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A MACRO MODEL AS A TOOL OF EFFICIENT MONETARY POLICY: CASE OF UZBEKISTAN

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ABSTRACT

This paper constructs a macroeconomic model (ISLM model) for the economy of Uzbekistan. The obtained results from the model have implications for providing Government regulations of goods and money markets. Nowadays this is really important for Uzbekistan to determine monetary and fiscal policy effects. For this paper in analysis and models construction were used wide range of secondary, statistical data of Uzbekistan for the period of 2000-2018 years.

Key words: Market, fiscal, monetary, model, econometrics, government.

INTRODUCTION

Nowadays, in Uzbekistan many reforms in fiscal and monetary policies are underway to develop and expand the economy. According to the Presidential Decree № 5614, which is approved on 8th January 2019, in cooperation with the World Bank and other international financial institutions, the 'Yo'lxaritasi'(Road Map) of the main directions of structural reforms of the Republic of Uzbekistan for 2019-2021 has been developed. The first and foremost appendix of this map is dedicated to improving the efficiency of fiscal policy and radical reform of the taxation system. In addition, the decree provides for strategies for strengthening monetary policy and ensuring price stability. IS-LM model is considered one of the main tools in macroeconomics, since it represents equilibrium of both goods and money markets.This model helps academicians to determine and interpret right macroeconomic policy to the economy of a country. In this paper IS-LM model is constructed for the close economy of Uzbekistan. This study derives IS equation for goods market and LM equation for money market. Simultaneously, scenarios of long-run and short-run effects of fiscal and monetary policy are derived one macroeconomic policy, between monetary and fiscal policies, would be concluded as an appropriate policy for the Uzbek economy based on the results obtained from the IS LM model. It means that if our IS curve is steeper, we will take Fiscal policies as an appropriate and if LM curve is steeper, then Monetary policy would be more accurate for the economy. Implementing right policy into economy is very important as it may effect on the economic growth of country.

LITERATURE REVIEW

The IS-LM model is still considered essential tool in macroeconomics (Vercelli, 1999, p.199). Ahmed (2005) considers ISLM model could be substantial tool for policy maker and academicians to analyse policy. Mankiw (1990) states the ISLM model as a best way to interpret macroeconomic policy. Blanchard (1997) and Robert Solow (1997) also, supportively to Mankiw (1990), describe the ISLM model as core of macroeconomics. From the results of ISLM model for Zimbabwe, Lyman Mlambo concluded that fiscal-policy would cause growth in Zimbabwe economy and the monetary policy could be supportive (Mlambo, 2013, p.340). The cause was that IS curve demonstrated vertical shape while LM was almost horizontal based on the ISLM model for Zimbabwe (Mlambo, 2013, p.339). The problem in implementing monetary policy, Mlambo (2013) faced, was that the interest rate changes do not have significant effect on Investment while interest rate is the route of monetary policy. Furthermore, time reference is the one problem that Hicks (1980-1981) has in the model.

By contemplating these statements of academicians, I support all their definitions about the ISLM model. Simultaneously, I am expecting that our ISLM model for Uzbekistan would demonstrate opposite results compared to the Zimbabwe. That is our LM curve would be steeper than IS curve that make us to realize monetary policy as an effective policy than fiscal policy.

Monetary policy is considered as main instrument in macroeconomics to maintain the stability of the economy. According to Sun, 2017, however, there is a negative relationship between money supply and economic development in the long run. That is, a change in money supply would impact negatively on economic growth in the long run. Moreover, according to Shodiev and Aminjonov (2018), money supply has long-term unidirectional causal effect on sustainable growth of Uzbekistan. Their results showed that money policy (money supply) has negative impact on real GDP in the short run, however, as the lags increase the effect becomes insignificant. Overall, Shodiev and Aminjonov concluded that proper use of monetary policy can contribute to maintaining sustainable growth of Uzbek economy.

Theoretical Background

In 1937-1938 years three economics Roy Harrod, James Meade and Oscar Lange had tried to explain the correlation between the theories of demand and liquidity preference with Keynes's theory as equations. At the same time, in 1937 John Hicks drew two curves of "SI-LL" in one of his famous article, named "Mr. Keynes and the Classics: A suggested interpretation". After some period, these curves became famous as IS-LM model with the help of Alvin Hansen who converted and popularized them. Therefore, this model is called IS-LM model or the Hicks-Hansen model. As we mentioned above the root of IS equation (goods market equilibrium) is Keynesian theory (https://www.hetwebsite.net/het/essays/keynes/hickshansen.htm)

Data and Methodology

This research used time series data of Uzbekistan for the period 2000-2019. Main portion of the data was obtained from Asian Development Bank Database (ADB, 2019) and Statistic Committee of Uzbekistan. Additionally, the length of period is prescribed by the data availability of the variables in this model, because of the interest rate is available from 2000 to 2019.

Table 1: Description of the Variables Included in Models

Variable s	Symbol	Description	Source
National Income	Y	Genuine Savings Rate. World Bank calculations	Asian Development Bank Estimates
Gross Capital Formation	I	Proportion of seats held by women in national parliaments (%)	Asian Development Bank Estimates
Consumption	C	GDP growth (annual %)	Asian Development Bank Estimates

Government Expenditure	GDP_per capita (at ppp prices)	GDP per capita, PPP (constant 2011 international $)	World Bank Estimates
Tax Revenue	T	Foreign direct investment, net inflows (% of GDP)	World Bank Estimates
Money Supply	M2	Tradeas % of GDP	World Bank Estimates
Interest Rate	R	Democracy Index, ranges from 0 to 10 (good).	World Bank Estimates
Disposable Income	Yd	Total natural resources rents (% of GDP)	World Bank Estimates

This paper estimates IS LM model for the economy of Uzbekistan. As IS LM model has two part of goods and money market, we bring IS model from goods market and LM from money market. Then we get more accurate equation to find income by joining the two: IS and LM equations into one model (or equation). Here we can see more broad and symbolic explanation of these statements:

The Goods market:

The derivation of IS equation, or goods market equilibrium:

Consumption function (equation1) $C_t = c_0+c_1Y_{dt} 0<c_1<1$

Disposable income (2) $Y_{dt}= Y_t- T_t$

Taxation function $T_t= \alpha_0+ \alpha_1Y_t 0<\alpha_1<1$ (3)

Investment $I_t =\gamma_0+\gamma_1 \cdot r$ (4)

Government expenditure (5) $G_t=\bar{G}$

National income equation $Y_t =C_t +G_t +I_t$ (6)

In these equations Y_t-National Income, C_t-Consumption, G_t-government expenditure, T_t-Tax, I_t-Investment, r- Interest Rate, Y_{dt}-Disposable Income which is derived by subtracting tax from national income (see Dornbusch and Fischer, 1984, p. 102). Now we rewrite the income equation by putting equations (1) to (5) into equation (6)

$$Y_t= c_0+c_1(Y- (t_0+t_1Y)) + \alpha_0+\alpha_1 \cdot r+ \bar{G} \quad (7)$$

And we generate IS equation by deriving Y (income) from equation (7):

$$Y_t= \frac{1}{(1-c1(1-t1))}(c_0-c_1t_0+\alpha_0+\alpha_1r+ \bar{G}) \quad (8)$$

Where $\frac{1}{(1-c1(1-t1))}$ is multiplier and $(c_0-c_1t_0+\alpha_0+\alpha_1r+ \bar{G})$ =A is autonomous.

Finally, we derive interest rate from this output equation (8):

$$\mathbf{Y_t = \pi_0 + \pi_1 r} \quad (9)$$

Where

$$\pi_0 =\frac{c0-c1t0+\alpha0+ \bar{G}}{(1-c1(1-t1))}$$

$$\pi_1 =\frac{\alpha1}{(1-c1(1-t1))}$$

The Money market:

To characterize the LM model we use following equations:

Money Demand $M^d_t = \varphi_{0} + \varphi_1 Y_t - \varphi_2 * r$ when $\varphi > 0$ (9)
Money Supply $M^s_t = M^s_0$ (10)
Equilibrium $M^d_t = M^s$ (11)

In these equations above M^s_t is money supply, M^d_t is money demand (liquidity preference).
Now we put equations (9) and (10) into equation (11):

$$M^s_0 = \varphi_{0} + \varphi_1 Y_t - \varphi_2 r \quad (12)$$

Then we derive interest rate from equation (12):

$$Y_t = \beta_0 + \beta_1 M^s_0 + \beta_2 r \quad (13)$$

Where $\beta_0 = -\frac{\varphi 0}{\varphi 1}$

$\beta_1 = \frac{1}{\varphi 1}$

$\beta_2 = \frac{\varphi 2}{\varphi 1}$

Research Results and Findings

The Augmented Dickey-Fuller (ADF) Test**.**

This test contains the difference of the testing variable as a dependent variable and trend, lag of the variable and the lag difference of the variable as independent variables. Symbolically:

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha i \, \Delta Y_{t-1} + \varepsilon_t \quad (14)$$

Where ΔYt is the difference of a time series variable under study, t is trend, Y_{t-1} is lagged values of the dependent variable and ε_t is random error term (see Gujarati, 2007, p.836).
This paper runs the regression model above for each variable of IS-LM model in order to check whether they are stationary or nonstationary.

Table 2: ADF Test Results

Variable	ADF test statistic			Order of integration
	Level	1st difference	2nd difference	
Y	-0.919	-1.496	-1.341	
C	-0.786	-1.762	-1.432	
T	-1.051	-1.999	-2.728*	I(2)
G	-1.079	-2.028	-2.223	
I	-1.229	-1.439	-2.076	
r	-0.513	0.133	2.100	
M2	4.672	2.297	1.669	
Yd	-0.706	0.669	1.950	

The results showed that all variables are nonstationary, that they contain a unit root. t values of all variables are insignificant even at 10% level, (see Appendix 1). The table also shows the ADF test results obtained with alternative way. According to these results, only one variable of Tax revenues in the model is stationary at 2nd difference at 10% significance, while-3.750, -3.000 and -2.630 are the critical values at 1%, 5% and 10% significant levels, respectively. All other variables contain a unit root, that they are nonstationary at level, 1st and 2nd difference.

Now it is obvious that all variables have the problems associated with nonstationary time series. Running a regression with nonstationary variables may cause the spurious regression issue. To avoid this problem, the nonstationary time series have to be transformed to make them stationary. In order to transfer, first, we should identify whether the variables are difference stationary (DSP) or trend stationary (TSP). We check the time series with each of these methods in turn.

Difference- Stationary Processes (DSP)

In this method we just run the first difference of a time series variable under study with its lagged value. Symbolically:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta Y_{t-1} \quad (15)$$

Where ΔY_t is the first difference of a time series and $\Delta Y_{t-1} = (Y_t - Y_{t-1})$ (see Gujarati, 2007, p.839). Then we check the t value of the lagged value of the time series after running the regression with -3.5064, -2.8947 and -2.5842 critical values for this model at 1, 5 and 10 percent, respectively.

The results showed that all of the time series are not difference stationary, except money supply (M2), that the t value are not significant at these critical values.

Trend-Stationary Process (TSP)

For this method the following regression should be run:

$$Y_t = \beta_0 + \beta_1 t + u_t \quad (16)$$

Where t is the trend. Running a regression of a time series with time makes the residual stationary (see Gujarati, 2007, p.840). From the results we obtained by running this model for each time series under study we can see that all of the time series are trend stationary. We can see this from the following line graphs of the time series.

From these graphs it is obvious that all of the variables are drawing a trend and they are trend stationary.

Now we know that all of the time series are trend stationary. That means taking difference of variables to avoid unit root problem is useless. The question is what to do in order to avoid spurious regression due to unit root? As IS-LM model contains several simultaneous-equation models (equations 1, 3, 4 and 12), we can use Cointegration test. Cointegration test, in other words regression of a unit root time series on another unit root time series, shows the long-run or equilibrium relation between time series variables.

This paper applies two testing methods for cointegration between variables: Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test and Cointegrating Regression Durbin-Watson (CRDW) Test.

Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test

It is obvious that our time series are not stationary at level that they contain unit root. Therefore, regressions on equations (1), (3), (4) and (12), that are cointegrating regressions, may be spurious. EG or AEG test is one method to define whether these regressions are spurious in the long run or not.

To apply this test, first, we run regressions on the equations:

$$C_t = c_0 + c_1 \cdot Y_{dt} \quad (1)$$

$$T_t = \alpha_0 + \alpha_1 \cdot Yt \quad (3)$$

$$I_t = \gamma_0 + \gamma_1 \cdot r \quad (4)$$

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$$M^s_0 = \varphi_{0+\varphi 1} \cdot Y_t - \varphi_2 \cdot r \qquad (12)$$

In this case these regressions are known as cointegrating regressions and the coefficients c_1, α_1, γ_1, $\varphi_1$and $\varphi_2$are cointegrating parameters. Second, we obtain residuals from each of these cointegrating regressions and we run regression with the residual's lagged value for each. Symbolically:

$$\Delta\hat{u}_t = \beta 1 \cdot \hat{u}_{t-1} \qquad (17)$$

We run this for each cointegrating regressions and we compare t values obtained from regression (17) with τ (tau) critical values of -2.5897, -1.9439 and -1.6177 at 1, 5 and 10% significance level, respectively.

The results obtained from our case shows that

Source: World Bank Development Indicators Database (World Bank, 2018), Asian Development Indicators Database (Asian Bank, 2018).

CONCLUSION

From these results it can be seen that Uzbek government has been increasing government purchases over the past 5 years. Taking into account the tools of monetary policy, especially interest rate, the government and central bank of Uzbekistan should provide an appropriate fiscal policy. In 2019 the government was increased even expand its expenditure up to more than 107 118.4 billion UZS. Moreover, the income tax in country is reduced from 28% to constant 12% from 2019. This means, Uzbek government is applying fiscal expansionary policy to the economy. The results showed that a rational interest rate corresponding to the level of goods market and money market is about 14.0 – 14.5 per cent.

APENDICIES

Appendix 1

The Unit root test. Augmented Dickey-Fuller (ADF) Test results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	D.Y	D.C	D.G	D.T	D.I	D.r	D.M2	D.Yd
Trend	3,340.982	666.124	-691.644	-714.657*	-136.277	-0.003*	184.347	1,591.411*
	(2,034.365)	(479.947)	(466.213)	(380.353)	(990.247)	(0.001)	(140.302)	(742.707)
L.Y	-0.990**							
	(0.434)							
LD.Y	-2.863							
	(5.260)							
L.C		-0.668**						
		(0.292)						
LD.C		1.196						
		(1.693)						
L.G			0.529					
			(0.523)					
LD.G			1.139**					
			(0.517)					
L.T				0.652				
				(0.473)				
LD.T				0.960**				
				(0.424)				
L.I					-0.075			
					(0.779)			
LD.I					0.249			
					(0.695)			
L.r						-0.486		
						(0.313)		
LD.r						-0.141		
						(0.298)		
L.M2							-0.067	
							(0.140)	
LD.M2							0.095	
							(0.328)	
L.Yd								-0.829*
								(0.443)
LD.Yd								0.410
								(1.189)
Constant	11,136.060**	4,964.220	3,154.435*	3,021.120**	2,340.091	0.133	-479.461	9,372.707*
	(4,191.740)	(3,058.236)	(1,461.258)	(1,183.102)	(3,558.865)	(0.085)	(490.019)	(4,337.772)
Observations	16	16	16	16	16	16	16	16
R-squared	0.322	0.306	0.408	0.468	0.139	0.325	0.629	0.358

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 2

Testing for Difference- Stationary Processes (DSP)

VARIABLES	(1) D.Y	(2) D.C	(3) D.T	(4) D.G	(5) D.I	(6) D.r	(7) D.M2	(8) D.Yd
L.Y	-0.068							
	(0.074)							
L.C		-0.076						
		(0.097)						
L.T			-0.123					
			(0.117)					
L.G				-0.127				
				(0.118)				
L.I					-0.137			
					(0.111)			
L.r						-0.076		
						(0.148)		
L.M2							0.132***	
							(0.028)	
L.Yd								-0.047
								(0.066)
Constant	4,183.906	2,211.678	879.302	1,000.779	1,577.116	0.013	32.198	3,011.674
	(2,875.476)	(1,949.626)	(861.100)	(939.390)	(1,196.732)	(0.034)	(239.698)	(2,090.548)
Observations	17	17	17	17	17	17	17	17
R-squared	0.053	0.040	0.069	0.072	0.092	0.017	0.593	0.032

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 3

Testing for Trend-Stationary Process (TSP)

VARIABLES	(1) Y	(2) C	(3) T	(4) G	(5) I	(6) r	(7) M2	(8) Yd
Trend	2,474.887***	1,249.032***	578.067***	640.638***	991.087***	-0.004***	960.773***	1,896.820***
	(169.151)	(137.462)	(90.707)	(96.944)	(126.456)	(0.001)	(65.755)	(111.282)
Constant	13,441.939***	7,325.727***	845.756	774.757	-443.134	0.265***	-1,268.577*	12,596.184***
	(1,830.953)	(1,487.938)	(981.846)	(1,049.356)	(1,368.808)	(0.006)	(711.758)	(1,204.561)
Observations	18	18	18	18	18	18	18	18
R-squared	0.930	0.838	0.717	0.732	0.793	0.750	0.930	0.948

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 4
Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test

Cointegrating regressions	$C_t = c_0 + c_1 Y_{dt}$	$T_t = \alpha_0 + \alpha_1 Y_t$	$I_t = \gamma_0 + \gamma_1 \cdot r$	(4)
VARIABLES	D.resid2	D.resid3	D.resid4	D.resid5
L.resid2	-0.402**			
	(0.187)			
L.resid3		-0.096		
		(0.265)		
L.resid4			-0.350	
			(0.242)	
L.resid5				-0.921**
				(0.410)
Constant	-267.962	-305.974	-190.894	-9.309
	(260.903)	(255.987)	(871.543)	(399.281)
Observations	17	17	17	17
R-squared	0.235	0.009	0.122	0.252

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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