AN ANALYSIS ON MONETARY CONDITION INDEX IN TURKEY BY USING STRUCTURAL VAR ANALYSIS

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Abstract
The Central Bank of Turkey (TCMB) has a significant power on aggregate demand and inflation expectation via monetary policy tools. While deciding monetary policies it's a crucial question and a discussion topic for TCMB (Turkish Republic Central Bank) if the policy makers should take into consideration Taylor Rule that mainly depends on the interest rate or Monetary Condition Index (MCI). The MCI that is a popular tool in the last decades that is calculated as a weighted average of the real short-term interest rate and the real effective exchange rate relative to their value in a base period. MCI also is a pointer that explains if the central banks policies expansionary or tight. The reality that MCI can have influence on the domestic currency and the foreign currency together is an advantage for MCI. This study aims to explain the possible effects of MCI on the aggregate demand in Turkey. Structural VAR analysis will be used for the analysis. The period for the analysis covers a period of starting from M1:2003 till M8:2015

Key words: *Central Bank, Monetary Condition Index, Monetary Policy, Structural Var Analysis, Taylor Rule.*

JEL Classification: *E43, E58, E60*

I. INTRODUCTION

Rules-Based monetary policy or discretionary monetary policy, which should preferred is still a questionnaire for economists of Central Banks. Rules-based monetary policies are important tools in terms of the relation and communication of the Central Banks with other financial institutions. Monetary Condition Index (MCI), are more popular starting from the early 90's. As a tool for monetary policy, many central banks consider the Monetary Condition Index that is a combination of short term interest rates and exchange rate. Canadian, New Zealand and the Swedish Central Banks can be examples for such policies (Benazic, 2012:48). It is possible to say that; MCI can be defined as an indicator of monetary variables that has an influence on economic growth and inflation. The most popular presentation of MCI is shown below (Esteves, 2003:25):

$$MCI_{rt} = \beta_r (i_t - i_{to}) + (1 - \beta_r) + \left[\ln \left[\frac{e_t}{e_{to}} \right] \right] \quad (1)$$

In the equation 1.1, "i" stands for the short term in interest rate, "e" for exchange rate and "t" is the period considered. MCI also includes some clues and gives information on the monetary policy that is implied. It is a sign of the tight monetary policy if the MCI value is more than 1, and oppositely, it is a sign for the expansionary monetary policy if MCI is less than 1 (Süslü ve Dişbudak, 2012:70). When considering MCI as a monetary policy tool, extra caution is advised. It should be restricted to consider MCI as a mechanic tool that is Central Bank should not arrange the MCI for the tenuous fluctuations in the exchange rate. Central Bank should be in charge to adopt MCI only after significant fluctuations in the exchange rate. It should be avoid also considering MCI as a short term objective for operation target (Kaytancı, 2008:18). The aim of the paper is to discover if Central Bank of Turkey implement tight or expansionary monetary policy in the period January 2006 that Central Bank of Turkey started to inflation targeting strategy to September 2015. MCI will assist us in our analysis.

In order to answer our question, the literature that tests MCI will be investigated and then the methodology will be followed to test the MCI for Turkey. In the last stage, the test results will be analyzed.

Researches investigates MCI such as Frochen (1996) for Germany, England, France, Spain and Italy, Dennis (1997), Kinch and Holton (2010) for New Zealand, Kannan et al. (2006) for India, Hyder and Khan (2006), Zulfiqar and Muhammad (2007) for Pakistan, Poon (2009, 2014) for Indonesia, Yaaba (2013) for Nigeria, Knedlik (2005) for South Africa, Poon (2010) for ASEAN 5 and Kodra (2011) for Albania has a common result. According to those studies, for the developing and open market economies, exchange rate expectations are very important variable for macroeconomic stability. Depending on that hypothesis, those researches offer MCI as a more efficient monetary policy when ruled-based monetary policies are considered.

On the other hand, Dennis (1997), offers MCI as a more efficient monetary policy tool compared to exchange rate or interest rate. There are also some other comments on MCI, like Eika et. al. (1996) and Benazic (2012). They both argue that MCI should not be considered as a monetary policy tool.

Kaytancı (2008) offers MCI as an optimum tool in open economies where Taylor rule suggested to be the optimal monetary policy tool in closed economies. Süslü ve Budak (2012) investigates that, Turkish Republic Central Bank considers MCI while determining monetary policy. Aydemir and Demirhan (2009) investigate the bi-directional causality from exchange rate to commodity prices. Kesiyerli and Koçaker (1999) underline the substitution theory between interest rate and the exchange rate while considering hot money movements. According to that paper, that substitution results an undefined MCI. For Turkish economy it is commonly investigated that there is a negative correlation from exchange rate to commodity prices.

II. METHODOLOGY

It is assumed that; Z_t is the endogenous variable vector with m dimension, β_0 is the constant term, θ deterministic variable (trend and dummy) and $u_t \sim$ iid $(0, \sigma^2)$;

$$A(L)Z_t = \beta_0 + \beta_1\theta + u_t \quad (2)$$

In order to renew that model respect to Johansen (1988) methodology, p is considered to be the lag lenght;

$$\Pi_i = -\left[I_N + \sum_{j=1}^{p} A_j \right] \text{ and } \Pi = -\left[I_N + \sum_{j=1}^{p} A_j \right] \quad (3)$$

$$\Delta Z_t = -\sum_{i=1}^{p-1} \Pi_i \Delta Z_{t-1} + \Pi Zp + u_t \quad (4)$$

This equation can be supposed in a simple way as $\Pi = \alpha\beta'$. For α and β matrixes, (mxr), m is the number of variables and r co-integrated vector quantity on the other hand β is he constant belongs to that co-integration situation. Null hypothesis is designed with the assumption that there are "r" co-integrated vector and Likelihood Ratio (LR) test is employed.

$$LR = -T \sum_{i=r+1}^{p} \ln(1 - u_i) \quad (5)$$

Vector autoregressive model (VAR), cannot reflect the effects of the variables in the model. In VAR model all variables should be assumed as endogenous variables. On the other hand, due to the fact that all variables in model involve the lag length values, they raise the degree of freedom problem (Kaya, 2014:189). Apart from that, in the VAR Model the economical shocks cannot be defined. Respect to that problems, VAR model was critiqued by Sims (1980), Clooey ve Leroy (1986), Sims (1986), Bernanke (1986), Blanchard ve Watson (1986) and Shapiro ve Watson (1988). That critics resulted as a new model that get over such problems; SVAR.

SVAR model is a traditional VAR model that created the restrictions depending on the economy theory. Blanchard and Quah (1988) evaluated the SVAR model as long term SVAR. In that new model, the shocks considered to have long term effects. VAR model;

$$Z_t = \Gamma_0 + \Gamma_1 Z_{t-1} + \Gamma_2 Z_{t-2} + \ldots + \Gamma_p Z_{t-p} + u_t$$

In the equation, t=1,2,3,…,T time index, Z_t is the endogenous variable vector with "m" dimension, u_t is the error term still with "m" dimension and with normal distribution. If it will be redefined as a medium process:

$$Z_t = A(L)u_t$$

And

$$A(L) = \sum_{j=0}^{\infty} A_j L^j$$

Structural shocks and the orthogonal restrictions in the A(L) matrix, the structural model is created. Error terms (u_t) in the VAR model and the linear combination of the economic shocks, v_t, exist in the equation as below:

$u_t = Av_t$

With the structural shock, VAR model can be shown as $\begin{bmatrix} IPI \\ INT \\ REER \end{bmatrix} = B(L) \begin{bmatrix} v_{IPI} \\ v_{INT} \\ v_{REER} \end{bmatrix}$ or $Z_t = B(L)v_t$. If

C(L)A=B(L) and C matrixes can be defined, reduced form of C(L) VAR can be obtained. After adopting the A matrix to the VAR model v_t will be in a normal form with the unit variance.

$$\begin{bmatrix} IPI \\ INT \\ REER \end{bmatrix} = A(L) \begin{bmatrix} A_{11} & 0 & 0 \\ A_{21} & A_{22} & 0 \\ A_{31} & A_{32} & A_{33} \end{bmatrix} \begin{bmatrix} v_{IPI} \\ v_{INT} \\ v_{REER} \end{bmatrix}$$

III. EMPIRICAL STUDY

In order to check the MCI for Turkish economy for the period January 2006 – September 2015 three variables were selected. Instead of using GDP as a variable, Romer and Romer (1989) followed and as a proxy variable Industry Production Index (IPI) will be included in the model. Second variable in the model is real exchange rate (REER). Short term nominal interest rate (INT) will be included in the model as a tool of TCMB monetary policy. All there variables are gathered from the International Finance Statistcis booklet (IFS) that is pressed by International Money Fund. In order to avoid variation problem, natural logarithms of all variables are concluded and all variables are detected from the seasonality problem via Moving Average method.

Table 1. Descriptive Statistics

	Average	Maximum	Minimum	Standart Deviation	Kurtosis	Skewness	Jarque-Bera
IPI	4.651	4.866	4.362	0.118	-0.354	2.433	4.009 (0.134)
INT	2.016	3.019	0.410	0.682	-0.521	2.832	5.449 (0.065)
REER	4.705	4.085	4.517	0.071	-0.020	2.536	1.0589 (0.589)

Note: Values in the parenthesis represent the possibility values

According to descriptive statistics; standard deviation is minimum for REER variable, and maximum for INT. It may be considered as a plus for MCI just because we mentioned before about the problems that occurs when considering REER or INT alone in a monetary policy. On the other hand, if the skewness ration is taken into consideration, that shows the assymetry in probability distribution of the sample, it is tended to the left. Jarque-Bera test, that offers normal distribution in null hypothesis, is rejected for INT in %90 confidince interval, and accepted for IPI and REER.

Unit Root Tests

In order to see the dynamic relations between the variables, VAR (vector auto regression) Model will be used. To prepare the variables for the VAR model analysis, variables should be in clear of unit root. Augmented Dickey-Fuller (1981, ADF) and Phillips-Perron (1988, PP) unit root tests that ignores structural breaks will be applied.

Table 2. ADF (1981) and PP (1988) Unit Root Tests

		Variables	ADF	PP		*Variables*	ADF	PP
Level	*Constant*	**IPI**	-1.633 (1) [0.462]	-2.999 (6) [0.037]	*First Diffirence*	**IPI**	-22.726 (0) [0.00]	-23.586 (1) [0.00]
		INT	-1.546 (0) [0.506]	-1.732 (3) [0.412]		**INT**	-9.106 (0) [0.00]	-9.103 (1) [0.00]
		REER	-2.337 (1) [0.163]	-1.816 (3) [0.371]		**REER**	-7.951 (0) [0.00]	-7.662 (7) [0.00]
	Constant +Trend	**IPI**	-2.404 (1) [0.375]	-5.804 (7) [0.00]		**IPI**	-22.645(0) [0.00]	-23.492 (1) [0.00]
		INT	-1.639 (0) [0.771]	-1.926 (3) [0.634]		**INT**	-9.078 (0) [0.00]	-9.075 (1) [0.00]
		REER	-3.370 (1) [0.060]*	-2.764 (3) [0.213]		**REER**	-7.936 (0) [0.00]	-7.634 (7) [0.00]

Not: *, **, *** denotes significance value of 1%, 5%, %10 levels, for the stationary of the series. The value that are in parenthesis show the optimal lag length for the SIC criteria. Mac Kinnon (1996) critical values, for the constant term in %1, %5 and %10 confidence interval respectively -3.485, -2.885 and -2.579. For the constant and trend model respectively critical values are; -3.483, -2.884 and -2.579. For PP test the values in the parenthesis shows the band length according to Newey-West by using Bartlett Kernel criteria. Critical values are same as ADF test. For PP, the Mac Kinnon (1996) critical values are for constant model, for the 1 %. 5 % and 10 % significance levels -3.485. -2.885. -2.579 and for constant and trend model -4.033. -3.446 and -3.148 respectively.

Dickey-Fuller (1981) and Phillips and Perron (1988) test results agree that the variables are not stationary

in the level. When the first difference [I(1)] of the all series are considered, they are all stationary for both constant and constant and trend models. For the SVAR model, first difference [I(1)] of the series will be considered. Pan Tula principal will be in our analysis to examine the long term co-integration between the variables. The cases 1 and 5 are too rare, most common models are 2, 3, and 4.

For the choice between those popular models, co-integration tests will be checked for model 2, 3 and 4 respectively. Ho: represents the first model and rank that co-integration hypothesis is accepted, and that model will be the appropriate model. Trace/Maximum eigenvalue statistics will be considered for Pan Tula Principal. (Asterio and Hall, 2007: 327-328).

Table 3: Pan Tula Principal (Trace Statistics)

Rank (r)	Model 2	Model 3	Model 4
None (r=0)	20.575 (0.690)*	17.650 (0.592)	26.299 (0.720)
At most 1 (r=1)	10.805 (0.560)	8.620 (0.401)	12.616 (0767)
At most 2 (r=2)	3.288 (0.528)	2.406 (0.120)	5.211 (0.566)

Not: The values within the parenthesis show the probability ratios. Consider the lines. Ho: represents the first model and rank that co-integration hypothesis is accepted, and that model will be the appropriate model.

Model 2 that has no co-integration will be employed. According to the results, there is no co-intergration between the variables in the long term. First differences of the variables are considered in the Structural VAR with respect to that fact.

Table 4.Long Term Structural VAR Analysis (SVAR)

	IPI	INT	REER
IPI	C(1) 0.030217 (0.00)	0	0
INT	C(2) -0.065720 (0.00)	C(4) 0.196259 (0.00)	0
REER	C(3) 0.009832 (0.00)	C(5) 0.005310 (0.01)	C(6) 0.021346 (0.00)

Note: The values within the parenthesis represents the probability ratios.

Considering the probability ratios, all variables and the results are significant in % 99 confidence level. C(1)=0.030217 stands for the effect of industry production index on itself, C(2)= -0.065720 stands for the effect of the interest rate on industry production, on the other hand, C(3)= 0.009832 stands for the effect of real interest rate on industry production index. These results lead us to write the equation for Monetary Condition Index as below:

$$MCI=0.009832 \square REER-0.065720 \square INT$$

According to Abdul (2002) if the interest rates are more dominant in the Monetary Condition Index is a proof of the fact that Central Bank focuses Inflation Targeting policy in the selected period. The situation in Turkey in the selected period is the same, and also parallel with the hypothesis of Abdul (2002). In that aspect, interest rates are more effective in the monetary policy and also within the money basis. In graph 1, the evaluation of the Monetary Condition Index is shown for the period starting from 2006 January till 2015 August.

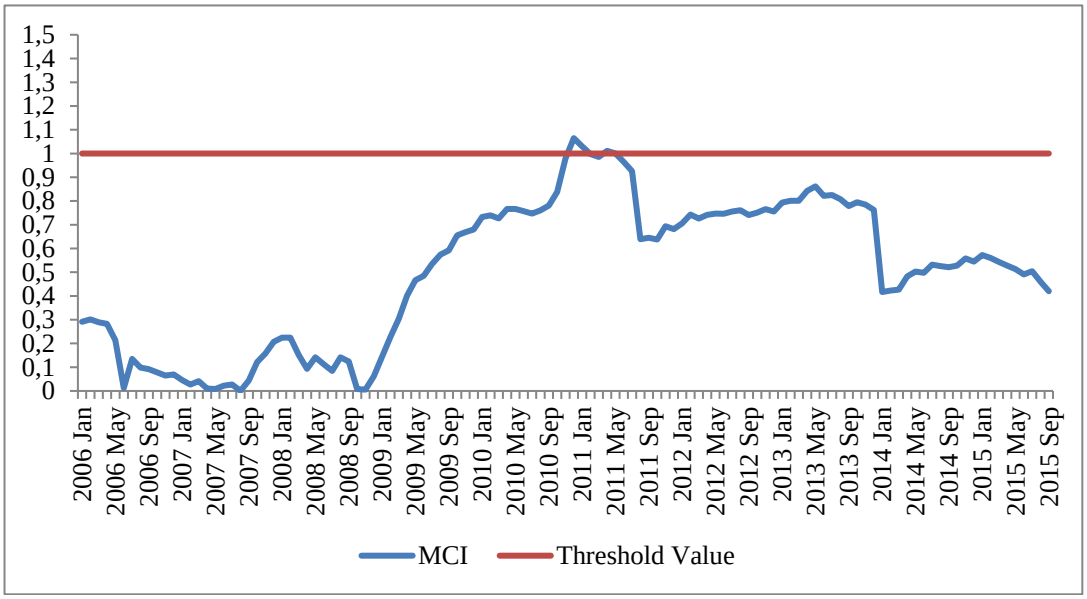

Figure 1 MCI for the Selected Period

Note: Own Calculations

If central banks face a positive demand shock, mostly and more commonly contractionary monetary policy is preferred. That policy will result as an increase for both interest rates and exchange rate. That increase in the components of the MCI will lead to an increase in the MCI ratio. For that reason, it is accepted that increases in the MCI is accepted as a sign of contractionary monetary policy, oppositely the decrease in the MCI is accepted as a sign of expansionary monetary policy (Kaytancı, 2008:17).

As mentioned before, values above 1 signs the contractionary monetary policy and value below 1 signs expansionary monetary policy. In the selected period, only for the period starting from December 2010 till May 2011 it is suggested that the central bank implied contractionary monetary policy. For the rest of the period expansionary monetary policy is implied. These policy change signs to the global crises, in order to get over the effects of the crises central bank chose contractionary monetary policies.

IV. CONCLUSION

Monetary Condition Index that was first used in Canada is a popular tool in the recent years. This research questions the MCI if it can be implemented for Turkish Economy. In order to test this hypothesis, dataset from January 2006 to September 2015 is considered in the empirical tests. Dickey-Fuller (1981) and Phillips-Perron (1988) unit root tests, in order to see the long term relations, Johansen (1988) co-integration test is hired. According to the results, Blanchard and Quah (1988) vector auto regression method is applied. The empirical results supports Dennis (1997); when MCI is considered as a monetary policy tool, that will be more efficient compared to the cases that REER or INT is considered as a monetary tool alone. Another important result is; Turkish Central Bank always applied expansionary monetary policies in the selected period except the December 2010 till the first half of 2011. It is important to see that regime change in the selected period. Some other tight policies that aim to limit the consumption and create savings are relevant to the test results in this period. Especially the regulations by the government in order to decrease over consumption make sense on behalf of inefficient savings. Examples for the regulations are; the long term loans became limited with only mortgage credits and government encouraged people for the private pension plans.

On the other hand, the fact that interest rate is more dominant in the monetary condition index is a proof for the situation that Central Bank of Turkey (TCMB) follows Taylor Rule. That also is a significant sign of the "inflation targeting" policy of the TCMB. Another outcome of the SVAR analysis is the negative relation between industry production index and interest rates. It should be advised for the central bank to insist to diminish the inflation for the aimed growth rates.

The fact that Kaytanci (2008) underlines is also critical for Turkey. As mentioned, Kaytanci suggests MCI for the open economies and Taylor Rule for the closed economies. That proposal makes sense due to the fact that developing countries has a current account deficit results from the over imports on exports. In the near history Turkish economy experienced such exchange crises. In order to avoid possible near future crises, exchange rate parity should be caution in the economy. All the facts that come together in our analysis suggest TCMB to follow a ruled based monetary policy. Even the dilemma between MCI and Taylor Rule is a difficult question to be answered, exchange rate parity seems to be too important to ignore.

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