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Why had the Money Market Approach been Irrelevant in Explaining Inflation in Azerbaijan during the Rapid Economic Growth Period?

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Abstract

The study examines whether inflation process can be explained within the framework of the Money Market Approach in the third stage of economic development of Azerbaijan economy covering 2004-2008. By employing dynamic modeling study concludes that the Money Market Approach has not been relevant for explaining Azerbaijani inflation. Because Azerbaijan, a resource rich small open economy in transition processes, has some stylized facts which are important to take into account in the analysis of the inflation. Since the Money Market Approach seems irrelevant one, the paper puts forward application of other alternative explanations for Azerbaijani inflation in the future. In this regard analyzing inflation in the context of resource dependence seems one of the relevant approaches due to high price increases mainly sourced from oil revenues.

Keywords: Inflation rate, Money Market Approach, Transition economy, Resource Abundance, Oil and Non-oil Sectors, Econometric modeling, Azerbaijan
JEL Classification Codes: P24, Q33, C22

1. Introduction

Analysis of inflation process is important at least by two points of view: inflation is a sign of macroeconomic stability and inflation is an indicator of living standard (social welfare). Therefore, one of the responsibilities of policy makers is to keep inflation in desired level.

In the case of Azerbaijan economy importance of investigation of the inflation processes is amplified by some undesirable consequences of oil boom. High oil price in the world markets and sharp increase in the oil extraction have leaded to expanding fiscal expenditures and therefore high money growth resulting high inflation rate since 2004. As Hasanov (2011) states, in the presence of expansionary fiscal policy due to insufficient independence, the Central Bank of Azerbaijan has to convert the export revenues of the government budget from US dollars to national currency, which in turn leads to high money growth and therefore high inflation. From the other side, in order to curb high

inflation rates in the Azerbaijan economy current monetary policy measures oriented to increases in interest rates and reserve requirements. Because of poorly developed financial markets and dependence of the commercial banks on the foreign borrowing, these measures are inefficient. Moreover, in order to prevent appreciation of the national currency the Central Bank of Azerbaijan tries to keep exchange rate stable by conducting fixed exchange rate regime. However, monetary policy of this design can influence inflation in short term by reducing the appreciation pace, but this effect disappears as a result of purchase of foreign exchange which leads to high price increases through high money growth. It is worth to note that according to official statistics M2, the broad money aggregate, and inflation have raised 8.9 times and 67.3 percent during the 2004-2008 respectively (www.azstat.org and www.cbar.az).

In general, economic development, as well as inflation dynamics in the Republic of Azerbaijan can be divided into three stages. The first stage, covering 1990-1995 is characterized by economic recession and hyperinflation levels, while one can observe macroeconomic stability in the background of stable economic growth and low rate of inflation in the second stage, 1996-2003. However, Azerbaijan economy has experienced rapid economic growth and high inflation rates since 2004 which can be considered as a beginning of the third stage of economic development.

The objective of this study is to examine that whether Azerbaijani inflation can be explained by the Money Market Approach in the third stage of economic development covering 2004-2008.

Beforehand we can assume that interest rate, one of the factors of inflation within the framework of the Money Market Approach, has not significant impact on inflation, due to weakly developed financial market in Azerbaijan economy.

By employing dynamic modeling study concludes that the Money Market Approach has been inappropriate for explaining Azerbaijani inflation in the third stage of economic development. Because Azerbaijan, a resource rich small open economy in transition processes, has some stylized facts which are important to take into account in the analysis of the inflation. In this regard paper puts forward that analyzing Azerbaijani inflation in the context of resource dependence seems one of the relevant approaches due to high price increases mainly sourced from oil revenues

The results of the research may be useful for policy makers in this regard that what kind of factors they should focus in the arrangement of Azerbaijani inflation. Additionally, if we take into consideration that there are a few papers which investigate inflation in the Azerbaijan economy, then this study can be considered as a contribution to existing related literature.

2. Brief Literature Review

Theoretically, inflation process is usually modeled as: (i) an interaction of supply and demand for money - Money Market Approach (Jonsson, 1999); (ii) a markup pricing mechanism – Markup Approach (De Brouwer and Ericsson, 1995); or (iii) particular factors affecting external disequilibria pressures (Purchasing Power Parity approach by Cassel (1918, 1921, 1922)) – Foreign Market Approach. Additionally, combination of abovementioned three approaches has been extensively used in the literature to model the inflationary process in transition and small open economies (Kim, 2001 for Polish; Golinelli and Ezoneplus, 2002 for Czech Republic, Hungary and Poland; Kuijs, 2002 for Slovak; Lissovolik, 2003 and Leheyda, 2005 for Ukraine; Zavkiev, 2005 for Tajikistan; Vizek, 2007 for Croatian, Melisso, 2005 for Euro Area) as well.

Since there is huge number of study which devoted to investigation of inflation processes in transition and small open economies, instead of to introduce wide literature review we would like to bring to attention an **interesting and important conclusion of some studies especially in the case of transition countries which emphasize that standard (concrete) approaches are not relevant for explaining inflation in such kind of economies.** For example, Bogetic and Mladenovich (2006) with their research have discovered that inflation in Belarus Republic during 1996-2001 cannot be considered as monetary phenomenon. In other words, money growth is unable to explain Belarus' inflation dynamics. They have explained this phenomenon, i.e. independence of inflation from money

supply in long and short run periods, with conducting tight fiscal policy in Belarus. Authors' such kind of conclusion is in line with findings of Chernookiy's (2004) for Belarus Republic. Another research carried out by Leheyda (2005) has found that markup approach is not relevant to explain Ukrainian inflation over the period 1997-2003.

Research history of inflation processes in Azerbaijan is not so long and rich. There are only few papers by Imanov and Hasanli (2001); Hasanli and Hasanov (2002); Hasanov (2004) and some reports from NBA and international organizations. Therefore, our study may contribute existing relevant research area by two ways: (a) there is very little body of studies investigating Azerbaijani inflation; (b) none of these studies examines that whether the Money Market Approach is relevant for explaining Azerbaijani inflation in the third stage of economic development.

3. Theoretical Framework

The **Money Market Approach** explains inflation as a result of excess money supply over real money demand. The approach, due to Friedman (1956), is based on the Quantity Theory of Money and relies on three assumptions: (a) velocity and hence demand for money is stable; (b) in the short run growth of money affects real output, but in the long run real output is determined by real factors such as employment, technology and capital; and (c) supply of money given exogenously can be controlled independently of demand for money that is determined by a different set of factors. According to this approach the demand for the non-tradable goods follows the overall demand in the economy and the price of the non-tradable goods (P_t^n) is determined by the internal money market equilibrium under which the real money supply ($m_t - p_t$) is equal to the real money demand ($m_t^d - p_t$):

$$P_t^n = k\left(m_t - \left(m_t^d - p_t\right)\right) \tag{1}$$

Note that, all variables here are expressed in natural logarithm form and *k* represents scale factor, i.e. the relationship between the aggregate demand and the demand for non-tradable goods.

In the simple form the demand for the real money can be expressed as a function of the real income (y_t) and interest rate (r_t) as below:

$$m_t^d - p_t = \alpha + \beta y_t - \chi r_t \tag{2}$$

Substituting Equation (2) into Equation (1) we can get price equation as below:

$$P_t^n = k\left(m_t - \left(\alpha + \beta y_t - \chi r_t\right)\right) \tag{3}$$

In sake of simplicity Equation (3) can be rewritten as following:

$$P_t^n = a_1 + a_2 m_t - a_3 y_t + a_4 r_t \tag{4}$$

Where, $a_1 = -\alpha k;\ a_2 = k; a_3 = \beta k; a_4 = \chi k$

4. Methodology and Data

4.1. Methodology

The Money Market Approach can be used in order to explain prices in the long- and short run. However, due to small sample span (only 5 years) it would not be advisable to check whether The Money Market Approach can explain Azerbaijani prices in the long-run by using various co-integration methods as Engle-Granger (1987), Johansen (1988), Bound Testing Approach (Pesaran et al., 2001)). Hence, it would be appropriate to test relevance of application of The Money Market Approach to Azerbaijani inflation in the short-run. Since some factors (for example, real income) within the framework of the Money Market Approach may have an impact on current inflation not contemporaneously, but with lags in the short run, Auto Regressive Distributed Lag (ARDL) modeling seems more relevant method. An ARDL model can be written as below:

$$\Delta y_t = c_0 + \sum_{i=1}^{n} \varpi_i \Delta y_{t-i} + \sum_{i=0}^{n} \varphi_i \Delta x_{t-i} + u_t \quad (5)$$

Where, y – is a depended variable; x – stands for explanatory variable; c_0 – is a drift coefficients; ϖ and φ - reflect short-run coefficients; Δ – is a difference operator; i – is lag order, t – denotes time; n – is a maximum number of lags; and u –is residuals. Assumed that residuals have $\left(\mu=0; \text{var}=\sigma^2\right)$ distribution, in other words they are white noise.

It is desirable that variables used in estimation to be stationary and the reason for this is that using non-stationary variables may produce spurious results (Gujarati and Porter (2009), p. 22, 747-748). Therefore, the first task is to check stationarity of time series of variables by means of Unit Root Tests. For this purpose we employ Augmented Dickey-Fuller (1981) (Hereafter ADF) Test (Gujarati and Porter (2009), p. 754-759). Note that null hypothesis for ADF Test is that underlying time series is non-stationary.

4.2. Data

In order to test whether the Money Market Approach holds in the case of Azeri inflation we need the following variables for econometric estimations:

Price (CPI). We use the Consumer Price Index (CPI) as a proxy for domestic price. Note that to choose CPI as a proxy also is relevant in terms of Equation (4) in this sense that most of studies use CPI as a proxy for price of non-tradable goods (Macdonald, 1997a; Clark and MacDonald, 1998; Clark and MacDonald, 2000; AlShehabi and Ding, 2008; Egert, 2009; Hasanov, 2010). Percentage change (or first difference of logarithm expression) of CPI can be considered CPI inflation. CPI time series was taken from web site of Central Bank of Azerbaijan (www.cbar.az) and 1995 was chosen as a base period.

Money supply (M1). Depending upon which monetary aggregate is more powerful in order to predict inflation behavior in a country in interest, different monetary aggregates can be used in analyses. According to previous studies M1 is more relevant for this purpose (Reports of Central Bank of Azerbaijan). However, in sake of getting parsimonious specification at the same time we may use other monetary aggregates instead of M1 in the estimations. Time series of monetary aggregates was taken from web site of Central Bank of Azerbaijan (www.cbar.az).

Interest rate (REF_RATE). We will use refinance rate of the Central Bank of Azerbaijan as interest rate and time series of this variable was taken from the web site of the Central Bank of Azerbaijan (www.cbar.az).

Real income (R_GDP). Plenty of studies use real GDP as a proxy for real income. In this regard we also use real GDP in our estimations. Following Zavkiev (2005, p. 17-19), we calculated real GDP time series by using time series of (a) real growth rates of GDP and (b) nominal value of GDP. Time series of real growth rates and nominal value of GDP can be taken from State Statistical Committee of Azerbaijan under request or from web site of Central Bank of Azerbaijan (www.car.az).

5. Econometric Estimation Outputs and Interpretation of Results

Estimation period covers 2004Q1-2008Q4 and all estimations are realized in E-views 7.0 program package.

Results of Unit Root Test are given in Table 1 below and based on these results we can conclude that all above mentioned variables are non-stationary in the levels and stationary in the first difference, in other words they follow I(1) process.

Table 1: Unit Root Test Results

Variables	Test method	In the level				In the first difference			
		c	*t*	Lag Length	Actual value	*c*	*t*	Lag Length	Actual value
LN(CPI)	*ADF*	Yes	Yes	0	-2.056333	Yes	No	1	-5.508687***
LN(M1)	*ADF*	Yes	Yes	0	-2.202065	Yes	No	0	-2.853243 *
LN(REF_RATE)	*ADF*	Yes	No	0	-1.306097	No	No	0	-1.978979**
LN(R_GDP)	*ADF*	Yes	No	4	-1.473123	Yes	No	2	-9.647487***

Note that LN, *c* and *t* denote natural logarithm, constant and trend respectively. *, ** and *** asterisk above actual values indicate statistical significance of actual value at the 10%, 5% and 1% significance levels respectively. Lag lengths are selected based on Schwarz information criterion.

Thus, firstly we are going to test whether the Money Market Approach is hold for Azerbaijani inflation by estimating following specification:

$$DLN(CPI)_t = \beta_1 + \beta_2 * DLN(M1)_t - \beta_3 * DLN(REF\_RATE)_t - \beta_4 * DLN(R\_GDP)_t + u_t \quad (6)$$

Where, *D* – is a first difference operator.

Econometric estimation of Equation (6) yields following result:

Table 2: Estimation outputs

Dependent Variable: DLN(CPI); Method: Least Squares; Sample: 2004Q1 2008Q4

Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	0.032518	0.012785	2.543423	0.0217
DLN(M1)	-0.003734	0.094048	-0.039699	0.9688
DLN(REF_RATE)	0.000544	0.069740	0.007796	0.9939
DLN(R_GDP)	-0.055296	0.037241	-1.484834	0.1570
R-squared	0.160990	Mean dependent var		0.029528
Adjusted R-squared	0.003675	S.D. dependent var		0.035261
S.E. of regression	0.035197	Akaike info criterion		-3.678881
Sum squared resid	0.019821	Schwarz criterion		-3.479735
Log likelihood	40.78881	Hannan-Quinn criter.		-3.640006
F-statistic	1.023362	Durbin-Watson stat		1.899025
Prob(F-statistic)	0.408453			

As shown from the Table 2, determinants have not any meaningful and significant impacts on inflation in terms of theoretical expectation of the Money Market Approach, test statistics and other econometric criteria. Broadly speaking, all three determinants have not statistically significant impact on inflation, moreover, according to estimation output M1 monetary aggregate has negative impact on inflation which is not consistent with theoretical expectation.

Note that in order to get meaningful results within the framework of the Money Market Approach some attempts (such as to include different lags of independent and dependent variables into estimation, to use other monetary aggregates instead of M1, to include dummy variable for capturing big spike in inflation dynamics in 2004) were realized, but they did not yield reliable results.

Thus, we can assume that the Money Market Approach is not relevant for explaining Azerbaijani inflation. This evidence can be explained by some stylized facts of Azerbaijani economy as below.

Some stylized facts of Azerbaijani Economy

1) Weakly developed financial market. Relationships between commercial banks and households and firms are not in satisfactory level in point of financial intermediation and the main source of commercial bank loans are the foreign banks and or international financial organizations. This evidence yields insensitive reaction of commercial banks to changes in refinance rate. That is why, although Central Bank of Azerbaijan has increased

refinance rate 2 times (from 7% to 14%) it could not prevent credit boom during the rapid economic growth period, 2004-2008;

2) High level of government spending. As stated in Introduction there is fiscal expansion in the economy driven by oil revenues. According to legislation system only national currency (manat) can be used for transaction within the country. This means that all oil revenues which are intended to spend by State Oil Fund or Government Budget must be converted to manat before spending. Since fixed exchange rate policy is being conducted rather than flexible, in order to prevent manat appreciation, the Central Bank of Azerbaijan obliged to buy these US dollars through injecting national currency into foreign exchange market which in its turn causes increase in money supply.

Consequently, due to weakly developed financial markets and high government spending refinance rate becomes inefficient tool for adjusting money supply and one should use exchange rate instead of interest rate which is in line with most of studies that investigate inflation in case of transition and small open economies (listed in Section 2.). So, we will use trade turnover based nominal effective exchange rate (NEER_T) in further estimations and its time series can be obtained from the official web site of Central Bank of Azerbaijan (www.cbar.az).

3) Dominance of oil sector in the economy. According to estimation results of the Money Market Approach to inflation, i.e. Equation (6) growth rate of real GDP has negative but statistically insignificant impact on inflation. One possible explanation for this case is that overall GDP in Azerbaijan economy in general consists of value added of non-oil sector and value added of oil sector, which each one has contrary influence on inflation. Exactly saying, value added by non-oil sector comprising goods and services has negative impact on inflation as predicted by theory. However, value added by oil sector, containing of oil revenues (US Dollars) positively effects on inflation: Oil revenues in US Dollars, the value added of oil sector, due to prevailing legislation system and insufficient independence of Central Bank of Azerbaijan lead to increases in money supply and therefore acceleration in inflation.

Since overall GDP comprising of two different components as value added by the oil and the non-oil sectors has insignificant impact on inflation, it would be relevant that instead of overall GDP to use its two components in the analysis. Note that real value added of oil (R _OIL_GDP) and non-oil (R _NOIL_GDP) sectors are calculated as the same manner as calculated real GDP.

As shown from Table 3 in the below, according to ADF Test outputs time series of natural logarithm expressions of NEER_T, R _OIL_GDP and R _NOIL_GDP are non-stationary in the level and stationary in the first difference.

Table 3: Unit Root Test Results

Variables	Test method	In the level				In the first difference			
		c	*t*	Lag Length	Actual value	*c*	*t*	Lag Length	Actual value
LN(NEER_T)	*ADF*	Yes	No	1	-2.300416	No	No	0	-1.977039**
LN(R_NOIL_GDP)	*ADF*	Yes	No	0	-2.695545	No	No	0	-7.599814***
LN(R_OIL_GDP)	*ADF*	Yes	Yes	0	-2.880373	Yes	No	0	-7.804874***

Note: Lag lengths are selected based on Schwarz information criterion.

Thus, instead of standard version of the Money Market Approach to inflation analysis as expressed in Equation (6) we should test the following specification:

$$DLN(CPI)_t = \beta_1 + \beta_2 * DLN(M1)_t - \beta_3 * DLN(NEER\_IM)_t - \beta_4 * DLN(R\_NOIL\_GDP)_t + \beta_5 * DLN(R\_OIL\_GDP)_t + \varepsilon_t \quad (7)$$

Here, ε - is residuals and it is assumed that they have $\left(\mu = 0; \text{var} = \sigma^2\right)$ distribution, in other words they are white noise.

Note that, Equation (7) takes into consideration stylized facts of Azerbaijani economy and it can be considered a modified version of the Money Market Approach.

Thus, we may consider that standard version of the Money Market Approach is not appropriate for explaining inflation in Azerbaijan economy and therefore, we employ its modified version which takes into account stylized facts of Azerbaijan economy.

Due to small number of observations we start to estimate Equation (7) with 2 lags of all independent and dependent variables and then by applying "specific to general" approach we tried to obtain meaningful specification. Table 3 in the below reflects more parsimonious specification:

Table 4: Estimation outputs of Equation (7)

Dependent Variable: DLN(CPI); Method: Least Squares; Sample: 2004Q1 2008Q4

Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006214	0.006938	0.895608	0.3856
DLN(M1(-1))	0.141095	0.042839	3.293591	0.0053
DLN(NEER_T(-1))	-0.283254	0.125974	-2.248501	0.0412
DLN(R_NOIL_GDP)	-0.054496	0.015176	-3.591009	0.0030
DLN(R_OIL_GDP(-2))	0.072878	0.021321	3.418194	0.0042
D_04Q4	0.065076	0.018545	3.509125	0.0035
R-squared	0.808100	Mean dependent var	0.029528	
Adjusted R-squared	0.739564	S.D. dependent var	0.035261	
S.E. of regression	0.017995	Akaike info criterion	-4.954130	
Sum squared resid	0.004533	Schwarz criterion	-4.655410	
Log likelihood	55.54130	Hannan-Quinn criter.	-4.895816	
F-statistic	11.79093	Durbin-Watson stat	1.286003	
Prob(F-statistic)	0.000130			

Test Results

Residuals Tests

Q-statistics

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |**. |	. |**. |	1	0.291	0.291	1.9588	0.162
. |. |	. *|. |	2	0.005	-0.087	1.9594	0.375
. |. |	. |. |	3	-0.003	0.023	1.9596	0.581
.**|. |	.**|. |	4	-0.224	-0.253	3.3430	0.502
. *|. |	. |*. |	5	-0.112	0.040	3.7102	0.592
. |. |	. |. |	6	0.073	0.086	3.8776	0.693
. |. |	. *|. |	7	-0.032	-0.084	3.9117	0.790
. |. |	. |. |	8	-0.045	-0.060	3.9869	0.858
. |*. |	. |*. |	9	0.181	0.213	5.2950	0.808
. |. |	. *|. |	10	-0.013	-0.116	5.3022	0.870
. *|. |	. *|. |	11	-0.102	-0.078	5.8137	0.885
. *|. |	. *|. |	12	-0.090	-0.113	6.2609	0.902

Normality Test: Jarque-Bera 1.249801 (0.535315)

	LM Test:	ARCH Test:	White Heteroskedasticity Test:
F-statistic	0.681594 (0.5244)	1.096063 (0.3098)	0.220082 (0.9479)
Obs*R-squared	2.040215 (0.3606)	1.150814 (0.2834)	1.457457 (0.9179)

Note: *Pobabilities in parentheses.* ***D_04Q4*** *stands for dummy variable in order to capture sharp price increase mainly sourced from raise in administrative price in the fourth quarter of 2004.*

Misspecification Test			
Ramsey RESET Test:			
	Value	**df**	**Probability**
t-statistic	0.035673	13	0.9721
F-statistic	0.001273	(1, 13)	0.9721
Likelihood ratio	0.001958	1	0.9647

The obtained specification successfully passes tests of parameters, residuals and misspecification, as shown from Table 3. Note that obtained estimation results also are consistent with economic theory and meets our expectations related to stylized facts of Azerbaijan economy.

According to the estimation outputs, while keeping other factors constant, 1% increase in growth rate of money supply (M1) with one lag causes 0.14% increase in inflation, while 1% raise (appreciation) in growth rate of trade turnover based nominal effective exchange rate of national currency (NEER_T) with one lag causes 0.28% decrease in inflation. Indeed, according to theory increase in money supply leads to rise in inflation. On another side this conclusion is consistent with stylized facts of Azerbaijan economy. So that, fiscal expansion sourced from oil revenues causes increase in money supply that is in turn accelerates inflation. In order to keep national currency stable, the Central Bank implements fixed rather than flexible exchange rate regime, but sharp pressure by fiscal expansion causes to appreciate exchange rate gradually. In this context appreciation of exchange rate leads to decrease in inflation rate.

Moreover, estimation results shows that 1% rise in the growth rate of value added by oil-sector in real terms with two lag leads to 0.07% increase in inflation while 1% increase in the growth rate of value added by non-oil sector in real terms causes 0.05% decline in inflation. Indeed oil revenues, final goods of the oil sector, increase excess demand for goods and services and therefore cause rise in inflation level. According to estimation result the impact of oil revenues on inflation happens not simultaneously, but two quarter later. Such kind of finding is consistent with spending mechanism of oil revenues in Azerbaijan. Exactly saying, oil revenues at the current time are spent approximately five or six months later when these revenues are transferred for budget spending purposes and are converted to national currency. These evidences can be considered stylized fact of Azerbaijan economy, a resource rich country. Differently from oil sector, value added by non-oil sector comprising of goods and services as a part of aggregate supply has negative impact on inflation which is consistent with economic theory.

6. Conclusion

The main conclusion of the study is that the Money Market Approach has not been appropriate for explaining Azerbaijani inflation in the third stage of economic development covering 2004-2008. Because Azerbaijan, a resource rich small open economy in transition processes, has some stylized facts which are important to take into account in the proper analysis of the inflation. In this regard as we assumed before interest rate is irrelevant for explaining inflation, while overall GDP growth has dual impact. From another side as other studies conclude, exchange rate is one of the main factors of inflation in the resource rich and transition countries.

Since the Money Market Approach seems irrelevant one, the paper puts forward application of other alternative explanations for Azerbaijani inflation in the future. In this regard analyzing price increases in the context of resource dependence seems one of the relevant approaches. Because Azerbaijan economy is resource rich and high price level mainly appear as the undesirable consequences of oil boom.

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