *Computational Statistics & Data Analysis*, *50*(12), 3567–3591. http://doi.org/10.1016/j.csda.2005.08.003

Huang, B. N., Hwang, M. J., & Yang, C. W. (2008). Causal relationship between energy consumption and GDP growth revisited: A dynamic panel data approach. *Ecological Economics*, *67*(1), 41–54. http://doi.org/10.1016/j.ecolecon.2007.11.006

Jarque, C. M., & Bera, A. K. (1980). Efficient tests for normality, homoscedasticity and serial independence of regression residuals. *Economics Letters*, *6*(3), 255–259. http://doi.org/10.1016/0165-1765(80)90024-5

Joya, O., & Nassif, C. (2013). April 2013 Afghanistan Economic Update. *Poverty Reduction and Economic Management, South Asia Region, The World Bank*, (April), 24.

Koenker, R. (1981). A note on studentizing a test for heteroscedasticity. *Journal of Econometrics*, *17*(1), 107–112. http://doi.org/10.1016/0304-4076(81)90062-2

Koizumi, K., Okamoto, N., & Seo, T. (2009). On Jarque-Bera Test For Assessing Multivariate Normality. *Journal of Statistics: Advance in Theory and Application*, *1*(2), 207–220.

Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.-H., Haberl, H., & Fischer-Kowalski, M. (2009). Growth in global materials use, GDP and population during the 20th century. *Ecological Economics*, *68*, 2696–2705. http://doi.org/10.1016/j.ecolecon.2009.05.007

Mo, P. H. (2001). Corruption and Economic Growth. *Journal of Comparative Economics*, *29*(1), 66–79. http://doi.org/10.1006/jcec.2000.1703

Mofrad, M. A. (2012). The relationship between GDP, Export and Investment: Case StudY Iran. *Business Intelligence Journal*, *5*(2), 401–405.

Mozumder, P., & Marathe, A. (2007). Causality relationship between electricity consumption and GDP in Bangladesh. *Energy Policy*, *35*(1), 395–402. http://doi.org/10.1016/j.enpol.2005.11.033

Mujica, L. E., Rodellar, J., Güemes, A., & López-Diez, J. (2008). PCA based measures: Q-statistic and T2-statistic for assessing damages in structures. In *Proceedings of the 4th European Workshop on Structural Health Monitoring* (pp. 1088–1095).

Munir, Q., & Mansur, K. (2009). Non-linearity between inflation rate and GDP growth in Malaysia. *Economics Bulletin*, *29*(3), 1551–1565.

Rois, R., Basak, T., Rahman, M. M., & Majumder, A. K. (2012). Modified Breusch-Godfrey Test for Restricted Higher Order Autocorrelation in Dynamic Linear Model – A Distance Based Approach. *International Journal of Business and Management*, *7*(17), 88–97.

Stern, D. I. (2011). The role of energy in economic growth. *Annals of the New York Academy of Sciences*, *1219*(1), 26–51.

Zaman, A. (2000). The Inconsistency of the Breusch-Pagan Test. *Journal of Economic & Social Research*, *2*(1), 1–11.