CHAPTER 3

THE EFFECTS OF TOTAL *M1* ON THE ECONOMY

There have been many studies done on the effects of money on inflation (see Belkas and Jones (1993), Tan and Cheng (1995), Dhakal and Kandil (1993), Duck Nigel (1993) and Fitzgerald (1999)). Some studies used narrow money like *M1* and some used *M2* and *M3*. Most studies find the relationship between money and inflation rate of the general price level aggregated in Consumer Price Index (*CPI*). Unlike other studies, this study intends to find further relationship between narrow money *M1* with individual components of *CPI*. This study also aims to analyse if the effects of narrow money, *M1*, have eroded over the years. This could due to the new technology of payments made without cash.

3.1 The Effects of Changes of Total *M1* on Inflation Rate

In order to analyse the relationship between the change in *M1* and the inflation rate, the following model will be used:

$$\dot{P}_t = \beta_0 + \beta_1 \dot{M1}_t + \varepsilon_t \qquad (3.1)$$

where $\dot{P}_t$ = change in price level (inflation rate)

$\dot{M1}_t$ = change in narrow money M1

ε_t = white noise error term

Equation 3.1 will be applied to analyse the impact of *M1* on the component of Total Consumer Price Index and on each individual components of *CPI*. $\dot{P}$ in the equation will represent change in price for the Total Consumer Price Index and other *CPI* components.

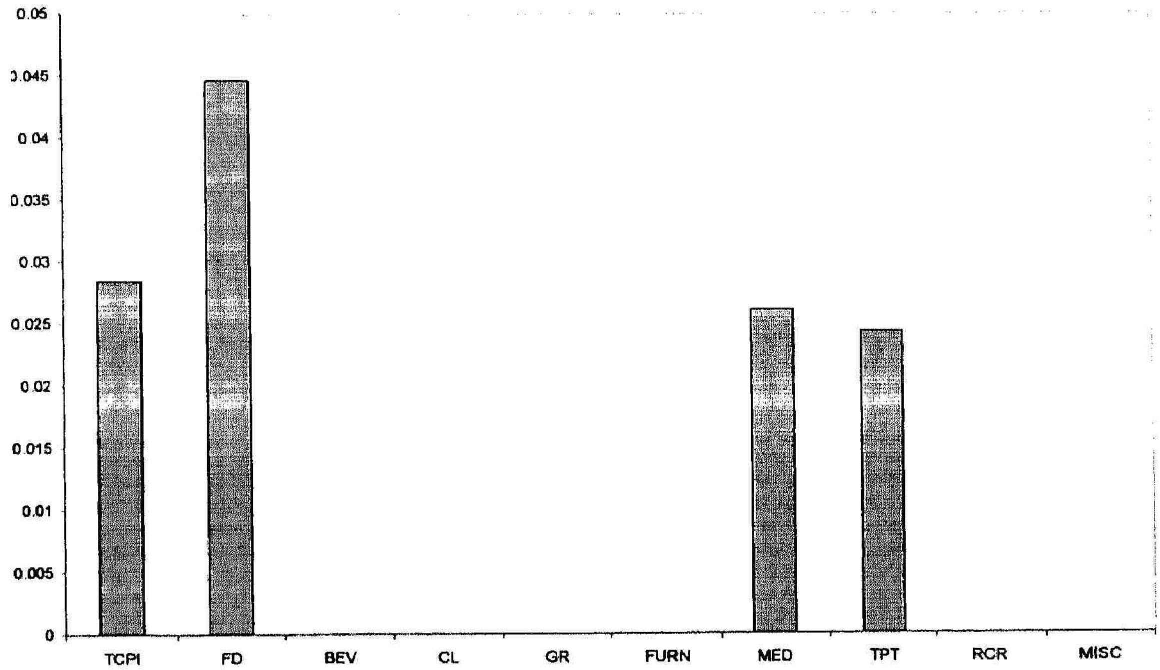
The results from the above regression are shown in Table 3.1. The estimated results show that not all of the components of inflation have a relationship with growth in *M1*. At 5% significance level, the results of *p-value* show that the change in *M1* only affects the inflation rate for Total *CPI*, Food *CPI* and Transport *CPI*. At 10% significance level, change in *M1* also affects the inflation rate of Medical Care *CPI*. The coefficients of change in *M1* are shown in the bar chart in Figure 3.1. A 1% increase in *M1*, inflation rate of Total *CPI* will increase by 0.028%, inflation rate of Food *CPI* will increase by 0.045%, inflation rate of Medical *CPI* will increase by 0.026% and inflation rate of Transport *CPI* will increase by 0.024%. Inflation rate of Food *CPI* is the most responsive to a change in *M1* followed by total *CPI*, Medical *CPI* and Transport *CPI*. These results are summarised in Table 3.1 and Figure 3.1 below.

Table 3.1 Regression of $\dot{P}$ on $\dot{M}1$

Inflation of *CPI* Components	Coefficient $\hat{\beta}_0$	Coefficient $\hat{\beta}_1$
Total *CPI* (*TCPI*)	0.2617*	0.0284*
	(0.0000)	(0.0003)
Food (*FD*)	0.2683*	0.0447*
	(0.0000)	(0.0054)
Beverage (*BEV*)	0.4149*	0.0419
	(0.0001)	(0.1598)
Clothing (*CL*)	0.1741*	− 0.004
	(0.0000)	(0.6713)
Gross Rent (*GR*)	0.2999*	0.0087
	(0.0000)	(0.5053)
Furniture (*FURN*)	0.2064*	− 0.005
	(0.0000)	(0.3848)
Medical Care (*MED*)	0.3292*	0.0261^{+}
	(0.0261)	(0.0948)
Transport (*TPT*)	0.2805*	0.0243*
	(0.0000)	(0.0361)
Recreation (*RCR*)	0.1263*	0.0040
	(0.0040)	(0.5990)
Miscellaneous (*MISC*)	0.3428*	0.0001
	(0.0280)	(0.2649)

Note: The *p-values* are in parentheses.
*Denotes statistical significance at 5% level
$^{+}$Denotes statistical significance at 10% level.

Figure 3.1 Comparisons of the Effects of $\dot{M1}$ on $\dot{P}$ of *CPI* Components



The above Figure 3.1 shows the estimated coefficients of those components, which have a significant relationship between inflation rate and growth in *M1*.

.1.1 Rolling Regression of $\dot{P}$ on $\dot{M1}$

As means of payment becomes more advanced such that payment is made by redit card or debit card, the role of *M1* may decline over the years. Thus an analysis alled 'rolling regression' will be carried out to see the trend of the effects of total *M1* n the inflation rate over the years (1975-2000). This analysis is done by first egressing the first thirty observations of the data and subsequently adding one bservation till the last observation of the data. The model for this analysis is the same s equation (3.1), as stated below.

$$\dot{P}_t = \beta_0 + \beta_1 \dot{M1}_t + \varepsilon_t \qquad (3.1)$$

This equation will be estimated using all the different CPI components. Below are liagrams (Figures 3.2 – 3.5) of the trend of the effects of *M1* to inflation rate of the lifferent components of *CPI* over the years (this analysis will only be tested on the CPI components which have significant relationship with *M1*).

Figure 3.2 Rolling Regression – Total *CPI*

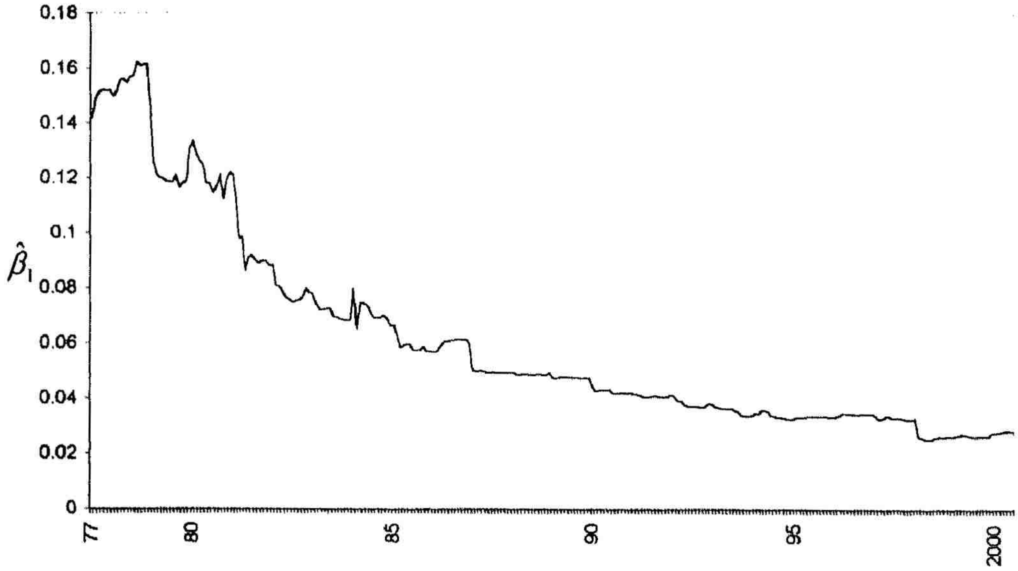


Figure 3.3 Rolling Regression – Food

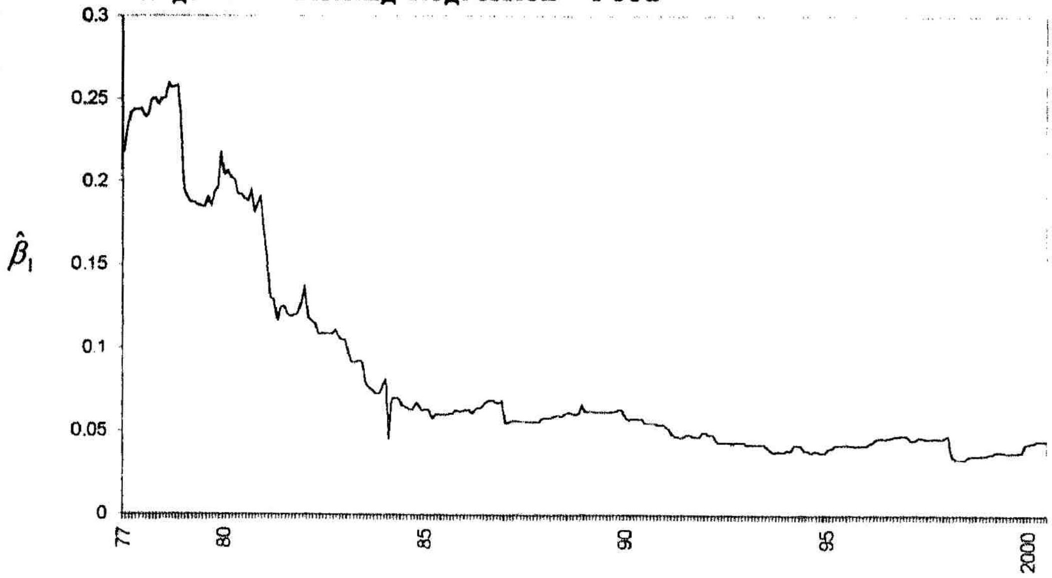


Figure 3.4 Rolling Regression – Transport

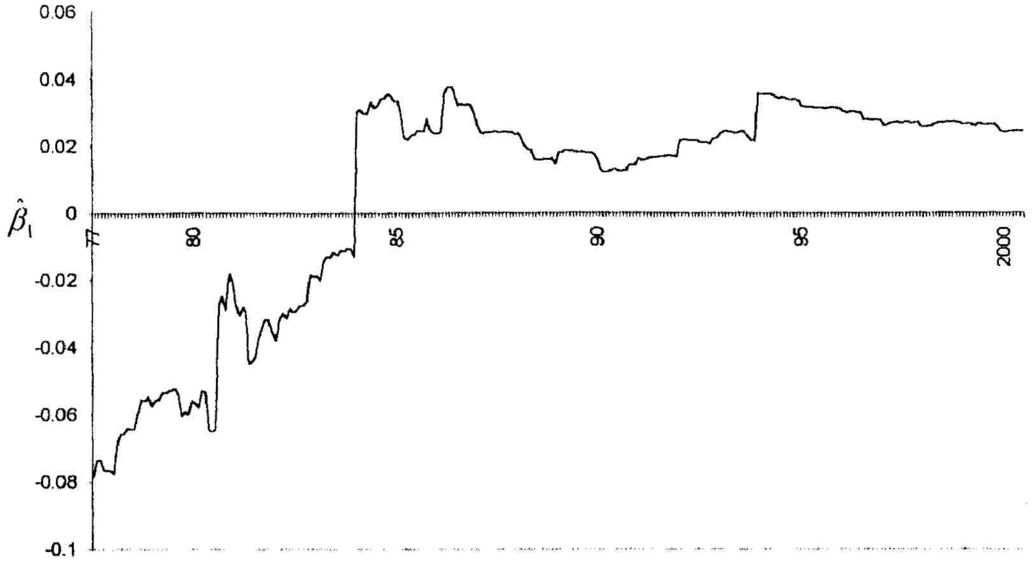
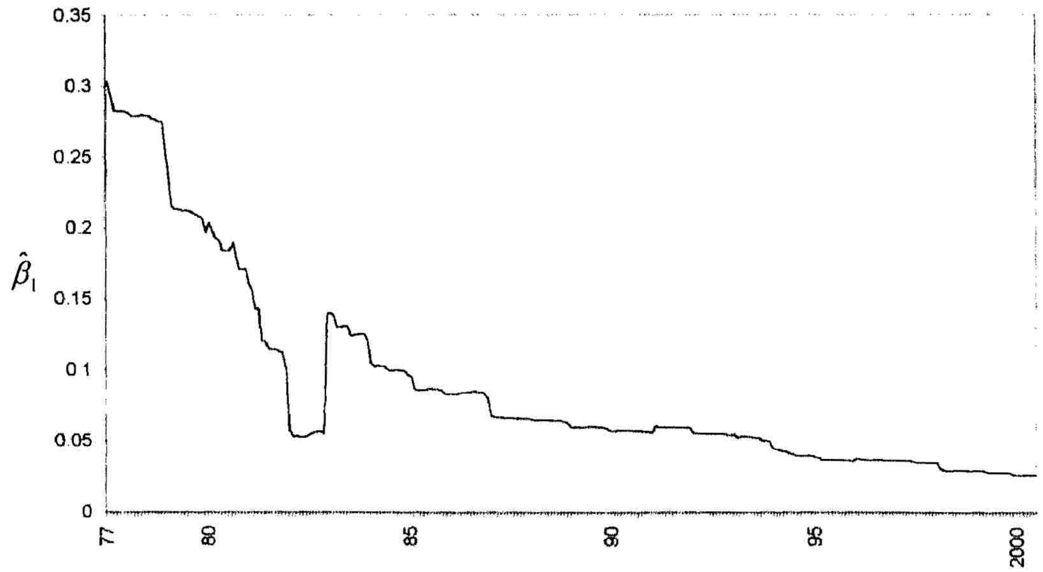


Figure 3.5 Rolling Regression – Medical Care



From the results of rolling regression (refer Figure 3.2 to Figure 3.5), over the 25 years, it can be seen that the coefficients of *M1* have dwindled. The decrease in $\hat{\beta}_1$ indicates that when there is an increase in *M1*, the change in inflation has become smaller over the years. The reason could be there are other means of payment that has taken place.

Nevertheless, there are other possible reasons of why the role of *M1* has fallen. One of the reason could be, a developing country like Malaysia, as our economy is growing the basic needs of society does not increase as much as it used to be. Thus for example, basic necessities like food, according to Engel's law, have income elasticity being less than one. According to a research done on OECD countries and LDCs, the studies found that food absorbed about one half of the consumption budget in the poorest countries, and only 20% for the most affluent. The effect of higher affluence would be to cause the income elasticity to fall. This idea is further proven when this research found that average income elasticity of food in the OECD countries is lower than that in the LDCs. The 'saving' on food is redistributed to housing and transport in particular (see Clements and Chen, 1996). Thus from these results, it helps to shed some light as to why the $\hat{\beta}_1$ of Food *CPI* and Medical Care *CPI* declined over the years and that the $\hat{\beta}_1$ of transport has risen from negative to a stable positive position.

This piece of findings shows that it could also be due to the degree of affluence that causes the dwindling role of money in Food and Medical Care component as a country becomes more affluent. Nevertheless, further studies needs to be done to isolate out if the dwindling of role of *M1* is caused by changing means of payments like the usage of credit card or it is due to the degree of affluence of a country or the emergence of *M2* and *M3*[1]. Perhaps all these reasons can explain why the effect of *M1* has been declining.

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[1] M2 and M3 have undergone some changes over the years and its definition have been changed to reflect the introduction of new financial instruments (see Money and Banking in Malaysia, 35th edition)

Thus the rolling regression does pose a possibility that the role of money has dwindled over the years and might be caused by the increasing usage of credit card. The research also do not single out the possibility of emergence of *M2* and *M3* and the degree of affluence which might have caused the falling role of narrow money.

3.1.2 Regression of $\dot{P}$ on Sum of Lags of $\dot{M}1$

According to some studies money does not affect the inflation rate instantaneously. Thus there is a possibility that it takes lag periods for a change in *M1* to affect the inflation rate. Following this possibility, a distributed lag model will be used to see the effect of *M1* on inflation in a longer run[2]. In this study, a lag period of 1-year to 5-years will be used. The purpose of this analysis is to study the responsiveness of inflation rate towards the change in *M1* (that is to find the elasticity of a change in *M1* on the inflation rate) and to analyse if growth in *M1* is a leading or a lagging variable.

The model will be as follows:

$$\dot{P}_t = \alpha + \sum_{i=0}^{n} \beta_i \dot{M}1_{t-i} + \varepsilon_t \qquad (3.2)$$

[2] Theory of inflation and money works best in the long run (see Mankiw 1994) rather in the short run and thus a longer period of lags is used to see the effect of M1 on inflation. This is also to see the long run M1 elasticity on inflation.

From the above regression of distributed lag model, the results in Table 3.2 show that at 5% level of significance, the lag of 1 year of change in *M1* are significant for the change in price of components of Total *CPI*, Food *CPI* and Transport *CPI*. For lag period of 2 years, at 5% significance level, the relationship of change in *M1* and inflation are significant for Total *CPI*, Food *CPI*, Clothing *CPI*, Gross Rent *CPI*, Furniture *CPI*, Transport *CPI* and Miscellaneous *CPI* are significant. For lag period of 3 years, those components that are significant are similar to those of 2 years lag period except Transport *CPI* and adding the Medical *CPI* component. The significant components of lag period of 4 years are similar to 3 years lag period except Clothing *CPI* and Furniture *CPI* which are not taken into considerations (even though they are significant) as the coefficient of sum of lags has fallen as compared to 3-years lag period.

Furthermore the results also show that at the maximum period of 5 years, a 1% increase in *M1* give rise to 0.34% increase in Total *CPI*, 0.51% increase in Food *CPI*, 0.52% increase in Gross Rent *CPI*, 0.11% increase in Furniture *CPI*, and a 0.41% increase in Medical Care *CPI*. At the maximum period of 4 years, Miscellaneous *CPI* is the most responsive towards 1% change in *M1* that is an increase of 0.53%. These results show that change in Miscellaneous *CPI* is the most responsive (elasticity of changes in inflation is highest) to change in *M1* followed by change in Gross Rent *CPI*, Medical Care *CPI*, Food *CPI* and Total *CPI*. Table 3.2 and Figure 3.6 to Figure 3.10 below show the coefficients of sum of lags for the distributed lag model.

Table 3.2 Regression of $\dot{P}$ on Sum of Lags of $\dot{M1}$

$\dot{P}$ of Components of *CPI*	Coefficients of Sum of lags						
	1 year	2 years	3 years	4 years	5 years	Minimum[1] Lag Period	Maximum[2] Lag Perioc
Total *CPI* (*TCPI*)	0.0894* (2.6478)	0.1745* (3.9096)	0.2433* (4.4489)	0.2911* (4.6021)	0.3401* (4.6054)	1 year or <	5 years or
Food (*FD*)	0.12054* (1.7201)	0.2251* (2.3752)	0.3246* (2.7749)	0.3755* (2.7335)	0.5082* (3.20942)	1 year or <	5 years or
Beverages (*BEV*)	0.0255 (0.1916)	0.0319 (0.1725)	0.1193 (0.5193)	0.3041 (1.0948)	0.37170 (1.0981)	Not significant	Not significant
Clothing (*CL*)	0.06074 (1.5214)	0.1751* (3.2437)	0.2258* (3.3443)	0.2238 (2.7393)	0.1682 (1.8305)	2 years	3 years
Gross Rent (*GR*)	0.04347 (0.7474)	0.1595* (2.1004)	0.2856* (3.10706)	0.4071* (3.8630)	0.5238* (4.3431)	2 years	5 years or
Furniture (*FURN*)	0.0074 (0.3127)	0.1087* (3.4084)	0.1309* (3.2653)	0.1056 (2.1878)	0.1080 (1.9036)	2 years	3 years
Medical Care (*MED*)	0.0639 (1.0312)	0.1361 (1.5923)	0.2435* (2.27)	0.3323* (2.57)	0.4086* (2.6263)	3 years	5 years or
Transport (*TPT*)	0.1480* (2.858)	0.1784* (2.5244)	0.1471 (1.6611)	0.0731 (0.6951)	– 0.0126 (– 0.0994)	1 year or <	2 years
Recreation (*RCR*)	– 0.0055 (– 0.1629)	0.0521 (1.1051)	0.0960 (1.6348)	0.0880 (1.2706)	0.1014 (1.2240)	Not significant	Not significan
Miscellaneous (*MISC*)	0.1420 (1.2479)	0.2987* (1.9076)	0.3963* (2.0156)	0.5326* (2.2522)	0.2851 (1.8794)	2 years	4 years

Note: The *t-statistics* are in parentheses.

*Denotes statistical significance at 5% level

[1]The minimum lag period for the relationship of change in *M1* and inflation rate to be significant.

[2]This sequential procedure of continuously adding lag periods stops when the regression coefficients of the lagged variables start becoming statistically insignificant and/or the coefficient drops as the lag period increases and/or the coefficient of the lags changes signs from positive to negative or vice versa (see Gujarati, 1995).

Figure 3.6 The Effects of Sum of Lags of $\dot{M}1$ on $\dot{P}$ (1 year)

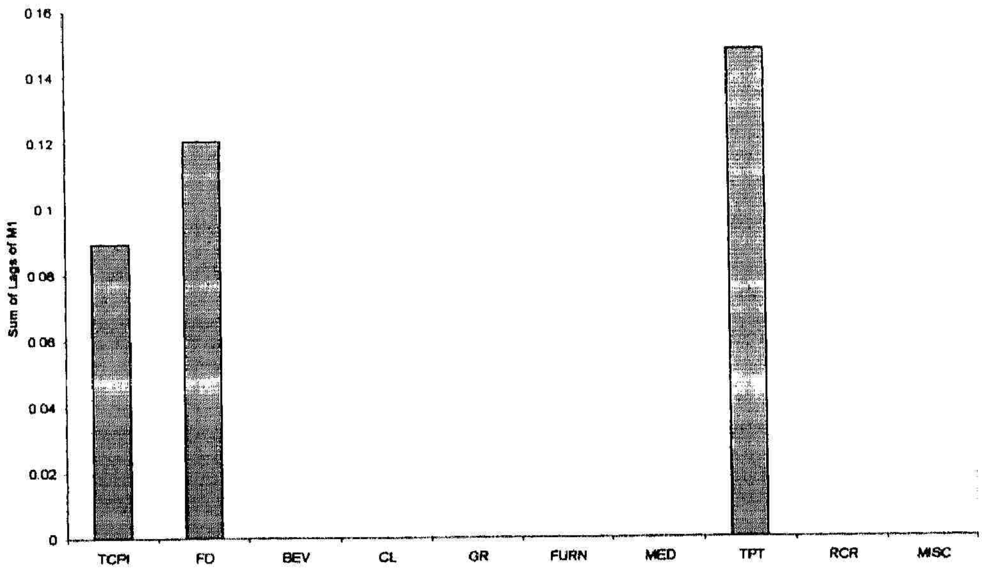


Figure 3.7 The Effects of Sum of Lags of $\dot{M}1$ on $\dot{P}$ (2 years)

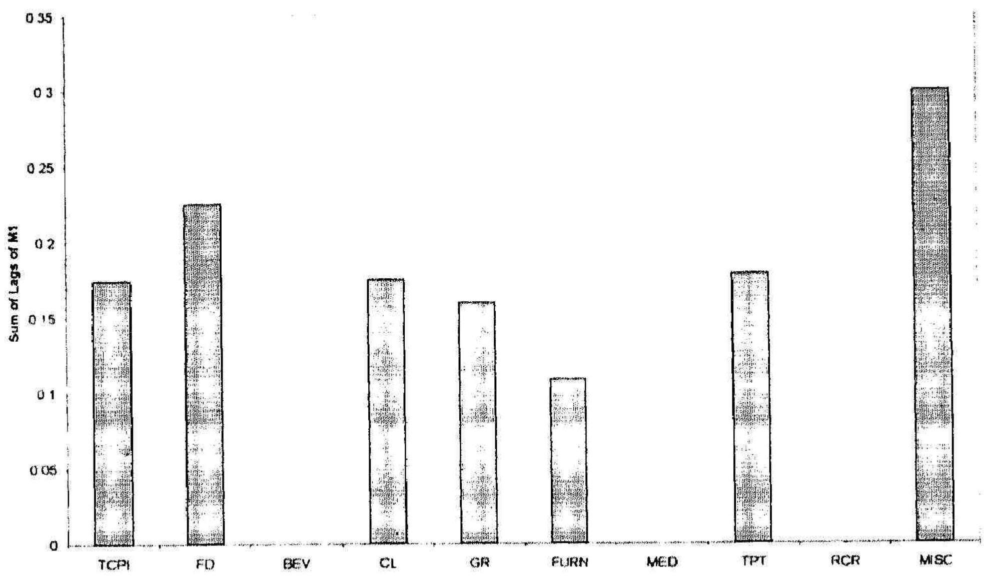


Figure 3.8 The Effects of Sum of Lag of $\dot{M}1$ on $\dot{P}$ (3 years)

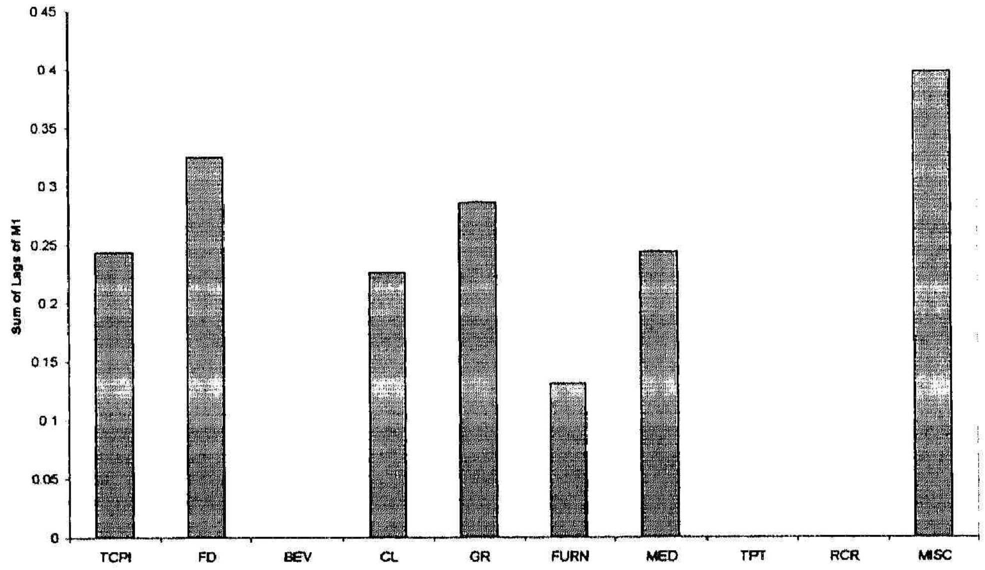


Figure 3.9 The Effects of Sum of Lags of $\dot{M}1$ on $\dot{P}$ (4 years)

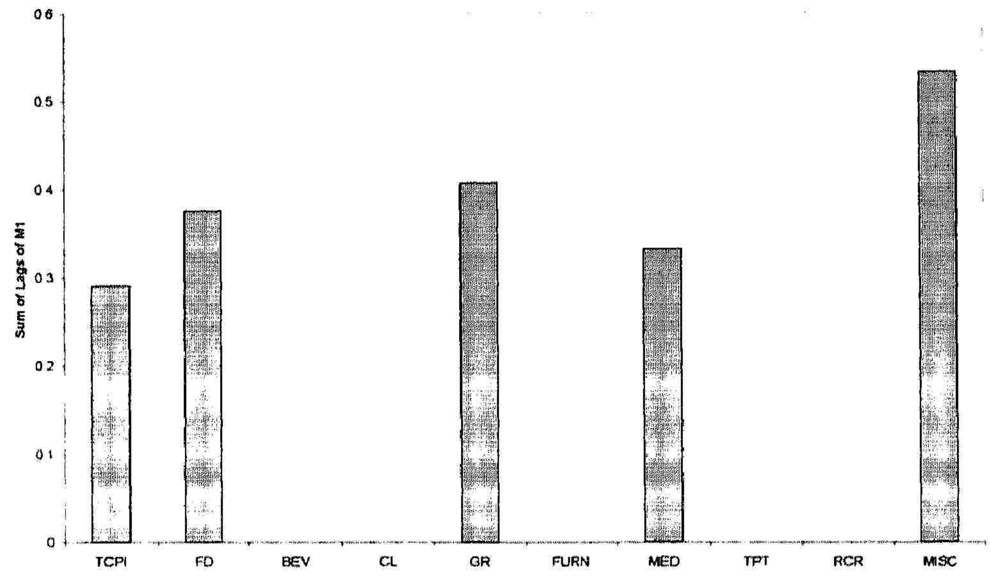
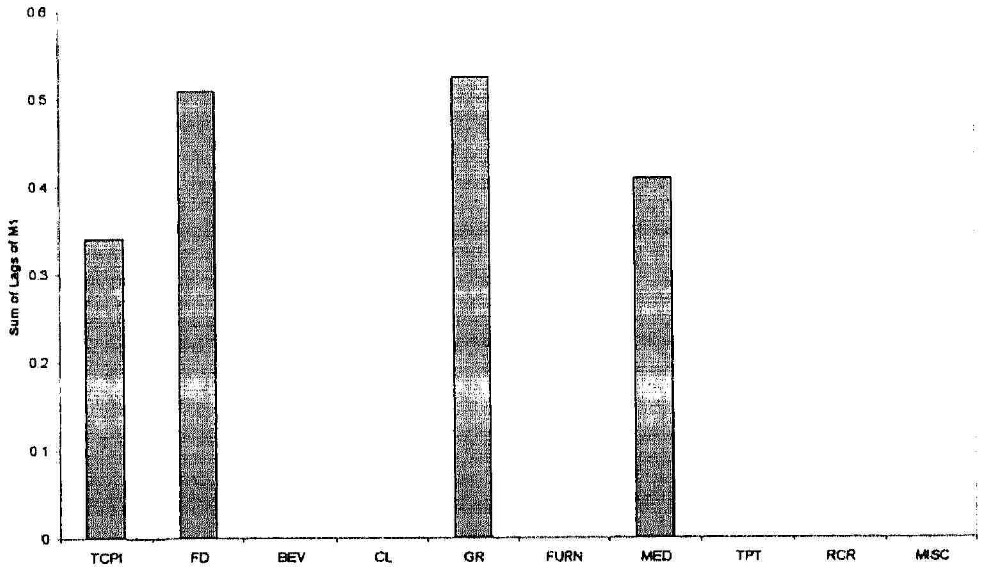


Figure 3.10 The Effects of Sum of Lags of $\dot{M1}$ on $\dot{P}$ (5 years)



From the analysis above the results indicate that when the lag period increases from 1-year to 2-years to 3-years to 4-years and to 5-years there are more components of *CPI* that have significant relationship towards changes in *M1*. There are components, which is significant consistently from 1-year lag period to 5-years lag periods. These components are Total *CPI* and Food *CPI*.

Furthermore, the money elasticity of inflation[3] increases as the lag period increases for some components like Total *CPI* (0.09 (1-year lag period) to 0.3401 (5-years lag period)) and Food *CPI* (0.12 to 0.51). Besides component like Gross Rent *CPI* has also been consistently significant from 2-years lag periods to 5-years lag periods. Considering the consistency of being significant throughout the lag periods and the magnitude of money elasticity of inflation, Food *CPI* and Gross Rent component are the most affected by growth in *M1*. Thus the monetary policy makers might consider the probability of inflation happening to these components when narrow money *M1* increases in the economy. Since credit card can be considered as the third form of narrow money[4] monetary policy makers should consider the increasing usage of credit cards in their policy making. From this analysis, growth in narrow money *M1* is a leading variable.

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[3] Money elasticity of inflation =coefficients of sum of lag periods

[4] See Business Korea Dec 1999

3.1.3 Granger Causality Test between $\dot{M1}$ and $\dot{P}$

Some economist put forward the theory that money should be the result instead of the cause of changes in economic activity[5]. The theory that lies behind this argument is that, money, instead of being exogenous, it might be endogenous if it changes to cater for the rise in cost or price of product where consumer needs to hold more money in buying more expensive goods. Granger-Causality test will be used in this case to see if the possibility of the bi-directional relationship exists between money and inflation.

Model's equation:

$$\dot{P}_t = \sum_{i=1}^{n} \lambda_i \dot{M}1_{t-i} + \sum_{j=1}^{n} \delta_j \dot{P}_{t-j} + u_{1t} \qquad (3.3)$$

$$\dot{M}1_t = \sum_{i=1}^{m} \alpha_i \dot{M}1_{t-i} + \sum_{j=1}^{m} \beta_j \dot{P}_{t-j} + u_{2t} \qquad (3.4)$$

where it is assumed that u_{1t} and u_{2t} are uncorrelated.

From the Table 3.3 below, at 5% significance level, *M1* Granger causes inflation for the component of Total *CPI* and Food *CPI*. At 10%, *M1* Granger causes inflation for the Gross Rent *CPI* and Transport *CPI*. On the other hand, for Beverage *CPI*, inflation Granger Cause *M1* at 10% significance level. This shows that the relationship from *M1* to inflation is stable. The consistent unidirectional relationship from *M1* to inflation rate[6] for most of the *CPI* components show that *M1* is an exogenous variable.

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[5] See Kaldor, Nicholas (1970)

[6] *M1* to inflation means inflation is a function of *M1*, $\dot{P} = f(\dot{M}1)$

Table 3.3 Granger Causality Test between $\dot{M}1$ and $\dot{P}$

ıple: 1975:01 2000:06 Total *M1*			
;:2 Obs:303			
l Hypothesis	*F*-Statistic	Probability	Outcome
ı does not Granger Cause $\dot{TCPI}$	6.66374	0.00148*	**Unidirectional**
›*I* does not Granger Cause $\dot{M}1$	1.72297	0.18031	
does not Granger Cause $\dot{FD}$	7.21487	0.00087*	Unidirectional √
does not Granger Cause $\dot{M}1$	1.31503	0.27002	
does not Granger Cause $\dot{BEV}$	0.57384	0.56398	Unidirectional √
‹ does not Granger Cause $\dot{M}1$	2.83026	0.06058*	
does not Granger Cause $\dot{GR}$	2.63841	0.07314^{+}	Unidirectional √
does not Granger Cause $\dot{M}1$	2.01761	0.13478	
does not Granger Cause $\dot{TPT}$	2.57803	0.07762^{+}	Unidirectional √
T does not Granger Cause $\dot{M}1$	0.22392	0.79951	

Note: * There's Granger Causality relationship at the 5% level
$^{+}$There's Granger Causality relationship at the 10% level
√ Those components that has the same Granger Causality relationship with the growth of *M1* as the Total *CPI*
Those components that show insignificant Granger Causality relationship are not reported.

In conclusion, from the above all three analysis to find the relationship between growth in *M1* and the inflation rate, only a few components have a significant relationship with *M1*. Nevertheless when lag periods is taken into account, *M1* does significantly cause inflation of several components of *CPI* such as Clothing, Gross Rent, Furniture, Medical Care and Transport. Total *CPI* and Food *CPI* have the most stable relationship with *M1* as it has significant results for all the three analysis above. Overall, the general inflation rate (Total *CPI*) is linked with growth in *M1* and it is fond to have a unidirectional relationship from changes in *M1* to inflation rate. Thus, these results seem to infer that growth in *M1* is a leading variable in the relationship with inflation and inflation rate might be procyclical towards growth in *M1*.

3.2 The Effects of Changes of Total *M1* on Output

According to monetarist, money supply is the force behind the changes in aggregate demand. Thus, this study intends to find out if changes in narrow money have an effect on changes in output. If it does, could growth in the usage of credit card possibly cause growth in output?

The relationship between a change in *M1* and output is expressed as follows:

$$\dot{IIP}_t = \beta_0 + \beta_1 \dot{M1}_t + \varepsilon_t \qquad (3.5)$$

where $\dot{IIP}_t$ = change in index of industrial production (output)

$\dot{M1}_t$ = change in narrow money *M1*

ε_t = white noise error term

From the results of the above regression as shown in Table 3.4, at 5% level of significance, most of the components of output have a significant relationship with *M1* namely *IIP* of Mining, *IIP* of Electricity, *IIP* of Manufacturing, *IIP* of Agriculture Product, *IIP* of Food, *IIP* of Tobacco and *IIP* of Wood Product. But the coefficients of *M1* do not approach statistical significance with the theoretically predicted (positive) signs in any of the regression except for Beverages and Product of Petrol and Coal component, which is significant at 10% significant level. Thus it looks like output is countercyclical towards growth in *M1* and this does not support the *a priori* postulation of relationship between output and growth of *M1* in Chapter 2.

Nevertheless, from the *a priori* assumption it is said that output (*TIIP*) is the leading variable to *M1* and perhaps this shows that *M1* is endogenous rather than exogenous. And if this is the case, the negative significant relationship between output and *M1* found in the analysis seems reasonable if *M1* is treated as endogenous. This could mean that when output falls, monetary policy maker increase the supply of money to stimulate the output growth. This relationship has to be further proven by Granger Causality test in section 3.2.3.

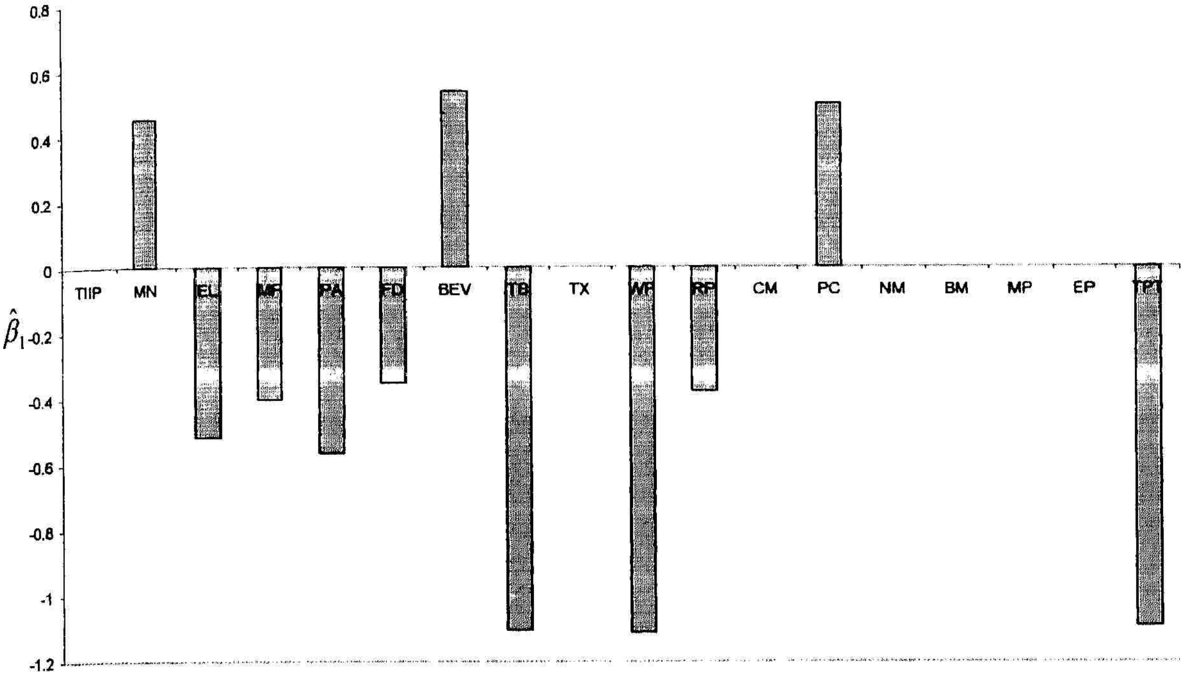
The following is the output of the analysis of the relationship between changes in $M1$ and changes in output.

Table 3.4 Regression of $\dot{IIP}$ on $\dot{M1}$

Component of *IIP*	Coefficient $\hat{\beta}_0$	Coefficient $\hat{\beta}_1$	Component of *IIP*	Coefficient $\hat{\beta}_0$	Coefficient $\hat{\beta}_1$
Total *IIP* (*TIIP*)	1.09617*	− 0.1388	Wood Product (*WP*)	2.9539*	− 1.1118*
	(0.0044)	(0.2141)		(0.0020)	(7.26E-05)
Mining (*MN*)	0.5166	0.4499*	Rubber Product (*RP*)	2.0419*	− 0.3792^{+}
	(0.5099)	(0.0500)		(0.0048)	(0.0721)
Eelctricity (*EL*)	1.5276*	− 0.5196*	Chemical (*CM*)	1.4209*	− 0.0475
	(0.0001)	(1.04E-05)		(0.0449)	(0.8178)
Manufacturing (*MF*)	1.5948*	− 0.4050*	Petrol and Coal (*PC*)	1.3305	0.4945^{+}
	(0.0016)	(0.0060)		(0.1427)	(0.0624)
Product Agriculture (*PA*)	2.0327*	− 0.5674*	Non-Metallic Product (*NM*)	1.3403^{+}	− 0.0530
	(0.0049)	(0.0072)		(0.0530)	(0.7884)
Food (*FD*)	1.2067*	− 0.3545*	Basic Metal (*BM*)	1.9962*	− 0.2073
	(0.0301)	(0.0292)		(0.0256)	(0.4257)
Beverages (*BEV*)	1.1303	0.5351^{+}	Metal Product (*MP*)	2.3656*	− 0.1898
	(0.2477)	(0.0615)		(0.0174)	(0.5116)
Tobacco (*TB*)	3.0655*	− 1.1060*	Electrical Product (*EP*)	2.1900*	− 0.2800
	(0.0112)	(0.0018)		(0.0011)	(0.1506)
Textiles (*TX*)	1.5249*	− 0.3024	Transport (*TPT*)	3.5725*	− 1.0935
	(0.0169)	(0.1039)		(0.0011)	(0.0006)

Note: The *p-values* are in parentheses.
*Denotes statistical significance at 5% level
$^{+}$Denotes statistical significance at 10% level

Figure 3.11 Comparisons of the Effects of $\dot{M1}$ on $\dot{IIP}$ of *IIP* components



The above Figure 3.11 shows those components' changes in output that has significant relationship with growth in *M1*.

3.2.1 Rolling Regression of $\dot{IIP}$ on $\dot{M}1$

Figure 3.12 Rolling Regression – Mining

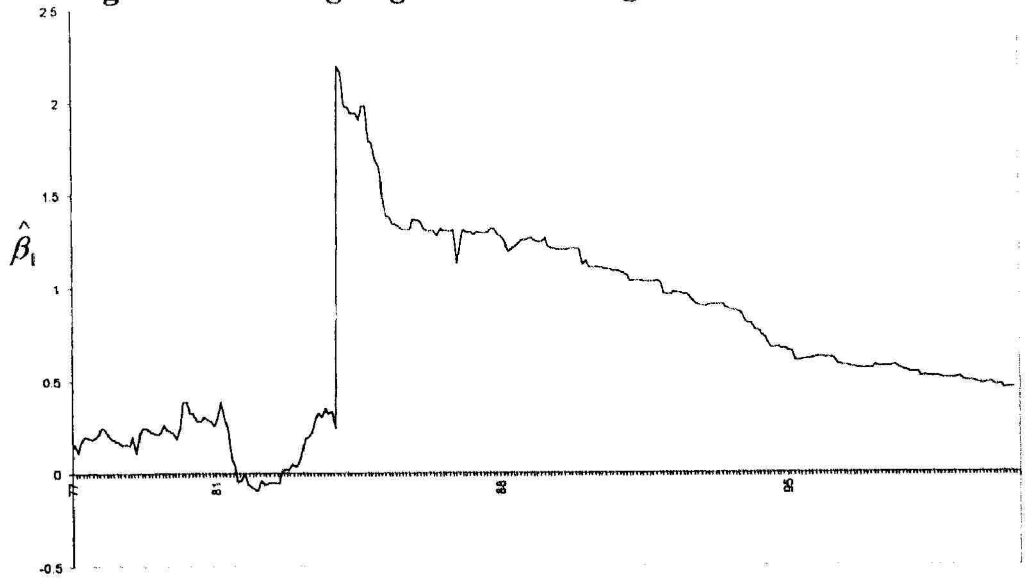


Figure 3.13 Rolling Regression – Electricity

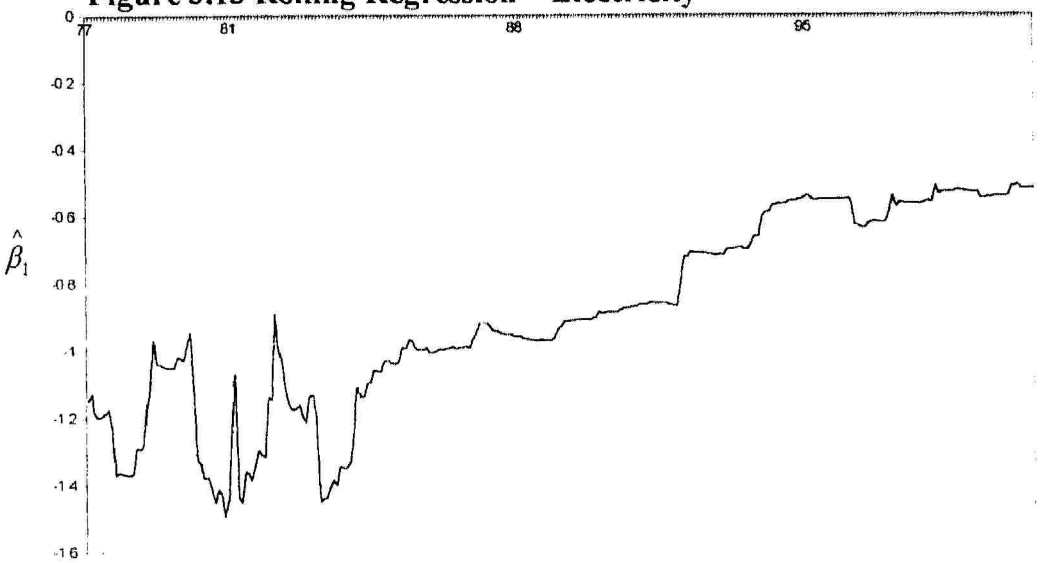


Figure 3.14 Rolling Regression – Manufacturing

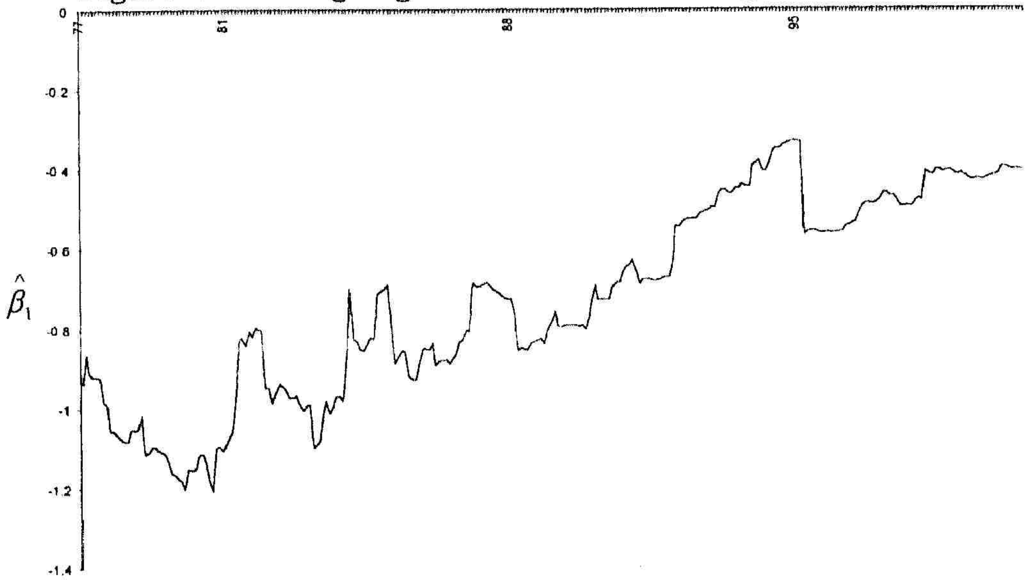


Figure 3.15 Rolling Regression – Product Agriculture

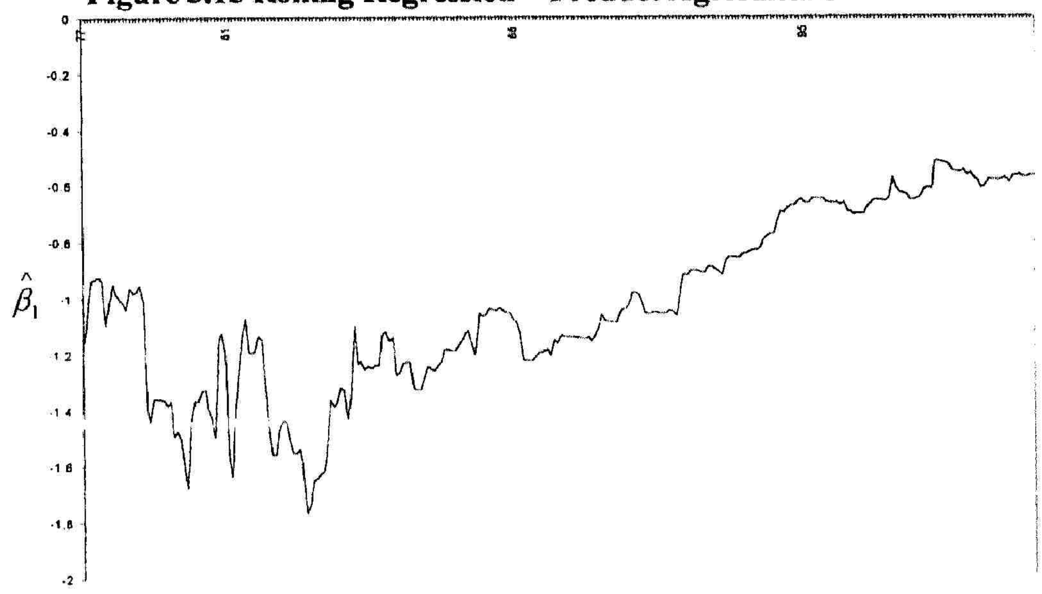


Figure 3.16 Rolling Regression – Food

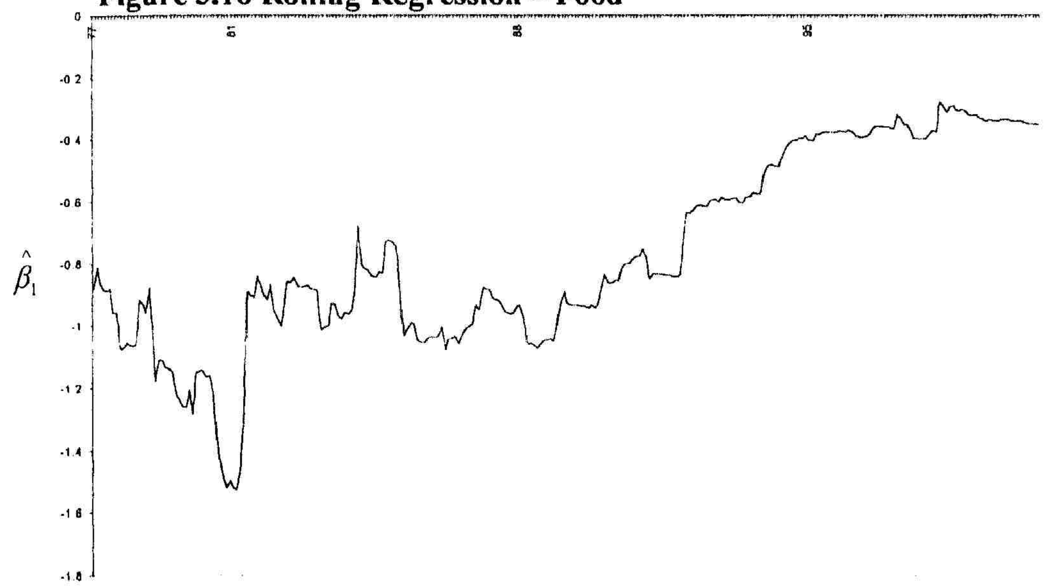


Figure 3.17 Rolling Regression – Beverages

Figure 3.18 Rolling Regression – Tobacco

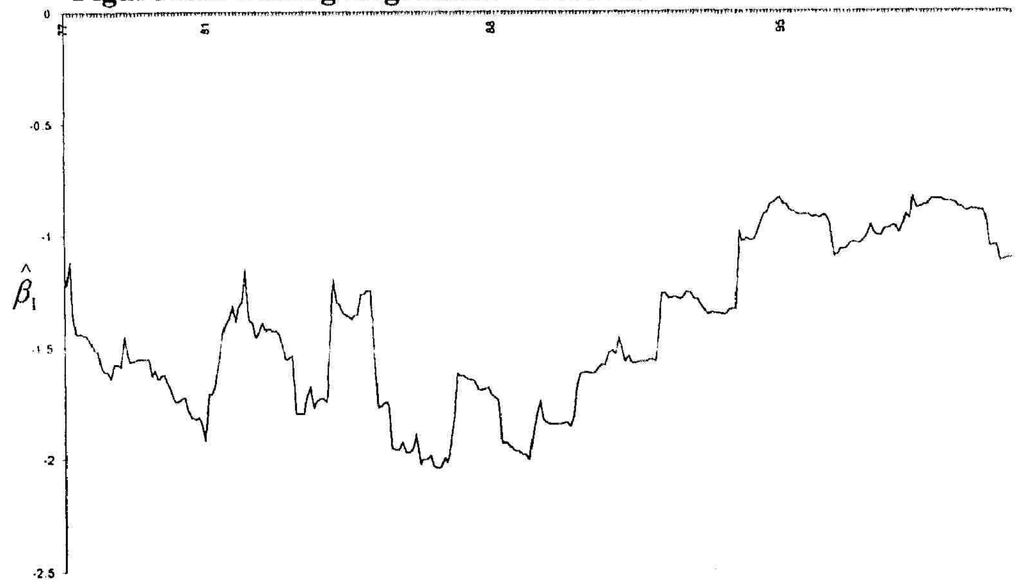


Figure 3.19 Rolling Regression – Wood Product

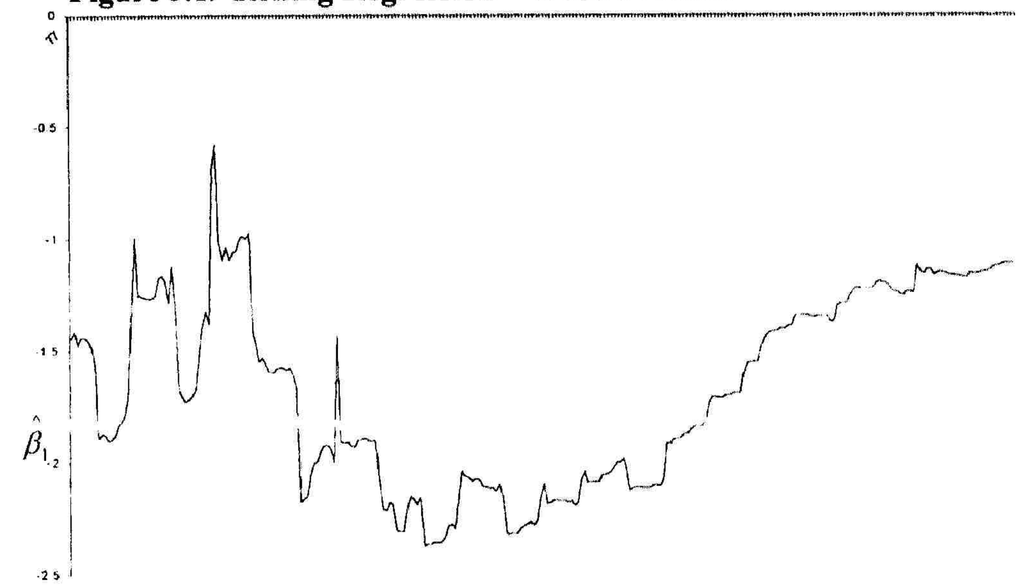


Figure 3.20 Rolling Regression – Rubber Product

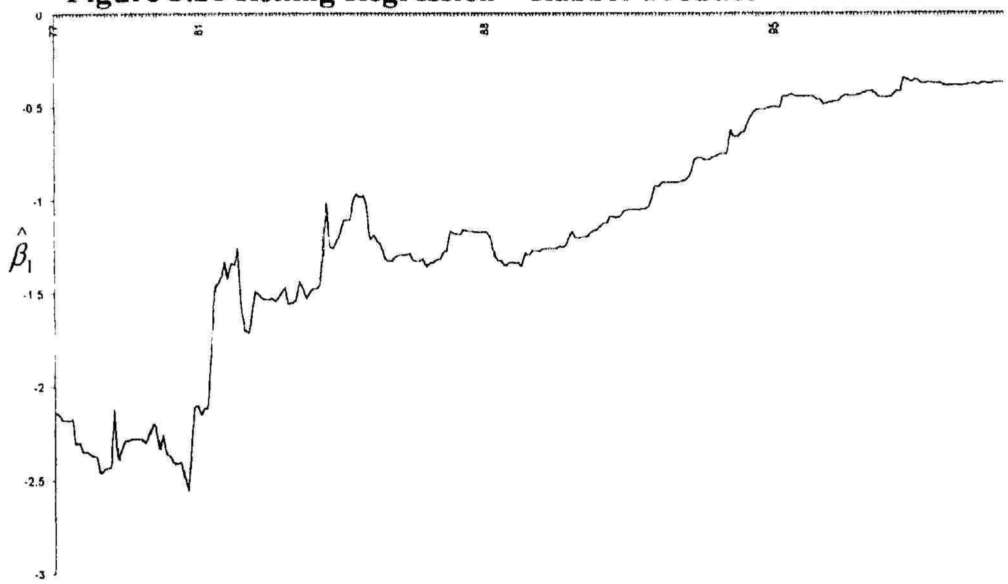


Figure 3.21 Rolling Regression – Petrol and Coal

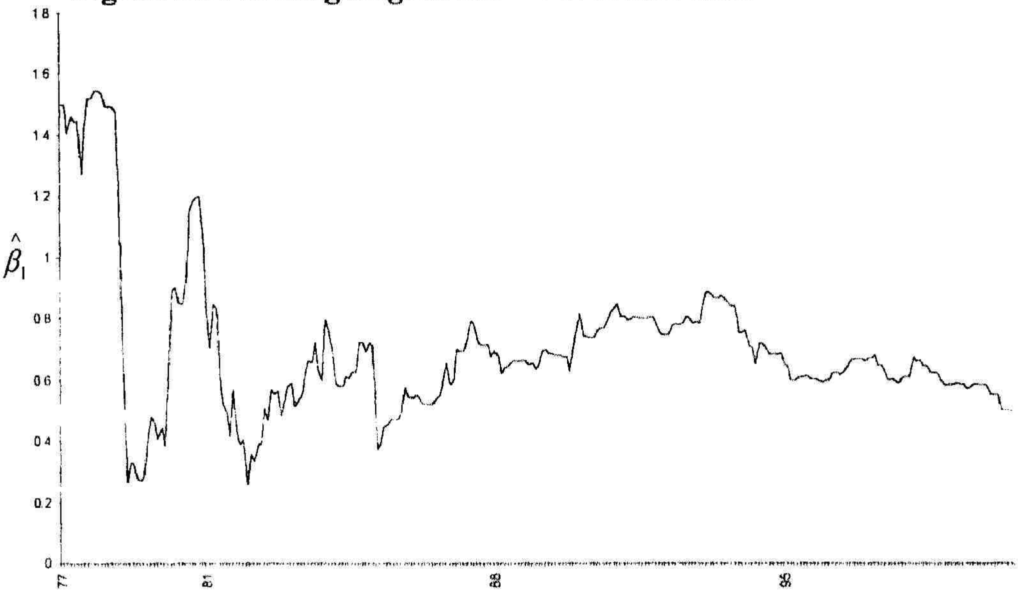
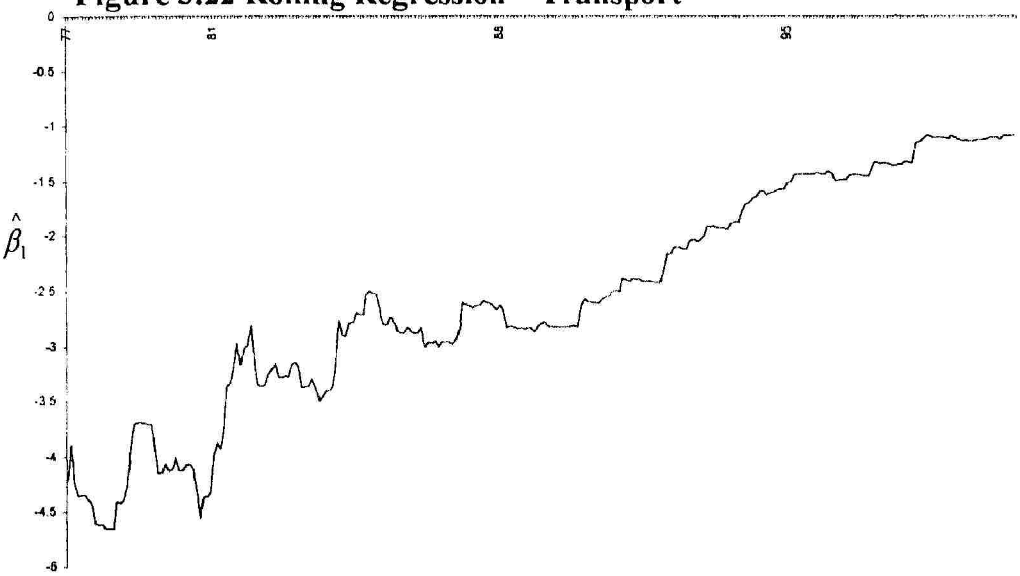


Figure 3.22 Rolling Regression – Transport



Figures 3.12 to 3.22 above, give the coefficient of *M1* for the long run. These estimated coefficients have also dwindled in absolute magnitude. This does suggest that the role of *M1* has fallen over the years. However, with the negative sign of the coefficients of *M1*, if policy makers increase *M1* during periods when output falls, the falling magnitude of coefficients of *M1* could indicate that the policy makers could have switched to use other monetary aggregates such as *M2* and *M3* to stimulate economic growth. Other means of payment like credit cards can also take over the role of *M1*.

3.2.2 Regression of $\dot{IIP}$ on Sum of Lags of $\dot{M}1$

It is frequently observed that a change in the monetary variable does not give instantaneous impact. The following model will be used to analyse the lag effect of changes in *M1* on changes in *IIP*. A lag of 1 year, 2 years, 3 years, 4 years, and 5 years will be tested.

$$\dot{IIP}_t = \alpha + \sum_{i=0}^{n} \beta_i \dot{M}1_{t-i} + \varepsilon_t \qquad (3.6)$$

From the above analysis, it is found that none of the components has a significant result towards sum of lags of *M1*. This will serve as another evidence that *IIP* could be the leading variable instead of growth in *M1*. *M1* seems to prove to be an endogenous variable rather than an exogenous variable. The results are shown in Table 3.5 below.

Table 3.5 Regression of $\dot{IIP}$ on Sum of Lags of $\dot{M}1$

Component of *IIP*	Coefficients of Sum of lags				
	1 year	2 years	3 years	4 years	5 years
Total *IIP* (*TIIP*)	– 0.03840 (– 0.07638)	– 0.24760 (– 0.35900)	– 0.43082 (– 0.50026)	– 0.55676 (– 0.53724)	– 0.75951 (– 0.60771)
Mining (*MN*)	0.23728 (0.22848)	0.16126 (0.11277)	0.00208 (0.00116)	– 0.45643 (– 0.21046)	0.12984 (0.04949)
Electricity (*EL*)	– 0.69157 (– 1.28682)	– 0.43906 (– 0.59097)	– 0.26976 (– 0.29280)	– 0.07067 (– 0.06449)	– 0.19686 (– 0.14891)
Manufacturing (*MF*)	– 0.37604 (– 0.56204)	– 0.21039 (– 0.22839)	– 0.54353 (– 0.47162)	– 0.95030 (– 0.68371)	– 1.34115 (– 0.79810)
Product Agrculture (*PA*)	– 1.29117 (– 1.35861)	– 1.38212 (– 1.06606)	– 1.19086 (– 0.76173)	– 1.18386 (– 0.64198)	– 1.48253 (– 0.67417)
Food (*FD*)	– 0.70291 (– 0.95778)	– 0.72866 (– 0.72156)	– 0.93975 (– 0.74526)	– 0.79095) (– 0.52600)	– 1.13833 (– 0.63793)
Beverages (*BEV*)	0.98543 (0.78126)	1.13888 (0.66004)	0.77149 (0.36077)	0.11676 (0.04560)	– 0.66469 (– 0.21564)
Tobacco (*TB*)	0.20977 (0.12924)	– 1.30424 (– 0.58635)	– 2.73268 (– 0.98007)	– 2.12516 (– 0.62768)	– 2.30532 (– 0.56111)
Textiles (*TX*)	– 0.44974 (– 0.54535)	– 0.49661 (– 0.43797)	– 0.80959 (– 0.57298)	– 1.06844 (– 0.63362)	– 1.38870 (– 0.69019)
Wood Product (*WP*)	– 2.05756 (– 1.61763)	– 1.97433 (– 1.13252)	– 2.64112 (– 1.20661)	– 3.24773 (– 1.24156)	– 3.85181 (– 1.23292)
Rubber Product (*RP*)	– 1.09190 (– 1.18412)	– 1.01557 (– 0.81053)	– 1.31854 (– 0.84542)	– 2.00810 (– 1.07556)	– 2.34820 (– 1.05148)
Chemical (*CM*)	– 0.13640 (– 0.14726)	– 0.42558 (– 0.33452)	– 0.42461 (– 0.26707)	– 0.91212 (– 0.47772)	– 1.11231 (– 0.48941)
Petrol and Coal (*PC*)	1.25321 (1.04656)	0.67160 (0.41055)	0.55844 (0.27822)	– 0.07679 (– 0.03204)	– 0.64479 (– 0.22666)
Non-Metallic Product (*NM*)	0.29408 (0.32370)	0.22270 (0.17896)	0.09494 (0.06249)	– 0.52501 (– 0.28832)	– 1.11303 (– 0.50953)
Basic Metal (*BM*)	– 0.41988 (– 0.38446)	– 0.44551 (– 0.32077)	– 0.65064 (– 0.38072)	– 0.41463 (– 0.20111)	– 0.84090 (– 0.34114)
Metal Product (*MP*)	0.63834 (0.48799)	0.90165 (0.50269)	0.85182 (0.37753)	1.68097 (0.61820)	2.01861 (0.61536)
Electrical Product (*EP*)	– 0.13023 (– 0.15078)	– 0.76802 (– 0.65718)	– 1.14335 (– 0.78333)	– 0.94255 (– 0.56894)	– 1.73558 (– 0.88981)
Transport (*TPT*)	– 1.10460 (– 0.76044)	– 1.40269 (– 0.70684)	– 1.57065 (– 0.65016)	– 2.33789 (– 0.81007)	– 4.48003 (–1.30951)

Note: The *t-statistics* are in parentheses.
None of the above components are statistical significance at 5% level

.2.3 Granger Causality Test between $\dot{M}1$ and $\dot{IIP}$

The following is an analysis done to test if there is a Granger Causal ·lationship between *M1* and *IIP* components.

$$\dot{IP}_t = \sum_{i=1}^{n} \alpha_i \dot{M}1_{t-i} + \sum_{j=1}^{n} \beta_j \dot{IIP}_{t-j} + u_{1t} \quad (3.7)$$

$$\dot{M}1_t = \sum_{i=1}^{m} \lambda_i \dot{M}1_{t-i} + \sum_{j=1}^{m} \delta_j \dot{IIP}_{t-j} + u_{2t} \quad (3.8)$$

/here it is assumed that u_{1t} and u_{2t} are uncorrelated.

The results from the Granger Causality test show that change in *M1* Granger ause the change in Total *IIP*, Manufacturing *IIP*, Wood Product *IIP*, Rubber Product *IP*, Product of Petroleum and Coal *IIP*, Electrical Product *IIP* and Transport quipment *IIP*. On the other hand changes in components like Tobacco *IIP*, Chemical nd Chemical Products *IIP*, Granger cause change in *M1*. The relationship between hanges in *M1* and the changes of output for the rest of the components like lectricity *IIP*, Agricultural Products *IIP*, Beverages *IIP*, Textiles *IIP*, Non-Metallic Aineral Products *IIP* and Basic Metals *IIP* are bi-directional. These results show that he relationship between *M1* and the components of output are inconsistent. The ranger causality relationship between changes in *M1* and changes in output is herefore unstable. There is no systematic pattern of *M1* being endogenous or xogenous.

The following Table 3.6 shows the results of the above analysis.

Table 3.6 Granger Causality Test between $\dot{M}1$ and $\dot{IIP}$

le: 1975:01 2000:06 Lag:2	Obs:303		
·Iypothesis	*F*-Statistic	Probability	Outcome
oes not Granger Cause $\dot{TIIP}$	18.4588	2.8E-08*	**Unidirectional**
loes not Granger Cause $\dot{M}1$	0.1128	0.89	
oes not Granger Cause $\dot{EL}$	23.9773	2.2E-10*	Bi-directional
loes not Granger Cause $\dot{M}1$	5.02833	0.00712*	
loes not Granger Cause $\dot{MF}$	14.2964	1.2E-06*	Unidirectional √
does not Granger Cause $\dot{M}1$	0.11035	0.89556	
loes not Granger Cause $\dot{PA}$	8.61106	0.00023*	Bi-directional
loes not Granger Cause $\dot{M}1$	3.98428	0.01961*	
oes not Granger Cause $\dot{FD}$	11.9755	9.9E-06*	Bi-directional
oes not Granger Cause $\dot{M}1$	3.17906	0.04304*	
oes not Granger Cause $\dot{BEV}$	4.80239	0.00886*	Bi-directional
does not Granger Cause $\dot{M}1$	2.63377	0.07348^{+}	
oes not Granger Cause $\dot{TB}$	1.27708	0.28037	Unidirectional √
oes not Granger Cause $\dot{M}1$	3.19045	0.04256*	
does not Granger Cause $\dot{TX}$	28.9387	3.3E-12*	Bi-directional
oes not Granger Cause $\dot{M}1$	11.7720	1.2E-05*	
oes not Granger Cause $\dot{WP}$	15.0268	6.1E-07*	Unidirectional √
oes not Granger Cause $\dot{M}1$	0.08341	0.91999	
oes not Granger Cause $\dot{RP}$	11.7871	1.2E-05*	Unidirectional √
oes not Granger Cause $\dot{M}1$	0.57489	0.56339	
oes not Granger Cause $\dot{CM}$	0.37096	0.69039	Unidirectional √
loes not Granger Cause $\dot{M}1$	2.75301	0.06536^{+}	
oes not Granger Cause $\dot{PC}$	2.40004	0.09247^{+}	Unidirectional √
oes not Granger Cause $\dot{M}1$	1.45252	0.23563	
oes not Granger Cause $\dot{NM}$	23.0295	5.0E-10*	Bidirectional
loes not Granger Cause $\dot{M}1$	2.79035	0.06300^{+}	
oes not Granger Cause $\dot{BM}$	9.01000	0.00016*	Bidirectional
loes not Granger Cause $\dot{M}1$	3.61201	0.02819*	
loes not Granger Cause $\dot{EP}$	7.60708	0.00060*	Unidirectional
loes not Granger Cause $\dot{M}1$	0.28172	0.75469	
loes not Granger Cause $\dot{TPT}$	4.19076	0.01604*	Unidirectional
loes not Granger Cause $\dot{M}1$	1.29853	0.27447	

Note: * There's Granger Causality relationship at the 5% level

$^{+}$ There's Granger Causality relationship at the 10% level

√ Those components that has the same Granger Causality relationship with the growth of *MI* as the Total *IIP*

Those components that show insignificant Granger Causality relationship are not reported.

In general, change in *M1* Granger causes change in Total *IIP*. In this case it shows that *M1* is an exogenous variable. As for the rest of the components of *IIP*, 7 out of 15 shows the same Granger relationship as *TIIP* that is from change of *M1* to growth in output. Nevertheless, the other 8 *IIP* components, they either have a bi-directional relationship between *M1* and output or the unidirectional relationship from growth of output to changes in *M1*. Thus Granger-Causality test does not show any systematic pattern as whether *M1* is endogenous or exogenous.

In conclusion, from the above all three analyses done to find the relationship between *M1* and output, there is no significant theoretical predicted signs for the relationship between *M1* and output. Thus it is difficult to gauge to what extent *M1* affects the output of each component. In the relationship between changes in *M1* and growth in output, it is found that *M1* is more of a lagging variable in the Malaysia context. Granger-Causality test does not show any systematic pattern as whether *M1* is endogenous or exogenous. With this inconsistent pattern of the relationship between *M1* and output, this is the likely reason of the insignificant relationship between *M1* and output in the Quantity Theory of Money analysis in Chapter 2.