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Estimating the role of money supply in determining aggregate investment in Pakistan

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ABSTRACT

This study investigates the role of money supply in determining the Pakistan's aggregate investment for the period 1980-2015. Hodric-Prescott Filter method has been applied for extracting the trend from the data. For estimating the results ordinary least squares method, granger causality test and Vector Autoregression has been used. The results revealed that money supply (M1 and M2) increases the aggregate investment in Pakistan. Other variables such as GDP growth rate and saving also showed a positive and significant association with aggregate investment. However, foreign direct investment remained insignificant. These findings recommended that the State Bank of Pakistan can used both M1 and M2 as an effective instrument of monetary policy for increasing the level of aggregate investment component of aggregate demand in the economy.

Keywords
Money Supply, Aggregate Investment, Granger Causality test
JEL Classification
E51, E52, E12

1. Introduction

Money supply is the total stock of money available in country at a specific time period. The central bank of a country usually adopts different tools i.e. open-market operations, reserve requirements and discount rate to control money supply in the country. The fluctuations in level of money stock in an economy have important implications for the performance of most of the macroeconomic indicators. On one side money supply expansion can put inflationary effects on an economy. While, on the other hand money supply increase may also affect the economic growth of a country positively. Moreover, money supply as a determinant of aggregate demand plays a crucial role in the formulation and successful implantation of monetary policy for the stabilization of business cycles. During a period of recession, central banks use expansionary monetary policies. In contrast,

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when the economy is in the expansion phase of business cycles, then the government can decrease the money supply for controlling inflation.

The monetary policy works through different transmission channels in an economy. Some of the channels are the interest rate channel, exchange rate channel, asset price channel, banking lending channel and balance sheet channel (Lucky & Kingsley (2017). Through these channels the central bank's monetary policy decisions affecting consumption and investment levels, employment and ultimately price level etc. (Mishkin, 1996).

It is a fact that all of these monetary transmission channels are having both positive and negative effects on all the major macroeconomic variables in an economy. However, the empirical results about all of these channels are still inconclusive. Therefore, it is important to explore the effect of monetary policy on different components of aggregate demand for a more detail understanding about its role in the economy (Khundrakpam, 2012; Nasko, 2016; Obadeyi et al, 2016). The different components of aggregate demand consist of aggregate consumption, aggregate investment, government expenditure and net exports. However, the fluctuations in all of these components of aggregate demand can result in a significant upward and downward shift in the output level in an economy. The aim of the present study is to investigate the impact money supply on aggregate investment in Pakistan.

2. Literature review

Gramm and Nash (1971) investigated that change in the stock of money can affect income of agriculture sector and investment in United States. Data were collected from 1919-1966 and the results showed the existence of a relationship between money stock and investment and income of agriculture sector. Gertler and Grinols (1982) also found that money supply affected investment. They also found that the investment depended on the capital holders demand for assets. Growth in money supply also affect inflation level and thus demand for capital also changed. However, they reported that money supply growth decreased the investment.

Gaiotti and Generale (2002) investigated the impact of monetary policy on behavior of investment and concluded that the role of money supply was an important determinant of the investment. Majeed and Khan (2008) investigated the determinants of private's investment in Pakistan utilizing a broader time period of 1970 to 2006. Augmented dickey fuller test was used to identify the trend in data and then ordinary least square technique was used for regression. The results indicated that private production, net inflows and past stocks are the main determinants of private investment. Ang (2010) investigated the key factors of investment in Malaysia, using bank credit for investment as a one of the explanatory variables. Using the time series data from 1960-2005 and applying the autoregressive distributed lag (ARDL) and the error correction model (ECM), found that there was a

positive effect of monetary assets in economy on investment. Furthermore, insecurity of macroeconomic variables affected private investment negatively.

Olweny and Chiluwe (2012) investigated the effect of monetary policy on investment in Kenya using the quarterly data from 1996-2009. They used the unit root and vector error correction model (VECM) to identify the short and long run relationship among the variables. The results indicated that public internal debt and treasury bill rate inversely affect private sector investment. Further, increase of money supply and internal saving increased the investment. The results of study suggested that to boost up investment, deposit rates should be attractive and lending rates low.

Ayeni (2014) examined the effect of major macroeconomic variables on investment in Nigeria using annual time series data from 1979-2012. For the analysis of the data, augmented dickey fuller test, Johansen co-integration and ARDL (for examining the long and short run association) were utilized. The results depicted that the exchange rate, GDP, financing private sector, rate of real interest and rate of inflation were important determinates of the investment in Nigeria.

Eshun, Adu and Buabeng (2014) using time series annual data from 1970-2010 and applying the ARDL bound test found that the high real rate of interest decreased investment in shorter run as well as in longer run and that unavailability of credit placed restrictions on the investment level. Imoughele and Ismaila (2014) examined the determinant of private saving in Nigeria utilizing the time series data from 1981-2012. They found that the determinants of the private investment in Nigeria are per capita income, inflation rate, financial deepening and term of trade. Ali and Shaheen (2016) examined the determinants of private investment in Pakistan using the time series data from 1980-2011. They found a negative association between inflation and investment. While a positive relationship of gross domestic product, savings and credit with the investment was found.

Umoru and Ohiomu (2017) explored the link between money supply and investment instability in Nigeria. They used restricted VAR model for analysis. The result of the analysis indicated the existence of co-integration in variables and shock of money supply was the reason of investment instability. They suggested that in Nigeria the policy makers need to focus on the money supply (M2) in implementing the monetary policy. Additionally, it is necessary that government should focus on interest rate management and investment in order to boost real sector activities.

Ajayi and Kolapo (2018) examined the impact of the gross domestic product, money supply, exchange rate, interest rate and inflation rate on investment of Nigeria. The result indicated that in short run, gross domestic product and exchange rate are positively related to private investment, while money supply was negative related to the domestic private

investment. In long run, money supply negatively affects the investment and gross domestic product positively affect the investment.

3. Research methods

This section presents the details about the data and the methods used to study the relationship between investment and money supply. First, in section 3.1, data, data sources and variables definitions are presented. After that the theoretical framework of the study has been given in section 3.2. Finally, section 3.3 outlines the empirical model.

3.1 Data and definitions of the variables of the study

The main objective of the study is to investigate the impact of money supply on the aggregate investment of Pakistan. For this purpose, time series annual data over the period of 1980 to 2015 have been used for the analysis. All the variables along with its definitions and symbols are given in table.1 as follows.

Table 1: Definitions of variables of the study

Variables	**Definition**	**Symbols**	**Sources**
Money Supply	Money Supply i.e. $M1^C$ and $M2^C$	MS^C	Economic Surveys of Pakistan Various Issues
Narrow Money Supply	Paper notes and coins in circulation in Million Rupees in Pakistan	$M1^C$	
Broad Money supply	Narrow Money + Checkable Deposits + Money Market Instruments in Million Rupees in Pakistan	$M2^C$	
Gross Domestic Product growth rate	Annual percentage changes in the Gross Domestic Product of Pakistan	$GDPr^C$	
Aggregate Investment	Pakistan Annual Total public and private investment in Million Rupees	I^C	
Saving Rate	Pakistan Annual saving Rate in Percentage	S^C	
Foreign Direct Investment	Total Foreign Direct Investment in an year in million rupees	Fdi^C	

The superscript "C" on the symbols of variables indicates the deviated form. For converting the data into deviation form and extracting only the cyclical component, Hodrick Prescott (HP) filter method is used. The purpose of the application of the HP filter method to data is to remove trend from data and making it stationary.

3.2 Theoretical framework

The relationship between money supply and aggregate investment can be understood in the framework of the Keynesian IS-LM approach. According to Keynesian approach, the money supply influences the national income through the aggregate demand channel. More

specifically, when there is a rise or fall in the money supply it will influence the various components of aggregate demand which will in turn affect the national income. Whereas, the components of the aggregate demand are aggregate consumption, aggregate investment, government expenditures and net exports.

The relationship between money supply and aggregate investment can be understood by focusing on figure.1 as below.

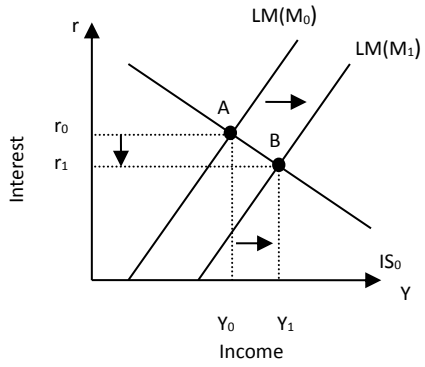

Figure 1: Effects of money supply on aggregate demand and national income

Figure 1 shows the relationship between the money supply and national income. In the figure interest rate (r) has been given on the vertical axis. Whereas, national income (Y) has been represented on horizontal axis. The graph shows simultaneous equilibrium in both the goods and money market at point "A" where the LM (M_0) is intersected with the IS_0. At this point the level of interest rate is (r_0) and income (Y_0).

Now suppose the money supply is increased by the central bank. This increase in the money supply will bring decrease in the interest rate. This fall in the interest rate from r_0 to r_1 will increase the aggregate demand in the economy through its different components i.e. aggregate consumption, business investment, government spending and net exports. With the increase in the aggregate demand, the LM curve will shift towards the right side from LM (M_0) to LM (M_1) i.e. from point "A" to point "B". This will in turn shift the income level from Y0 to Y1.

In light of figure.1, another framework has been developed which is showing the relationship between the money supply and aggregate investment. This relationship between the money supply and aggregate investment given in figure.2 provides the basis for the development of the empirical model of the study given in equation (1).

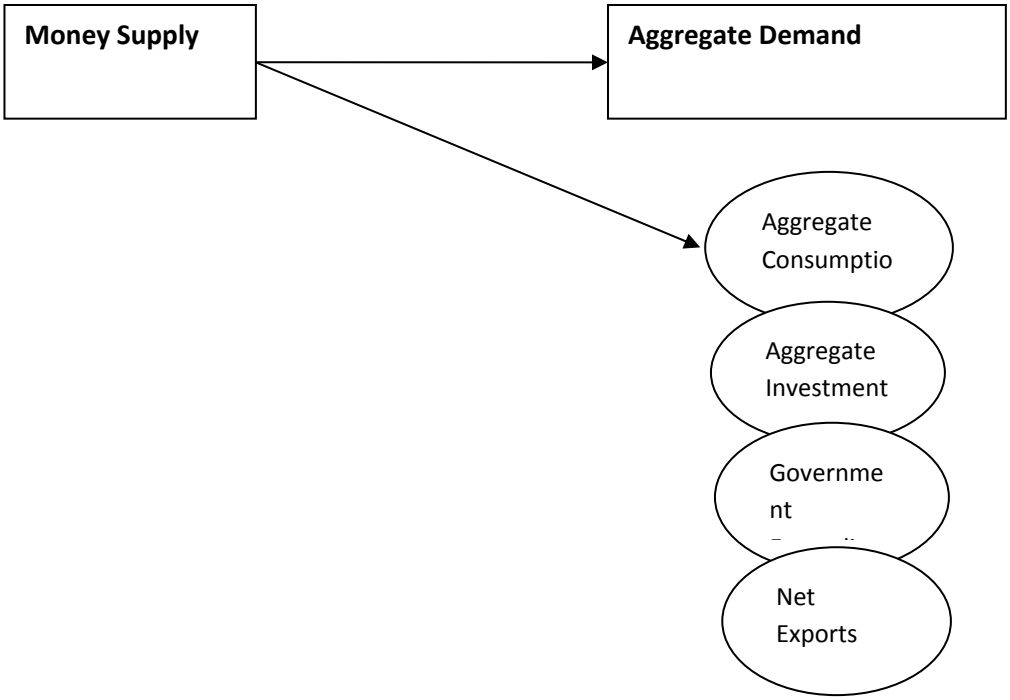

Figure 2: Relationship between money supply and aggregate investment

3.3 Empirical model

For examining the relationship between money supply and aggregate investment, equation (1) has been formulated.

$$I^C = \alpha_0 + \alpha_1 Ms^C + \alpha_2 GDPr^C + \alpha_3 S^C + \alpha_4 Fdi^C + e_i \quad (1)$$

Equation (1) shows the aggregate investment function in which the aggregate investment I^C is dependent variable while $Ms^C, GDPr^C, S^C, Fdi^C$ are independent variables. In addition, $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the coefficients and e_i is the error term.

For the computation of the results of the study different econometric techniques have been used. Then Granger Causality test has been used for checking the interrelationship between the study variables. Then VAR test has been applied for checking the relationship between the variables through a system equation.

4. Results and discussion

The present section shows the empirical results of the study. First, section 4.1 shows the regression results. Then, section 4.2 shows the Granger Causality test results. Finally, the Vector Autoregression results have been presented in section 4.3.

4.1 Regression results for the investment model with M1 and M2

To check the relationship between the money supply and aggregate consumption, Ordinary Least Squares method has been applied. The regression results are given in table 2 as follows.

Table 2: Regression results of investment model with M1 and M2

$I^C = \alpha_0 + \alpha_1 Ms^C + \alpha_2 GDPr^C + \alpha_3 S^C + \alpha_4 Fdi^C + e_i$					
$M1^C$			$M2^C$		
Independent variables	**Coefficient**	**St. Error**	**Independent variables**	**Coefficient**	**St. Error**
$M1^C$	0.168226**	0.261576	$M2^C$	0.010450**	0.029145
$GDPr^C$	20360.02**	9159.402	$GDPr^C$	21128.15**	10846.15
S^C	16157.39	7837.185	S^C	16273.18**	7968.465
Fdi^C	1.160148	0.267463	Fdi^C	0.961514	0.344151
Intercept	1.19E-08	15130.31	Intercept	1.33E-08	15614.12
R- Square : 0.52 Adj. R- Square : 0.48 DW Statistics : 1.71			R- Square : 0.51 Adj. R- Square : 0.49 DW Statistics : 1.73		

- Asterisk *, ** and *** shows 1%, 5% and 10% level of significance.

Table 2 shows the regression results of the study with M1 and M2 separately in the model. The results show that M1 and GDP growth rate are statistically significant and showing a positive impact on aggregate investment. Whereas, saving and foreign direct investment remained insignificant. In the second model on the right side, M1 has been replaced with M2. The purpose of putting M2 instead of M1 in the model is to know whether it can make any difference. The results show that M2, GDP growth rate and saving were significant and showing a positive impact on aggregate investment.

4.2 Results of granger causality test for the investment model.

The granger causality test results have also been computed for the investment model which is placed in table 3 as follows.

Table 3: Granger causality test results for investment model with M1

Null Hypothesis	**Observation**	**F- Statistic**	**Probability**
$M1^C$ does not AffectI^C I^C does not Affect$M1^C$	33	0.07890 0.35265	0.0243 0.0059
$GDPr^C$ does not Affect I^C I^C does not Affect $GDPr^C$	33	8.79289 6.68508	0.0011 0.0042
S^C does not Affect I^C I^C does not Affect S^C	33	0.91793 2.28466	0.0110 0.1205
Fdi^C does not Affect I^C I^C does not AffectFdi^C	33	10.8625 3.33284	0.5003 0.6503

GDP^{rC} does not Affect $M1^C$ $M1^C$ does not Affect $GDPr^C$	33	0.31758 0.60938	0.7305 0.0507
S^C does not Affect $M1^C$ $M1^C$ does not AffectS^C	33	0.85775 1.85947	0.4350 0.1745
Fdi^C does not Affect $M1^C$ $M1^C$ does not Affect Fdi^C	33	4.05798 4.21268	0.0283 0.7252
S^C does not Affect $GDPr^C$ $GDPr^C$ does not AffectS^C	33	6.21502 2.33090	0.0058 0.1158
Fdi^C does not Affect $GDPr^C$ GDP^{rC}does not Affect Fdi^C	33	4.24238 5.76688	0.0246 0.0080
Fdi^C does not Affect S^C S^C does not Affect Fdi^C	33	3.05324 0.87792	0.6632 0.4268

First, granger causality test results have been computed for the investment model with M1. It has been noted that money supply and investment affect each other. Similarly, GDP growth rate and investment also affects each other. Moreover, two-way relationships have been also found between foreign direct investment and GDP growth rate. Furthermore, one-way relationship has been found between the other variables except FDI and saving rate which does not show any relationship with each other.

After that M1 has been replaced with M2, and granger causality test has been applied to data again. The results computed are given in table 4, as below.

Table 4: Granger causality test results for investment model with M2

Null Hypothesis	**Observation**	**F- Statistic**	**Probability**
$M2^C$ does not AffectI^C I^C does not Affect$M2^C$	33	3.07070 3.71399	0.0623 0.0371
$GDPr^C$ does not Affect I^C I^C does not Affect $GDPr^C$	33	8.79289 6.68508	0.0011 0.0042
S^C does not Affect I^C I^C does not Affect S^C	33	0.91793 2.28466	0.4110 0.1205
Fdi^C does not Affect I^C I^C does not Affect Fdi^C	33	10.8625 3.33284	0.0003 0.0503
$GDPGr^C$ does not Affect $M2^C$ $M2^C$ does not Affect $GDPGr^C$	33	4.18739 1.02536	0.0256 0.3717
S^C does not Affect $M2^C$ $M2^C$ does not AffectS^C	33	1.85767 0.52824	0.1748 0.5954
Fdi^C does not Affect $M2^C$ $M2^C$ does not Affect Fdi^C	33	11.4724 10.6518	0.0002 0.0004
S^C does not Affect $GDPr^C$ $GDPr^C$ does not AffectS^C	33	6.21502 2.33090	0.0058 0.1158
Fdi^C does not Affect $GDPr^C$ $GDPr^C$does not Affect Fdi^C	33	4.24238 5.76688	0.0246 0.0080
Fdi^C does not Affect S^C S^C does not Affect Fdi^C	33	3.05324 0.87792	0.0632 0.4268

First, granger causality test results have been computed for the investment model with M2 too. The results show that two way relationship has been found between money supply and investment, GDP growth rate and investment, FDI and investment, FDI and Money supply (M2) and FDI and GDP growth rate. However, one-way relationship has been noted between other variables except saving rate and money supply.

4.3 VAR Results for the investment model

Investment model results of VAR with M1 and M2 have been shown in this section. First the individual significance of the variables for each model of the whole system equation has been checked. After that the joint significance of all the variables of different models has been computed through Wald test. Finally, the Cholesky decomposition test is used for the computation of impulse response functions.

4.3.1 Individual significance of the variables of VAR model with M1.

For showing the individual significance of the variables, VAR test has been applied. The results are given in table 5. In the table the individual significance of the explanatory variables has been checked for the five models of the system i.e. investment, money supply (M1), GDP growth rate, saving rate and foreign direct investment.

First, the investment model results show that two lags for investment, two lags for money supply (M1), second lag for GDP growth, first lag of saving rate turned significant, whereas, foreign direct investment turned insignificant. Similarly, in the money supply model only money supply and GDP growth rate turned significant. Moreover, in the GDP growth rate mode, investment, money supply, lag GDP growth rate, saving rate and foreign direct investment became significant. Similarly, in the saving rate model, only investment turned significant. However, in the foreign direct investment model all variables turned insignificant.

Table 5: Results of VAR for investment model with M1

	I^C	$M1^C$	$GDPr^C$	S^C	Fdi^C
I^C (-1)	0.414714** (0.20934) [1.98102]	0.264508 (0.30228) [0.87503]	6.31E-06** (6.6E-06) [0.95107]	1.20E-05 (1.1E-05) [1.13843]	0.304287 (0.13453) [2.26185]
I^C (-2)	0.285718** (0.18617) [1.53474]	-0.361579 (0.26882) [-1.34507]	3.48E-06** (5.9E-06) [0.58985]	2.05E-06** (9.4E-06) [0.21886]	-0.171599 (0.11964) [-1.43434]
$M1^C$ (-1)	0.296313** (0.15948) [1.85798]	0.155850** (0.23028) [0.67677]	1.05E-06 (5.1E-06) [0.20738]	2.71E-07 (8.0E-06) [0.03371]	0.183899 (0.10249) [1.79437]
$M1^C$ (-2)	0.120552** (0.17040) [0.70746]	0.025937 (0.24605) [0.10541]	8.21E-06** (5.4E-06) [1.52084]	1.16E-05 (8.6E-06) [1.35234]	-0.231122 (0.10950) [-2.11063]

$GDPr^C$ (-1)	19488.11 (6680.26) [2.91727]	1396.679** (9646.02) [0.14479]	0.468930 (0.21169) [2.21519]	0.503346 (0.33666) [1.49511]	4482.225 (4292.92) [1.04410]
$GDPr^C$ (-2)	14977.32** (7235.23) [2.07006]	-5812.181 (10447.4) [-0.55633]	0.210520** (0.22927) [0.91820]	0.237622 (0.36463) [0.65168]	6191.032 (4649.56) [1.33153]
S^C (-1)	1624.993** (4015.74) [0.40466]	-5634.751 (5798.56) [-0.97175]	0.084712** (0.12725) [0.66569]	0.297915 (0.20238) [1.47207]	3528.701 (2580.63) [1.36738]
S (-2)	202.1481 (4126.05) [0.04899]	142.8277 (5957.85) [0.02397]	0.146605 (0.13075) [1.12127]	-0.107262 (0.20794) [-0.51584]	412.6367 (2651.52) [0.15562]
Fdi^C (-1)	1.248696 (0.27408) [4.55591]	-0.978436 (0.39576) [-2.47227]	1.94E-05** (8.7E-06) [2.23483]	-1.34E-05 (1.4E-05) [-0.97073]	0.714889 (0.17613) [4.05879]
Fdi^C (-2)	-0.343613 (0.38112) [-0.90160]	0.607276 (0.55032) [1.10350]	-8.82E-06 (1.2E-05) [-0.73016]	1.64E-05 (1.9E-05) [0.85237]	-0.903702 (0.24492) [-3.68984]
C	2257.226 (7550.39) [0.29895]	-898.8537 (10902.4) [-0.08245]	-0.017303 (0.23926) [-0.07232]	0.084542 (0.38051) [0.22218]	869.4860 (4852.09) [0.17920]
R-squared	0.690508	0.593550	0.563488	0.489189	0.366058
Adj. R-squared	0.676194	0.580618	0.545074	0.477002	0.359720
Sum sq. residuals	4.08E+10	8.50E+10	40.93773	103.5419	1.68E+10
S.E. equation	43047.45	62158.69	1.364114	2.169435	27663.50
F-statistic	16.21135	1.101072	2.839958	2.106878	7.204032

4.3.2 Joint significance of the variables of VAR model with M1

The joint significance of the variables has been checked by using the Wald test. The overall significance of all the four models of the system i.e. investment model, money supply model, GDP growth rate model, saving rate model and foreign direct investment model has been checked. Table 6 shows that for all the models, no restriction has been put on the explanatory variables with the hypothesis that all these explanatory variables do not influence the dependent variables. However, all of these hypotheses have been rejected and it is confirmed that all the explanatory variables in all the models do influence the explained variables. From the investment model it is clear that money supply (M1) does play role in the determination of the aggregate investment.

Table 6: Wald test results for joint significance VAR model with M1

Null Hypotheses of all models: The joint effect of all the independent variables is equal to zero			
Investment Model			
Test Stat.	Value	Df	Prob.
Chi- Square	162.1173	11	0.0000
Money Supply(M2) Model			
Test Stat.	Value	Df	Prob.
Chi- Square	11.01552	11	0.0420
GDP Growth Rate Model			
Test Stat.	Value	Df	Prob.
Chi- Square	0.0028	11	0.0028
Saving Model			
Test Stat.	Value	Df	Prob.
Chi- Square	21.09896	11	0.0324
Foreign Direct Investment Model			
Test Stat,	Value	Df	Prob.
Chi- Square	72.04038	11	0.0000

4.3.3 Impulse response function results of VAR Model with M1

Cholesky decomposition is used for examining the response of the dependent variables to independent variables in all the seven models. The results are given in figure 3 as follows.

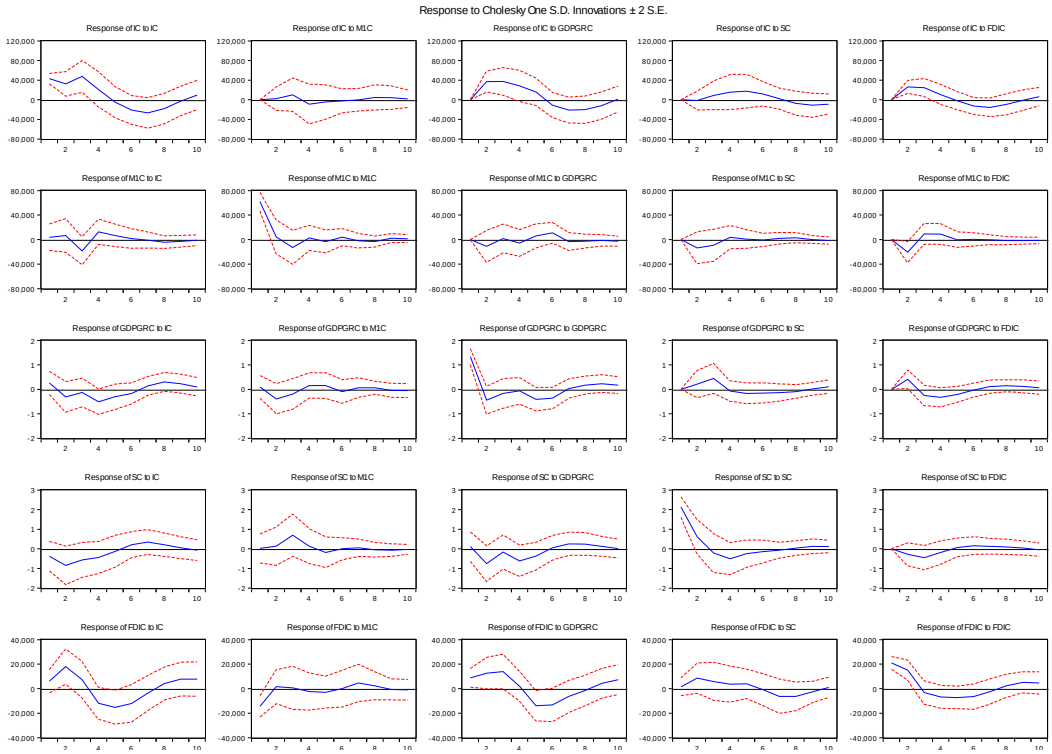

Figure 3: Impulse response function results of VAR model for M1

The results show the shocks received from the explanatory variables by dependent variables in the entire model.

4.4. VAR Results for the investment model with M2

The present sections show the VAR results with M2, First, VAR results has been computed for investigating the individual significance of the variables through a system analysis. Then Wald test has been applied for showing the over significance of the variables. Finally, Cholesky decomposition test is used for the computation of impulse response functions.

4.4.2 Individual significance of the variables of VAR model with M2

For showing the individual significance of the variable's VAR test has been applied. The results are given in table 7. In the table the individual significance of the explanatory variables has been checked for the five models of the system i.e. investment, money supply (M2), GDP growth rate, saving rate and foreign direct investment.

First the investment model results show that lag investment, lag money supply, lag GDP growth rate, and lag saving rate became significant in the investment model. Similarly, in the money supply model only money supply and foreign direct investment turned significant. Moreover, in the GDP growth rate model investment, money supply, lag GDP growth rate and saving rate tureen significant. Similarly, in the saving rate model only investment, money supply and saving rate became significant. Finally, in the foreign direct investment model lag values of investment, GDP growth rate turned significant, whereas, all other variables remained insignificant.

Table 7: Results of VAR model with M2

	I^C	$M2^C$	$GDPr^C$	S^C	Fdi^C
I^C (-1)	0.477987** (0.20133) [2.37415]	5.914224 (1.64977) [3.58488]	1.31E-05** (6.7E-06) [1.96621]	4.56E-06** (1.1E-05) [0.42143]	0.026602** (0.11329) [0.23481]
I^C (-2)	0.472664 (0.17158) [2.75470]	0.719550 (1.40603) [0.51176]	3.47E-06 (5.7E-06) [0.61061]	2.24E-06 (9.2E-06) [0.24298]	-0.043393 (0.09655) [-0.44943]
$M2^C$ (-1)	0.046599** (0.02280) [2.04413]	0.528302** (0.18680) [2.82811]	9.61E-07** (7.6E-07) [1.27085]	1.13E-06 (1.2E-06) [0.92042]	-0.017484 (0.01283) [-1.36303]
$M2^C$ (-2)	0.021799** (0.01622) [1.34374]	0.024041 (0.13294) [0.18085]	4.23E-07** (5.4E-07) [0.78606]	1.26E-07** (8.7E-07) [0.14505]	0.040432 (0.00913) [4.42920]
$GDPr^C$ (-1)	21613.38** (6125.84) [3.52823]	29156.34 (50197.4) [0.58083]	0.406120** (0.20316) [1.99905]	-0.596378 (0.32920) [-1.81159]	8898.768** (3446.98) [2.58161]
$GDPr^C$ (-2)	14945.21 (6750.81) [2.21384	56390.25 (55318.5) [1.01937]	0.196829 (0.22388) [0.87916]	0.111858 (0.36279) [0.30833]	6360.126** (3798.64) [1.67432]
S^C (-1)	1156.336 (3991.91) [0.28967]	20449.35 (32711.2) [0.62515]	0.034245** (0.13239) [0.25867]	0.323421** (0.21452) [1.50762]	1086.915 (2246.23) [0.48388]

S^C (-2)	1159.180** (3926.46) [0.29522]	-27164.13 (32174.8) [-0.84427]	0.179044** (0.13022) [1.37497]	-0.122269 (0.21101) [-0.57945	1043.100 (2209.40) [0.47212]
Fdi^C (-1)	1.037172 (0.25692) [4.03697	13.76025** (2.10528) [6.53605]	2.24E-05 (8.5E-06) [2.62332]	-1.21E-05 (1.4E-05) [-0.87890]	0.751103 (0.14457) [5.19555]
Fdi^C (-2)	-1.344520 (0.43468) [-3.09312]	9.841367 (3.56194) [2.76292]	1.13E-05 (1.4E-05) [0.78294]	-1.47E-05 (2.3E-05) [-0.62924]	-0.737086 (0.24459) [-3.01352]
C	941.5429 (7188.24) [0.13098]	1351.896 (58903.1) [0.02295]	0.011165 (0.23839) [0.04684]	0.049431 (0.38629) [0.12796]	949.9758 (4044.79) [0.23486]
R-squared	0.500399	0.412214	0.431473	0.367243	0.275483
Adj. R-squared	0.490581	0.405947	0.412143	0.355081	0.260703
Sum sq. residuals	3.74E+10	2.51E+12	41.12674	107.9904	1.18E+10
S.E. equation	41227.34	337831.7	1.367259	2.215548	23198.41
F-statistic	17.87288	10.91192	2.816796	1.929463	11.17248

4.4.3 Joint significance of the variables of VAR model with M2

The joint significance of the variables has been checked by using the Wald test. The overall significance of all the four models of the system i.e. investment model, money supply model, GDP growth rate model, saving rate model and foreign direct investment model has been checked. The results computed are given in table 8. For all the models no restriction has been put on the explanatory variables with the hypothesis that these all these explanatory variables do not influence the dependent variables. However, all of these hypotheses have been rejected and it is confirmed that all the explanatory variables in all the models do influence the explained variables. From the investment model it is clear that money supply (M2) does play role in the determination of the aggregate investment.

Table 8: Wald test results for joint significance VAR model with M2

Null Hypotheses of all Models: The overall effect of the independent variables is equal to zero			
Investment Model			
Test Stat.	Value	Df	Probability
Chi- Square	178.732	11	0.0000
Money Supply(M2) Model			
Test Stat.	Value	Df	Probability
Chi- Square	109.120	11	0.0000
GDP Growth Rate Model			
Test Stat.	Value	Df	Probability
Chi- Square	28.171	11	0.0030
Saving Model			
Test Stat.	Value	Df	Probability
Chi- Square	19.323	11	0.0455
Foreign Direct Investment Model			
Test Stat.	Value	Df	Probability
Chi- Square	111.724	11	0.000

4.4.4 Impulse response function results of VAR model with M2

Cholesky decomposition is used for examining the response of the dependent variables to independent variables in all the seven models. The results are given in figure 4 as follows.

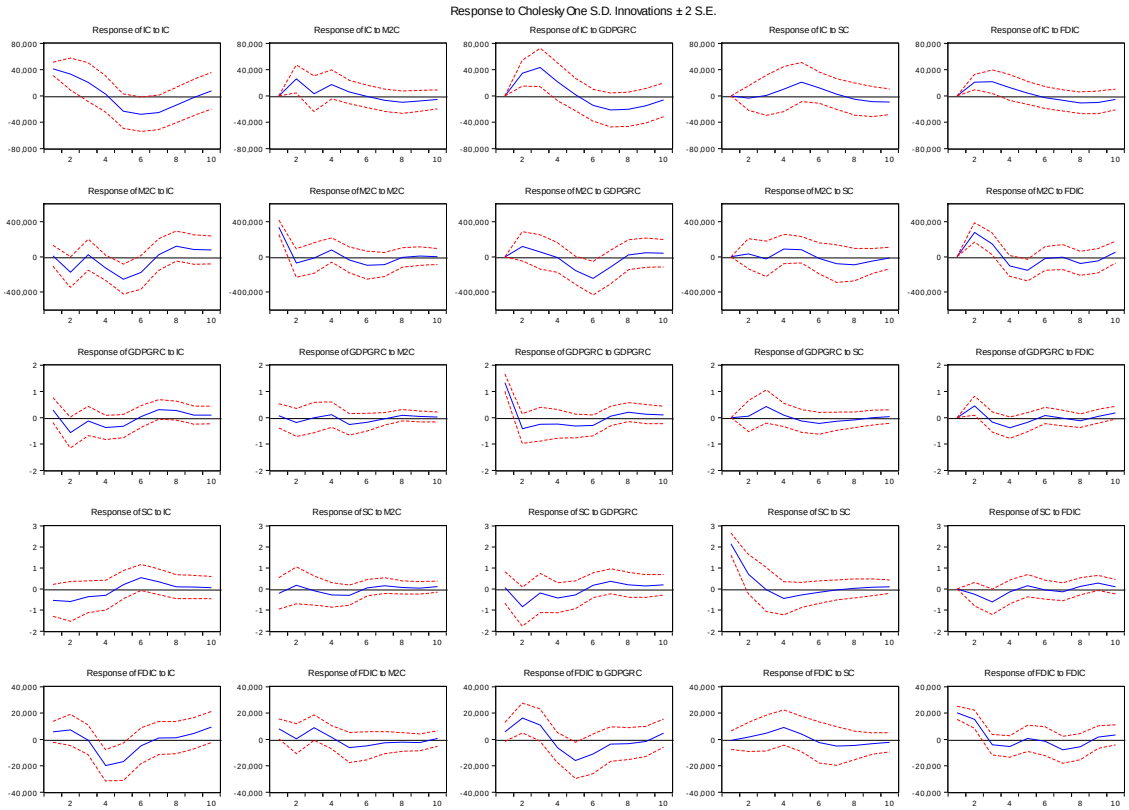

Figure 4: Impulse response function results of VAR model for M2

The results show that aggregate investment in this model is affected by shocks from all the explanatory variables. Similarly, money supply, GDP growth rate and inflation have also been affected by shocks from the explanatory variables.

5. Conclusion

The study estimated the role of money supply (i.e. M1 and M2) in the determination of the aggregate investment component of aggregate demand for Pakistan during the period 1980 - 2015. First, Hodric Prescott filter method was applied to the data for separating the cyclical components from the trend components of the data for making the data stationary. After that ordinary least squares method was applied for the regression results. Granger Causality test has also been applied for checking the causal relationship between the variables. Vector Auto regression for the robustness of the results also applied. The results showed that monetary aggregates i.e. M1 and M2 positively affect the aggregate investment in Pakistan. Furthermore, the Granger causality test showed a one directional relationship

from M1 and M2 towards aggregate investment. Similarly, the Vector Auto regression also supported these results and revealed a positive relationship between money supply and aggregate investment. Furthermore, Gross Domestic Product growth rate and saving also turned positively significant. However, foreign direct investment remained insignificant. It is concluded on the basis of that monetary policy aggregates both M1 and M2 play an important role in the determination of the aggregate investment in Pakistan.

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