CHAPTER 14

THEORITICAL EXPLANATIONS OF FINDINGS OF GRNGER CAUSALITY UNDER 'BASKET PEG' AND 'MARKKET DETERMINATION' REGIMS

14.1 Introduction

The regime under the 'Pegged Exchange Rate System' is marked by the presence of *Bi-directional Causality between exchange rate and money supply.* In this regime variation in *money supply* ***Granger Caused*** *variations in exchange rate* which, in turn, **'Granger Caused'** further variations in money supply.

Again, the regime under the 'Freely Floating Exchange Rate regime' is marked by the presence of **'Uni-directional Causality'** running from money supply to exchange rate. Exchange rate appeared to be completely **'exogenous'** to the VAR system.

These findings testify for

(i) the existence of 'structural shift' in the historical dataset, and consequently

(ii) the 'causal' relations between money supply and exchange rate varied to two sub periods.

These lead us to enquire into the *theoretical backgrounds* explaining the variations in such causal relations' over different exchange rate regimes. This Chapter is being devoted to address this issue.

14.2 Relation Between Money Supply and Exchange Rate: The Model

According to Mundell-Fleming Model, an open economy with rapid capital mobility can be described by the following equations

$$Y = C(Y - T) + I(r^*) + G + NX(e) \qquad IS \qquad (14.1)$$

$$M / P = L(r^*, Y) \qquad LM \qquad (14.2)$$

$$r = r^* \qquad (14.3)$$

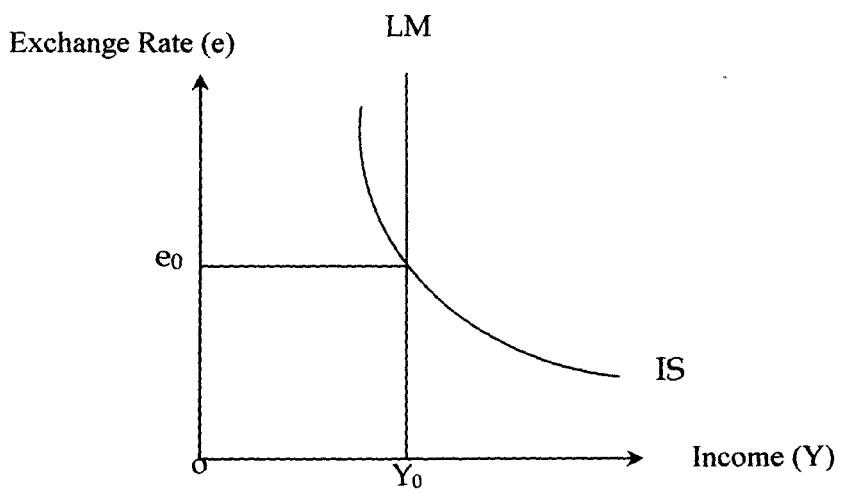
The equation (14.1) describes equilibrium in the goods market and the equation (14.2) describes equilibrium in the money market. The $r = r^*$ equation i.e., equation (14.3) represents the assumption that the international flow of capital is sufficiently ***'rapid'*** so as to keep the domestic interest rate (r) equal to the world interest rate (r^*).

In this system the exogenous variables are fiscal policy instruments *G* and *T*, monetary policy instrument *M*, the price level *P* and world interest rate r^*. The endogenous variables are *Y* and the exchange rate e. Here e represents the foreign price of the domestic currency per unit. For example, *e* = Dollar/Rupee. Consequently, the spot exchange rate (*s*) = *1/e* = Rupee/Dollar.

The *IS* curve, as shown by the equation (14.1), slopes downwards because a higher exchange rate reduces net export (*NE*) which in turn reduces aggregate income. The *IS* curve summarizes the negative relationship between exchange rate (*e*) and income (*Y*). The *IS* and *LM* curves are shown in the Figure 14.1 below

Figure 14.1

***IS-LM* Schedule for an Open Economy with Rapid Capital Mobility**



The *LM* curve is **Vertical** because the exchange rate does not enter into the *LM* equation. Given the world interest rate (r^*), the *LM* equation determines the aggregate income, regardless of the exchange rate.

The intersection of the *IS* and *LM* schedules shows the exchange rate and the level of income at which both goods and the money market are in equilibrium. With this diagram we can show, following the Mundell-Fleming model, how aggregate demand and exchange rate (*e*) respond to changes in money supply.

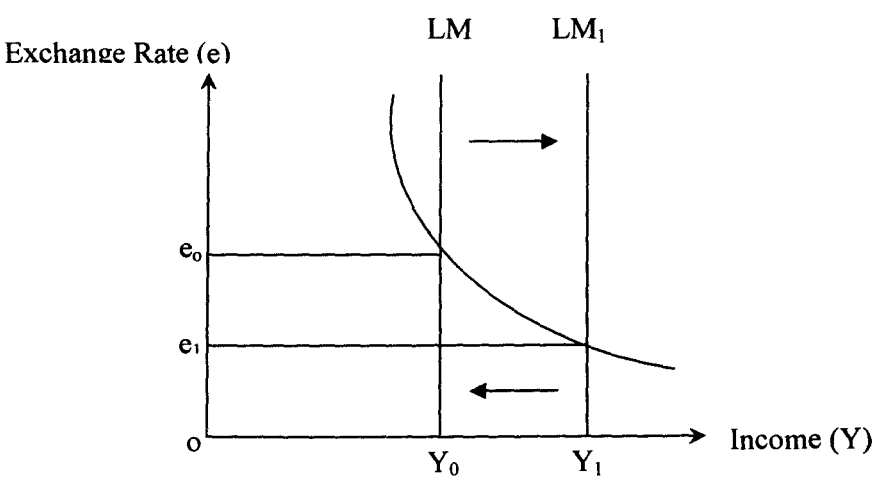
14.3 Effects of Money Supply on Exchange Rate under Basket-Peg System

In the Basket-Peg system', the official exchange rate (spot exchange rate) of foreign currencies in terms of rupees are determined. These rates are *'official'* at *'target'* rates. These rates are often revised following the changes in international prices of these countries. However, once the *'official'* or *'target'* rates are fixed, the Reserve Bank of India tries to maintain it. Under such *'Crawling Peg'* system, possibility of *'arbitrage'* arises. The *'arbitrage'* activities are the special features of the 'Basket-Pegging' system.

Let us assume that the *'quoted'* or *'target'* exchange rate (e) is \$ 0.025/Re i.e., s = Rs. 40/\$. The RBI seeks to maintain this exchange rate (e_0).

Figure 14.1

Effects of Money Supply Change on Exchange Rate under Pegged System



The RBI increases the money supply and *LM* curve (given prices fixed by the Keynsian assumption) shifts to LM_1. Consequently, exchange rate falls to e_l. Rupee suffers depreciation and Dollar becomes more expensive. Let us assume that, e_l = \$0.02/Re. i.e. s = Rs. 50/\$. Here e_l is the ' *Market exchange rate'*.

It, therefore, follows that exchange rate (*e*) declines and 's' appreciates following rise in money supply. This indicates that, ***under the 'Basket-Pegged System', variation in money supply 'Granger Causes' variation in exchange rate.***

14.4 Effects of 'Arbitrage' on Exchange Rate and Money Supply under 'Basket-Pegged System'

Market exchange rate (e_l) is lower then the 'quoted' exchange rate (e_0). By the 'quoted' exchange rate, \$ 1 = Rs. 40. But the prevailing market exchange rate is \$ 1 = Rs. 50. Consequently, Dollar is more expensive in the market. This leads to 'arbitrage' activities.

An arbitrager can buy dollar from the RBI by paying Rs. 40/\$. He can sell that dollar in the market for Rs. 50/\$. Thus he reaps a profit of Rs. 10/\$. So long as market exchange rate is lower then the *'quoted'* exchange rate, such *'arbitrage'* will go on. The RBI will be loosing dollars and rupees will be flowing to the RBI. As a result, money supply will decline in the market and *LM* curve will shift to the left leading to a rise in market exchange rate.

Such *'arbitrage'* activities will stop only when the 'market' exchange rate equals the 'quoted' exchange rate. This will happen when the decline in money supply following arbitrage activities causes the *LM* schedule to reach its original position.

It, therefore, appears that under *'Basket-Pegged'* System, *'arbitrage'* activities arise when 'market' exchange rate deviates from the *'quoted'* exchange rate. Such variation in exchange rate, through *'arbitrage'* activities, causes variations in money supply in subsequent periods. Consequently, ***exchange rate variations are found to 'Granger Cause' variations in money supply.***

Thus in the *'Basket-Pegged System'*, ***money supply affects and is affected by exchange rate. Initially, variations in money supply 'Granger Cause' exchange rate variations. These variations in exchange rate, in turn, generate 'arbitrage' activities and eventually***

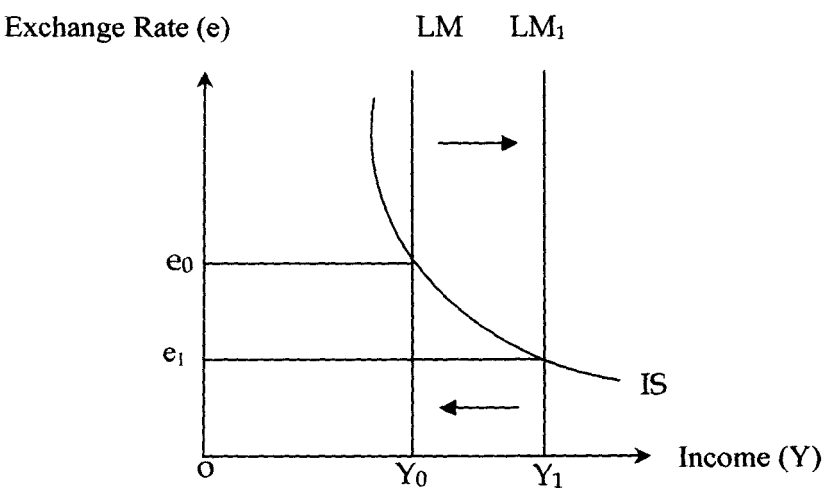
'Granger Cause' variation in money. Consequently, the 'Basket-Pegged' system is marked by the existence of Bi-directional Granger Causality between money supply and exchange rate.

14.5 Money Supply and Exchange Rate under 'Market Determination System'

The *'Market Determination System'* represents *'Free Float'* for exchange rate in which market forces determine exchange rate. The Central Bank of the country does not interfere with such determination. Consequently, the system is marked by the absence of 'arbitrage' activities in the marked following any change in money supply and change in exchange rate.

Figure 14.3

Effects of Money Supply Change on Exchange Rate Under Free Float



In Figure 14.3 the initial equilibrium exchange rate and income level were e_0 and y_0 respectively. Now money supply rises and *LM* curve shifts to LM_1 prices being fixed. Exchange rate falls from e_0 to e_1 and income level rises from Y_0 to Y_1. Following rise in money supply rupee depreciates and dollar appreciates. Consequently, *variation in money supply is found to 'Granger Cause' the variation in exchange rate.*

However, because of the absence of any 'arbitrage' activities henceforth, *LM* curve does not shift back. As a result, *variation in exchange rate fails to 'Granger Cause' further variation in exchange rate.* e_1 stands where it is now unless further changes in money supply or fiscal instruments take place. Under this situation, '***Uni-directional Granger Causality'*** *running from money supply to exchange rate is the common phenomenon.*

14.6 Empirical Findings

(A) In chapter 12, the VAR model with equations (12.1) and (12.2) has been estimated. The endogenous variables are money supply and exchange rate. Joint estimations of these equations consider the impact of the shocks of any endogenous variable on the other endogenous variable. This allows us to examine the effects of the shocks, transmitted through the monetary channel, on exchange rate. Similarly, it offers us a scope of examining the impact of the shocks, transmitted through exchange rate channel, on money supply. Thus, the VAR model enables us to examine, under the 'Basket Pegging System',

(i) the effect of money supply variation on exchange rate, and

(ii) the effect of 'arbitrage' activities on money supply.

Consequently, under the 'Pegging System', ***'Bi-directional Granger Causality'*** was observed and this observation conforms to the theoretical findings in section 14.3

(B) In chapter 13, the same VAR model has been estimated under the *'Free Floating System'*. In this system, these exists no 'arbitrage' activities following changes in exchange rate. Consequently, *'Uni-directional Granger Causality'* running from money supply to exchange rate was observed. This observation is in conformity with the theoretical proposition observed in section 14.4.