Retracted: The Effect of Global Liquidity on Macroeconomic Parameters

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Abstract

Depending on the international economic integration as a result of the increasing globalization, national economies have become more sensitive to the external economic developments. In such an environment, it is important to understand the concept of international liquidity and its effects. We analyze the effect of global liquidity on Turkish economy in this study. To examine the impact of global liquidation on Turkish economy empirically, Vector Autoregressive (VAR) model and cointegration tests are applied by using the data between 1990Q1-2008Q3 periods. Cointegration results indicate that global liquidation moves together with Turkey's national income, inflation rate, treasury benchmark interest rate and real exchange rate in the long run. According to the results of Granger causality test, it is seen that there is causality from global liquidation towards Turkey's key macroeconomic variables. The impact-response analysis of the VAR model figures out the increase in global liquidity leads an appreciation in Turkey's real exchange rate, decreases national income, inflation and interest rates. The results of the variance decomposition confirms that the longer the period under review, the stronger the effect of global liquidation. Our findings in this study emphasize the importance of global integration and liquidity on Turkish economy which is articulated with the world economy.

Introduction

Since 1980's, the financial markets has grown rapidly with the globalization. New financial instruments have been used and flow of capital has accelerated more than ever. In this process, the amount of money in the world which means the total amount of global liquidity has increased due to low-interest monetary policies pursued by central banks, growing power of money creation by new financial instruments and the leverage effect. Because of the increasing importance since 2000's, the concept of global liquidation became more popular, movements and imbalances in the world economy have been related more with global liquidation. Reduction in capital inflows affects the economies negatively by leading depreciation of local currency, increasing inflation, difficulty in borrowing of banks and companies from abroad (King, 2006).

In recent years, capital inflows to developing countries have increased especially after 2002. Net capital inflow to developing countries has reached 929 billion dollar level in 2007 which was 118 billion dollar in 2002. In 2008, increase in global liquidation has slowed down and capital inflow decreased to 466 billion dollars. Enhancing macroeconomic structure of developing countries explain a part of this increase. However, increasing global liquidation which seeks higher returns has become influential in the course of capital flows. After 2002, a parallel relationship has seen between money movements to developing countries and external obligations of banks which is accepted as an indicator of global liquidation. External obligations of banks have reached a 3,6 trillion dollars level in 2006 which was 716 billion dollars in 2002 (Chandrasekhar, 2008).

After 1980's, Turkish economy is liberalized with the stabilization program and the movement of capital between Turkey and the other countries is released which deepened the effects of global liquidation. Our aim in this study is to search the effect of global liquidity on important macroeconomic parameters in Turkey. In the second part of the study, we cover the literature related with the effects of macroeconomic parameters. We evaluate different terms and measurement approaches of the liquidity in the third part. Part four presents the findings about the impact of global liquidation on Turkey's national income, inflation rate, interest rate and real exchange rate examined by using the time series data analyses such as VAR model, cointegration, Granger causality, impact response and variance

decomposition. Finally, part five concludes and covers our further comments.

The Literature Review

The studies which are held to analyze the economic effects of global liquidation generally focus on the effects of growth and inflation. However, the effect of global liquidity on variables such as asset prices, risk premium, capital movements and imbalances has been searched in numerous studies.

Souza and Zaghini (2006) analyzed the impact on growth and inflation by using the structural VAR model in a monetary policy shock which is applied by aggregating the data of G-5 countries. Accordingly, a positive global liquidity shock has an improving effect on the output in the short-run, but in the medium and long run this effect disappears. It is also found that global liquidity shock has a temporary positive impact on the results. While global liquidity shock affects economic activity with a delay of 2 quarters, the maximum effect which is seen after 2 years, has eliminated after 5 years. Then it is concluded that global liquidity shock has only nominal effects in the long run. Filho (2002) analyze the relationship between global liquidity and Brazil's growth rate by using the data for the period 1966-2000. According to the analysis in which the ratio of foreign exchange reserves to the external debt is used as a measure of global liquidity, it is found that 9% of Brazil's growth rate volatility is due to developments in global liquidity.

The studies try to explain the relationship with global liquidation and inflation, point a positive relation between the two variables. Increase in liquidity, on the one hand with the real and financial asset prices, on the other hand through the revival of economic activity, increase the inflationist pressures. In the study of Belke and Orth (2007) applied for OECD countries by using their aggregated data, it is identified that a positive global liquidity shock increases the GDP deflator permanently. Ruffer and Stracca (2006) analyzed the effect of global liquidity shock on the economy with VAR methodology by using the aggregated quarterly data of G-5 countries. The study concluded that global liquidation is a significant indicator of global inflationary pressures. Including the data of 15 countries and applying the probit model, Roffia and Zaghini (2007) found that a period of strong monetary growth leads to high inflation. It is indicated that the relationship between global liquidity and inflation is not significant in the short-run, however, become significant after a few periods and the significance increase in the long run. In contrast to the positive relationship observed between global liquidation and inflation in literature, increased competition and productivity arising from globalization created a negative impact on the inflation in 2002-2006 periods. Due to quick integration of low-cost producers such as China and India to global trading system, inflation remained low despite the increase in global liquidation. The increased openness level of the countries with the globalization has limited the increase in the prices of globally tradable goods (IMF, April 2006).

Changes in global liquidity directly affect asset prices rapidly. With the increase in the global liquidation, the amount of investable funds rise, more supply of the funds increase the demand for a variety of assets and their prices. Baks and Kramer (1999) found that aggregated financial growth in G-7 countries has an impact on interest rates and returns of stocks. According to this study, increase in liquidity has a positive effect on the amount of fund in the market and also the supply of funds seeking higher returns increase the demand for assets. Borja and Goyeau (2005) test the relationship between global liquidation and asset prices in the US, Eurozone and ASEAN Zone, and have evidence that the relationship between asset prices and M1 (narrow money supply indicator) is stronger than the relationship with M3 (broad money supply indicator). According to the regression results, global liquidation affects the asset prices in US and Eurozone but it has no effect on the asset prices in ASEAN Zone. Applying the logit model, Bruggeman (2007) analyzed the monetary relationship between liquidity conditions and asset prices. In this study, periods of excessive liquidity is detected and analyzed that whether this periods are followed by an increase in asset prices. It is indicated that periods which has strong economic activity, low interest rates, rapid growth in credits, and liquidity increase which is supported by low inflation are generally followed by excessive increase in asset prices.

Loose monetary policies pursued by central banks could increase the real estate prices by increasing the global liquidation. The studies of Giese and Tuxen (2001) show the increase in global liquidation after 2001, increases the real estate prices. Moreover it is concluded that the relationship between global liquidity and stock prices is weak. Belke and Orth (2007) intended to determine the relationship between global liquidation and asset prices by using aggregated quarterly data of OECD countries and VAR methodology. According to the impact-response analysis, increase in global liquidation has a positive effect on global house price index but no relationship is found between global liquidation and MSCI world index.

According to the discussions in the literature, despite a negative relationship between increases in the foreign exchange reserves and long-term government bond interest rate are observed, there are differences in the empirical results. The effect of increases in reserve on the interest rate changes between 30 and 200 basis points. Warnock and Warnock (2006) denotes a positive relationship between the long term government bonds interest rate and the other indicators such as growth, US benchmark interest rate, risk premium, budget deficit and expected inflation. Moreover the increase in global reserves has a positive effect on the foreign capital into the U.S. and decreases the interest rates. When foreign governments do not take government bonds of U.S., it is found that there will be a 90 basis point increase in the interest rate. Moreover, this effect will be doubled if the foreigners sell government bonds.

There is a close relationship between global liquidation and risk premium. Increase in global liquidation decreases risk premium by increasing the demand for the government bonds issued by developing countries. Şahinbeyoğlu et al. (2006) identify factors that determine the risk premium, and mark factors as risk appetite, debt to national income ratio, US monetary policy, foreign currency credit rate of the country and important macroeconomic news. Hartelius et al. (2008) states risk premium of the developing countries is determined by their credit rate which is an indicator of the country's macroeconomic situation and also external factors such as US interest rate and VIX volatility index. The volatility of the risk premium is 60 % explained by external factors and country's credit rating. Moreover, it is found that the effect of external factors has become stronger due to financial globalization and acceleration of capital flows.

Changes in global liquidation also affect the exchange rates of the countries through the balance of payments. In the known literature, we could not find any study that analyzes the relationship between trade volume and global liquidation. However, the study conducted by us indicates a negative relationship between trade volume and global liquidation. On the other hand, increase in global liquidation increases the capital inflow in both long and short terms and this situation leads to appreciation of local currency. In this context, after 2002, due to increasing globalization, appreciation of local currency is not a surprising event. Appreciated currency affects the countries' foreign exchange and inflation rate. According to the empirical studies which use VAR models, it is found that increase in global liquidation leads to appreciation of local currency in the short term but this effect is eliminated in the long term (Sousa and Zaghini, 2007).

Global liquidation also affects the balance in world economies. After 2001, loose monetary policies implemented by governments led the long-term interest rates to historic low levels by increasing the amount of liquidity in the world (Dedola, 2006). Decreasing interest rates reduced savings but increased current account deficit by supporting increase in investment. Bracke and Fidora (2008) used global shocks, preference shocks and investments shocks as variables in order to explain increasing external imbalances. According to the analysis result which addresses USA and Asia Zone by using structural VAR model, imbalances and volatilities in the financial market prices are affected by global liquidity variables.

The Measurement of Global Liquidity and Determinants of Global Liquidity

Liquidity of a business means its sufficiency of paying debt of cash and other assets which is measured by its current ratio, cash ratio and acid-test ratio. Indicators such as monetary base, credits, M2 and M3 refer to the monetary liquidity. Liquid market is considered to be beneficial for financial markets and financial stability. Liquid market encourages potential market participants and contributes to the deepening of the markets with the arrival of more investors. Withdrawal of investors from the market in consequence of negative events, reduce the liquidity of the market and worsen the expectations (Browne and McKiernan, 2005).

In general, global liquidity indicators can be divided into two bases: price and quantity. As a price based indicator, nominal and real interest rates are frequently used. In order to measure monetary liquidity which reflects the monetary policy of the country, a price indicator such as interest rate or the variables based on money supply and loans can be used. Quantity based indicators can be calculated as total foreign exchange reserves or foreign exchange reserves plus monetary base. The concept of international liquidity is used as synonym with foreign exchange reserves of the countries for a long time. For many years, the changes in countries' foreign exchange reserves are analyzed as developments of global liquidity. However, there are many other factors such as money supply that determines global liquidity. In recent years, global supply of dollars is widely used as an indicator of liquidity.

Baks and Kramer (1999) propose two different liquidity concepts; market liquidity and financial liquidity. Market liquidity is defined as financial

markets' absorption capacity of temporary fluctuations in supply and demand. On the other hand, financial liquidity is related with the short-term interest rates and the amount of money. The authors are formed a global measure of liquidity in their analysis by focusing on the financial liquidity in G-7 countries. Ruffer and Stracca (2006) have obtained a global liquidity indicator by using the monetary size of G-5 countries. Agostino and Surico (2007) have used the average growth of broadly defined money supply of G-7 countries and the first component of money supply growth rate as a global liquidity indicator.

Belke and Orth (2007) have achieved a global liquidity indicator by using the broad seasonally adjusted financial magnitudes of US, Euro Zone, Japan, England, Korea, Australia, Switzerland, Sweden, Norway and Denmark. First, each country's national income data is translated into a common exchange rate and country weights were determined by dividing it to the total value of national income. Monetary quantities are multiplied by the determined weights of each country and a global liquidity indicator is obtained by totaling them. Many other studies also applied the same method to different country groups. Sousa and Zaghini (2006) are obtained a global liquidity indicator by totaling the monetary size of G-5 countries which is converted with the same exchange rate, without using any global indicator and any weighting technique.
From the studies listed above, it is seen that the mostly used global liquidity indicator is the money supply of G-3, G-5 and G-7 country groups. Due to the effectiveness of quantity-based indicators in empirical studies, they are superior to the price-based indicators such as interest rate. Global liquidity indicator which is expressed as monetary base and total of reserves is considered to be insufficient since it does not reflect the deposits and many of the new financial instruments.

In our study, the liquidity index is formed by using broadly defined money supply of G-5 countries which reflects the global liquidity most accurately due to the adjustments according to the purchasing power parity and national income. The index is formed as follows:

$$IL = \sum_{i=1}^{5} M_i^5 E_{ppp}^{i,\$} \left(GDP_i^5 \frac{E_{ppp}^{i,\$}}{GDP_{top}^{\$}}\right)$$

.....(1)

In the equation (1), IL refers to the international liquidity, M_i^5 refers to money supply in local currency in country i, GDP_i^5 refers to the national income in local currency in country i, $E_{ppp}^{i,\$}$ refers to the exchange rate which is calculated according to ppp (purchasing power parity) of each country, $GDP_{top}^{\$}$ indicates the total of national incomes of each country which is converted to dollars by using each countries' purchasing power parity. The index is adjusted according to the purchasing power parity of the countries to prevent the volatility of the dollar when it is used as common exchange unit. Since the definition of money supply is narrow in some countries, the weighted GDP is placed into the equation (1).

The Empirical Analysis

In this study, Turkey's national income "Y", inflation rate "P", benchmark Treasury bond interest rate "I" and real exchange rate "E" are used as variables. The data is obtained from TurkStat, Turkish Treasury and The Central Bank of Turkey. In the study, quarterly data which compromise 1990Q1-2008Q3 periods are used. Since the process of opening up Turkish economy is completed in 1989, it is decided to initiate the analysis from the year of 1990. On the other hand, since the effects of the global financial crisis were seen at the last quarter of 2008, the data after last quarter of 2008 was not considered.

The logarithmic data is used generally for the financial data to close normality. We take the logarithm of the data and then the data series are purified from seasonality by using the tramo-seats method. Since time series analysis is used in this study, stability of all series is analyzed primarily. Afterwards, vector auto regression (VAR) model was set up, cointegration analysis was done and then causality between the series was investigated. Finally, impact-response and variance decomposition analysis within the framework of VAR model was performed.

Analysis of Stability

In this study, analysis of stability is examined by using Dickey Fuller (ADF) and Philips-Peron test.

Before analyzing the stability of series with ADF test, the graphics of the series are investigated. Analyzing the graphs gives us an opinion about the stability of the series.

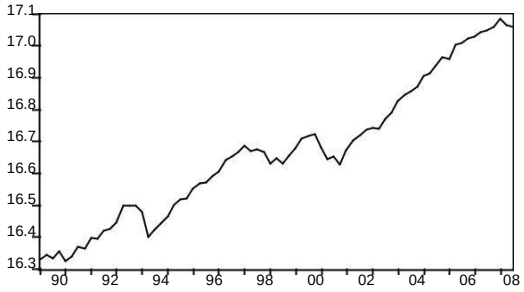

Figure 1: Y (National Income)

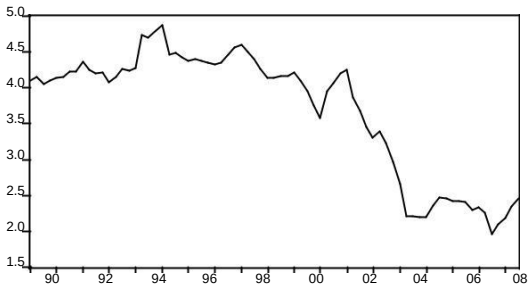

Figure 2: P (Inflation Rate)

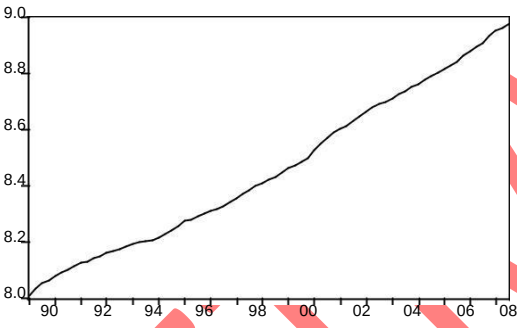

Figure 3: L (International Liquidity)

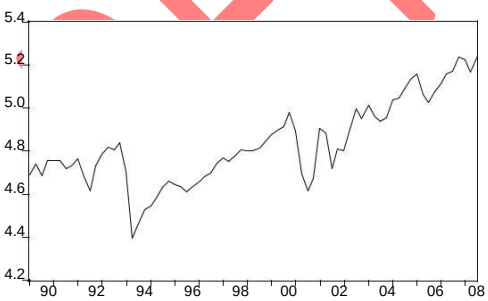

Figure 4: E (Real Exchange Rate)

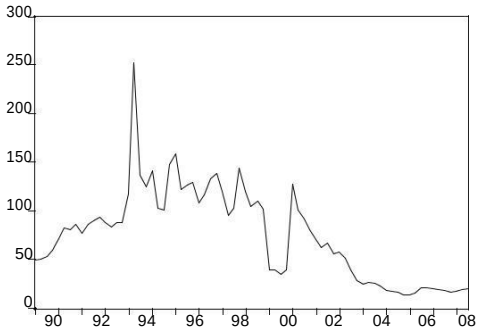

Figure 5: I (Treasury Bond Interest Rate)

When the graph of the series is analyzed above from figure 1 through figure 5, it is seen that the series of Y (National Income), P (Inflation Rate), L (International Liquidity), I (Treasury Bond Interest Rate) and E (Real Exchange Rate) are not stable. Inflation and interest rates decreases after 2002, however national income, liquidity and real exchange increases with fluctuations. To have an exact result about the stationary of the series, it is beneficial to use ADF test. Table 1 presents the results of ADF test.

At the left side of the Table 1, you can observe that Y, P, L, I, and E series are not stable since t statistics of the level are lower than the critical values of ADF. At the right side of the table it can be said that series are I(1) stable. In other words, the first differences of the series are stable. Stability of the series is also examined by Philips-Peron test as robustness. Table 2 presents the results of this test.

The results of the Philips-Peron tests are in parallel with ADF test results. The left side of the table 2 above demonstrates the level test results of the Y, P, L, I and E series. Since absolute values of the series are lower than the critical value, it can be said that series are not stable. At the right side of the table, the first difference test results are shown. Since absolute values of these series are higher than critical value, we reject the main hypothesis that the series have a unit root. In other words, first differences of the series are stable again.

As the series are I(1) stationary, it is possible to check a cointegration relationship between the series. Because of this reason, vector auto regression model (VAR) will be set up firstly.

Table 1: The Results of ADF Test

Level		First differences	
Variables	**t-stat**	**Variables**	**t-stat**
Y	-0.014	ΔY	-6.093**
P	-0.078	ΔP	-3.622**
L	2.617	ΔL	-5.231*
I	-2.404	ΔI	-10.313*
E	0.207	ΔE	-8.018*

For Y and P the critical value of ADF test 1%=-3.53, 5%=-2.90

For L, I, and E the critical value of ADF test 1%=-3.52, 5%=-2.90

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For L, I, and E the critical value of ADF test 1%=-3.52, 5%=-2.90

* 5% significance level
**1% significance level

Table 2: The Results of Philips-Peron

Level		First differences	
Variables	**t-stat**	**Variables**	**t-stat**
Y	-2.26	ΔY	-7.84*
P	-2.04	ΔP	-6.39*
L	2.05	ΔL	-6.06*
I	-2.28	ΔI	-12.42*
E	1.47	ΔE	-7.93*

For Y and P the critical value of ADF test 1%=-4.09, 5%=-3.47

For L and I the critical value of ADF test 1%=-3.52, 5%=-2.90

For E the critical value of ADF test 1%=-2.60, 5%=-1.95

For Y and I the critical value of ADF test 1%=-3.52, 5%=-2.90

For P and E the critical value of ADF test 1%=-2.60, 5%=-1.95

For L the critical value of ADF test 1%=-4.09, 5%=-3.47

*1% significance level

Vector Auto Regression (VAR) Model Analysis

Within the framework of this study, VAR model was formed for Turkey's economy. 'Y', 'P,' I', 'E' and 'L' are used as variables. It is not certain to

form VAR model whether with the state level of the series or by taking the differences of them. At this point, the pioneers of VAR models, Sims, Stock and Watson (1990), are followed and model series are estimated within their state level.

It is very important to sequence the variables in VAR model. Monetary and financial indicators are put at the end of the sequence since they are easily affected from the shocks than real variables (Belke and Orth, 2007). International liquidity is placed at the top of the sequence. At this point, it is assumed that Turkey's economy is not large enough to influence the global liquidation. The order is as follows; L ➪ Y ➪ P ➪ I ➪ E.

While setting up the VAR model, lag number should be considered primarily. We should use AIC (Akaike Information Criteria), SC (Schwarz Information Criteria) and FPE (Final Prediction Error) in order to determine the length of lag. Table 3 shows the lagged values which make the criteria minimum. Schwarz (SC) and Hannan-Quin (HQ) data criteria indicate the lag length as 1. Also, AIC and FPE indicate lag length as 2 and Log Likelihood (LG) indicates lag length as 5. The 5 lag lengths are not preferred because of missing and low number of data. On the other hand, since quarterly data is used, setting 1 lag length is not enough. Thus, it is appropriate to determine the delay length as 2 according to AIC and FPE.

Table 3: Lag Length Criteria for the VAR Model

Lag	LG	FPE	AIC	SC	HQ
0	-136.16	4.76E-0	4.236	4.561	4.364
1	371.417	4.02E-1	-9.751	-8.617*	-9.301*
2	402.991	3.37E-1*	-9.941*	-7.999	-9.171
3	421.773	4.18E-1	-9.761	-7.009	-8.669
4	436.903	5.92E-1	-9.475	-5.913	-8.062
5	473.856*	4.65E-1	-9.821	-5.451	-8.087
6	489.324	7.22E-1	-9.545	-4.365	-7.491

As a result of the crisis in 1990-2008, Turkey's macroeconomic variables fluctuated more than ever. These fluctuations damage the series and reduce the quality of data. The properties of Turkey's macroeconomic data constitute a problem for empirical studies. To overcome this problem, it is appropriate to use a dummy variable in the crisis periods. For this reason, dummy variables of 1994, 1999, and 2001 are created and included to the model. However, dummy variable of 1994 and 1999 are not statistically significant so they are removed. Thus, to estimate VAR model, only the dummy variable of 2001 is included.

After setting up VAR model, cointegration analysis is executed in the next section. The results of VAR model is shown below in Table 4:

Cointegration Analysis

Presence of long-term relationship between liquidation (L), national income of Turkey (Y), inflation rate (P), treasury benchmark interest rate (I), and real exchange rate is tested by using Johansen method. In this study, whether using Engle-Granger or Johansen method is discussed for the cointegration analysis. If there is more than one cointegration vector, Engle-Granger method will not be valid. On the other hand, based on VAR

model, the number of the cointegration vectors exist between the variables could be determined by applying the Johansen method. Therefore, a more realistic analysis can be made without limiting the

test with expecting just one vector. Because of this superiority, Johansen method was preferred.

Basically, it is determined how many cointegration vectors are in VAR model by using Maximum Likelihood Ratio Test of Johansen:

$$\lambda_{trace}(q,n) = -T\sum_{i=q+1}^{k}\ln(1-\hat{\lambda}_i) \quad \text{.....(2)}$$

If there is k unit variable, cointegration vector number will be k-1; so the range of r; r=0, 1, 2… k-1, 0<=r<=n. In the equation (2), T is the observation number for prediction and λ is biggest estimated eigenvalue. Trace statistic does not have X^2 distribution. Table values are at Osterwald-Lenun (1992). The main hypothesis in the trace assumes there is k or less cointegration vector.

In Johansen approach, there is Maximum Eigenvalue test to find the number of cointegration vector. The main hypothesis is set up as there is r unit cointegration vector and the alternative hypothesis is set up as there is r+1 unit cointegration vector. The statistic of Maximum Eigenvalue test is below:

$$\lambda_{max} = -T\log(1-\hat{\lambda}_{r+1}) \quad \text{.....(3)}$$

Maximum Eigenvalue statistic does not have X^2 distribution too. Table values are at Osterwald-Lenun (1992).

Johansen cointegration test result of this study is shown at the table 5. As it can be seen in the table 5, either trace statistic or maximum eigenvalue statistic shows just one cointegration vector. For the trace statistic the main hypothesis is r=0, which means there is no cointegration vector and alternative hypothesis is set as r <=1. We reject the main hypothesis because calculated value is bigger than critical value at a significance level of 5%. At the second stage the main hypothesis is set up as r<=1 and alternative hypothesis is set up r<=2. The main hypothesis is accepted because calculated value is lower than critical value, in other words, there can be only one cointegration vector.

Table 4: VAR Model

	LLIK_SA	LGDPTR_SA	LENF_SA	FAIZTR_SA	LKURTR_SA
LLIK_SA(-1)	1.158	-0.531	2.096	-511.98	1.934
	-0.113	-0.664	-4.034	-767.745	-1.213
	[10.210]	[-0.798]	[0.519]	[-0.666]	[1.594]
LLIK_SA(-2)	-0.165	0.641	-2.971	340.577	-1.806
	-0.113	-0.662	-4.026	-766.338	-1.211
	[-1.465]	[0.968]	[-0.737]	[0.444]	[-1.492]
LGDPTR_SA(-1)	-0.033	0.7853	-0.481	-82.991	-0.174
	-0.026	-0.153	-0.931	-177.017	-0.279
	[-1.277]	[5.129]	[-0.516]	[-0.468]	[-0.622]
LGDPTR_SA(-2)	0.056	0.096	1.011	320.036	0.164
	-0.027	-0.161	-0.975	-185.597	-0.293
	[2.063]	[0.603]	[1.036]	[1.724]	[0.562]
LENF_SA(-1)	-0.002	0.011	0.941	-12.431	0.061
	-0.003	-0.019	-0.118	-22.478	-0.035
	[-0.623]	[0.568]	[7.967]	[-0.553]	[1.731]
LENF_SA(-2)	0.0045	-0.021	-0.126	20.914	-0.067
	-0.003	-0.017	-0.108	-20.591	-0.032
	[1.509]	[-1.221]	[-1.171]	[1.015]	[-2.061]
FAIZTR_SA(-1)	-2.69E-05	-7.82E-05	0.0002	0.357	-0.0004
	-2.50E-05	-0.00014	-0.0008	-0.166	-0.0002
	[-1.09356]	[-0.544]	[0.258]	[2.151]	[-1.701]
FAIZTR_SA(-2)	-4.61E-05	0.0001	0.001	-0.073	0.0001
	-2.20E-05	-0.0001	-0.0001	-0.146	-0.0002
	[-2.128]	[0.842]	[2.141]	[-0.504]	[0.819]
LKURTR_SA(-1)	0.013	0.049	-0.331	-63.842	0.717
	-0.015	-0.089	-0.545	-103.74	-0.163
	[0.888]	[0.551]	[-0.608]	[-0.615]	[4.374]
LKURTR_SA(-2)	-0.025	-0.115	0.501	-68.133	0.0376
	-0.014	-0.086	-0.525	-99.926	-0.157
	[-1.701]	[-1.333]	[0.955]	[-0.681]	[0.238]
Constant	-0.263	1.398	-1.776	-1834.95	0.287
	-0.103	-0.603	-3.666	-697.686	-1.102
	[-2.552]	[2.318]	[-0.484]	[-2.630]	[0.261]
D0102	0.008	-0.031	0.226	18.111	-0.104
	-0.002	-0.016	-0.099	-19.006	-0.031
	[2.996]	[-1.885]	[2.271]	[0.952]	[-3.471]
R-squared	0.999	0.992	0.983	0.787	0.965
Adj. R-squared	0.999	0.991	0.981	0.749	0.958
Sum sq. resids	0.000	0.025	0.956	34624.4	0.086
S.E. equation	0.003	0.021	0.125	23.824	0.037
F-statistic	40053.09	713.093	323.326	20.601	153.208
Log likelihood	315.33	186.368	54.658	-328.49	142.377
Akaike AIC	-8.31041	-4.777	-1.168	9.328	-3.571
Schwarz SC	-7.9339	-4.401	-0.792	9.705	-3.195
Mean dependent	8.472352	16.676	3.681	75.745	4.834
S.D. dependent	0.275527	0.215	0.887	47.616	0.185
Determinant Residual Covariance			1.96E-11		
Log Likelihood (d.f. adjusted)			382.063		
Akaike Information Criteria			-8.823		
Schwarz Criteria			-6.941		

Table 5: Johansen Cointegration Test

Cointegration Rank	Trace Statistics	5%	Cointegration Rank	Max Statistics	5%
r≤0	99.62*	88.80	r=0	47.44*	38.33
r≤1	52.18	63.88	r=1	21.52	32.12
r≤2	30.66	42.92	r=2	14.46	25.82
r≤3	16.20	25.87	r=3	11.12	19.39

For Maximum Eigenvalue statistics, main hypothesis is set as r=0, means there is no cointegration vector and the alternative hypothesis is set as r=1. We reject the main hypothesis because calculated value is bigger than the critical value at a significance level about 5%. At the second stage, the main hypothesis is set up as r=1 and alternative hypothesis is set up r=2. The main hypothesis is

accepted because calculated value is lower than critical value; means there is only one cointegration vector for Maximum Eigenvalue too. The observed series act together in long-term according to Johansen cointegration results.

Since there is cointegration among the series, the next step will be examining the causality analysis and causality direction.

Granger Causality Analysis

Causality will be analyzed for both short and long-term, as the series are I(1) and cointegrated. Coefficient of the error correction model specifies the correction of the long-term equilibrium's deviation. If the coefficient of the error correction is included, strong Granger Causality is obtained. The Granger model applied in this study is as follows etc.:

$$\Delta T = \alpha_1 + \left(\sum_{i=1}^{n} \beta_{1i} \Delta T_{t-i}\right) + \left(\sum_{i=1}^{n} \delta_{1i} \Delta L_{t-i}\right) + \left(\sum_{i=1}^{n} \phi_{1i} \Delta P_{t-i}\right) + \left(\sum_{i=1}^{n} \lambda_{1i} \Delta I_{t-i}\right) + \left(\sum_{i=1}^{n} \varphi_{1i} \Delta E_{t-i}\right) + \theta_1 ECT_{t-1} + \varepsilon_{1t} \quad \text{.....} \quad (4)$$

$$\Delta P = \alpha_2 + \left(\sum_{i=1}^{n} \beta_{2i} \Delta P_{t-i}\right) + \left(\sum_{i=1}^{n} \delta_{2i} \Delta L_{t-i}\right) + \left(\sum_{i=1}^{n} \phi_{2i} \Delta T_{t-i}\right) + \left(\sum_{i=1}^{n} \lambda_{2i} \Delta I_{t-i}\right) + \left(\sum_{i=1}^{n} \varphi_{2i} \Delta E_{t-i}\right) + \theta_2 ECT_{t-1} + \varepsilon_{2t} \quad \text{.....} \quad (5)$$

For the short-term causality F test is applied to the ΔL's lagged values in the equations above. For the long-term causality F test is applied to the ΔL's lagged values in the equations and the coefficient of the error correction term (ECT) together. The causality relationship between global liquidity and Turkey's national income (Y), inflation rate (P), Treasury bond benchmark interest rate (I), real exchange rate (E) is shown at table 6.

Table 6: Granger Causality Test

Dependent Variable	The Source of Causality (Dependent Variable)	
	Short-Term Causality	Long-Term Causality
	ΔL	ECT/ΔL
ΔY	4.349*	3.165*
ΔP	2.363	4.999*
ΔI	0.139	6.401***
ΔE	0.041	3.032

Appropriate lag length is determined by using AIC and SC
*10% significance level
**1% significance level

As indicated in the table 6, global liquidity in the short term is a Granger Cause just for the national income. For the long-term, global liquidity is Granger cause of national income and inflation in 10 percent significance level and it is also the Granger cause of real exchange rate in 1 percent significance level. Granger causality test indicates that global liquidity has distinct impact on Turkey's macroeconomic variables in the long-term.

Impact Response and Variance Decomposition Analysis

Impact response and variance analysis are often used to understand the effect of the global liquidity on macro economy. Functions of impact response analysis reflect the effect of random error term's standard deviation shock on internal variables' current and future values. Functions of impact response analysis have an important role to detect symmetrical relationship, and dynamic interactivity among the inspected variables in VAR model. The most effective variables on macroeconomic size are found by variance decomposition analysis. Also, functions of impact response are used to understand whether this variable is usable or not as a political tool. Impact responses are shown below from figure 6 through 10.

Figure 6: Impact response of liquidity to itself

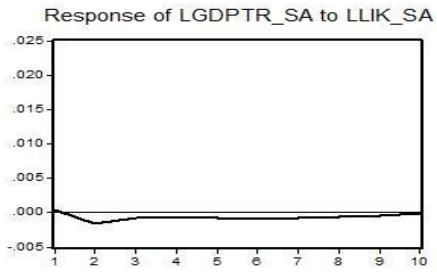


Figure 7: Impact response of national income to liquidity

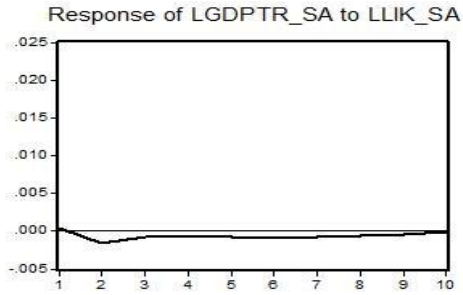


Figure 8: Impact response of inflation to liquidity

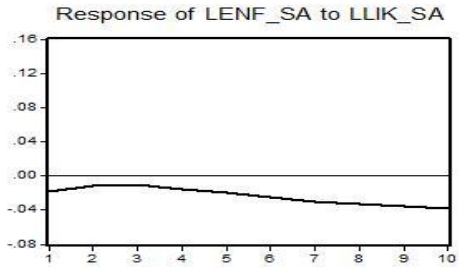


Figure 9: Impact response of interest rate to liquidity

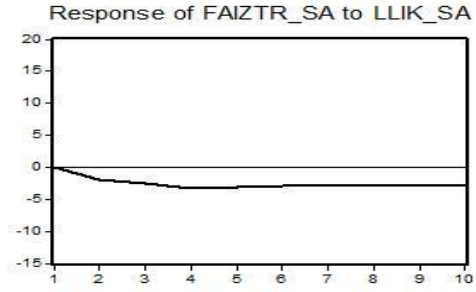
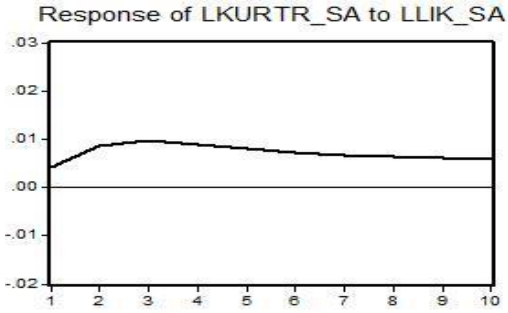


Figure 10: Impact response of exchange rate to liquidity



The straight lines on the graph show the reaction of national income (Y), inflation rate (P), treasury bond interest rate (I), and real exchange rate (E) to one standard error shock which is given to global liquidity. At the graph, X axes refer to quarterly terms and Y axes mean that there are how many unit effects of shock on variables. It can be seen from figure 10 that the changes on global liquidity will have positive impact on Turkey's real exchange rate in 3 years time. The negative effect of global liquidity on national income, inflation and interest rate is observed strongly.

Impact response analysis indicates that positive global liquidity shock decreases Turkey's inflation. This result is normal for Turkey case but it is contradictory with the other results in the literature. Turkey's inflation rate was high in 1990 where liquidity increase is low. At those periods the high inflation is observed due to Turkey's internal dynamics such as high borrowing requirement, unstable banking sector, and inconsistent monetary and fiscal policy. After the increase in global liquidity in 2001, while the inflation rate in the world was increasing, inflation reduced in Turkey as a result of the structural reforms and a successful economic program implemented by Turkey. Hence, the effect of positive shock on global liquidity was negative on Turkey.

From the results, it can be seen that increase in international liquidity reduces the interest rate of Turkey. Being parallel with the literature, this result is a factor of the positive effect of increasing fund supply with global liquidation on demand to bonds. During the periods of abundant global liquidity, demand of either domestic or foreign investors to bonds and bills increase and as a result of increasing demand, interest rates decrease.

In our Turkey case, increase in global liquidity has a positive effect on increasing real exchange rate, in other words it leads to appreciation of currency. Fund movements gather pace with increase of global liquidity, so fund inflow increases. Both

short-term and long-term fund inflow with global liquidity increases the value of currency. In opposite, when international liquidity shrinks, fund inflow decreases and fund outflow increases. For this reason, any increase in international liquidity decreases the value of currency.

Variance decomposition takes one of the internal variables and treats it as separate shock which affects all the internal variables. Hence, variance decomposition gives information about dynamics of system. The aim of the variance decomposition is to uncover the effect of predictions for every random shock on error variance. Error variance of prediction, for h length term, is expressed as the additive of each variable to error variance. Every variance obtained in this way, is proportioned with total variance, and relative weight is found. As it can be seen in Cholesky decomposition, the sequence of variables has an effect on the variance decomposition results. In the table 7, variance of national income in short-term is almost explained by itself. When the length of the period become longer, volatility of the national income's effect on itself decrease but the effect of other variables increases proportionally. The variables explain the variance in inflation and its weight in different time periods can be seen at the table 8. As being parallel to the literature, volatility in inflation is explained by itself due to viscosity in prices. The variables explain volatility in Treasury bond interest rate (I) and real exchange rate (E) and their weights in different time periods are seen at the table 9 and 10, respectively. If the length of the period become longer, the explanation power of global liquidity of volatility in interest rate and real exchange rate becomes slightly increase. The liquidity mostly affects the variance decomposition of national income in table 7. In the fifth year liquidity has 38% effect on the variance decomposition of the national income.

Conclusion

With the increase of the commercial and financial relations with other countries, Turkey was more affected by the international developments especially after 2002. Thus, it has become important to analyze global liquidity and its effects on Turkey's economy. In this study, the relationship between global liquidity indicator and Turkey's national income, inflation rate, benchmark interest rate of treasury, real exchange rate is investigated by using the quarterly data of 1990Q1-2008Q3.

Since time series analysis is used, the stationarity of the series is examined firstly. By using the Augmented Dickey Fuller (ADF) and Philips-Peron tests, these series are found to be stationary in the first level. According to our analysis of Johansen cointegration test, it is found that series are cointegrated and act together in the long term. This means there is a significant relationship between global liquidity indicator and Turkey's macroeconomic variables in the long run.

The Granger causality test was executed in the next stage to probe both long term and short term causality relationship. It is observed that global liquidity is Granger cause of national income in the short term. However, in the long run global liquidity is Granger cause of national income and inflation rate at 10% significance level; but it is Granger cause of the real exchange rate at 1 % significance level.

In this study, impact-response and variance decomposition analysis are also performed for future predictions. According to the impact response analysis, changes in the global liquidation will have a negative effect on the national income in three years period. Moreover a positive global liquidity shock will have a positive effect on reducing inflation. Although this result is the opposite of the literature, it should be seen as normal for the Turkey case. In Turkey case, increase in global liquidation has an effect on reducing the interest rate and appreciating the local currency as similar to the results in the literature. Increase in global liquidation increases the supply of foreign currency and accelerates the capital inflows which appreciate the local currency of developing countries such as Turkey. Variance decomposition analysis indicates that all the variables are explained by itself in the short run. The longer the maturity period is, the stronger the effect of the global liquidation on the variance of the variable's volatility. Interestingly, the effect of global liquidity on national income will increase after the fourth year and national income is mostly affected variable from global liquidity. This result may be due to the excess liquidity in the economy, which would cause negative effects on the first three years.

Hence the results of our analysis assert that developments in global liquidation directly affect the macroeconomic variables of Turkey. Therefore, while analyzing Turkey's economy, the factors affecting the global liquidation should be monitored closely.

Table 7: Variance Decomposition of National Income (Y)

LGDPTR_SA

Period	S.E.	LLIK_SA	LGDPTR_SA	LENF_SA	FAIZTR_SA	LKURTR_SA
1	0.020	0.032	99.967	0	0	0
2	0.027	0.342	98.705	0.0817	0.627	0.242
3	0.030	0.338	98.611	0.089	0.591	0.369
4	0.032	0.357	97.283	0.256	1.457	0.643
5	0.034	0.383	95.160	0.819	2.387	1.251
6	0.035	0.414	92.791	1.608	3.029	2.157
7	0.037	0.437	90.423	2.435	3.484	3.217
8	0.038	0.444	88.149	3.221	3.865	4.319
9	0.038	0.434	86.035	3.938	4.199	5.391
10	0.039	0.421	84.147	4.571	4.471	6.389

Table 8: Variance Decomposition of Inflation Rate (P)

LENF_SA

Period	S.E.	LLIK_SA	LGDPTR_SA	LENF_SA	FAIZTR_SA	LKURTR_SA
1	0.125	2.093	5.799	92.107	0	0
2	0.177	1.442	10.259	87.774	0.262	0.262
3	0.212	1.225	12.463	82.552	3.571	0.188
4	0.234	1.421	12.470	80.067	5.883	0.159
5	0.248	1.912	11.366	79.143	7.423	0.155
6	0.258	2.716	10.488	77.891	8.706	0.198
7	0.268	3.755	10.045	75.851	10.037	0.309
8	0.276	4.954	9.894	73.123	11.514	0.512
9	0.284	6.255	9.908	69.947	13.065	0.821
10	0.292	7.605	10.001	66.571	14.581	1.243

Table 9: Variance Decomposition of Treasury Bond Interest Rate (I)

FAIZTR_SA:

Period	S.E.	LLIK_SA	LGDPTR_SA	LENF_SA	FAIZTR_SA	LKURTR_SA
1	23.824	0.000	34.724	5.040	60.234	0
2	26.273	0.506	37.054	4.192	57.801	0.444
3	27.013	1.295	35.189	4.107	56.855	2.551
4	27.692	2.641	34.456	4.191	54.988	3.722
5	28.346	3.766	33.294	4.358	53.843	4.736
6	28.967	4.672	31.949	4.346	53.534	5.497
7	29.552	5.450	30.721	4.223	53.447	6.158
8	30.086	6.170	29.684	4.081	53.276	6.787
9	30.574	6.846	28.813	3.951	53.006	7.381
10	31.022	7.468	28.052	3.843	52.711	7.925

Table 10: Variance Decomposition of Real Exchange Rate (E)

LKURTR_SA:

Period	S.E.	LLIK_SA	LGDPTR_SA	LENF_SA	FAIZTR_SA	LKURTR_SA
1	0.037	1.292	29.598	0.443	15.528	53.137
2	0.049	3.771	26.536	0.663	23.195	4.834
3	0.056	5.945	25.255	0.549	24.592	43.656
4	0.060	7.247	24.501	0.501	25.067	42.682
5	0.064	8.051	24.332	0.549	25.643	41.423
6	0.066	8.592	24.394	0.641	26.173	40.198
7	0.068	9.031	24.403	0.747	26.601	39.216
8	0.071	9.443	24.301	0.859	26.936	38.461
9	0.071	9.844	24.118	0.971	27.207	37.859
10	0.072	10.238	23.895	1.069	27.443	37.353

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