CHAPTER 2

A MACRO PERSPECTIVE ON MONEY, INFLATION AND OUTPUT

2.1 Money and Inflation: A Review

Over the decades, much research has been done on the role of money in the economy to measure the strength and the direction of the relationship between money and inflation. The economists especially the monetarists[1] believe that money does affect the level of economic activities, for example, inflation in a country. Most studies have been carried out using time series data as well as cross sectional data across different countries to attest the relationship between money and inflation. For example, a study has been done in six developing Asian countries on the determinants of inflation. This sample included low and moderate high inflation cases. The results showed that only three of these countries where the money supply entered the specification of the empirical model as an important determinant of the inflation rate. These countries are Malaysia, Singapore and also Bangladesh (see Dhakal and Kandil 1993).

In another studies of money, inflation and output, using Geweke's approach to Wiener-Granger causality, it appeared that there is strong evidence of bi-directional causality between money supply and nominal output and also money supply and consumer price index (see Tan K.G. and Cheng C.S., 1995). The diversity of the various researches is not only on the data that is being used, for example, time series data or cross sectional data but also the different monetary aggregates being used. The type of monetary aggregates used to measure money growth might affect the findings.

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[1] Monetarists believe that fluctuations in the money supply are responsible for most large fluctuations in the economy. They argue that slow and steady growth in the money supply would yield stable output, employment, and prices (see Mankiw, 1994).

According to Fitzgerald (see Fitzgerald 1999) broader definitions of money, namely the *M2* and *M3* monetary aggregates provide results that suggest a relatively close relationship between money and inflation as compared to narrower definition of money, namely *M1*, which showed no clear relationship between money and inflation. In an effort to control the level of inflation, policy makers usually target the broader monetary aggregates such as *M2* and *M3* and pay lesser attention on the growth rate of *M1*.

Nevertheless, the results of the correlation between money and inflation have never been the same in many of the end results. Studies have shown that the differences in the end results are probably due to, first, the research being done on different countries that has different background in the growth rate of money and inflation. For example, most studies that reported a close relationship between money and inflation are studies done on countries with high rates of money growth and inflation whereas much less clear relationship exists within countries with relatively small changes in money growth. Secondly the time period which the data is being used is also of importance as the degree of correlation between growth of money and inflation depends much on if it is a long run or short run period of data being used (see Fitzgerald 1999).

2.2 Money and Output: A Review

Money has also been considered as one of the important variables which affect the output level. The New Classical Macroeconomics (NCM) hypothesis states that the effects of anticipated changes in money supply on real variables are neutral (Lucas (1973), in Mohabbat and Al-Saji 1991) but Mohabbat and Al-Saji's study showed that both anticipated and unanticipated money growth have positive significant influence on output. This study has been done using data of oil-producing country (Middle Eastern country, Iraq).

There was another research that studied on Latin American countries (13 LDCs in Latin and Central America) on the effects of anticipated monetary policy and real output (see Choudhary and Parai). The conclusions of this study are similar to Mohabbat and Al-Saji's research. In another study, a different approach is being

adopted (as compared to most which used the NCM hypothesis or the rational expectation structural neutrality, RESN model) which incorporated real money balance in the production function which proved that money was a productive input and that money growth also raised the rate of technical progress (see Sephton 1988). Karras and Stokes (1999), examined if the asymmetric effects of money on output is an international phenomenon. The results showed that negative money-supply shocks were shown to have a stronger effect on output than positive shocks.

2.3 Is Money Exogenous or Endogenous? A Granger Causality Test

"Quantity theorists[2] often treat the quantity of money as exogenous, mainly on the grounds that the monetary authorities ultimately influence it" (see Duck, 1993). But according to this research paper, this assumption is controversial. The reason is because a country that practices fixed exchange rate, in the long run, the money supply is an endogenous variable. Nevertheless Duck (1993) recognised that there are times when the monetary authorities in each country sustained independent monetary policy, and the quantity of money is then treated as exogenous may have some validity.

There is also another paper (see Beltas and Jones, 1993) attempted to estimate the causal relationship between the money supply and inflation for the Algerian economy during the period 1970-88. The objective was to provide additional evidence to the debate on whether growth in money supply affects inflation or vice versa. The empirical results only showed that there is a unidirectional causality, which is from the money supply to inflation with no feedback. The overall indication of the results appeared to suggest that the growth of the money supply caused inflation and not vice versa. This study used *M1* and *M2* to measure the growth of money supply (see Beltas and Jones, 1993).

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[2] Quantity theorists examine the quantity of money that affects the economy through the Quantity Theory of Money model. Quantity theorists' perception is similar to those of monetarists that is money growth has significant impact on the economic variables.

In an attempt to analyze the underlying determinants of inflation for six Asian developing countries, the studies found that all countries under examination, the results appear consistent with the direction of causality as postulated by the monetarist view. In all the six countries in Asia: Bangladesh, India, Malaysia, Pakistan, Singapore and South Korea, growth of money Granger-cause inflation (see Dhakal and Kandil, 1993).

2.4 Quantity Theory of Money

Quantity Theory of Money attests the relationship between a given change in the rate of growth of the quantity of money and the change in the rate of growth of nominal income and in inflation (see Duck, 1993). Quantity theorist called the following equation as quantity equation (see Mankiw, 1994)

Money × Velocity = Price × Income

$$M \times V = P \times Y \tag{2.1}$$

The quantity equation written in percentage form is as follows:
(% Change in M) + (% Change in V) = (% Change in P) + (% Change in Y)

$$\dot{M}+\dot{V} = \dot{P}+\dot{Y} \tag{2.2}$$

Assuming velocity is constant, equation 2.2 is modified to be as follows.

$$\dot{M} = \dot{P}+\dot{Y} \tag{2.3}$$

The dynamic version of the Quantity Theory of Money is also known as the Classical Dynamic Aggregate Demand Curve. Within the quantity theory framework, growth of output is assumed as exogenously determined by factors such as technological change and factors of production. Thus in the long run, when prices are assumed to be more flexible, growth in the quantity of money will cause inflation.

Using the above equation (2.3), an analysis is being carried out using the Malaysian data for the rate of growth of narrow money *M1* as the percentage change in quantity of money, the rate of growth of total *CPI* as the inflation rate and the rate of growth of total *IIP* as the percentage change in output. Equation (2.3) is modified as follows to test if growth of *M1* affects the inflation rate:

$$\dot{TCPI}_t = \beta_0 + \beta_1 \dot{M1}_t - \beta_2 \dot{TIIP}_t + \varepsilon_t \qquad (2.4)$$

Table 2.1 Regression of $\dot{TCPI}$ on $\dot{M1}$ and $\dot{TIIP}$

Coefficient $\hat{\beta}_0$	0.2826* (0.0000)
Coefficient $\hat{\beta}_1$	0.0257* (0.0007)
Coefficient $\hat{\beta}_2$	0.0191* (0.0000)
R-squared	0.1129

Note: The *p-values* are in parentheses
*Denotes statistical significance at 5% level

From Table 2.1 it can be summarised that growth in narrow money, *M1* does affect inflation. For a 1 percent increase in *M1* there will be an increase of inflation of 0.03 percent. These results serve as an *a priori* view that there's relationship between narrow money, *M1* and inflation.

Another analysis will be carried out to test if there's relationship between *M1* and output. The model for this analysis will be as follows:

$$\dot{TIIP}_t = \beta_0 + \beta_1 \dot{M1}_t - \beta_2 \dot{TCPI}_t + \varepsilon_t \qquad (2.5)$$

Table 2.2 Regression of $\dot{IIP}$ on $\dot{M}1$ and $\dot{TCPI}$

Coefficient $\hat{\beta}_0$	2.1144* (0.0000)
Coefficient $\hat{\beta}_1$	−0.0284 (0.7957)
Coefficient $\hat{\beta}_2$	3.8906* (0.0000)
R-squared	0.079

Note: The *p-values* are in parentheses
*Denotes statistical significance at 5% level

From Table 2.2 it can be summarised that for a 1 percent increase in *MI* there will be a decrease (negative relationship) of output of 0.03 percent. Nevertheless this relationship is not significant at 5% significance level. Thus growth in narrow money, *MI* does not affect growth in output. These results serve as an *a priori* view that there's no relationship between narrow money, *MI* and output.

2.5 Are Inflation and Output Procyclical, Countercyclical or Acyclical?

Before carrying out further tests, it helps to have *a macro* view if inflation and output are procyclical[3], countercyclical or acyclical[4] towards money. Figures 2.1, 2.2, 2.3 show graphs of the residual, actual and the detrended line of each, narrow money *M1*, price level (total *CPI* (*TCPI*)) and the output (total *IIP* (*TIIP*)). It can be observed from these figures that *TCPI* seems to be procyclical except for the period roughly between 1980-1984, which it shows a countercyclical pattern towards the movement of narrow money *M1*. *TIIP* seem to be procyclical towards the changes of money supply *M1* as both variables are moving in same direction. Besides, *TIIP* seems to be the leading variable as the trough of *TIIP* occurs before the trough of *M1*.

Nevertheless, this is an *a priori* view of the long run trends. In smaller intervals, the above interpretation from the figures might or might not hold to be true. Thus this is just the *a priori* view of relationship between *M1* with *TCPI* and *M1* with *TIIP*.

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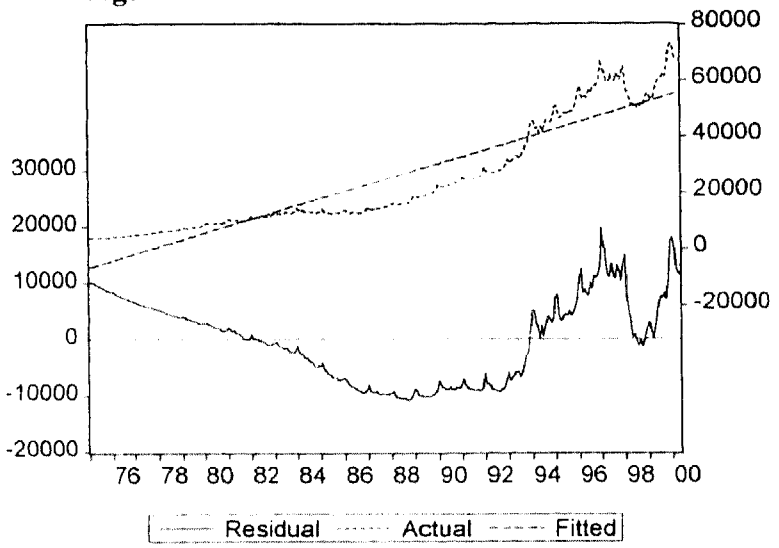
[3] A variable that moves in the same direction as the movement of another variable, the former variable is said to be procyclical towards the latter variable, while a variable that moves in the opposite direction is countercyclical.

[4] A variable, which are acyclical means, it is not moving in a way that linked somewhat systematically to the movement of another variable.

Figure 2.1 Deseasonalised *MI*

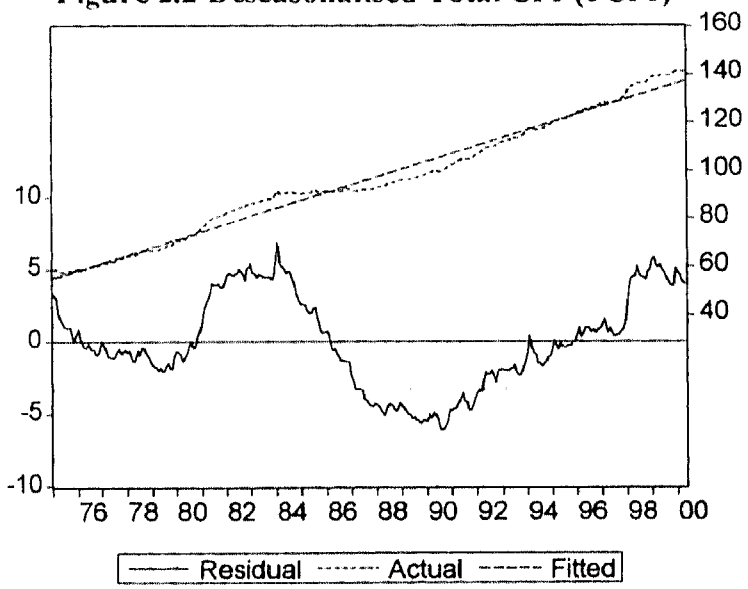


$$MI = \alpha + \beta t + \varepsilon$$

$$\hat{MI} = \hat{\alpha} + \hat{\beta} t$$

$$MI - \hat{MI} = \varepsilon$$

Figure 2.2 Deseasonalised Total *CPI* (*TCPI*)

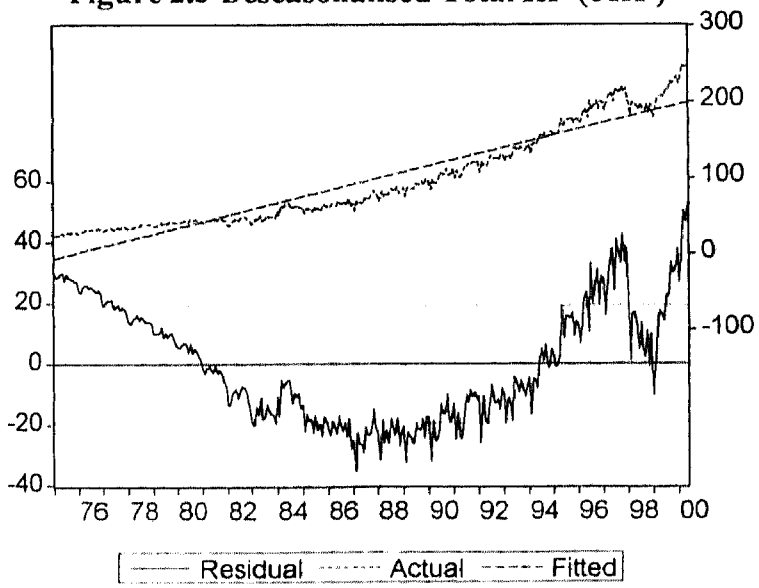


$$TCPI = \alpha + \beta t + \varepsilon$$

$$\hat{TCPI} = \hat{\alpha} + \hat{\beta} t$$

$$TCPI - \hat{TCPI} = \varepsilon$$

Figure 2.3 Deseasonalised Total *IIP* (*TIIP*)



$$TIIP = \alpha + \beta t + \varepsilon$$

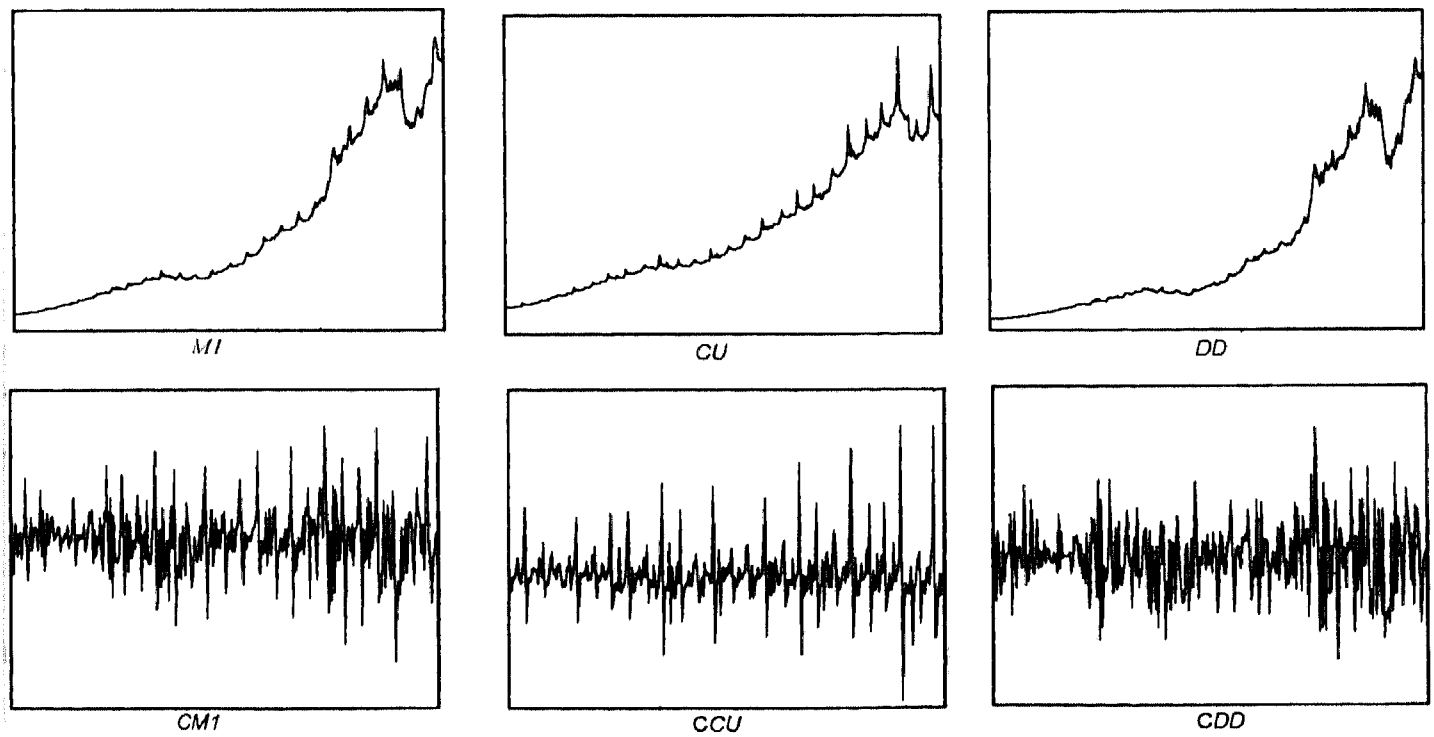
$$\hat{TIIP} = \hat{\alpha} + \hat{\beta} t$$

$$TIIP - \hat{TIIP} = \varepsilon$$

The following panels of graphs show the actual data (January 1975 – June 2000) and its first difference[5] of

- *MI* and its components, Currency in circulation and Demand deposit (Figure 2.4)
- *TCPI* and its 9 components are shown in Figures 2.5a, 2.5b, 2.5c, and 2.5d. The individual components of *CPI* are Food (*FD*), Beverages (*BEV*), Clothing (*CL*), Gross Rent (*GR*), Furniture (*FN*), Medical Care (*MED*), Transport (*TPT*), Recreation (*RCR*) and Miscellaneous (MSC)
- *TIIP* and its 17 components are shown in Figures 2.6a, 2.6b, 2.6c, 2.6d, 2.6e and 2.6f. The individual components of *IIP* are Mining (*MN*), Electricity (*EL*), Manufacturing (*MF*), Processing Agriculture Products (*PA*), Food (*FD*), Beverages (*BEV*), Tobacco Products (*TB*), Textiles (*TX*), Wood and Wood Products (*WP*), Rubber Products (*RP*), Chemical and Chemical Products (*CM*), Petroleum and Coal (*PC*), Non-Metallic Mineral Products (*NM*), Basic Metals (*BM*), Metal Products (*MP*), Electronic and Electrical Products (*EP*) and Transport Equipment (*TPT*).

Figure 2.4 Trends of Narrow Money *M1*, Currency in Circulation (*CU*) and Demand Deposits (*DD*) and its First Difference



[5] C before each variable indicates first difference. For example, change in *M1* is indicated by *CM1*.

Figure 2.5a Trends of *CPI* components, Total *CPI* (*TCPI*), Food (*FD*) and Beverages (*BEV*) and its First Difference

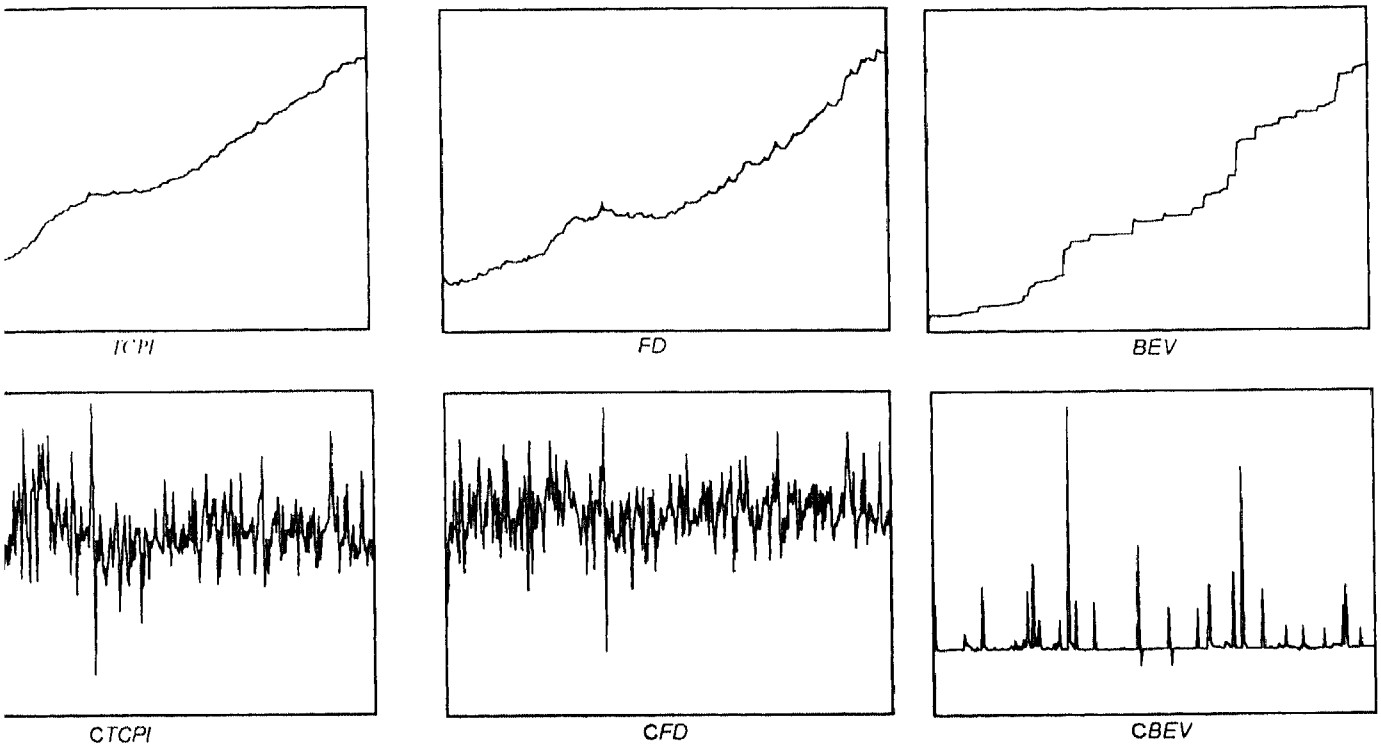


Figure 2.5b Trends of *CPI* components, Clothing (*CL*), Gross Rent (*GR*) and Furniture (*FURN*) and its First Difference

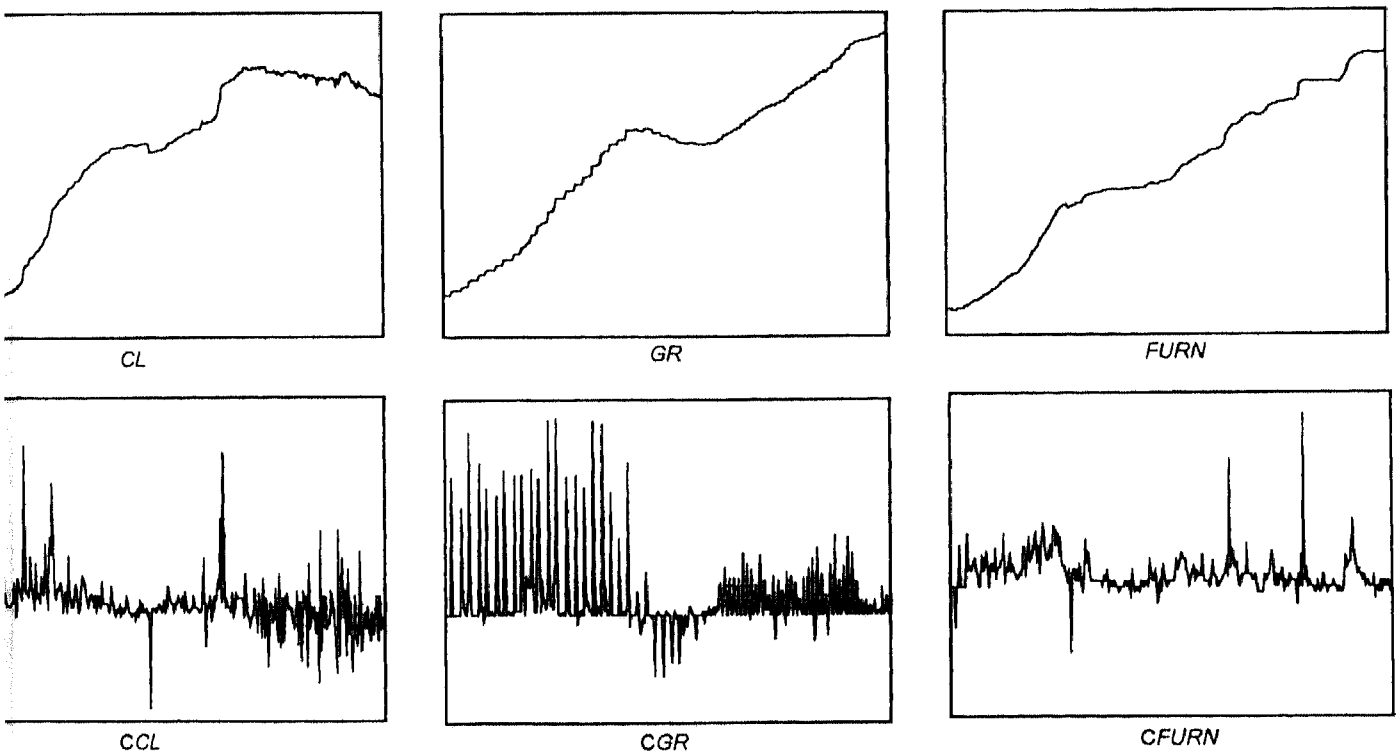


Figure 2.5c Trends of *CPI* components, Medical Care (*MED*), Transport (*TPT*), and Recreation (*RCR*) and its First Difference

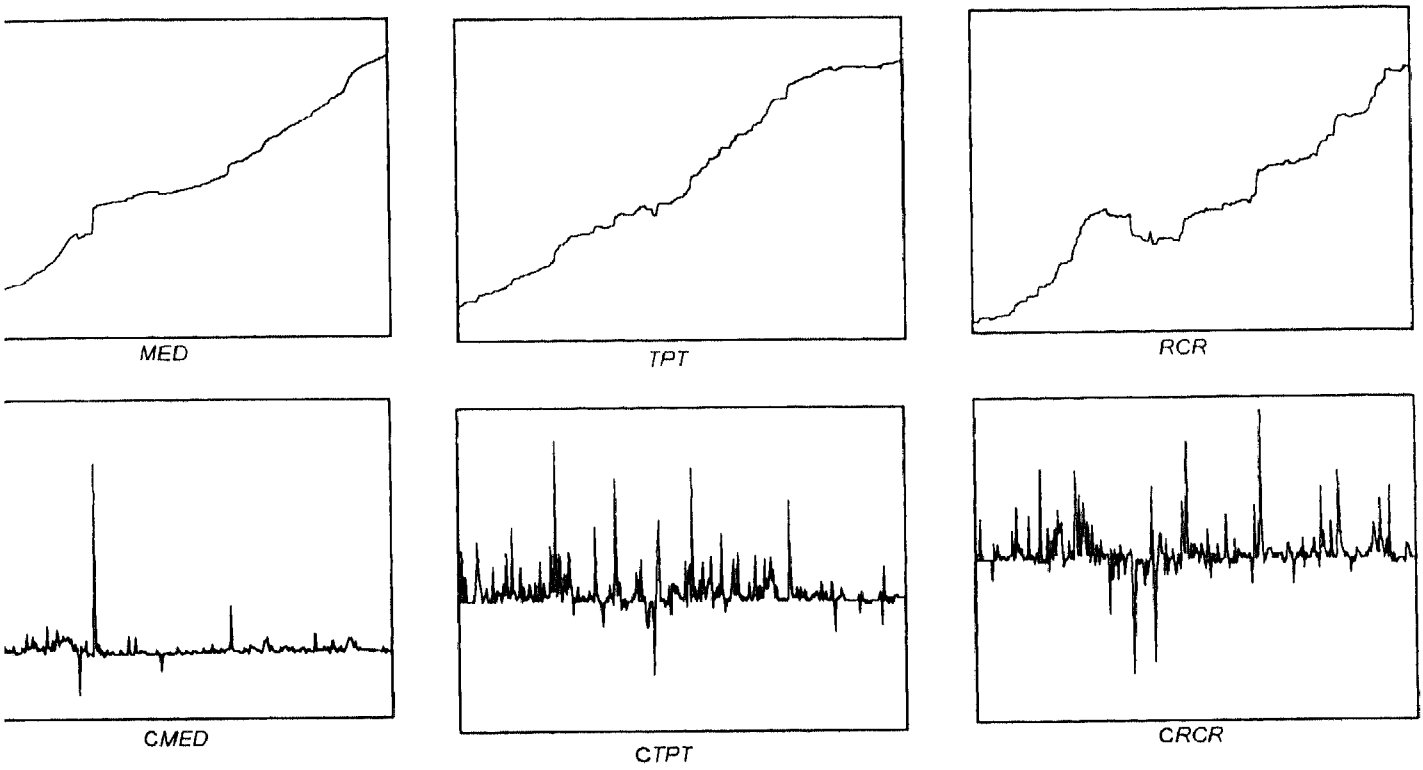


Figure 2.5d Trends of *CPI* component, Miscellaneous (*MISC*) and its First Difference

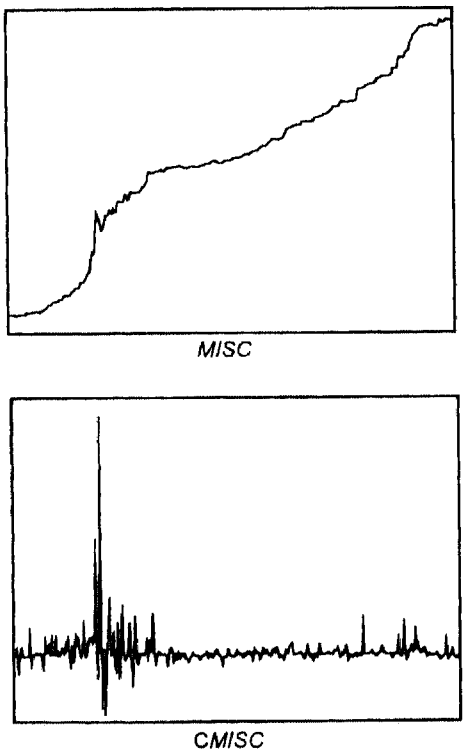


Figure 2.6a Trends of *IIP* components, Total Index of Industrial Production (*TIIP*), Mining (*MN*) and Electricity (*EL*) and its First Difference

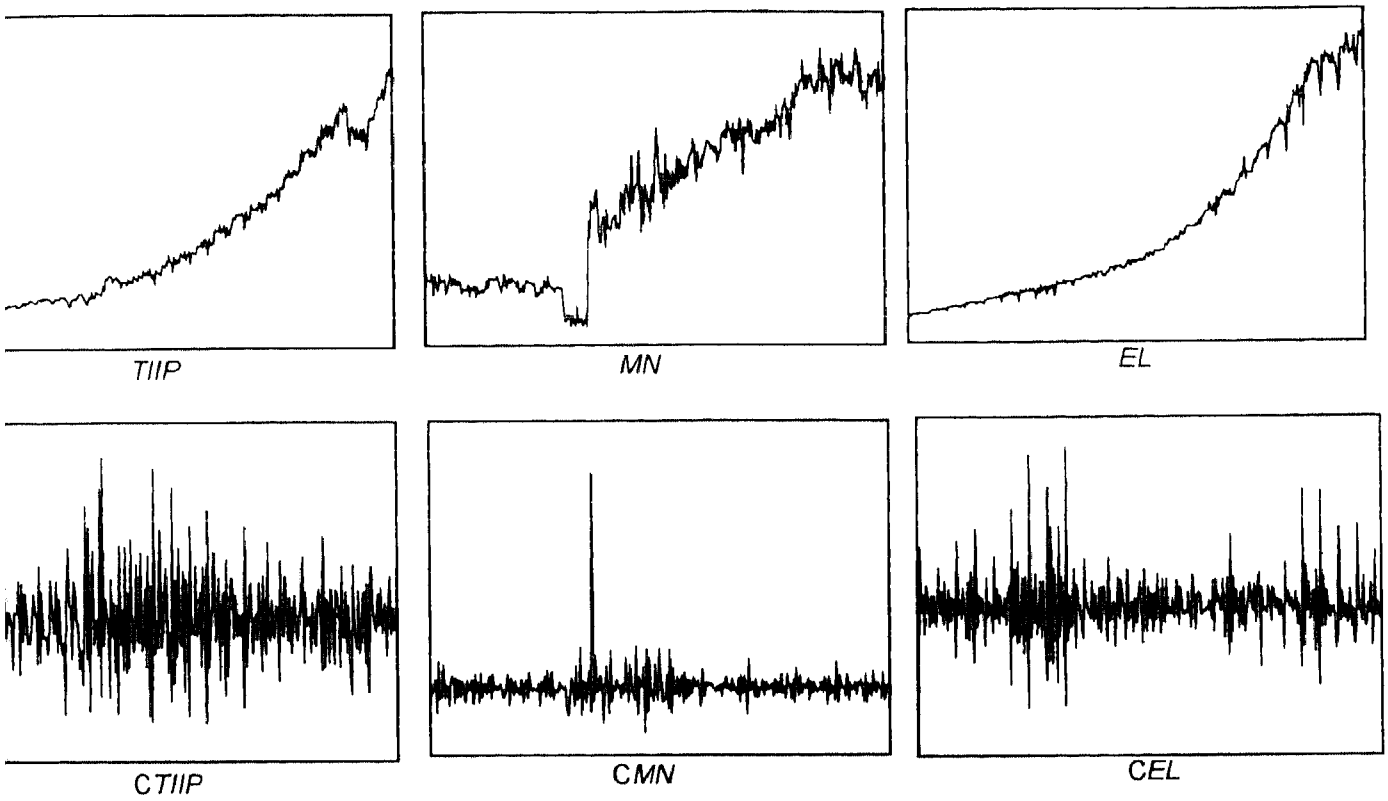


Figure 2.6b Trends of *IIP* components, Manufacturing (*MF*), Processing of Agriculture Product (*PA*) and Food (*FD*) and its First Difference

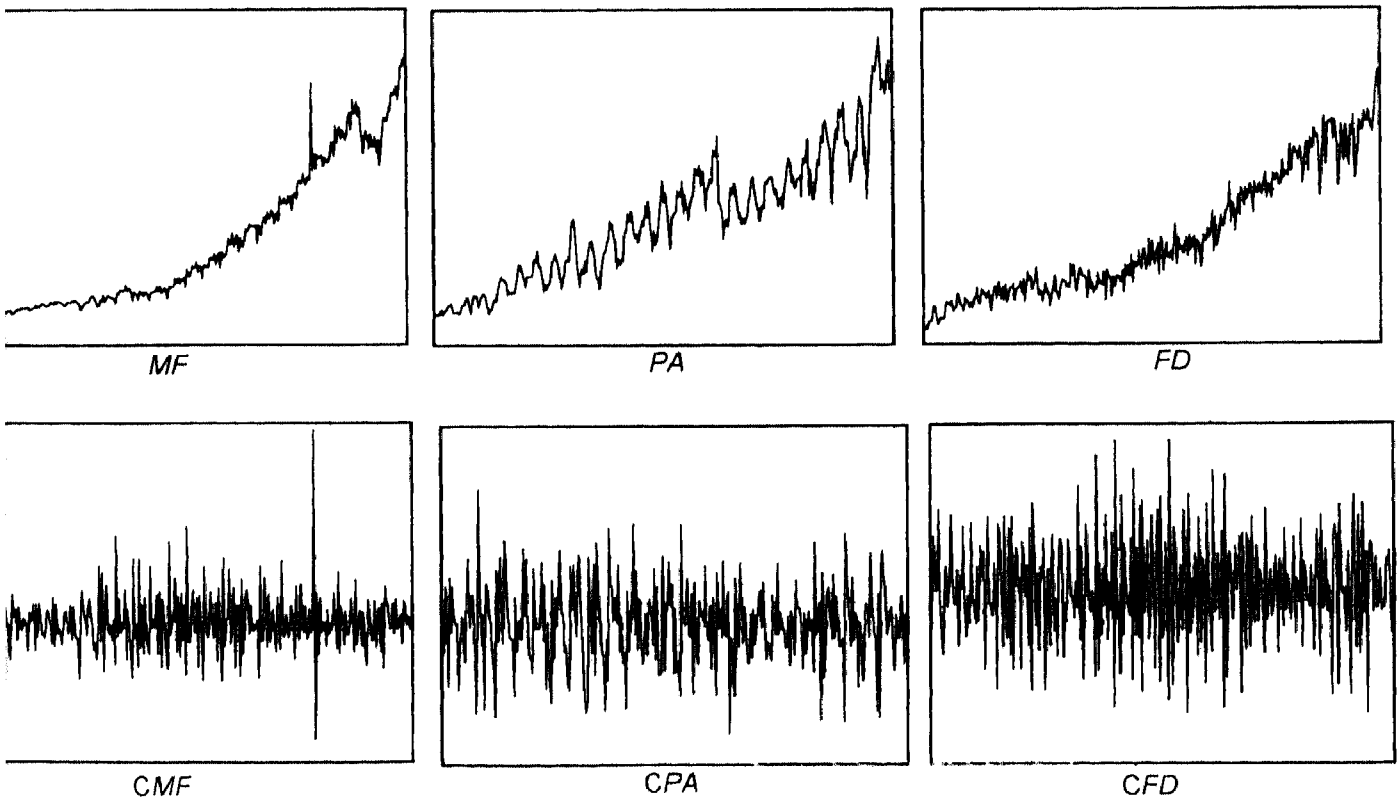


Figure 2.6c Trends of *IIP* components, Beverages (*BEV*), Tobacco Products (*TB*) and Textiles (*TX*) and its First Difference

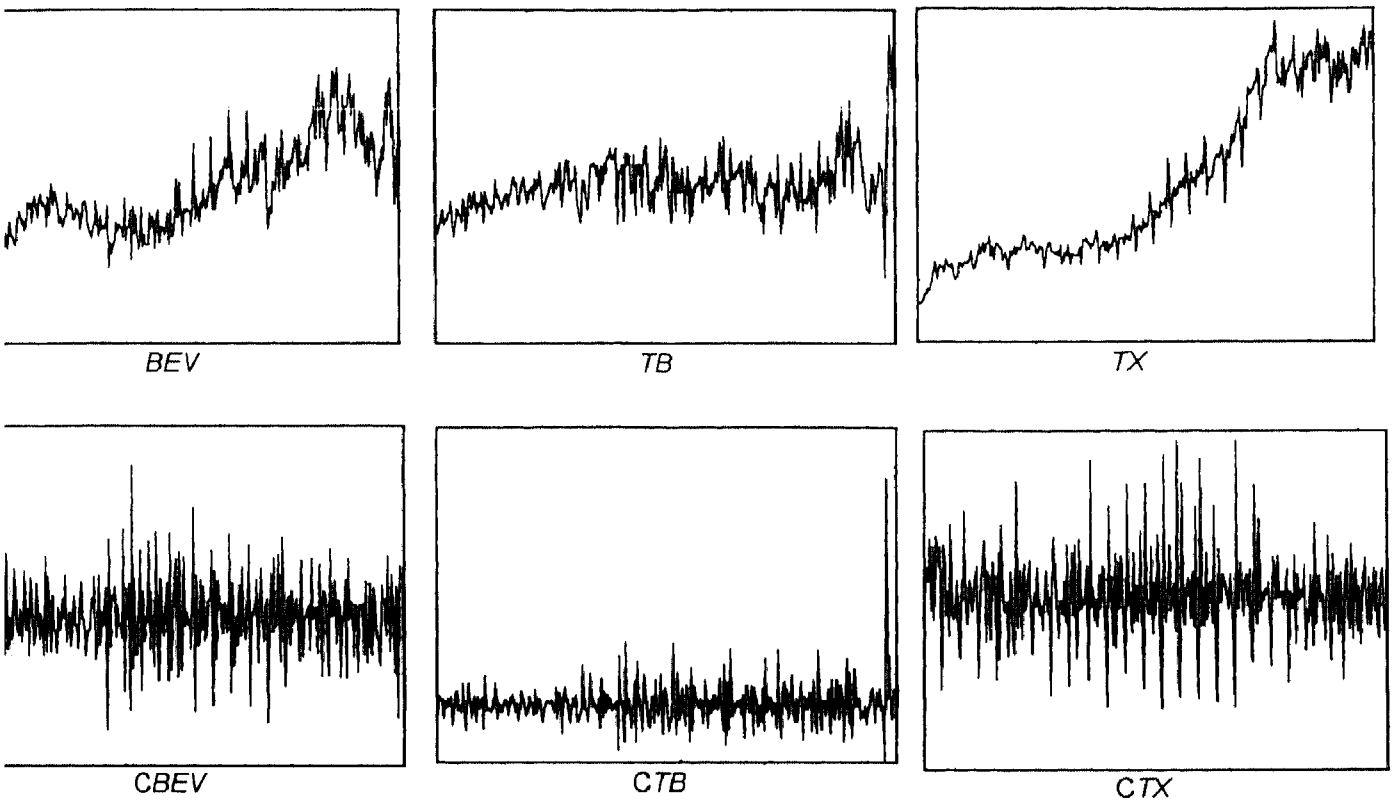


Figure 2.6d Trends of *IIP* components, Wood and Wood Products (*WP*), Rubber Products (*RP*) and Chemical and Chemical Products (*CM*) and its First Difference

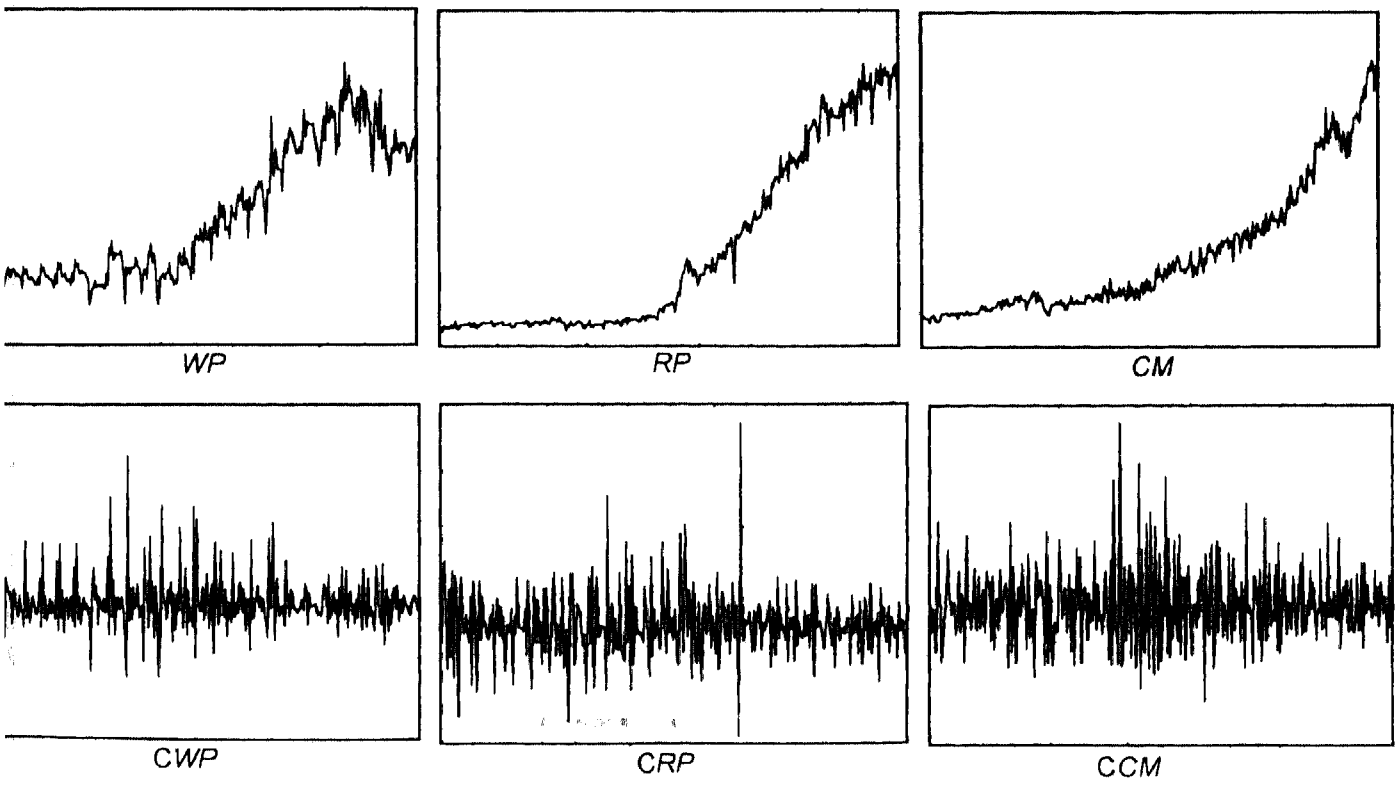


Figure 2.6e Trends of *IIP* components, Petroleum and Coal (*PC*), Non-Metallic Mineral Products (*NM*) and Basic Metal (*BM*) and its First Difference

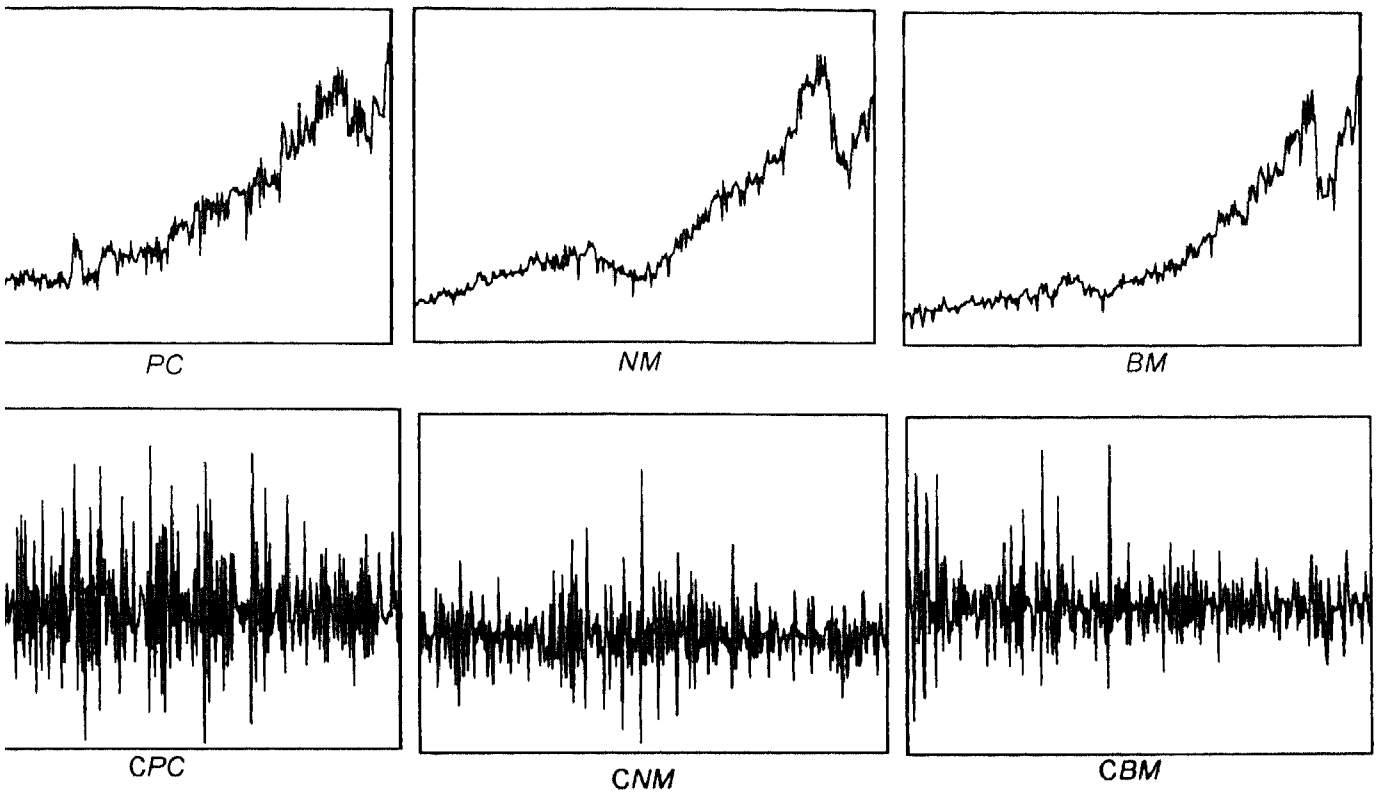


Figure 2.6f Trends of *IIP* components, Metal Products (*MP*), Electronic and Electrical Products (*EP*) and Transport Equipment (*TPT*) and its First Difference

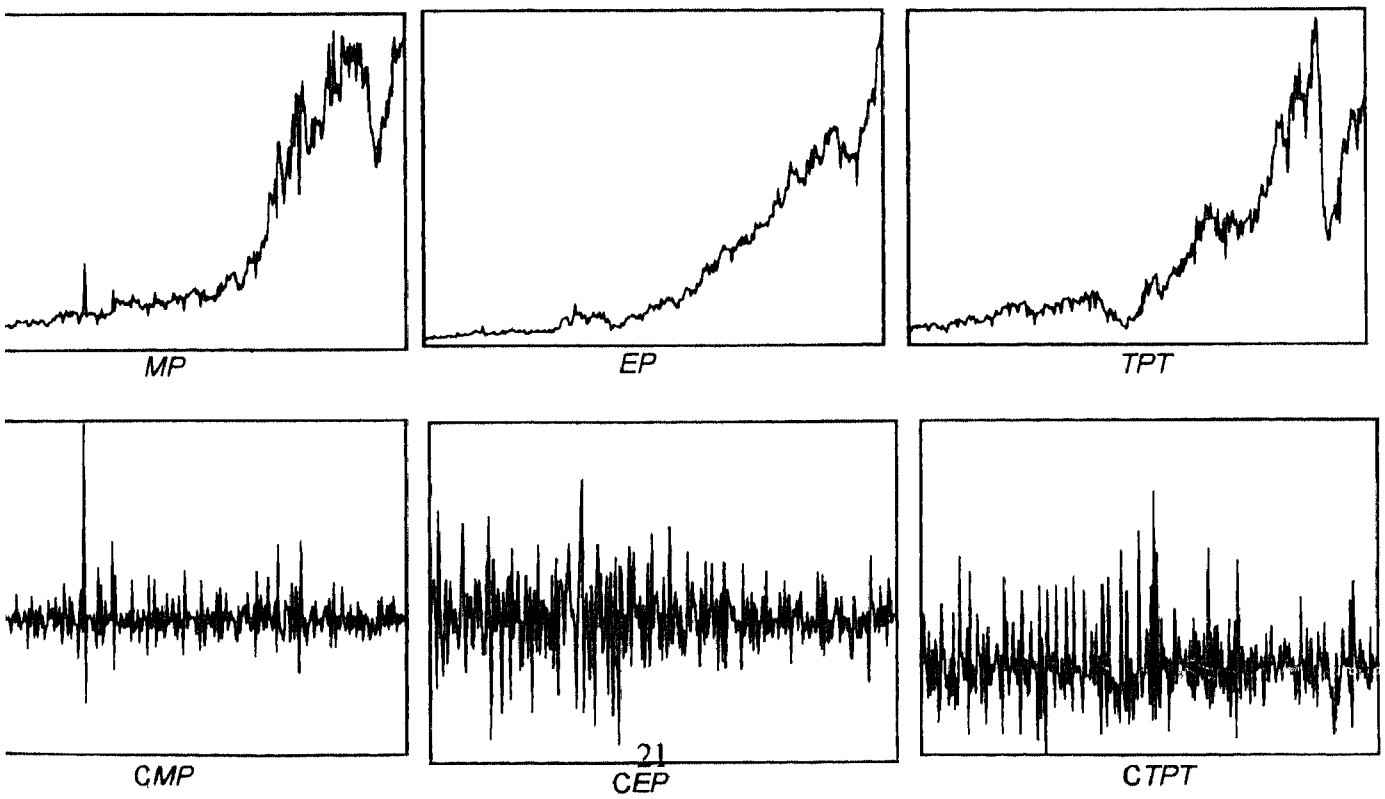


Table 2.3 Coefficients of Variation of Narrow Money, *TCPI* and its Components and *TIIP* and its Components.

Components	Mean	Standard Deviation	Coefficient of variation (cv)
MI	**24873.05**	**19605.26**	**0.79**
CU	9485.65	5977.68	0.63
DD	15387.4	13738.96	0.89
TCPI	**96.52**	**24.15**	**0.25**
FD	100	27.82	0.28
BEV	99.01	38.54	0.39
CL	93.28	15.56	0.17
GR	96.71	22.89	0.24
FURN	95.32	16.65	0.17
MED	96.31	26.7	0.28
TPT	90.61	25.2	0.28
RCR	99.58	10.8	0.11
MISC	92.83	26.06	0.28
TIIP	**97.48**	**62.79**	**0.64**
MN	84	35.2	0.42
EL	105.71	77.04	0.73
MF	102.62	74.68	0.73
PA	74.71	37.74	0.51
FD	103.12	37.45	0.36
BEV	88.78	29.62	0.33
TB	95.31	17.16	0.18
TX	95.02	49.68	0.52
WP	92.54	49.53	0.54
RP	113.15	107.03	0.95
CM	110.43	78.99	0.72
PC	92.73	51.49	0.56
NM	105.05	59.57	0.57
BM	114.3	75.68	0.66
MP	151.99	142.52	0.94
EP	113.83	112.99	0.99
TPT	105.04	91.89	0.87

From the collected secondary data of narrow money and *TCPI*, *TIIP* and their respective components, the mean and standard deviation is obtained to calculate the coefficient of variation[6]. This measurement is used to compare the relative variability of any of the two data sets. The coefficient of variations of the data set is shown in Table 2.3 above.

In general, narrow money seems to have relatively higher variability as compare to *TCPI* and *TIIP*. Narrow money has variability, which is three times of *TCPI*'s variability and more than one time of *TIIP*'s variability. As for individual components of narrow money, demand deposits have the highest variability (cv = 0.89). For the individual components of *TCPI*, Beverage *CPI* has the highest variability (cv = 0.39). Electronic and Electrical Products *IIP* has the highest variability (cv = 0.99) among *TIIP*'s components.

[6] Coefficient of variation, *cv = standard deviation / mean* (see Keller, Warrack and Bartel, 1994)