

Open Economy Macroeconomics and its Relevance to India

Selected papers presented at the Workshop
Organised at Pune during 15th - 17th March 1990

**GOKHALE INSTITUTE OF POLITICS AND ECONOMICS
PUNE 411 004**

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**OPEN ECONOMY MACROECONOMICS
AND ITS RELEVANCE TO INDIA**

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Foreword

While economists continue to debate whether India is an open economy or a closed economy, all along through the years of developmental planning, we have been greatly plagued by and concerned with the foreign exchange problem. We have never been able to get over the foreign exchange problem. Even in the Eighth Plan, being currently finalised, our large balance of payments deficit has become a major problem to reckon with and will in all probability necessitate scaling down the growth rate target. Our outstanding external debt (including deposits in the Indian commercial banks by the Non-resident Indians) at the end of March 1990 was more than 22 per cent of our GDP at current market prices. Debt services payments, excluding those on NRI deposits as percentage of export of goods and invisibles other than official transfer receipts was estimated at 21.5 per cent during 1989-90. While our exports have been growing at a faster rate than our imports, our trade deficit has increased in the recent past and the balance of payments on current account, including invisibles, has deteriorated because of heavy debt servicing burden as well. We can, therefore, ill-afford to ignore problems relating to foreign trade and international monetary and financial developments.

During the past 10-15 years, discussions of macro-economic theory and policy have also more and more come to be cast in an open economy framework, that is, in a framework which takes into account the implications of the interaction of the domestic economy with the developments in the external sector of it and with the developments in the world economy. Questions such as the determination of the equilibrium exchange rate system, impact of capital movements on the domestic economy, etc., have received considerable attention from economists.

We organised a workshop at the Institute during March 15-17, 1990, with a view to taking stock of the theoretical and empirical analyses developed recently in this field and to examining the relevance of these analyses and policy formulations to the Indian economy. While this was our objective, we chose to start this process from the current research works of the workers in the field.

About twenty scholars took part in the workshop. The proceedings were grouped into seven sessions under various sub topics : (i) Exchange Rates, (ii) Empirical Analysis of Exchange Rates, (iii) Structure of Trade, (iv) External Debt, (v) Macro-economic Policy and Adjustment Processes, (vi) Transmission of World Economic Fluctuations to the Indian Economy, and (vii) Implications of Recent Development in the World Economy. Twenty two papers were presented at the workshop. Professor John Williamson, Senior Fellow, Institute for International Economics, Washington, D.C., U.S.A. delivered the keynote address on the theme of the workshop.

The papers presented at the workshop were subjected to a refereeing process for inclusion in the present volume. However, not all the papers recommended by the referees for publication in the present volume could be included here as some of the authors had made commitments to publish the papers elsewhere.

We are grateful to all the participants of the workshop for

presenting their papers in the workshop and for the highly stimulating discussion at the workshop; and particularly to Professor John Williamson for his keynote address and for his participation and valuable comments during the workshop. We thank the authors of the papers included in the present volume for allowing us to publish the papers here, and the referees for carefully going through the various papers and making helpful suggestions on them.

The workshop was financed out of a generous grant made to the Institute in 1989 by Ford Foundation for starting a section at the Institute in the area of international economics and for support for research, training and seminars in international economics. The grant is also expected to enable the existing research work at the Institute in the areas of monetary and macroeconomics and finance to expand into the related open economy aspects. The Ford Foundation had earlier extended very generous financial assistance to the Institute for more than twelve years beginning with 1955-56 for strengthening the research and training programmes of the Institute. The recent grant from the Ford Foundation, one of the activities under which was the workshop under reference, marks the renewal of the old association between the Ford Foundation and the Institute, and we are grateful to the Foundation for it.

Most papers presented at the workshop and included in the present volume represent work in progress. It is hoped that the publication of these papers will evoke useful comments and generate discussion on the issues addressed to in them. It is also hoped that the papers being published here will create greater interest among research workers to examine the open economy aspects of the macroeconomic and the developmental experience of the Indian economy.

Gokhale Institute of
Politics and Economics,
Pune 411 004

V. S. Chitre
Director

June 1991

WORKSHOP ON OPEN ECONOMY MACROECONOMICS
AND ITS RELEVANCE TO INDIA

Opening Session : Welcome and Introduction Prof. V.S. Chitre,
Director

Keynote address Prof. John H.
Williamson

Session 2 : Exchange Rates

Chairman: B.S.R. Rao

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|--|---|
| 1. The Exchange Rate :
A Survey of Some
of the Theoretical
and Empirical Issues | M. Thomas Paul

Discussant:
V.G. Joshi |
| 2. New Frontiers of
Research in Exchange
Rate Analysis | S.V. Bokil
Discussant:
L.M. Bhole |
| 3. A Multi-country
Model of Income and
Exchange Rate
Determination | R. Parchure
Discussant:
V.S. Chitre |

Rapporteur: M.K. Datar

Session 3 : External Debt

Chairman: V.S. Chitre

- | | |
|---|--|
| 1. Third World Debt
Crisis with Focus on
the Implications of
External Debt for
Macroeconomic
Policies of LDCs. | James Weaver |
| 2. Asian Debt Scenarios
for 1990s. | R. Tandon

Discussant:
M.K. Datar |
| 3. Increasing Global
Openness and
Developing Countries'
Debt Problems | S. Mukherjee
Discussant:
R. Tandon |

Rapporteur: V.G. Joshi

Session 4 : Empirical Analysis of Exchange Rates

Chairman: D.M. Nachane

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|---|---------------------------------|
| 1. Foreign Exchange
Rates: Comparison of
Time Series (ARIMA)
Forecasts |)
)
)
) M. Thomas Paul |
|---|---------------------------------|

2. Foreign Exchange Rate)
 Forecasting: Vector) Discussant:
 Auto Regression Results) Manmohan Agarwal
 for some Quarterly Rates)
3. Foreign Exchange Rates:)
 Regression Forecasting)
 Models for Some Major)
 Currencies)

4. The ECU Ganti Subrahmanyam
 Discussant:
 B.S.R. Rao

Reporteur: V.G. Joshi

Session 5

Structure of Trade

Chairman: S.V. Bokil

1. Trends in Current Account Deficit and Balance of Trade: Separating Facts from Prejudices A. Virmani
 Discussant:
 S.V. Bokil
2. Composition of Imports, Expenditure Switching and Trade Policy M.K. Datar
 Discussant:
 S.V. Bokil
3. Impact of Import Liberalisation on Export Intensities: A Study of the Indian Private Corporate Sector N.S. Siddharthan
 Discussant:
 A. Vasudevan

Rapporteur: M.K. Datar

Macroeconomic Policy and Adjustment Process

Chairman: Ganti Subrahmanyam

1. International Aspects of Monetary Policy in India L.M. Bhole
 Discussant:
 K.R. Holla
2. Macroeconomic Policy Responses to External Shocks : A Case Study of Jamaica Manmohan Agarwal and Nira Goel
 Discussant:
 D.M. Nachane
3. Some Notes on the International Adjustment Process: Implications for Developing Countries A. Vasudevan
 Discussant:
 S.V. Bokil

4. The Monetary Approach to the Balance of Payments and Exchange Rate: Empirical Evidence Relating Specifically to India

V.G. Joshi
Discussant:
Thomas Paul

Rapporteur: R. Parchure

Session 6 : Transmission of World Economic Fluctuations to the Indian Economy

Chairman: A. Vasudevan

1. The Transmission of World Growth Cycle to the Indian Economy
- V.S. Chitre
2. The Transmission of Fluctuations in Economic Activity from Abroad: Some Evidence from India
- Smriti Mukherjee
Discussant:
L.M. Bhole
3. Inter-relationships between National Stock Markets: A Preliminary Study of India, U.S.A. and Japan
- B.S.R. Rao and Umesh Naik
Discussant:
G. Subrahmanyam

Rapporteur: Thomas Paul

Implications of Recent Developments in the World Economy

Chairman: B.G. Bapat

1. East Europe's Reforms and Developing Countries' Trade Prospects
- Nambiar, et.al.
Discussant:
B.G. Bapat
2. Purchasing Power Parity: A Re-examination of the post-1970 Evidence
- D.M. Nachane

Rapporteur: Thomas Paul

Closing Session : Chairman: V.S. Chitre

Rapporteurs: V.G. Joshi
Thomas Paul
M.K. Datar
R. Parchure

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Recent Developments in Open Economy Macroeconomics*

John Williamson

The convening of this conference is a welcome sign that Indian economists, like their peers in other countries, are becoming increasingly conscious of the benefits that a country can gain by integrating itself into the global economy. These benefits are primarily microeconomic: they permit an economy to achieve output of greater value from a given set of inputs. They may also permit the inputs to grow more rapidly, if export-led growth overcomes the foreign exchange constraint. On the other hand, integration into the world economy does make an economy more exposed to global shocks, and coping with these accentuates the challenge to macroeconomic policymakers.

This paper addresses three of the important issues that arise in designing a macroeconomic policy that will permit prudent integration into the global economy.

Macroeconomic Modelling

The large macroeconometric models used for serious forecasting and policy simulations contain the distilled conventional wisdom of the profession at any point in time. Their evolution over the last decade hardly justifies the fashionable despair about the supposed collapse of macroeconomics. On the contrary, they seem to pin down tolerably well the impact of changes in most exogenous factors and policy events on critical variables like income, inflation, and the current account of the balance of payments. The main innovation in these models over the past decade has been their incorporation of rational expectations, at least as an option. Comparisons between versions of the same model and without rational expectations show quite clearly that the "policy ineffectiveness theorem" of Robert Lucas (1981) is only half right: incorporation of rational expectations *does* reduce the impact of changes in monetary policy, but it does *not* eliminate them and render policy ineffective (Bryant et. al. 1989, Helliwell 1989).

* Keynote address to the workshop on "Open Economy Macroeconomics and its Relevance to India" organized by the Gokhale Institute of Politics and Economics, Pune, 15-17 March 1990.

Similarly, the evidence suggests that households change their savings to offset about one-half of any change in fiscal policy, but not that the full "Ricardian equivalence" of Rober Barro (1974) holds (Masson and Knight 1986). 1/

One thing that these models tell us rather clearly is that fiscal indiscipline is a prescription for inflation, and that continued fiscal indiscipline will lead to a continuing acceleration of inflation rather than to the "purchase" of a continuously higher level of output. This is a major reason why professional opinion has now converged on the importance of macro-economic prudence, which means above all fiscal discipline. (Another reason is the increasing realization that the inflation tax is among the most regressive of all taxes.)

The main ambiguities that remain in these models arise from our inability to predict the behaviour of exchange rates. The effect of a more expansionary fiscal policy, for example, is notoriously ambiguous. At one time there was hope that the introduction of rational expectations into the theory of exchange rate determination (Dornbusch 1976) would lead to useful predictive models. Forward-looking agents will understand that a monetary expansion will imply lower domestic interest rates, so in condition of capital mobility interest arbitrage will require that domestic currency be expected to appreciate in order to equate expected yields at home and abroad. But the domestic currency will be expected to appreciate only if it initially falls below its long-run equilibrium level (determined by purchasing power parity or the requirement of balance of payments equilibrium): hence the phenomenon of overshooting. Anyone who wants to manage exchange rates needs to make sure that their proposals are consistent with the market acting as Dornbusch implies it will - but he should not rely on it acting that way, for the evidence shows that even with this extension our models are not capable of *predicting* the behaviour of exchange rates better than a random walk for horizons of less than two years (Messee and Rogoff 1983).

Exchange Rate Policy

Our inability to predict the behaviour of a floating exchange rates does not imply that it is impossible to manage exchange rates. We know perfectly well how to *influence* an exchange rate: by intervention in the exchange market backed up when necessary by changes in monetary policy (which amounts to much the same thing as "unsterilized" intervention).

A managed exchange rate is a natural component of a strategy of "outward orientation", of seeking to integrate the local economy into the world economy in order to exploit the benefits offered by participation in a large competitive market. A fixed exchange rate can become overvalued through excessive domestic inflation, and a floating exchange rate can become overvalued through the Dutch disease or capital inflows. Only a deliberate policy of managing the exchange rate so as to maintain competitiveness can give assurance that a policy of opening the economy will be spearheaded by export growth, so that import liberalization will result in redeploying resources to more productive uses rather than risking throwing them into disuse.

It must, however, be recognized that a policy of managing the exchange rate to maintain competitiveness - i.e., of seeking a constant *real* exchange rate - deprives the exchange rate of its traditional role as a "nominal anchor" (Dornbusch 1982, Adams and Gros 1987). Some domestic nominal magnitude needs to be targeted to provide an alternative nominal anchor. The traditional candidate, the money supply, is not available if monetary policy is to be used in a significant way to target the exchange rate. The obvious choice, which is particularly appealing to those who want to hedge their bets as to whether the world is "really" Keynesian or monetarist, is to target the growth of nominal income or some allied concept (such as the growth of nominal domestic demand, advocated by Williamson and Miller 1987).

What is meant by the term "a competitive exchange rate"? Basically, one means an exchange rate such as to generate a rate of growth of exports - which in practice means of nontraditional export - sufficiently rapid to allow the economy to grow at the maximum rate permitted by its supply-side potential without running into a balance of payments constraint. Alternatively, it is the (real, effective) exchange rate that will combine internal and external balance in the medium term.

The starting point for any calculation of an exchange rate that satisfies these criteria - what I have elsewhere termed the "fundamental equilibrium exchange rate" (Williamson 1985) - must be some target for the current account of the balance of payments. In the case of India, I regard development prospects as sufficiently promising to justify targeting the largest foreign borrowing, i.e., current account deficit, that can be expected to be sustainable in the medium term without risking a debt crisis. I would guess that this may be some 1.5 per cent of GDP, or possibly as high as 2 per cent if sources of finance which share the risk of adverse shocks with the lender can be secured. 2/ One then needs a forecast of the future development of the current account balance with an unchanged real exchange rate, assuming that output grows at the rate permitted by the supply side. If this forecast current account deficit exceeds the target, one needs to devalue (accompanied by contractionary fiscal policy to keep the growth of demand to the rate permitted by the supply side). The extent of the needed devaluation has to be calculated from a model, which may vary, depending on availability, from a crude "elasticities" calculation to the simulation of a full macro-econometric model. 3/

Exchange rate policy should seek to maintain the market rate close to such a target unless and until there is evidence that the target is inappropriate. This means pegging to a basket which maintains the *effective* exchange rate constant against short-run volatility among the major currencies: the intervention rates against the intervention currency have to be adjusted to offset movement of the intervention currency against the other currencies in the basket. Second, the rate at which the domestic currency is pegged to the basket has to be changed so as to offset differential inflation and maintain the *real effective* exchange rate constant. The target real effective exchange rate may need adjusting if it turns out that the balance of payments does not develop as anticipated, if important real shocks affect the balance of payments position, or if there are persistent differences in underlying capital flows from those assumed in calculating the PEER.

How does trade policy fit into the picture? Basically, one should assume in undertaking the calculations described above that trade policy has been chosen on grounds of microeconomic efficiency. In my view these call for widespread and progressive liberalization, starting off with tariffication of all quantitative restrictions on imports. Tariffication can be expected to reduce the distortions inevitably produced by nonprice rationing, to transfer rents from importers to the government, to reduce opportunities for corruption, and to save government expenditure. I see no conceivable reason for delaying a step with such multiple benefits. The subsequent reduction of tariffs can be spread out over time and its pace varied with state of the macroeconomy: the best time to liberalize imports is when the balance of payments and demand are both strong, so that tariff cuts can help ease inflationary pressures and thus perpetuate rather than threaten growth, and the worst time is when both the balance of payments and demand are weak. Such endogenous variation in the pace of import liberalization provides an effective adjustment mechanism until such time as liberalization is complete.

The principles of macroeconomic policy would then be that monetary policy would consist primarily of partially unsterilized intervention and would thus be used for exchange rate management; fiscal policy would be used to manage demand so as to keep the growth of nominal domestic demand consistent with controlling inflation, maintaining growth, and allowing room for desired change in the balance of payments; and trade policy would be directed to opening the economy at a pace that would backstop macroeconomic management. This is largely the application to the conditions of a country like India of the principles embodied in the Williamson-Miller "blueprint" for policy coordination among the G-7 (Williamson and Miller 1987).

Debt and Capital Flows

A great deal has been written about the debt crisis in recent years, and I shall avoid going over that literature. I restrict myself to a few comments on the context of that debate.

First, the debt crisis has concerned debt owed to the commercial banks. This has emphasized that one of the advantages of direct investment is the way in which profit remittances vary with the state of the economy, rather than constituting a prior charge on the economy's resources. In addition, direct investment brings with it technology, access to foreign markets, and managerial know how. Once an economy has been liberalized sufficiently to avoid the danger that foreign investment could lead to "immiserizing growth" (Brecher and Diaz-Alejandro 1977), I can see no sensible reason why a country should look such a gift-horse in the mouth.

Second, let me comment on our understanding of what drives real capital flows in the longer term. The traditional theory has centered on the size of the capital stock. When an economy is first opened up to the world economy, it has a low capital stock (per head), presumably therefore a high marginal productivity of capital, low income, and therefore savings too low to exploit the investment opportunities available at the world interest rate. It can therefore profitably import capital. If development is successful, income and therefore savings will rise over time, until

eventually the country will be able to provide for its entire domestic investment from domestic savings. At that point it will of course have built up an external debt position and therefore face net debt service payments, leading at some stage to a negative resource transfer. The country may in due course move on to become a capital exporter, and eventually it may reach the stage of net creditor and hence enjoy once again a positive resource transfer as its debt service receipts exceed new capital outflows.

It is this "stages" theory which underlies the notion that it is normal for developing countries to import capital, and therefore motivates the term "negative resource transfer" used in the debt literature to signify a situation in which debtors must make debt service payments that exceed their net receipt of capital. It provides the basis for my suggestion in the preceding section that India should aim to running as large a current account deficit as is consistent with prudence.

A new literature is developing which points to demographic factors as another key determinant of capital flows (Masson and Tryon 1990). Among countries at the same stage of development, some may have growing labour forces and therefore high investment needs, others may have a stable labour force with a large proportion of the working population in the high-savings pre-retirement years, and still others may have a large retired population and therefore a particularly low overall savings rate. The United States is a country with a growing labour force and a relatively small part of the population in the high-savings phase of the life-cycle, and this helps explain why it is currently a capital importer despite a capital stock per head that should make it a capital exporter according to the stages theory. Japan has a particularly high proportion of its population in the high-savings phase, and this helps explain why it is a capital exporter. In due course demographic trends will automatically tend to reverse that position, hence some imbalance should not be taken as a policy problem.

Another type of capital flow that we can understand tolerably well is what is usually termed "capital flight": placement of funds abroad by residents who are (perhaps rationally) concerned by the risks they perceive in domestic holding of capital. These risks may involve expropriation occasioned by political ideology, the possibility of devaluation arising from an attempt to hold an over-valued exchange rate, or a fear of taxation, perhaps via inflation, provoked by attempts to service an excessive level of debt. It can be individually rational to reallocate one's portfolio so as to try and sidestep these risks even though the social productivity of capital at home may be higher than abroad, public policy may therefore be directed to attempting to thwart capital flight rather than at adjusting the current account to secure a real transfer corresponding to the capital flow. Of course, such a policy is unlikely to be viable for long, and hence, even if outward capital controls are employed, they need to be supplemented by policies that will remove the stimulus for capital flight.

A "debt crisis" is a situation in which a debtor country has difficulty in servicing its external debt. Debt crises arise from overborrowing/overlending. Naturally this is a phenomenon that is more easily recognized *ex post* than *ex ante*, but it is too cynical to dismiss the feasibility of avoiding crises through prudence in borrowing (or lending): some countries, like India

and Colombia, went out of their way in the late 1970s to resist by accepting loans that were being pushed on them by imprudent banks. It is not an accident that India has so far avoided being dragged into the debt crisis or that Colombia is the one country in Latin America that has avoided rescheduling. Once overborrowing has been made apparent by an adverse change in circumstances, there is no international legal mechanism for receiving debt contracts analogous to national bankruptcy proceedings, which is why the debt crisis drags on endlessly while imposing severe costs on both debtors and creditors. Indeed, in substantial part because of the debt crisis, many developing countries - including most of those in Africa and Latin America - have experienced a "lost decade" so far as development is concerned. (But this is *not* true for Asia, where two-thirds of the population of the developing world lives.)

In sum, capital mobility does offer the possibility of real economic gains from transferring resources from areas where savings are abundant relative to investment needs to those where marginal rates of returns are higher. But if mishandled it can be dangerous. Capital flight can lead to flows that are socially perverse, debt crises can bring costs that far outweigh the benefits of being able to invest more for a time. The overwhelming moral is that countries need to restrain their foreign borrowing to take advantage of thrift and productivity to a level that is safely sustainable. One has to begin to worry about whether India may not be in danger of breaching that level.

Concluding Remarks

I hope that in the coming years India will indeed seek to play its full role in the world economy, rather than remaining half-isolated in a vain search for self-sufficiency. I hope also that the above thoughts will contribute to understanding of the macroeconomic policies that will enable such a quest to be pursued prudently.

Institute for International Economics,
Washington.

Footnotes

1. The empirical findings that incorporation of rational expectations do not imply policy ineffectiveness or Ricardian equivalence imply respectively that markets do not all clear in the short run and that some agents are liquidity constrained.
2. The most likely source with this property seems to me to be the vast pool of equity capital seeking investment in the world's stock markets, whose managers are increasingly recognizing the attractions of putting a part of their portfolio into emerging markets like those of India.

3. Essentially this amounts to solving an equation for the current balance CB, of the form $CB = f(Y, RER, \text{trade restrictions})$ to find the RER needed when CB is at its target value, Y grows at the rate permitted by supply-side potential, and trade restrictions are at the level (or on the path) preferred on microeconomic grounds.

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New Frontiers of Research in Exchange Rate Analysis

S. V. Bokil

This paper attempts to present the progress of research work on exchange rates during the recent years. It has been divided into three sections. Section I presents the work that was carried on within the Keynesian framework. Section II presents a review of monetary models of exchange rate determination and frustrations met in that area. It also comments on the new emerging literature on macro-economic modelling. Section III presents a summary of the work on the effects of large exchange rate shocks on prices and quantities. Here, it first discusses the exchange rate pass-through to export/import prices and quantities and then takes up an analysis of new concept named as "hysteresis". The paper offers some concluding remarks.

I

When the Bretton Woods system was being set up, the economics of the balance of payments and exchange rates was characterised by two distinct theoretical frameworks. One was the classical monetary theory of payments adjustment (i.e., the specie-flow mechanism) traceable to David Hume. The ascendancy of the Keynesian economics and the concern for domestic macroeconomic stabilisation turned this doctrine into an academic curiosity during the 1950s and 1960s. The other framework came to be known as the 'elasticity approach'. This approach was consistent with some of the assumptions of the Keynesian framework, (like infinite supply elasticities, export and import aggregation to form a two-goods framework), In this formulation, with supply prices fixed, a devaluation can change the relative price between export and import goods and bring about resource shifts and expenditure-switching to generate an improved trade balance, provided the Marshal-Lerner condition is satisfied in the neighbourhood of the initial zero trade balance. This derivation, which led to a large number of empirical studies on demand elasticities of exports and imports and the elasticity approach, became a part of conventional wisdom.

In the early '50s came some ad hoc modifications of this result in the form of foreign trade multiplier, the concept of absorption and the Laursen-Metzler Effect (1950). It was, however,

James Meade who systemised this body of knowledge by writing two volumes on 'International Economic policy'. He used Hicks-Slutsky methods to analyse tariff-subsidy affects and the framework of foreign trade multiplier to analyse the impacts of fiscal/monetary/exchange rate policies on internal/external balance. He considered the effects of other exogeneous disturbances (like demand/supply/terms of trade) on relative prices, income and the balance of payments. He enriched his analysis by incorporating non-traded goods and by discussing the question of internal balance through wage flexibility. However, Meade could not produce a well-integrated model where the real sector and the monetary sector closely interact, Meade did have a well-specified money market but he ruled out its real influence through his assumption of internal balance of keynesian neutral monetary policy. Capital movements in Meade's framework were meant to accommodate goods movements and there were no autonomous capital movements arising out and the excess demand and supply of the stock of bonds. Mundell happened to be the first to have taken the essential steps in this direction.

It was Mundell and Fleming who built up a first-ever, well integrated open economy model containing equations for a goods market, a money market and the balance of payments. This simple formulation was used to obtain fiscal/monetary policy multipliers under fixed and flexible exchange rates. It showed that on the one hand monetary policy loses its effectiveness under fixed exchange rates because of high degree of capital mobility but fiscal policy retains it; but on the other hand under flexible exchange rates and high degree of capital mobility monetary policy regains its effectiveness but fiscal policy loses the same through an exchange rate appreciation and an associated import surplus. Mundell also used this model to suggest a monetary-fiscal policy, mix, through his Principle of Effective Market Classification to tackle the Meade-Tinbergen dilemma of internal-external balance.

Thus, the Mundell-Fleming model laid the foundation for open economy macro-economics. For the last thirty years many economists have taken the inspiration from this model and have made it more realistic. Initially, Mckinnon and Oates (1966), Mckinnon (1969) and Branson (1974) launched their efforts to incorporate stock-flow relationships and balance sheet identities embedded in various behavioural functions of the private and the government sectors, subject to intertemporal budget and portfolio constraints. These formulations showed that once stock-flow complications are brought in, the Mundell-Fleming results have to undergo drastic changes. Thus, it is not possible for the government to pursue money-financed or bond-financed fiscal deficits without facing its own portfolio constraints or without provoking the private sector to react in a predictable way, subject to its (private sector's) portfolio constraints. It is easy to see how this interaction works. Under fixed exchange rates, continuous money-financed deficits will cause an increasing import surplus and capital outflows (i.e., private sector's reaction to drive out the excess money either through trade account or capital account). This will come up against a finite level of reserves of the Central Bank, similarly, bond-financed fiscal deficits under fixed exchange rates would evoke a monetary squeeze provoking the private sector bring in money from abroad through an exchange of goods for money or an exchange of bonds for money. This action restores portfolio balance in the private sector but the central bank's level of

reserves becomes alarmingly large calling for a halt to this policy. Under flexible exchange rates, these alternative forms of fiscal policy will respectively cause continuous exchange rate depreciation or appreciation and cause cumulative vicious circles of inflation and depreciation or recession and appreciation amidst destabilising portfolio shifts on account of valuation changes in the private/public sector wealth. Mckinnon and Branson also showed that as long as flows are changing stocks cannot be in equilibrium; and when stocks reach equilibrium, flows come to rest at zero level. For example, savings-wealth relationship says that unless wealth reaches a desired level, savings have to add to wealth and when wealth reaches a desired level, savings have to be zero. They thus showed that the long-run implication of stock-flow models is the stationary state where policy multipliers tend to zero. However, in the actual world, we rarely reach such a state; in reality we have stocks adjusting to flows and flows changing due to growth and other exogenous impulses. So, the working out conditions for stationary state equilibrium and its time paths did not retain economists' interest for long. By the early 1970s, the world had changed over to floating exchange rates in the face of high degree of capital mobility stagflationary conditions and current account imbalances in the wake of the first oil shock economists redirected research interest to exchange rate determination.

II

When exchange rates began to move a great deal in the '70s, the world economic environment was characterised by the world monetary ease and reinforcement of inflationary trends. Some economists took a global view of these developments and began talking in terms of 'global monetarism', the world monetary standard, the world monetary supply transmitting to different countries through trade channels according to underlying stable money demand functions. Hume's doctrine of natural distribution of species was found to be relevant in this connection. However, economists at Chicago formulated what came to be known as the monetary approach to the balance of payments and exchange rates. Harry Johnson offered its initial formulation. He started with a world economy that ensured a perfect goods arbitrage (i.e., the Law of One Price) and continuous prebalance of the purchasing power parity. In this world, relative prices and shifts therein do not make any appearance. Because of the invariance of relative prices, the world economy becomes one-good economy. Thus, substitution effects and resource allocation effects among traded goods, or between traded and non-traded goods are assumed away. Johnson did not introduce any capital market transactions, probably because of the implicit assumption of perfect asset substitutability ensured by uncovered interest parity. In such a formulation, monetary disturbance alone can explain the shifts in the balance of payments or exchange rates. Under fixed exchange rates, any excess money supply is driven out through an eventual trade deficit and any shortage of money is made good through an eventual trade surplus. The money supply is endogenous. Under floating exchange rates, an increase in the money supply exerts pressure on the exchange rate in the goods market either through excess imports; or else the exchange rate proportionately depreciates in response to domestic inflation preserving goods arbitrage. The opposite results will arise when the money supply is reduced. The money supply is exogenous.

Other results, however, are puzzling because they are against the conventional wisdom. In this formulation, Y (fixed output at the full-employment level) and r (real interest rate) are fixed. An increase in output in this model increases the demand for real balances, leads to a trade surplus via decline in expenditure, and causes an appreciation of the exchange rate. A decline in the money demand allows the price-level to increase to clear the money market, which via PPP must depreciate the exchange rate. A rise in the rate of interest reduces the demand for money and with the money stock unchanged, the excess supply of money causes either capital outflows (or higher imports) and a depreciation of the exchange rate, but this can also be instantaneously ensured through the uncovered interest parity whereby a proportionate exchange rate depreciation, will present capital outflows.

The empirical tests of these propositions were soon initiated. Incorporating the propositions above, the reduced form equation looks as follows:

$$s = a + (m - m^*) - \theta (y - y^*) + \lambda (r - r^*)$$

but under uncovered interest parity the expected exchange rate change $\Delta s^e = (r - r^*)$ and if the purchasing power parity prevails, the expected exchange rate change is equal to the expected inflation differentials, i.e., $\Delta s^e = \pi_e - \pi_e^*$

This substitution gives us

$$s = a + (m - m^*) - \theta (y - y^*) + \lambda (\pi_e - \pi_e^*)$$

s, m, m^*, y, y^* are all in logs.

θ income elasticity

λ semi-inflation elasticity of exchange rate with respect to

$$(\pi_e - \pi_e^*)$$

Bilson (1979) cites a number of studies where the monetary propositions hold good but only hyper-inflationary conditions yield such results (e.g., Germany in the 1920s and some Latin American Countries in the 1970s), where rates of inflation are moderate, the equation yields poor results.

The unsatisfactory nature of the Chicago version led R. Dornbusch (1976) to formulate a sticky price model which leads to the overshooting of the real exchange rate. Dornbusch accepts the Chicago version only as the long-run relationship where both the purchasing power parity and the uncovered interest parity hold good. But in the short-run it is assumed that goods prices are sticky, but the asset markets adjust instantaneously to preserve the uncovered parity. This means in the short-run the real exchange rate overshoots its long-run equilibrium value. For instance, an increase in the money supply will cause a decline in the interest rate. To prevent capital outflows, the exchange rate will depreciate (in nominal terms) proportionately but because of the sticky prices, this implies a real exchange rate depreciation, (i.e., the real exchange rate overshoots $S > \bar{S}$) where S is the domestic currency units per unit of foreign exchange. Over time, exchange rate expectations will take the following form:

$$s^e = Q (\bar{S} - S) \text{ where}$$

$$0 < Q < 1.$$

This means if the actual exchange rate is above the long-run equilibrium exchange rate (\bar{S}), then speculators will expect S to fall towards \bar{S} at the rate Q per period (i.e., they would expect the exchange rate to depreciate in future). This means that in the short-run, due to sticky prices the purchasing power parity relation between the exchange rates \bar{S} and $P - \bar{P}^*$ does not hold good. Moreover, $\Delta s^e = (i - i^*)$ because of the uncovered interest parity and $(i - i^*) \neq (\pi^e - \pi^e)$ as there are no secular inflationary expectations. So, the Dornbusch formulation looks as follows :-

$$\frac{\bar{S}}{S - S} = \frac{(\bar{m} - \bar{m}^*) - \theta (y - y^*)}{\frac{1}{Q} (i - i^*)} \quad \text{--- (1)}$$

$$\text{i.e., } S = \bar{S} - \frac{1}{Q} (i - i^*) \quad \text{--- (2)}$$

1 and 2 gives us

$$S = (\bar{m} - \bar{m}^*) - \theta (y - y^*) - (i - i^*)$$

Since $\frac{1}{Q} < 1$, the exchange rate overshoots in the short run. The money market clears through interest rate and exchange rate changes. In the Dornbusch model, the initial overshooting might be, apart from monetary shifts at home and abroad, due to fiscal policy shifts, natural resource discovery (e.g., an oil boom) and an appreciation of the exchange rate can cause recession. In the Dornbusch model, flexible exchange rates do not insulate the economy from foreign disturbances. For overshooting to take place disturbances must be unanticipated. Anticipated events under rational expectations follow long-run values, and cannot cause overshooting.

The most comprehensive discussion of the overshooting question we find in Bhandari (1982). He shows that in a general equilibrium model, the goods market parameters (income and interest elasticity of demand) can enter along with money market parameters (i.e., income elasticity and semi-interest elasticity of real money demand) into the overshooting formula. He further shows that if the goods parameters are more sensitive to exchange rate changes while capital mobility is of low degree (i.e., money market parameters are not very sensitive to exchange rate changes) an undershooting of exchange rate can take place. This finding resembles one by Frankel and Rodriguez (1982) and Niehans (1977).

Frankel (1979) produced a model which is of general type. With the monetary version's assumption of the uncovered parity, which is retained in the Frankel model we have the expression for the gap ($\bar{S} - S$).

$$\Delta S_e = \bar{S} - S = \frac{1}{Q} (i + \bar{\pi}_e) - (i^* + \bar{\pi}_e^*)$$

where $\bar{\pi}_e$ and $\bar{\pi}_e^*$ are the expected rates of inflation and i and i^* are real interest rates but we know in the long run

$$\bar{S} = (\bar{m} - \bar{m}^*) - \theta (\bar{y} - \bar{y}^*) + \lambda (\bar{\pi}_e - \bar{\pi}_e^*)$$

and so,

$$s = \bar{s} + \Delta s^e$$

$$\text{i.e., } s = (m - m^*) - \phi (\bar{y} - \bar{y}^*) + \lambda (\bar{\pi}_e - \bar{\pi}_e^*)$$

$$+ \frac{1}{Q} (i + \bar{\pi}_e) - (i^* + \bar{\pi}_e^*), \text{ rearranging the terms}$$

$$s = (\bar{m} - \bar{m}^*) - \phi (y - y^*) + (\lambda + \frac{1}{Q}) (\bar{\pi} - \bar{\pi}^*)$$

$$- \frac{1}{Q} (i - i^*)$$

$$\text{put } (\lambda + \frac{1}{Q}) = \beta \text{ and } -\frac{1}{Q} = \alpha$$

This gives us

$$s = (\bar{m} - \bar{m}^*) - \phi (\bar{y} - \bar{y}^*) + (\beta \bar{\pi}_e - \bar{\pi}_e^*) + \alpha (i - i^*)$$

If $\beta = 0$, we get the Dornbusch model, and if $\alpha = 0$, we get the monetary version. So the Frankel model can make a distinction between short-run and long-run determinants of the exchange rate. In the short-run, because of the price stickiness, deviation from the long-run equilibrium value can occur and we get the Dornbusch result. In the long-run, the expected rate of exchange rate depreciation is given by the expected inflation differential between the domestic and foreign currency and we obtain the Chicago results. The Frankel model is called the real interest model.

The empirical test of the Frankel Formulation (1974) (1978) gave positive results but his 1983 tests are rated by him as a disaster because of the wrong signs, serial correlation, insignificant coefficients.

In recent years, the models of Bilson-Dornbusch-Frankel type have been subjected to severe criticisms (Boothe and Gulisman (1983). The causes for the collapse of the monetary model can be listed as follows:

1. The model was subject to static restrictions like linearity (by logs) and it chose variables in relative terms, (i.e., equality of coefficients across countries).

2. The stationarity in variables was taken for granted. It was later realised that data in terms of the levels of variables was non-stationary. Only first differences could have stationary distribution. Non-stationary data can lead to spurious correlation (high R^2 and low Durbin-Watson Statistics).

3. The long-term equilibrium relationships between the regressand and the regressor that the variables are cointegrated of order 1. But no cointegration tests were made before the variables were chosen.

4. The model was a failure in out-of-sample situations.

5. The unrestricted version of this model with OLS and Cochrane-ocutt methods show tremendous instability of the model coefficients and do not support the central proposition of the monetary approach that the money supply and the exchange rate hold proportionate relationship.

6. The model is a test of several hypotheses jointly. When various hypotheses were tested separately, almost every piece failed to support the propositions it enunciated. A large number of tests on PPP and the rational expectations hypothesis did not furnish any empirical support. The hypothesis of stability of demand for money functions and money supply processes have collapsed due to structural change and innovations in money and capital markets paving the way for global financial integration. The covered interest parity held good between euro-currency markets and many on-shore markets of large industrialised countries but the tests of the uncovered interest parity led to large forecasting errors. The attempts to explain the discrepancy by means of risk-premia, Peso problem and rational theory of speculative bubbles did not fully take care of the problem particularly when the ascent and descent of currencies like the U.S. Dollar was so prolonged and large. Recently Koren Lewis (1989) has shown that a learning model of the exchange rate can take care of only 50 per cent forecasting errors. Economists are now veering round the view that markets behave in an irrational manner. Only irrationality can explain the wild fluctuations in the real exchange rate of many countries.

The frustration over the collapse of monetary models of exchange rate determination has led in recent years to new macro-economic models which have become more sophisticated. These models show that we have come a long way since the presentation of the Mundell and Fleming model and its portfolio-type versions. The rise of more open and sophisticated international financial markets has affected macroeconomic model-building in a number of ways. The real exchange rate variability and large and variable current account imbalances are to some extent consequences possible due to the existence of these financial markets. These markets also offer wide scope for risk-covering and risk-reducing opportunities to individual asset holders. These developments have drastically changed the nature of open-economy macro-economic models. Currently a typical macro-economic model has to have an optimising framework so as to be free the Lucas Critique (1976). It must also be dressed in a general equilibrium garb to catch economic interactions between goods and asset markets. It must bear intertemporal and stochastic treatment because financial markets provide opportunities for intertemporal and risk-covering trades where forward looking behaviour (expectations) plays a crucial role. In each model responses to fiscal/monetary/trade policy action as also responses to real world disturbances like changes in technology, investment opportunities, oil shocks, crop failures can be vastly different from those in the earlier non-stochastic partial static models. In this framework, large changes can occur in a competitive equilibrium as optimal response of the economy to exogenous disturbances or a change in government policy (Stockmen 1988). Exchange rates and current account can then turn out to be endogenous variables.

This is seen in the recent work on the effects of fiscal policy by Gernberg and Swaboda (1989) and Frenkel and Rezin (1988). In an intertemporal framework, a decision between current consumption and future spending is shown to reflect a mix between current goods and assets. This mix is determined by the intertemporal terms of trade (relative price) between current goods and future goods, which is nothing but the real interest rate in a world of integrated goods and assets markets. An increase in the

spendings on current goods determined by the sum of government spendings, private spendings, wealth holdings and the risk factor raises the real interest rate. Current goods and future goods both consist of their respective trade and non-traded components. The public sector and private sector propensities to spend as between traded and non-traded components of each type of goods and between present and future goods could be different. The models of revenue raising (namely, consumption taxes VS income taxes) can also make the difference. The real interest rate will be determined as per directional changes in spendings (i.e., shifts towards/against the government sector) and associated biases. The real exchange rate/current accounts are determined by a pattern of intercountry distribution of outputs, government spendings private absorptions, wealth holdings and the risk factor. The distribution pattern is revealed by the differences between the variables just mentioned. This view reveals that expenditure reducing policies affect a current account deficit while expenditure switching policies will only affect the real exchange rate, keeping the current account deficit unchanged.

III

In the area of real exchange rate analysis, research on exchange rate pass-through and exchange rate hysteresis have occupied the bulk of attention. We shall now review the work of this kind, and draw liberally on the contributions by the leading economists in this area.

The theoretical framework for studying the exchange rate pass-through was provided by Dornbusch (1987). With perfect competition and no entry costs the exchange rate pass-through to import and export prices should be perfect. But in manufactures we have product differentiation, market concentration and concern for market shares. So Dornbusch studies the pass-through under a variety of market forms; Cournot's oligopoly, Dixit-Stiglitz imperfect competition (DS). Extended Dixit-Stiglitz (EDS) (i.e., imperfect competition with conjectural variation and a market form of competition along a circle. The Cournot model assumes perfect substitution among alternative supplies and places and shows more variation in the mark-up in response to cost shocks and has the potential of a far richer pattern of response to cost shocks. In the D-S model, each country is fully specialised and foreign and domestic goods are imperfect substitutes, wages are fixed in national currency and are sticky. The EDS formulation incorporates strategic interaction among different firms. Competition on the circle is a model where differentiated products are marketed but consumers buy their own brands and not some of each as in the D-S model. Consumers testes are spread over unit circle but firms are on the circle. Domestic and foreign firms have different costs so symmetric equilibrium does not necessarily exist. Consumer's surplus is a function of price and distance and his maximisation does not synchronise with his preference.

For Cournot's model, we get an expression for the elasticity of equilibrium price with respect to exchange rate as:

$$\phi = \frac{n^*}{N} (e w^* / p)$$

This elasticity has two determinants relative number of foreign

firms n^*/N and the ratio of marginal cost w^* to price p of foreign supplies. Since both these ratios are fractions, the dollar appreciation will lower the price less than proportionately. If there are a few firms in the industry, most of which are domestic, foreign firms will absorb the dollar's appreciation in the form of extra profits.

For export firms, the dollar's appreciation will lower marginal revenue with unchanged marginal costs in dollars. A cut in output/sales raises foreign currency price; but in the dollar it declines though less than proportionately. The elasticity of foreign price with respect to exchange rate is given by-

$$\phi^* = - (n/N^* (w/e p)^*)$$

i.e., ϕ^* is a negative function. This means $1 + \phi^*$ will be the elasticity of the dollar price of exports with respect to a dollar's appreciation. If $\phi > 1 + \phi^*$ the dollar prices of exports will rise relative to dollar import prices. If $\phi = 1 + \phi^*$, the relative prices of exports and imports will remain unchanged.

Given the wages at home and abroad, the p-S model provides strong predictions about the impact of dollar appreciation.

Exporting firms at home still follow the dollar mark-up prices. Accordingly, dollar prices will remain unchanged. It will also affect their sales and profits which means the foreign price of exports will rise in the same proportion and hence raise the relative price in foreign market.

Prices of domestic variants will remain the same but prices of imported variants will fall in proportion of the decline of dollar unit costs. Import prices will fall relative to exports prices, and to domestic prices, if they too remain unchanged like export prices. This is the exact specification of the fixed price Keynesian model given the labour costs and an invariant mark-up.

In the E-D-S model, foreign firms reduce their prices proportionately less than the reduction in unit labour costs and domestic firms cut their prices. This is a result more akin to the Cournot model.

In the last model where price and distance both matter, relative price of imported goods decline and the change in the relative price measured depends on the number of firms and the degree of substitutability between different variants. Along with the change in relative price, consumers trade off the reduction in price for the larger distance from their most preferred location. So they shift demand for home firms to foreign firms.

In the last few years, following the lead provided by Dornbusch (1987) research on exchange rate pass-through has begun. Hooper and Mann (1989) investigate how quickly the change in the exchange rate in the 80s affected U.S. import prices of manufactured goods. The behaviour of the U.S. trade balance depends upon these pass-throughs.

Foreign firms are assumed to have some degree of control over their prices in the U.S. market as a result of market imperfections with and without product differentiation. Then U.S. prices are modelled as mark-ups over their costs, where the mark-up can vary according to demand pressure and competition in the U.S. market.

According to demand pressure and competition in the U.S. market. The authors define the exchange rate pass-through as the ratio of the change in import price to the change in the exchange rate when other factors affecting prices are held constant. If the pass-through is complete, the foreign producers' mark-ups and profit margins are unaffected by exchange rates. If the pass-through is less than complete, foreign mark-ups and profit margins decline when the dollar depreciates and vice-versa when it appreciates.

In all estimates short-run elasticity of import prices to the exchange rate is 20% the long-run is between 46% to 74% with most falling between 50% to 60%. The authors test for lags upto 12 quarters and conclude that the adjustment takes place within upto 7 quarters. By mid-1989, import prices have adjusted fully to the dollar depreciation that reached the low point at the end 1987. They also find that there is little evidence of any change in the pass-through equation during the past decade. They find that Japanese firms do not behave differently from total imports. If the Japanese price imports to the U.S. market, they are not alone in doing so. Partial pass-through implies fluctuations on profit margins. Profit margins on Japanese and total imports had fallen from abnormally high levels achieved in mid-80s. But margins have not been squeezed to unsustainably low levels by the decline of the dollar, so further price movements will take place only when further exchange rate movements take place.

We now turn to "hysteresis". As said above, in economics, it is a new idea and is associated with persistent effects that remain behind long after the cause that gives rise to them has disappeared. Here the cause concerned is a large and prolonged exchange rate disturbance (depreciation or appreciation) and the persistent effects take the form of irreversible structural changes. The focus of the current literature on "the exchange rate hysteresis" is on specifying circumstances and deriving conditions under which this phenomenon can occur. We first specify the circumstances.

(1) Like the literature on the exchange rate pass-through the various write-ups on "hysteresis" specify market conditions. Here we find the choice can range from perfect competition to perfect monopoly with Cournot oligopoly and Chamberlain's monopolistic competition coming in between. It means the results on hysteresis do not depend upon any specific market conditions.

(2) Hysteresis can only occur over time, the framework which leads to these effects involves intertemporal decision-making. Here the choice has to be made between finite time horizon and infinite time horizon. Given the time horizon, the parameters of this decision-making must be specified, e.g., p - rate of discount.

(3) The results obtained depend on entry and exit costs which foreign firms have to incur in order to enter and withdraw from a foreign market. These costs are in nature of "sunk costs". Entry sunk costs consist of expenditures incurred for advertisement campaigns, setting up of sales and after-sales-service network, bringing up the product upto health and safety standards. This is the expenditure on the supply side. On the demand side, discounts on sales, discounts on repeat purchases, providing

specific spare parts could be looked upon as investment in future market shares. Exit costs consists of statutory lay-off compensation, expenditure to meet other contractual obligations, and costs incurred on dismantling sales and after sales-service network. It is these "sunk costs" which play a crucial role in deciding entry-exit decisions. These costs are incurred by foreign firms in home markets and denominated in home currency. For establishing "hysteresis" sunk costs only on entry are enough. Some models recognise, besides entry costs, maintenance costs needed to maintain sales and service outlets. To highlights the role of "sunk costs" they make an assumption of entry sunk costs are greater than maintenance costs, which is a reasonable assumption. Entry and exit costs can make entry and exit problems symmetrical.

(4) The next thing to consider is the modelling of the exchange rate. The results depend upon the assumptions made in this connection. In one case, the exchange rate takes a jump in the period one from its previous level (i.e., from e_0 to e_1) remains there for $(n-1)$ periods and returns to e_0 in the n^{th} period. In some other model, the exchange rate is modelled as a random variable in continuous time (the Brownian Motion), and in yet another model, the exchange rate changes are assumed to be independently and identically distributed. The case of mean-reversion can also be incorporated when the exchange rate behaviour is systematic.

With this lay-out of the initial circumstances, we can now show how the results on "hysteresis" are obtained. The most simple case is the one explained by Baldwin (1988). He assumes Chamberlain-type monopolistic competition with imperfect constitution between any two varieties of the same product. An increase in the number of varieties in an industry shifts down and makes more elastic the demand curve for each variety. So the number of firms m_1 (i.e., varieties) enters as an argument in the inverse demand function of facing every home and foreign firm.

Since an appreciation of the dollar affects favourably the dollar costs of a foreign supplier to the U.S. market, increasing his operating profits, he faces the question whether and when he should enter; likewise when a depreciation of the dollar takes place, dollar costs of his foreign supplies go up and the question of exit faces him. This means that the exchange rate enters as one more argument in the demand function faced by the foreigner. In Baldwin's model market conditions in the importing country are assumed to take the form of multi-period Cournot-Nash monopolistic competition, where new entrants to the market optimally chose their output and price assuming outputs of others remain fixed. The other assumption relates to the modelling of the exchange rate. It is assumed to revert to its original level e_0 during the n^{th} period after staying at e_1 between one and period $(n-1)$. This is a deterministic of exchange rate determination (a Markov type behaviour) and assumes a finite time-horizon. The paper shows that the present value of aggregate operating surplus for foreign firms besides the number of firms in the industry, is a function of (1) the size of exchange rate change, (2) time dimension of that change. A distinction between large and small exchange rate change is drawn to highlight "hysteresis".

An exchange rate appreciation which is small in size and which

is expected to return soon to its original level can only raise the discounted value of operating surplus and does not induce new firms to enter. An exchange rate appreciation which is large (say, 40%) and sustained (say, 5 years) not only raises the operating surplus but induces some firms to enter and thus cause a structural change in the industry. This can be seen from the Figure I. Because of the "sunk costs", the entry condition in this model is $S^* > F$ and the exit condition is $S^* < O$. This means the traditional exit/entry band given by Marshall gets widened because of the sunk costs.

The initial conditions are : $S_0 = S^*$ = the initial surplus of domestic/foreign firms; e_0 = initial exchange rates. When the number of firms in the industry is m_1 , the operating surplus $S_0 > F$, so some firms will enter the industry. This number is uncertain. Depending upon this number, Cournot-Nash equilibrium in the period zero would be determined at any point between a and b. Suppose such a point is c, which determines both number of firm m_2 and the operating surplus S_2 . Now let there be an exchange rate appreciation. The operating surplus in the industry goes up from S_2 to S_2' so some firms will enter and the new number of firms will determine new equilibrium between a^1 and b^1 , say at c^1 . Eventually the operating surplus will come down to S_4 , but the number of firms remain the same. This is "hysteresis".

Baldwin's model uses a deterministic exchange rate model (perfect forecasting). It shows that exchange rate uncertainty is not the cause of hysteresis. It is the sunk costs making for separate entry conditions (making for the zone of inaction), that causes hysteresis.

Dixit (1989a and 1989b) introduces both entry costs/exit costs and exchange rate uncertainty (exchange rate is modelled as a random walk in continuous time) (See Figure II). Dixit looks at the question of hysteresis as a dynamic programming problem. The active state of a firm is looked upon as of having two options; one of continuing to be active and one of becoming inactive. An inactive firm, likewise, is having two options; one of remaining inactive and one of becoming active. The valuation of these options is arrived through an application of stochastic calculus $1/$. The solution arrived at is different from the usual one given by the Black-Scholes formula. It is arrived at as a simultaneous solution of the values of two states which are call options on each other. Entry and exit costs then appear as factors which widen the band of non-exit no-entry zone. The problem is stochastic because the market price P_m is a function of the number of firms and the real rate of exchange (random walk in continuous time). Dixit specifies both exit and entry costs, and the boundary conditions look as follows:

$$P_H > w + rk$$

$$P_L < w - rl$$

where P_H = entry price; P_L = exit price; w implies variable costs and rk is the interest on the entry costs and rl is the interest on the exit costs, the zone between these boundaries is called the zone of inaction and the source of hysteresis. The solution that simultaneously gives the consistent values of two options, one for remaining in and one for remaining out in two situations

FIGURE - 1

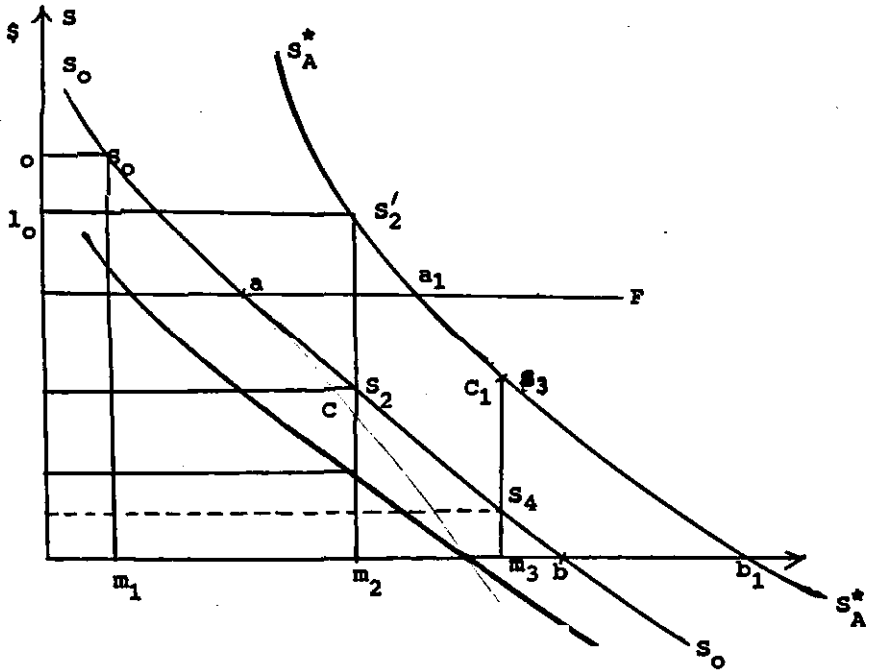
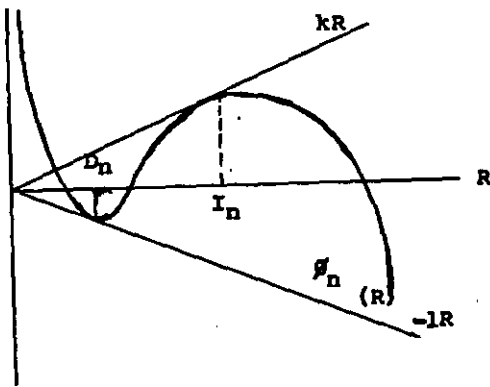


FIGURE -2

Determination of Entry and Exit Triggering Exchange Rates.



of entry and exit.

In order to find which option must be exercised, these states have to be valued. Because the exchange rate behaviour and the number of firms in the industry are uncertain the problem of valuation of entry and exit situations have to be looked upon as a dynamic programming problem. The solution has to be obtained simultaneously and will define two exchange rates I_n and D_n . I_n is the entry triggering exchange rate and D_n is exit - triggering one. These I_n and D_n are the exchange rates where it becomes optimal to effect entry and exit, respectively. The paper shows that the entry trigger and exit trigger points were wide enough where the entry cost K , exit cost l and the uncertainty exchange rate parameter are quite small. The same is true of the band at the industry level. The central contribution of this paper is to show that the ongoing uncertainty is a more potent generator of "hysteresis" than "sunk costs". (See Figure III).

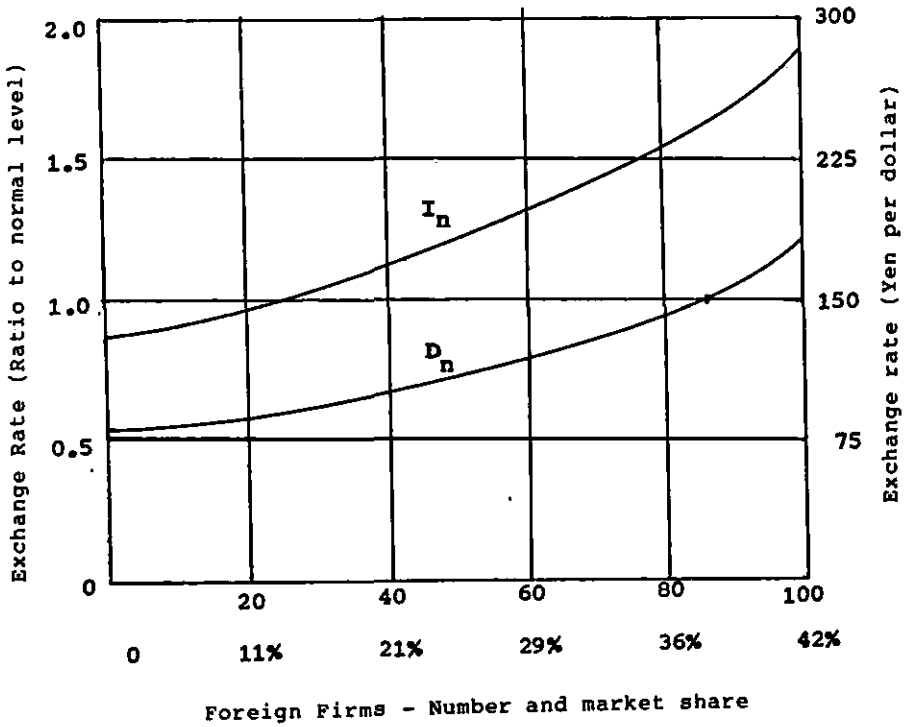
The paper also discusses exchange rate pass-through. It shows that even if supply and demand elasticities are increased substantially the pass-through coefficient does not increase substantially. In this model, as R increased beyond the entry triggering level, the import price declines because new firms enter and because the existing firms expand. The reverse will be the case when R decreases. The model has not considered the effect on domestic firms; hence pass-throughs are under-estimated. In spite of this, the pass-through coefficient in the phase where the number of firms remains constant is quite small, while its values in phases with entry or exit are much larger, perhaps close to one. This means in the early phases of a rise and fall in the exchange rate, we get little pass-through but in the later stages, the effect is much larger, and breaks the relation between the exchange rate and the dollar prices of importables could provide test of the hysteresis in various industries.

Baldwin and Krugman (1989) show that aggregation of industries as per their ascending scale of sunkenness is possible; so a prolonged exchange rate change of large size can create hysteresis at the manufacturing sector level. The second point which this paper makes is the study of hysteresis requires a case study data rather than usual statistical tools. The third point related to the feedback of trade to the exchange rate. If the economy has a large hysteretic sector, then this effect could be more effective.

Froot and Klemperer (1989) have looked at hysteresis from the demand side. Firms invest today to win consumer's allegiance by means of direct discounts, discounts on repeat sales, etc., to build a market share which becomes an argument in tomorrow's profit function. This means the short term reversible exchange rate change would not be allowed to pass-through into import prices and quantities. In this framework, an appreciation raises the import prices measured in foreign currency and a depreciation lowers them. This is reflected in fluctuating profit margins. Authors present some empirical support to their propositions.

FIGURE - 3

Trigger Exchange Rates for Entry and Exit



Conclusions :

This paper has extensively surveyed the research on exchange rates during the past few years. While the monetary models of exchange rate determination have failed to deliver goods, major breakthroughs are possible in the area of macro-economics of exchange rates. Even in our country, this line of research is more promising because we know very little how the exchange rate pass-through in imports/exports/import prices/export prices are determined. Likewise, since markets in our country suffer from a number of imperfections, macro-economic models incorporating various rigidities could/should be built to study the effects of fiscal/monetary policies under high degree of capital mobility given the present regime of floating exchange rates. Fortunately, because of market imperfections, the Keynesian results on fiscal/monetary policy multipliers are akin to us than some of the Recardian equivalences obtained by the protagonists of "rational expectations".

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Footnote

1. Maximisation and minimisation of the stochastic function involves the solution of differential equations based on 'ito's lema'.

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Forecasting of Some Major Exchange Rates : Structural and Time Series Model's Results

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It is generally pointed out that the forecasting performance of the structural models of the exchange-rate determination is poorer than that of the native Random-walk models. Among the most influential of the empirical studies of exchange-rate forecasting models were those performed by Meese and Rogoff (1983 a, 1983 b, 1985) (M - R) who found that during the 1976-1984 period on structural or time-series technique could appreciably outperform the Random-walk at any forecasting horizon shorter than 12 months. The forecasts M - R constructed were based on the actual future values of the exogenous variables.

Bilson (1978 a), Frankel (1979) and Frenkel (1981) present evidence suggesting that the monetary model broke down, while Dornbusch (1980) and Frankel (1982, 1984) draw the same conclusion for the portfolio - balance approach. Backus (1984) concentrated on the exchange-rate between the U.S. and Canadian Dollars and tested a number of portfolio - balance models, and he has concluded that Random-walk produced the best post sample predictions. Woo (1985) has worked with a monetary model which outperformed the Random-walk model in predicting the exchange-rate between the U.S. Dollar and Deutschmark during a forecasting period from March 1980 through October 1981. Meese and Rogoff (1985) extended the analysis of their first two papers in a number of directions; to Mark-Yen and Mark-Pound, Dollar-Mark, Dollar-Yen and Dollar-Pound; to real exchange-rates as well as nominal exchange-rates. The models of systematic behaviour are found to be slightly better than in earlier studies.

2. Description of the data and econometric methodology

2.1 Data

The data set consists of quarterly observations for Rupee/Dollar, Dollar/Sterling, Deutschmark/Dollar, Swiss Franc/Dollar, and Yen/Dollar exchange-rates from 1974:1 to 1988:2. The money supply statistics used in M1 or its equivalent in India, the U.K., Germany, Switzerland, and Japan, collected from the *International Financial Statistics*. Interest rates are short-term which are either prime-rates of banks, or the bank-rate. The data for the growth in the industrial production, and changes of the current account balances are also taken from the I.F.S.

2.2 Structural models

The following structural models were used

$$\text{Log SAT1} = \alpha + \beta_1 \log \text{MT1} + \beta_2 \log \text{IPT1} + \beta_3 \text{RT1} + \beta_4 \text{CAT1}^* + u_t \quad \dots (1)$$

$$\text{Log SAT1} = \alpha + \beta_1 (\log \text{MT1} - \log \text{MT2}) + \beta_2 \log \text{IPT1} + \beta_3 (\text{RT1} - \text{RT2}) + \beta_4 \text{CAT1}^* + u_t \quad \dots (2)$$

SAT1 = The domestic currency price of one unit of foreign currency (Dollar), except in the case of Dollar Sterling exchange-rate of the U.K.

MT1 = The money supply in the domestic country (money and demand deposits as given in the IFS, M1 definition).

MT2 = The money supply in the foreign country (the U.S.A. in this case).

IPT1 = Growth in the industrial production of the domestic country.

RT1 = The short-term interest-rate/discount rate in the domestic country.

CAT1* = The growth rate in the current account of the balance of payments.

u_t = The error term in the OLS regression which follows the usual properties.

The foregoing are combinations of the monetary and portfolio balancing models. According to the monetary model, the increase in money supply is expected to have a positive sign as the exchange-rate is defined as the domestic currency price of unit of foreign currency. The index for industrial output is expected to have a positive sign in portfolio balancing Keynesian framework, as more industrial output/real income is expected to lead to more imports and hence the domestic currency value is expected to depreciate. However, in the same portfolio-balancing framework, the increase in industrial output can be taken as the sign of a strong economy, by international investors who may demand more domestic currency denominated assets, and hence the domestic currency can appreciate. Also in monetary models, it is supposed to increase in the value of the domestic currency, as increase in real income increases the domestic demand for money in relation to the supply of money. The increase in the short-term interest-rate is expected to increase in domestic currency value under the portfolio balancing framework, as there will be more demand for domestic currency denominated assets. And this of course means that open-interest parity does not hold good. But if open-interest

rate parity holds good as under a monetarist model framework the increase in short term interest-rates will cause a fall in the domestic demand for money and hence it will cause a fall in the value of the domestic currency.

The increase in the current account surplus, under the portfolio-balancing framework of less than perfect substitutability of domestic and foreign currency denominated assets and when open-interest rate parity does not hold good, will result in an increase in the value of the domestic currency, as the risk premium for holding foreign currency denominated asset will increase.

2.3 Vector-Auto-Regression (VAR)

The VAR technique provides an opportunity to assess the dynamic inter-relationships that characterize the data without imposing the strong a priori restrictions common in traditional empirical macro-economic work, especially considering the fact that many a time, the exogeneity/endogeneity distinction may be spurious.

A VAR is not a single regression equation but a system of regressions with one equation for each variable in the system. Given the variables of interest and identical regressors in each equation, estimation of the auto-regressive system is a set of OLS-regressions with the current value of each variable being regressed on its own lagged values and lagged values of every other variable in the system.

While VAR - system may be easy to estimate, the estimates are difficult to interpret due to the multi-collinearity. Therefore we must consider also the Vector Moving Average Representation (VMAR). The VMAR expresses current values of the variables in terms of current and lagged values of the innovations (current disturbance in the equation of a given variable) in all variables of the system. It is used mainly to analyse the short-to medium run effects on each variable of given innovation to each of the variables. In VMAR we distinguish between the impulse response function and the variance decomposition. The impulse response function describes the effect of an innovation ("shock" of one standard error) in a given variable on the movement of the level of the same or another variable in the system. Variance decomposition breaks down variation in the system into components due to variation in the "shocks". This is done in terms of the forecast error variance. The variance decomposition is a valuable tool because it communicates which variables have a relatively sizable independent influence on other variables in the system.

2.4 Auto-Regressive Time Series Method (ARIMA)

The Univariate Box-Jenkins Auto-Regressive Integrated Moving Average (UBJ-ARIMA) model is a special class of univariate time-series models that uses only the past information of the series being analysed. Though the UBJ - ARIMA models have been proved

to be more robust than structural models in forecasting economic activity (Nelson 1973), their use has not been appreciated much in exchange-rate modelling. An attractive feature of the model perhaps lies in the availability of wide choice of forecast functions and an efficient iterative method of identification, estimation and diagnostic checking.

A general UBJ-ARIMA model is represented by:

$$\phi_p(B) \quad P(B^S) (1-B)^d (1-B^S)^d Z_t = \theta_q(B) \quad Q(B^S) \varepsilon_t \quad \dots(3)$$

Z_t is the standardized vector of a given time-series; ε_t is a sequence of identically distributed uncorrelated errors referred to as the 'white noise' 'd' is the degree of non-seasonal differencing; 'D' is the degree of seasonal differencing; 's' is the length of the seasonal span; 'B' is the backward shift operator; $\phi_p(B)$ is a non-seasonal autoregressive operator (polynomial in B) of order p; $I_p(B^S)$ is a seasonal autoregressive operator (polynomial in B) of order P; $\theta_q(B)$ is a non-seasonal moving average operator (polynomial in B) of order q; and $H_Q(B^S)$ is a seasonal moving average operator (polynomial in B) of order Q and $H_Q(B^S)$ is a seasonal moving average operator (polynomial in B) of order Q.

Equation (3) represents an ARIMA process of ARIMA (p,d,q) (P,D,Q). As already indicated the lower case letters (p,d,q) represents the non-seasonal orders and the upper case letters (P,D,Q) represent the seasonal orders of the process. A non-seasonal ARIMA model is a special case of the above model with P = D = Q = 0; i.e., equation (B) reduces to

$$\phi_p(B) (1-B)^d Z_t = \theta_q(B) \varepsilon_t \quad \dots\dots\dots(4)$$

Which is an ARIMA (p,d,q) model.

A random walk model is, in effect, a special case of ARIMA (p,d,q) with p = 0, d = 1, and q = 0, with the error term following a 'white noise' process. In back shift form:

$$(1-B)Z_t = \zeta + \varepsilon_t$$

Where ' ζ ' is the drift parameter. If ' ζ ' = 0 the ' Z_t ' series follow a random walk without drift, and if ' ζ ' \neq 0, the series follow a random walk with drift, with ' ε ' being the pure 'white noise' in both cases.

3. Forecasting Results 1/

3.1 Rupee/Dollar Exchange-Rate

From 1984: first quarter to 1988: first, the structural models

are able to forecast reasonably well the Rupee/Dollar rate. In fact they perform better than ARIMA models in terms of the forecasting efficiency upto 1988: first quarter. Also the VAR-model performs better than ARIMA-models upto 1988. The foregoing findings are in contradiction with the common belief that for exchange-rate forecastings, ARIMA-models perform better than structural models. But from the 1988: Second quarter onwards Rupee depreciation is higher than earlier period, and ARIMA-models perform better than structural and VAR-models. The regression equations for India, show that the money supply and interest rate increases, make the value of Indian Rupee depreciate. The VAR-results show that the past lag data of the Rupee/Dollar rate are more important for predicting future exchange-rates, than other exogenous variables.

3.2 Deutschmark/Dollar Rate

From 1984: first quarter to 1986: fourth quarter the structural regression models and VAR-models are perhaps more efficient than ARIMA models for forecasting Deutschmark/Dollar. At that period dollar was high in value. But from 1987: first quarter onwards Deutschmark began to increase in value and this turning point is being captured by ARIMA-models and not the structural regressions or VAR-models. ARIMA (1,1,1) linear and log-models forecast efficiently after 1987: first quarter. The structural models show that growth of industrial production contributes to the value of Deutschmark 2/. The VAR-model's results show that in the case of Germany, apart from the exchange-rate's own lagged values, other exogenous variables like money supply, growth of industrial output, and interest-rates are also statistically significant in explaining future exchange-rate values. But it is surprisingly not so in the case of exchange-rates other than Deutschmark/Dollar.

3.3 Dollar/Sterling-Rate

The same trends of results are discernible for Dollar/Pound rate. From 1984: first quarter to 1986: fourth quarter structural, and VAR models are better than ARIMA models. Even structural models were not able to capture the fall in the value of Sterling in 1985. But from 1986 onwards the value of sterling began to increase, and this rise in sterling has been tracked down only by the ARIMA - models. Both regression and VAR models are inefficient in tracking down this change in 1986, for Dollar/Pound. However, the regression of (SR) No.4 is slightly better than Sr.No. 1 and Sr No.2. The structural regression models show that whenever money supply increases, the value of sterling goes down. But whenever the rate of interest (short-term) increases, the value of sterling goes up 3/. The VAR results show that the lagged values of the Dollar/Sterling rate are more important for forecasting Dollar/Pound- rate, than other exogenous variables.

3.4 Swiss Franc per Dollar Rate

One peculiar feature of the Swiss Franc/Dollar rates'

forecasting is that the structural models, especially $Sr(3)$, the ARIMA models and VAR-models are all equally efficient. Another difference with other countries is that in the structural regression equations, the sign of the money supply is negative which implies that whenever money supply increases in Switzerland, the value of Swiss Franc goes up. This can happen if, whenever the Value of Swiss Franc goes down, the Swiss Central Bank intervenes in the foreign exchange-market, sells the foreign exchange and buys the Swiss-Franc, the money supply goes down, and this in turn leads to an inverse relation between money supply and the value of Swiss Franc. However, the VAR-results show that the lagged values of the exchange-rate are more important than other exogenous variables to forecast Swiss Franc /Dollar-rate. The ARIMA (linear) model predicts that by 1990 fourth quarter Swiss Franc /Dollar rate would be 1.6948, whereas the regression model $Sr(3)$ predicts the same would be 1.4779. In any case, all forecasting models point to the possibility of the appreciation of the Swiss Franc.

3.5 Yen/Dollar Rate

Unlike in the case of Swiss Franc/Dollar, in the cases of Yen/Dollar rate there are wide fluctuations over different models forecast. This may be partly because of the reason that there are wide fluctuations in the actual data of the Yen/Dollar rate itself. As is well-known, from 1985 onwards the actual value of Yen began to increase. From 1987 onwards, the appreciation of Yen has been a higher order, and infact no foregoing models have been able to capture this extent of appreciation. However, to some extent, the $SR(3)$, $SR(4)$, ARIMA (1,1,1) linear and logs, and the VAR, models capture the foregoing. The regression results (which are not reported here), point out one peculiarity for Japan that the growth of current account surplus and short-term interest rates have a negative significant effect on the value of Yen. The ARIMA (1,1,1) linear model predicts that by 1990: fourth quarter the Yen/Dollar rate would be 127.403, whereas regression $SR(3)$ predicts that the same would be 144.564.

4. Concluding Comments

Among the various forecasting models, discussed above, ARIMA (1,1,1) models are able to capture the turning points, better than perhaps other models. Among the family of the ARIMA models, the fact that ARIMA (1,1,1) models are found to be significant in terms of 'Q' statistics, implies that it is very difficult to rule out some trend element for even quarterly exchange-rate data. And structural models are not less important in explaining exchange-rate changes, viz., the impact of monetary policy and money supply increase on exchange-rates. However, when it comes to forecasting out of the sample periods, ARIMA. Models perform better than structural regression models.

The Forecasts, []* Theil's U, () RMSE of Rupee/Dollar Rate

TABLE 1

Model	Period Actual Values if Available	1984 :I 10.741	II 10.972	III 11.579	IV 12.158
SR (1)		10.870 0.012* (0.057)	10.913 0.005* (0.023)	10.857 0.064* (0.227)	11.172 0.085* (0.254)
SR(2)		11.182 0.04* (0.193)	10.403 0.053* (0.231)	10.739 0.075* (0.265)	11.171 0.0846* (0.254)
SR (3)		- -	- -	- -	- -
SR(4)			- - -	- - -	- - -
ARIMA (1,1,1) linear		14.0314 1.5599* (3.2117)	14.184 1.0342* (2.757)	14.336 0.7182* (2.3305)	14.489 0.4593* (1.8029)
ARIMA (1,1,1) log		13.438 1.0324* (0.214)	13.597 0.6593* (0.1725)	13.759 0.4365* (0.1355)	13.922 0.2546* (0.09291)

SR (1) - Structural Regression Model 1
 SR (2) - Structural Regression Model 2
 ARIMA (1,1,1) - ARIMA (1,1,1) Model
 VAR - Vector Auto Regression Model
 SR (3) - Structural Regression Model 3
 SR (4) - Structural Regression Model 4

Table 1 contd...

Model	Period Actual Values if Available	1985 :I 12.838	II 12.498	III 12.048	IV 12.091
SR (1)		11.5206 0.108* (0.279)	11.433 0.085* (0.235)	11.345 0.06* (0.186)	11.757 0.028* (0.086)
SR (2)		12.114 (0.058)*	11.573 (0.076)*	11.586 (0.039)*	12.371 (0.023)*
SR (3)		(0.15)	(0.213)	(0.121)	(0.097)
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		14.641 0.64* (2.296)	14.793 0.924* (2.897)	14.946 0.946* (3.09)	15.098 0.864* (2.938)
ARIMA (1,1,1) log		14.088 0.398 (0.132)	14.255 0.597* (0.18)	14.424 0.617* (0.188)	14.596 0.563* (0.182)
VAR		11.392 0.954* (0.231)	11.481 0.466* (0.123)	11.628 0.024* (0.007)	11.773 0.27* 0.0801
Model	Period Actual Values if Available	1986 :I 12.312	II 12.5	III 12.592	IV 13.039
SR (1)		11.898* 0.034 (0.099)	11.891* 0.049* (0.139)	11.902* 0.056* (0.153)	12.299* 0.050* (0.145)
SR (2)		12.951 0.051* (0.146)	12.289 0.017* (0.0473)	12.943 0.028 (0.075)	13.558 0.039 (0.097)
SR (3)		12.026 0.024* (0.176)	11.786 0.008* (0.051)	11.897 0.027* (0.158)	12.342 0.018* (0.088)
SR (4)		12.573 0.011* (0.001)	12.077 0.119* (0.018)	12.56 0.063* (0.011)	13.037 0.106* (0.022)
ARIMA (1,1,1)		15.25 0.805* (2.963)	15.555 0.647* (2.668)	15.708 0.694* (2.844)	15.859 0.838* (3.231)

Table 1 contd...

Model	Period Actual Values if Available	1986 : I	II	III	IV
		12.312	12.5	12.592	13.039
ARIMA (1,1,1) log		14.769 0.528* (0.176)	14.944 0.529* (0.183)	15.122 0.421* (0.159)	15.301 0.459* (0.174)
VAR		11.89 0.512* (0.142)	11.973 0.325* (0.86)	12.099 0.228* (0.059)	12.258 0.153* (0.035)
Model	Period Actual Values if Available	1987 : I	II	III	IV
		13.015	12.781	13.049	13
SR (1)		12.649 0.0285* (0.071)	12.314 0.037* (0.097)	12.514 0.0419* (0.1037)	12.832 0.013* (0.033)
SR (2)		14.856 0.132* (0.329)	13.559 0.059* (0.154)	13.776 0.054* (0.344)	14.164 0.086* (0.214)
SR (3)		12.913 0.0175* (0.076)	12.3503 0.068* (0.24)	12.5904 0.091* (0.274)	12.91 0.101* (0.261)
SR (4)		14.187 0.233* (0.054)	13.087 0.343* (0.0973)	13.298 0.291* (0.0967)	13.686 0.195* (0.075)
ARIMA (1,1,1) linear		15.859 0.835* (3.231)	16.012 0.753* (3.116)	16.165 0.812* (3.317)	16.317 0.829* (3.426)
ARIMA (1,1,1) log		15.483 0.565* (0.0204)	15.667 0.511* (0.195)	15.853 0.557* (0.210)	16.041 0.574* (0.219)
VAR		12.3759 0.152* (0.032)	12.479 0.0315* (0.008)	12.6233 0.009* (0.002)	12.821 0.118* (0.028)

Table 1 contd...

Model	Period Actual Values if Available	1988 :I 13.043	II 13.429	III 14.276	IV 14.920
SR (1)		-	-	-	-
SR (2)		-	-	-	-
SR (3)		12.657 0.095* (0.263)	12.783 0.063* (0.196)	12.909 0.023* (0.072)	13.036 0.024* (0.068)
SR (4)		13.205 0.243* (0.087)	13.315 0.057* (0.176)	13.315 0.003* (0.009)	13.417 0.021* (0.061)
ARIMA (1,1,1) Linear		6.469 0.707* (3.193)	16.622 0.466* (2.498)	16.774 0.334* (2.006)	16.926 0.282* (1.798)
ARIMA (1,1,1) log		16.231 0.491* (0.201)	16.424 0.323* (0.152)	16.619 0.232* (0.119)	16.816 0.199* (0.108)
VAR		12.982 - -	13.147 - -	13.354 - -	13.628 - -

Model	Period Actual Values if Available	1989 :I 15.201	II 16.105	III 16.605	IV
SR (1)		-	-	-	-
SR (2)		-	-	-	-
SR (3)		13.165 0.059* (0.163)	13.295 0.057* (0.154)	13.426 0.055* (0.136)	13.559 -
SR (4)		13.505 0.034* (0.096)	13.681 0.002* (0.006)	13.472 0.0026* (0.0066)	13.6005

Table 1 contd...

Model	Period Actual Values if Available	1989 :I	II	III	IV
ARIMA (1,1,1)		17.079	17.231	17.384	17.536
linear		0.157*	0.101*		
		(1.126)	(0.778)		
ARIMA (1,1,1)		17.016	17.218	17.629	17.422
log		0.113*	0.077*		
		(0.0668)	(0.048)		
VAR		13.873	14.113	14.41	14.764

Model	Period Actual Values if Available	1990 :I	II	III	IV
SR (1)		-	-	-	-
SR (2)		-	-	-	-
SR (3)		13.692	13.828	13.964	14.102
SR (4)		13.731	13.863	13.996	14.129

The Forecast * Theil's, () RMSE Of Deutschmark per Dollar Rate

TABLE 2

Model	Period Actual Values if Available	1984 :I 2.7025	II 2.7095	III 2.9189	IV 3.0529
SR (1)		2.3988 0.1192* (2.092)	2.6484 0.0228* (0.3828)	2.3722 0.2073* (1.5474)	2.4864 0.2052* (1.1471)
SR (2)		2.5465 0.0595* (1.044)	2.7376 0.0103* (1.173)	2.5147 0.149* (1.112)	2.3076 0.279* (1.564)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		2.092 5.648* (0.6359)	2.074 2.684* (0.8641)	2.055 2.2298* (1.0168)	2.036 1.878* (1.2389)
ARIMA (1,1,1) log		2.089 6.336 (0.2689)	2.071 3.0128 (0.3522)	2.052 2.5084 (0.4058)	2.035 2.1172 (0.4791)
VAR					
Model	Period Actual Values if Available	1985 :I 3.2563	II 3.0867	III 2.849	IV 2.5839
SR (1)		2.3716 0.31703* (1.3025)	2.3499 0.2727* (1.4361)	2.2669 0.2285* (2.0816)	2.41208 0.0688* (5.6824)

Table 2. contd...

Model	Period Actual Values if Available	1985 :I 3.2563	II 3.0867	III 2.849	IV 2.5839
SR (2)		2.5842 0.231* (0.949)	2.5787 0.179* (0.947)	2.5356 0.117* (1.061)	2.3504* 0.0947* (7.822)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		2.0173 2.2214* (1.088)	1.9986 3.4475* (0.8691)	1.9799 47.9035* (0.6227)	1.9612 1.6116* (0.4039)
ARIMA (1,1,1) log		2.0168 2.5137* (0.4343)	1.999 3.0175* (0.3629)	1.9818 54.606* (0.27404)	1.9645 1.8363* (0.1863)
VAR		2.5179 0.0999* (0.187)	2.4419 0.02962* (0.0999)	2.4034 0.0094* (0.3011)	2.3266 0.0588* (0.2847)
Model	Period Actual Values if Available	1986 :I 2.3463	II 2.2464	III 2.0856	IV 2.0076
SR (1)		2.3609 0.00622* (0.0738)	2.4349 0.0806* (0.6301)	2.3827 0.1332* (0.6589)	2.5034 0.2207* (0.9187)
SR (2)		2.4833 0.0567* (0.6728)	2.5216 0.116* (0.9037)	2.5409 0.1974* (0.977)	2.5497 0.239* (0.995)
SR (3)		2.1083 0.1221* (2.0493)	2.1331 0.2767* (2.0646)	2.0954 0.3042* (1.7002)	2.1347 0.3889* (1.598)
SR (4)		2.2495 0.0658*	2.2577 0.2211*	2.2189 0.3286*	2.2497 0.3364*

Table 2 contd...

Model	Period Actual Values if Available	1986 :I	II	III	IV
		2.3463	2.2464	2.0856	2.0076
SR (4)		(1.104)	(1.6496)	(1.8368)	(1.3819)
ARIMA (1,1,1) linear		1.9424 0.9207* (0.3227)	1.9237 0.3533* (0.1806)	1.9049 0.2058* (0.1214)	1.8862 0.03697* (0.02801)
ARIMA (1,1,1) log		1.9474 1.0455* (0.1515)	1.9304 0.3926* (0.0861)	1.9136 0.2204* (0.0567)	1.8969 0.0637* (0.0219)
VAR		2.2966 0.0087 (0.0284)	2.232 0.0662 (0.142)	2.214 0.0195 (0.0359)	2.162 0.0286 (0.04002)
Model	Period Actual Values if Available	1987 :I	II	III	IV
		1.8395	1.8032	1.8393	1.7055
SR (1)		2.5819 0.339* (1.0346)	2.5485 0.3459* (0.9951)	2.5489 0.3263* (0.9953)	2.5963 0.4204* (1.0424)
SR (2)		2.7458 0.4006* (1.224)	2.497 0.3255* (0.9363)	2.5133 0.3122* (0.9524)	2.3465 0.3191* (0.7911)
SR (3)		2.1881 0.3502* (1.8442)	2.1355 0.3094* (2.8189)	2.1363 0.1904* (15.72)	2.1129 0.1069* (1.268)
SR (4)		2.3610 0.2849* (1.5003)	2.2022 0.2239* (2.0404)	2.2158 0.1613* (13.328)	2.1879 0.0421* (0.4996)
ARIMA (1,1,1) linear		1.8675 0.0574* (0.0456)	1.8487 0.0122* (0.0093)	1.8301 0.119* (0.1058)	1.8113 0.1006* (0.0735)
ARIMA (1,1,1) log		1.8804 0.0909* (0.0331)	1.8639 0.0132* (0.0456)	1.8477 0.1696* (0.0713)	1.8316 0.0829* (0.0274)

Table 2 contd...

Model	Period Actual Values if Available	1987 :I	II	III	IV
		1.8395	1.8032	1.8393	1.7055
VAR		2.1609 0.03102* (0.0414)	2.1233 0.03102* (0.0051)	2.135 0.0036* (0.0051)	2.109 0.1029* (0.1216)
Model	Period Actual Values if Available	1988 :I	II	III	IV
		1.8661	1.7756	1.8493	1.9339
SR (1)		2.5626 0.3172* (1.0123)	2.6653 0.4062* (1.1188)	-	-
SR (2)		2.3719 0.2399* (0.7655)	2.2783 0.2493* (0.6866)	-	-
SR (3)		2.1057 0.05178* (0.4049)	2.1356 0.00466* (0.0231)	2.1063 0.0614* (0.2554)	2.1397 0.1735* (0.5295)
SR (4)		2.1197 0.005* (0.039)	2.1261 0.062* (0.307)	2.9818 0.114* (0.474)	2.1476 0.249* (0.762)
ARIMA (1,1,1) linear		1.7926 0.002* (0.0017)	1.774 -	1.755 -	1.726 -
ARIMA (1,1,1) log		1.816 0.036* (0.0135)	1.7998 -	1.784 -	1.769 -
VAR		2.1229 0.0228* (0.0332)	2.117 0.04636* (0.0596)	2.151 -	2.1429 -
Model	Period Actual Values if Available	1989 : I	II	III	IV
		1.9242	1.6281	1.5969	-

SR (1)

Table 2 contd...

Model	Period Actual Values if Available	1989 :I 1.9242	II 1.6281	III 1.5969	IV -
SR (2)		-	-	-	-
SR (3)		2.1362 0.1691* (0.4866)	2.1327 0.1496* (0.4566)	2.1293 0.2142* (0.5312)	2.1258
SR (4)		2.0409 0.199* (0.575)	1.9903 0.186* (0.568)	2.1477 0.249* (0.618)	2.1429
ARIMA (1,1,1) linear		1.718	1.699	1.680	1.661
ARIMA (1,1,1) log		1.753	1.738	1.723	1.693
VAR		2.1861	2.1864	2.2397	2.2452

The forecasts, Theil's, U_i () RMSE of Dollar per Sterling Rate

TABLE 3

Model	Period Actual Values if Available	1984 : I 1.4346	II 1.3967	III 1.2977	IV 1.2162
SR (1)		1.4765* 0.0241* (0.057)	1.431* 0.124* (0.251)	1.469* 0.005* (0.0089)	1.2101* 0.348* (0.538)
SR (2)		1.657 0.2002* (0.475)	1.706 0.226* (0.456)	1.626 0.031* (0.456)	1.254 0.283* (0.055)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		1.681 0.5035* (0.3751)	1.677 0.5473* (0.4523)	1.6728 0.592* (0.5491)	1.6685 0.5126* (0.4024)
ARIMA (1,1,1) log		1.6956 0.577* (0.262)	1.691 0.625* (0.324)	1.6864 0.674* (0.408)	1.6819 0.588* (0.285)
VAR					
Model	Period Actual Values if Available	1985 : I 1.1152	II 1.2576	III 1.3759	IV 1.4367
SR (1)		1.579 0.210* (0.399)	1.552 0.076* (0.174)	1.484 0.021* (0.053)	1.467 0.022* (0.057)
SR (2)		1.48 0.1703* (0.4383)	1.491 0.0486* (0.324)	1.445 0.0157* (0.112)	1.459 0.045* (0.04)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1)		1.664	1.660	1.6558	1.6515

Table 3 contd...

Model	Period Actual Values if Available	1985 :I	II	III	IV
		1.1152	1.2576	1.3759	1.4367
ARIMA (1,1,1) linear		0.4197* (0.2799)	0.3545* (0.2148)	0.3435* (0.2069)	0.3435* (0.2069)
ARIMA (1,1,1) log		1.677 0.488* (0.193)	1.673 0.417* (0.147)	1.668 0.4049* (0.1414)	1.664 0.3049* (0.0924)
VAR		1.3967 0.0405* (0.0401)	1.3608 0.0263* (0.0302)	1.3405 0.6371* (0.0493)	1.3203 0.0647* (0.0935)
Model	Period Actual Values if Available	1986 :I	II	III	IV
		1.4404	1.5087	1.4895	1.4292
SR (1)		1.473 0.097* (0.281)	1.369 0.128* (0.281)	1.310 0.0416* (0.359)	1.371 0.162* (0.105)
SR (2)		1.377 0.0663* (0.115)	1.412 0.142* (0.193)	1.293 0.142* (0.397)	1.393 0.025* (0.065)
SR (3)		1.669 0.055* (0.175)	1.572 0.102* (0.296)	1.515 0.102* (0.275)	1.589 0.109* (0.275)
SR (4)		1.657 0.206* (0.471)	1.650 0.167* (0.424)	1.632 0.140* (0.359)	1.681 0.089* (0.260)
ARIMA (1,1,1) linear		1.647 0.252* (0.134)	1.643 0.269* (0.149)	1.639 0.335* (0.205)	1.635 0.177* (0.089)
ARIMA (1,1,1) log		1.659 0.325* (0.103)	1.655 0.395* (0.141)	1.65 0.223* (0.063)	1.645 0.016* (0.004)
VAR		1.313 0.6944*	1.304 0.0414*	1.308 0.0172*	1.312 0.00016*

Table 3 contd...

Model	Period Actual Values if Available	1986 I	II	III	IV
		1.4404	1.5087	1.4895	1.4294
VAR		(0.137)	(0.0669)	(0.0269)	(0.00024)
Model	Period	1987 :I	II	III	IV
		1.5417	1.6427	1.6166	1.7547
SR (1)		1.312 0.267* (0.501)	1.257 0.259* (1.032)	1.248 0.374* (0.942)	1.208 0.419* (1.935)
SR (2)		1.276 0.189* (0.586)	1.306 0.229* (0.884)	1.225 0.277* (1.006)	1.234 0.352* (1.0243)
SR (3)		1.532 0.094* (0.224)	1.499 0.186* (0.377)	1.506 0.0515* (0.092)	1.483 0.439* (0.680)
SR (4)		1.614 0.091* (0.255)	1.587 0.162* (0.407)	1.565 0.046* (0.143)	1.563 0.035* (0.134)
ARIMA (1,1,1) linear		1.631 0.042* (0.0167)	1.626 0.0121* (0.005)	1.622 0.476* (0.137)	1.618 0.746* (0.183)
ARIMA (1,1,1) log		1.641 0.042* (0.009)	1.637 - -	1.632 0.493* (0.049)	1.628 0.789* (0.101)
VAR		1.324 0.0139* (0.0238)	1.330 0.00062* (0.0013)	1.343 0.057* (0.112)	1.349 0.0091* (0.0243)
Model	Period	1988 :I	II	III	IV
		1.7967	1.8429	1.6955	1.7904
SR (1)		1.182 0.473* (2.471)	1.483 0.473* (3.282)	1.231 0.321* (1.409)	1.269 0.344* (1.988)

Table 3 contd...

Model	Period Actual Values if Available	1988 :I	II	III	IV
		1.7967	1.8429	1.6955	1.7904
SR (2)		1.165 0.434* (2.559)	1.186 0.441* (3.060)	1.115 0.419* (1.845)	1.109 0.479* (2.769)
SR (3)		1.437 0.0334* (0.635)	1.459 0.191* (0.438)	1.564 0.139* (0.354)	1.605 1.147* (0.377)
SR (4)		1.5213 0.032* (0.118)	1.5318 0.116* (0.599)	1.5246 0.166* (0.982)	1.5468 0.185* (1.283)
ARIMA (1,1,1) linear		1.6133 1.171* (0.234)	1.609 0.261* (0.091)	1.605 0.753* (0.189)	1.606 0.187* (0.187)
ARIMA (1,1,1) log		1.624 1.258* (0.129)	1.619 0.262* (0.049)	1.615 0.804* (0.106)	1.610 0.769* (0.104)
VAR		1.356 0.0019* (0.006)	1.351 0.075* (0.262)	1.346 0.025* (0.058)	1.329 0.039* (0.118)
Model	Period Actual Values if Available	1989 :I	II	III	IV
		1.783	1.6281	-	-
SR (1)		1.279 0.333* (1.878)	1.243 0.270* (1.008)	-	-
SR (2)		1.054 0.526* (2.970)	0.893 0.600* (2.24)	-	-
SR (3)		1.5969 0.0411* (0.119)	1.541 0.0172* (0.6481)	1.473 0.106* (0.267)	1.4574

Table 3 Contd...

Model	Period Actual Values if Available	1989 :I 1.783	II 1.6281	III	IV
SR (4)		1.4853	1.3544	1.5184	1.52
		0.106*	0.146*	0.183*	-
		(0.467)	(0.846)	(1.0313)	
ARIMA (1,1,1) linear		1.596	1.592	1.588	1.584
		0.087*	-	-	-
		(0.036)			
ARIMA (1,1,1) log		1.606	1.602	1.597	1.593
		0.072*	-	-	-
		(0.0163)			
VAR		1.307	1.269	-	-
		0.037*	-	-	-
		(0.106)			

The Forecasts, * Theil's U, () RMSE Of Swiss Franc per Dollar Rate

TABLE 4

Model	Period	1984 :I	II	III	IV
	Actual Values if Available	2.1975	2.2459	2.4409	2.5145
SR (1)		1.9644 0.1121* (0.58101)	1.9541 0.1392* (0.81301)	1.9446 0.2273* (2.5859)	1.9193 0.2701* (4.6409)
SR (2)		2.1165 0.03755* (0.1946)	2.1102 0.06235* (0.36424)	2.0537 0.1727* (1.96484)	2.1414 0.16062* (2.7595)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		2.1254 0.3372 (0.1364)	2.1094 1.6567* (0.3474)	2.0935 3.2101* (0.4369)	2.0775 6.6097* (0.694)
ARIMA (1,1,1) log		2.093 0.4705* (0.07795)	2.077 2.0435* (0.1684)	2.063 3.8955* (0.2053)	2.048 7.8279* (0.3041)
VAR					
Model	Period	1985 :I	II	III	IV
	Actual Values if Available	2.7556	2.5926	2.3463	2.134
SR (1)		2.002 0.3195* (0.5779)	1.9711 0.2741* (9.9241)	1.9765 0.1715* (1.3457)	1.8579 0.1385* (0.6233)
SR (2)		2.0967 0.27329* (8.1932)	2.1158 0.20321* (7.3578)	2.1237 0.09966* (0.78203)	2.03534 0.04733* (0.21296)
SR (3)		-	-	-	-
SR (4)		-	-	-	-

Table 4 contd...

Model	Period Actual Values if Available	1985 :I	II	III	IV
		2.7556	2.5926	2.3463	2.134
ARIMA (1,1,1) linear		2.0616 9.4304* (0.54696)	2.0456 1.0404* (0.31661)	2.0297 0.23278* (0.12025)	2.0138 0.03059* (0.02059)
ARIMA (1,1,1) log		2.03302 11.3152* (0.2503)	2.01842 1.2935* (0.1577)	2.0039 0.3234* (0.0701)	1.98953 0.003396 (0.0009955)
VAR		2.0804 0.2624* (2.9028)	2.04924 0.1969* (2.7127)	2.0177 0.0589* (0.1846)	1.9838 0.04719* (0.0886)
Model	Period Actual Values if Available	1986 :I	II	III	IV
		1.9772	1.8674	1.6868	1.6643
SR (1)		1.9647 0.0063* (0.0212)	1.8589 0.0046* (0.0129)	1.8111 0.0711 (0.1554)	1.7822 0.0685* (0.1454)
SR (2)		2.1631 0.0899* (0.301)	2.074 0.105* (0.295)	2.077 0.208* (0.455)	2.14 0.252* (0.534)
SR (3)		1.9299 0.0172* (10.5012)	1.8355 0.0651* (0.4576)	1.8002 0.0379* (0.7502)	1.7286 0.123* (0.0811)
SR (4)		1.9015 0.1545* (0.6949)	1.8349 0.0391* (0.1308)	1.8448 0.0175* (0.0492)	1.8659 0.0895* (0.1957)
ARIMA (1,1,1) linear		1.9978 0.1461* (0.1145)	1.9819 0.2896* (0.2791)	1.9859 0.2896* (0.2857)	1.9499 0.2896* (0.3886)
ARIMA (1,1,1) log		1.9752 0.1397* (0.04892)	1.96104 0.3174* (0.1434)	1.94695 0.3216* (0.1497)	1.93297 0.4014* (0.2166)

Table 4 contd...

Model	Period	1986 : I	II	III	IV
	Actual Values if Available	1.9772	1.8674	1.6868	1.6643
VAR		1.9506 0.1186* (0.1724)	1.9164 0.1378* (0.1727)	1.8839 0.2334* (0.2386)	1.85196 0.1121* (0.1120)
Model	Period	1987 : I	II	III	IV
	Actual Values if Available	1.5454	1.4914	1.5254	1.5025
SR (1)		1.8071 0.1564* (0.28701)	1.7986 0.1873* (0.3226)	1.753 0.1390* (0.2492)	1.5354 0.0905* (0.14096)
SR (2)		2.1809 0.345* (0.632)	2.2137 0.395* (0.6802)	2.1094 0.324* (0.581)	1.8407 0.272* (0.424)
SR (3)		1.7482 0.1436* (0.0484)	1.7217 0.0952* (0.1423)	1.6778 0.0419* (0.0805)	1.4626 0.01633* (0.2262)
SR (4)		1.8954 0.1143* (0.2429)	1.9099 0.2042* (0.3746)	1.8392 0.2473* (0.426)	1.6686 0.18707* (0.3352)
ARIMA (1,1,1) linear		1.9340 0.3516* (0.4267)	1.9181 0.3681* (0.3767)	1.9021 0.3348* (0.4837)	1.8862 0.3875* (0.4954)
ARIMA (1,1,1) log		1.9191 0.4259* (0.2449)	1.9053 0.3895* (0.2152)	1.8916 0.4587* (0.29196)	1.878 0.4641* (0.3047)
VAR		1.8232 0.1655* (0.1478)	1.7966 0.1862* (0.15866)	1.7744 0.1549* (0.1356)	1.7554 0.3134* (0.2482)

Table 4 contd...

Model	Period	1988 : I	II	III	IV
	Actual Values if Available	1.3748	1.4182	1.5642	1.4961
SR (1)		1.5058 0.0911* (0.138)	1.5196 0.0690* (0.109)	1.5455 0.012* (0.0226)	1.5098 0.0091* (0.0158)
SR (2)		1.8739 0.3097* (0.4679)	1.9069 0.2968* (0.4693)	1.8639 0.1753* (0.3289)	1.7895 0.17907* (0.3101)
SR (3)		1.3974 0.1436* (0.2473)	1.408 0.0952* (0.1706)	1.4502 0.04195* (0.6536)	1.4302 0.01633* (0.02467)
SR (4)		1.7328 0.1737* (0.2706)	1.7317 0.2314* (0.4956)	1.6859 0.1997* (0.3166)	1.631 0.0749* (0.1406)
ARIMA (1,1,1) linear		1.8702 0.3539* (0.4361)	1.8543 0.2523* (0.2741)	1.8383 0.2826* (0.3263)	1.8224 0.2114* (0.2263)
ARIMA (1,1,1) log		1.8645 0.4259* (0.2664)	1.8511 0.3057* (0.1612)	1.8378 0.3471* (0.1985)	1.8246 0.2642* (0.1367)
VAR		1.7414 0.27601* (0.2139)	1.7311 0.2375* (0.1905)	1.7258 0.1938* (0.17600)	1.7238 0.1604* (0.1372)
Model	Period	1989 : I	II	III	IV
	Actual Values if Available	1.5801	1.6967	1.6606	1.75861
SR (1)		1.6281 0.0299* (0.0572)	1.6704 0.0156* (0.0346)	-	-
SR (2)		1.9059 0.1875* (0.3587)	1.9227 0.125* (0.2769)	-	-

Table 4 contd....

Model	Period Actual Values if Available	1989 : I	II	III	IV
-SR (3)		1.5397 0.0075* (0.01193)	1.5473 0.0756* (0.14189)	1.5355 0.0452* (0.07806)	1.5238 -
SR (4)		1.7089 0.08633* (0.1495)	1.7457 0.0784* (0.1499)	1.6851 0.0284* (0.6298)	1.6762 -
ARIMA (1,1,1) linear		1.8065 0.0983* (0.0938)	1.7905 -	1.7745 -	1.7586 -
ARIMA (1,1,1) log		1.8115 0.1306* (0.0583)	1.7985 -	1.7856 -	1.7600 -
VAR		1.7261 0.0572* (0.0527)	1.7308 0.01229* (0.1269)	1.7386 -	1.7475 -

Model	Period Actual Values if Available	1990 : I	II	III	IV
SR (1)		-	-	-	-
SR (2)		-	-	-	-
SR (3)		1.5122	1.5007	1.4892	1.4779
SR (4)		1.6673	1.6497	1.64101	1.6789
ARIMA (1,1,1) linear		1.7427	1.7267	1.7108	1.6948
ARIMA (1,1,1) log		1.7474	1.7474	1.7348	1.7224
VAR		1.7578	1.76803	1.7783	1.7873

The Forecast, * Theil's U, () RMSE of Yen per Dollar Rate

TABLE 5

Model	Period Actual Values if Available	1984 : I 231.01	II 229.61	III 243.46	IV 246.02
SR (1)		218.304	220.102	218.124	212.103
		0.0566*	0.0423*	0.0423*	0.148*
		(0.222)	(0.162)	(0.544)	(0.775)
SR (2)		221.37	212.65	214.15	225.12
		0.043*	0.077*	0.128*	0.89*
		(0.168)	(0.294)	(0.635)	(0.464)
SR (3)		-	-	-	-
SR (4)		-	-	-	-
ARIMA (1,1,1) linear		208.465	205.463	202.46	199.458
		0.3265*	0.6821*	0.6821*	1.3342*
		(24.1475)	(40.9997)	(46.5621)	(61.2244)
ARIMA (1,1,1) log		193.586	190.892	188.239	185.619
		1.1658*	1.3402*	2.0869*	1.7188*
		(0.2572)	(0.2817)	(0.3420)	(0.3287)
VAR					
Model	Period Actual Values if Available if Available	85: I 257.68	II 257.73	III 238.64	IV 207.09
SR (1)		209.364	210.971	215.88	208.27
		0.208*	0.173*	0.100*	0.006*
		(1.429)	(1.006)	(0.452)	(0.016)
SR (2)		231.13	226.35	210.601	213.65
		0.109*	0.102*	0.125*	0.031*
		(0.748)	(0.593)	(0.563)	(0.086)
SR (3)		-	-	-	-

Table 5 contd ...

Model	Period	1985 :I	II	III	IV
	Actual Values if Available	257.68	257.73	238.64	207.09
SR (4)		-	-	-	-
ARIMA (1,1,1)		196.456	193.453	190.451	187.449
linear		0.1084*	0.7422*	0.7422*	0.0297*
		(52.277)	(48.189)	(19.6412)	(3.4332)
ARIMA (1,1,1)		183.037	180.491	177.979	175.505
log		1.2186*	0.4326*	0.1712*	0.00533
		(0.2933)	(0.1655)	(0.08215)	(0.00309)
VAR		183.335	188.782	204.221	185.6
		57.764*	47.946*	36.226* ³	32.0798*
		(1.223)	(0.8084)	(0.3988)	(0.2914)
Model	Period	1986 :I	II	III	IV
	Actual Values if Available	187.88	170.13	155.77	160.29
SR (1)		201.692	197.173	199.583	185.39
		0.0709*	0.1475*	0.2478*	0.1455*
		(0.1538)	(0.2633)	(0.3822)	(0.2366)
SR (2)		211.595	205.735	201.888	203.268
		0.119*	0.19*	0.259*	0.238*
		(0.258)	(0.339)	(0.399)	(0.383)
SR (3)		183.262	177.877	179.95	165.369
		0.227*	0.286*	0.249*	0.177*
		(1.183)	(1.969)	(1.446)	(0.790)
SR (4)		170.43	204.42	166.767	169.956
		0.301*	0.081*	0.097*	0.184*
		(1.358)	(0.223)	(0.211)	(0.328)
ARIMA (1,1,1)		184.446	181.444	178.442	175.44
linear		0.085*	0.1534*	0.1057*	0.1281*
		(11.314)	(22.672)	(15.1496)	(19.2673)

Table 5 contd...

Model	Period	1986 : I	II	III	IV
	Actual Values if Available	187.88	170.13	155.77	160.29
ARIMA (1,1,1)		170.656	168.282	165.941	163.634
log		0.0543*	0.0966*	0.163*	0.1098*
		(0.0347)	(0.0661)	(0.1231)	(0.0797)
VAR		162.797	178.069	193.001	164.761
		25.5017*	5.833*	10.8278*	10.8278*
		(0.1995)	(0.04102)	(0.0787)	(0.02998)
Model	Period	1987 :I	II	III	IV
	Actual Values if Available	153.17	142.67	146.92	135.79
SR (1)		185.252	182.048	184.677	179.582
		0.1793*	0.2437*	0.2287*	0.2795*
		(0.2695)	(0.3309)	(0.3235)	(0.3557)
SR (2)		204.346	201.888	195.323	201.816
		0.288*	0.347*	0.285*	0.396*
		(0.433)	(0.471)	(0.403)	(0.504)
SR (3)		161.919	160.883	162.818	157.758
		0.073*	0.025*	0.045*	0.144*
		(0.199)	(0.054)	(0.079)	(0.222)
SR (4)		155.847	170.217	152.149	167.078
		0.0678*	0.0586*	0.0173*	0.1765*
		(0.105)	(0.094)	(0.026)	(0.239)
ARIMA (1,1,1)		172.437	169.435	166.433	163.43
linear		0.1663*	0.1246*	0.1647*	0.1847*
		(26.765)	(19.5127)	(27.6404)	(32.4281)
ARIMA (1,1,1)		161.357	159.112	156.899	154.717
log		0.1796*	0.2195*		0.2203*
		(0.1444)	(0.1896)		(0.1944)
VAR		145.855	172.669	182.82	144.4
		4.3418*	22.9579*	30.673*	45.0214*
		(0.02998)	(0.1478)	(0.2031)	(0.2776)

Table 5 contd...

Model	Period	1988 :I	II	III	IV
	Actual Values if Available	128	125.61	133.71	125.28
SR (1)		176.893	178.085	182.209	199.583
		0.3235*	0.3491*	0.3095*	0.3236*
		(0.3829)	(0.4041)	(0.3863)	(0.3735)
SR (2)		211.883	203.142	193.604	206.351
		0.504*	0.4807*	0.3701*	0.499*
		(0.5965)	(0.5566)	(0.4619)	(0.5759)
SR (3)		154.87	156.027	159.462	151.072
		0.0312*	0.0556*	0.1201*	0.1027*
		(0.0503)	(0.0835)	(0.1632)	(0.1453)
SR (4)		167.562	166.277	153.497	184.341
		0.0349*	0.2078*	0.2693*	0.2805*
		(0.0495)	(0.2639)	(0.3188)	(0.3247)
ARIMA (1,1,1) linear		160.428	157.426	154.424	151.421
		0.1788*	0.1219*	0.1466*	0.11403
		(0.31816)	(20.7136)	(26.1412)	(19.9689)
ARIMA (1,1,1) log		154.717	152.565	150.442	148.349
		0.2203*	0.1438*	0.1909*	0.1512*
		(0.1944)	(0.1179)	(0.16902)	(0.13002)
VAR		133.776	171.313	171.82	124.907
		47.716	47.9632*	39.8121*	32.9379*
		(0.2807)	(0.2783)	(0.2424)	(0.1908)
Model	Period	1989 :I	II	III	IV
	Actual Values if Available	128.45	138.07	-	-
SR (1)		170.556	180.007	-	-
		0.2835*	0.2652*		
		(0.3369)	(0.3448)		
SR (2)		215.753	210.937		
		0.5185*	0.4238*		
		(0.6164)	(0.551)		

FORECASTING OF SOME MAJOR EXCHANGE RATES

Table 5 contd...

Model	Period	1989 : I	II	III	IV
	Actual Values if Available	128.45	138.07		
SR (3)		148.23 0.1499* (0.1908)	158.624 0.1906* (0.2255)	152.44 - (0.2511)	150.48 -
SR (4)		162.636 0.138* (0.1722)	156.831 0.3862* (0.4458)	171.008 0.2359* (0.2805)	152.078 -
ARIMA (1,1,1) linear		148.419 0.04439* (7.3467)	145.417 -	142.414 -	139.412 -
ARIMA (1,1,1) log		146.285 0.0556* (0.0438)	144.252 -	142.245 -	140.266 -
VAR		127.169 24.7758* (0.1462)	172.19 12.8191* (0.08017)	157.967 -	105.737 -

Footnotes

1. The results of ARIMA and VAR from 1990 are not presented in the table due to the pressure on space. They are available from authors on request.
2. The detail results of regression and VAR-models are not presented here. They are available from the authors on request. The same is true for all currencies.
3. The table of regression coefficients is not enclosed. Interested readers may write to the authors.
4. 'Q' statistics are not reported for various ARIMA family models, here. Interested readers can get them from the authors.

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Composition of Imports, Expenditure Switching and Trade Policy

M. K. Datar

The open economy framework is increasingly used for theoretical analysis of macro economic problems as also for discussions regarding policy analysis and policy reforms. The policy literature has grown largely in the context of developing countries; their problems and experiences. While the policy literature has been influenced by developments in theoretical literature, the latter largely remains at an abstract level.

The theoretical literature typically considers a small open economy as the subject matter of enquiry. The smallness is defined in terms of price taking behaviour. Small open economy would be a price taker when it sells as well as when it purchases in international markets. Distinction between tradeable/non-tradeable goods is an essential feature of open economy framework. The possibility that producers of specialised primary commodities may not be, at times, price takers in export markets is recognised. In such cases the line of distinction is drawn between national/international goods and the two sector framework is preserved. The framework is used for analysing macro problems like determination of output, wages, price and effects of macro economic shocks $1/$. While the 'structuralist' tradition has concentrated for long on the difficulties developing countries would face in the given structure of 'international transactions, Taylor (1984) has recently presented a macro-economic framework which incorporates some distinguishing features of developing countries. That in an interdependent world an open economy framework is more appropriate to analyse macro economic problems than a closed economy framework can hardly be contested. But it is felt that the approach of incorporating special features of developing countries in the analytical frame would be useful.

This paper highlights some special features of large developing economies that have implications for policy analysis in an open economy framework. It is argued here that the size of an economy would be linked to its degree of openness. For large countries the dependence on trade would be of a different type which would be reflected in commodity composition of tradeables in general and importables in particular. The typical commodity structure of importables has certain implications for use of expenditure switching policies and sequencing of export

liberalisation and import liberalisation 2/.

The paper is divided in 3 sections. Section 1 considers the nature of trade dependence in large and small economies. Section 2 analyses the significance of the commodity structure of importables for BOP situation. It also considers the implications for use of expenditure switching policies and for sequencing of trade liberalisation policies. Section 3 elucidates the arguments in Sections 1 and 2 with recent Indian experiences.

Section 1

The open economy framework of macro economic analysis currently in vogue is well suited for 'small' countries. The smallness is relevant in the context of price taking behaviour in international markets and this aspect is well recognised. It is relevant for small economies in one more sense; i.e., in terms of their absolute size. Ability to manage income generation process within their borders differ significantly among different economies. This could be measured from share of exports/imports to its national income. It is not even remotely suggested that the difference in exports/GDP ratio among different economies are 'natural'. Nor is there any intention to deny the influence of trade policies on the level of this ratio. In fact, it would have been ideal to construct a measure of the openness of an economy which is based on policy induced restrictions on external trade and investment. This is quite a difficult task and would need a separate exercise. The only contention here is that the observed range of exports to GDP ratio is considerably wide and would indicate the relative size of tradeable/non-tradeable sectors. The relative sizes of tradeable/non-tradeable sectors would indicate different degrees of integration with international economies. It is contended that the relative size of tradeable sector would, to some extent, depend on absolute size of a country. A small country cannot hope to be self sufficient because of its narrow resource base and/or small size of domestic market. A large sized country, on the other hand, with its diversified resource endowments would have more opportunities to use its resources domestically with marginal inputs from and sales to international markets. These differences in relative size of traded/non-traded sector and the implicit different degrees of integration with international markets would have macro economic implications.

The World Bank Development Report 1989 presents data on the share of exports of commodities and non-factor services to GDP for 100 countries whose population is more than one million. The range of this ratio is quite wide i.e., from 4% to 124% in 1987. Modal group was the range 20% - 40% which consisted 44 countries. For 10 countries this ratio was less than 10%, and for 30 countries the ratio ranged between 10% -20%. In the case of remaining 16 countries the ratio exceeded 40%.

The exports to GDP ratio appears to have negative relationship with population and geographical area of a country two important measures of size of a country. Simple correlation co-efficient between export/GDP ratio and geographical area was 0.24. The correlation co-efficient between export/GDP ratio and population was found to be -0.20. These simple correlation co-efficient were not significant statistically. Simple regression equations were estimated with population/area as independent variable and exports/

GDP ratio as dependent variable.

$$\text{EXP/GDP} = 28.44 - 0.002 \text{ Area} \quad R = 0.06 \quad (1)$$

(2.46)

$$\text{EXP/GDP} = 27.47 - 0.025 \text{ Pop} \quad R = 0.04 \quad (2)$$

(1.98)

(figures in brackets denote 't' ratios)

Both these equations do not fare well on the basis of R but it is noteworthy that the B co-efficients are significant in these equations. While a more rigorous exercise in specification and estimation of a regression equation to explain inter country differences in exports/GDP ratio would be necessary so as to correctly gauge the effect of size variables, the above mentioned results may at least be considered as indicative i.e., differences in absolute size of an economy are important in explaining degree of its openness. These differences in the degree of openness would be a relevant factor in macro economic analysis of open economies. It is noteworthy that Harberger (1988) has defined smallness of an economy in terms of absolute size of the population in the context of policy making and economic policy in small developing countries 3/.

It is argued here that for a 'small' country (which would generally indicate larger degree of openness), given the small size of its domestic market, international trade is necessary to get the benefits of large scale production. International trade is necessary also because exports enable it to acquire products which it could not (would not) be producing. Such a country is certainly small in the sense that it would have a price taker role in international market. More over, given the sizeable degree of openness, as reflected in higher level of exports/GDP ratio, would mean international factors would have an equal, if not more, influence on macro stability in relation to national factors. For a large country, the resource endowments are diversified and with its wider human resources it would be in a position to utilise them domestically. Size of domestic market is large or potentially so in such economies. It need not therefore, have to look out for markets in other countries. It however would depend on imports for supply of crucial inputs (viz., oil) or intermediate goods and on a wider range of capital goods and technical knowhow if it is a developing country. Its access to imported goods and technology would be limited by its export earnings. Though external borrowing would weaken the links between export earnings and capacity to import, at least over short periods of time, the strategy to import through borrowing cannot be sustained unless export earning are raised sooner than later.

Size of tradeable sector being relatively small, importance of domestic factors for macro economic stability would be paramount. But importance of tradeables and particularly importables is also crucial because imports of capital goods/technology would influence investment and therefore future output. When intermediate goods are imported current output levels too would be conditional on availability of imports.

Predominance of non-traded/national sector has implications for performance of tradeable sector too. Natural shocks, like

crop failure would necessitate large scale imports of foodgrains, when a large country enters international foodgrains or other commodity markets or is expected to enter, prices tend to harden. Under the influence of similar shocks capacity to export agricultural products would be severely limited. The expenditure switching policies alone are unlikely to be successful unless these are supplemented by expenditure changing policies. The non-tradeables like transport, power would have a crucial bearing on performance of tradeable sector. Thus given the relative sizes of national/international sectors, expenditure switching and expenditure changing policies would hardly become substitutes. The open economy literature generally treats expenditure switching policies superior to expenditure reducing policies. In large developing economies relatively smaller size of tradeable sector would put a limit to potential macro effects of expenditure switching policies. In fact, for expenditure switching policies to become effective it would be necessary that these are mixed with appropriate expenditure changing policies.

Moreover the efficiency of input use in non-traded sector would influence the competitiveness of export sector as non-traded goods would be used in export production. In a small open economy, on the other hand, relatively large size of traded goods sector would make tradeable and non-tradeable sector equally important in the context of macroeconomic equilibrium.

Section II

The nature of commodities imported/exported by developing countries and its implications on growth and stability have been widely acknowledged. The LDC exports are likely to have low Engle elasticities in developed country markets while their imports would have high Engle elasticities. Primary commodity exporting LDCs (except oil exporting countries) would experience fluctuations in their export earnings due to fluctuations in export prices. Moreover in view of the increasing use of synthetic substitutes avenues for market expansion are low.

In the case of a Large Developing Country, the exports are likely to be relatively diversified and hence instability resulting from commodity concentration may not be very much significant. But the low Engle elasticities of exported goods in foreign markets and high Engle elasticities of imported goods in the domestic market is very relevant.

The price sensitiveness of demand for exports and imports is also likely to be different. While the price elasticity of export demand would depend on factors like availability of substitutes, the type of commodities (perishable or otherwise) etc., export demand is in general, likely to be more sensitive to price changes. This is to be expected in view of the price taker role of exporters in international markets. The observed elasticities could be lower partly because the supply of exports in several countries in general and for primary commodities in particular is unlikely to be price elastic. Nevertheless, price elasticity of export demand is likely to be more than the price elasticity of demand for imports. Price elasticity of import demand is likely to be low, for several reasons. Some of these are :

(a) Imports of crucial intermediates like petroleum products in efforts to reduce demand through price increases are unlikely to succeed.

(b) Imports of capital goods/technology : These may not always fall under (a) but at times, in absence of domestic substitutes and the restrictive market for technologies/embodied machines demand would be price inelastic. Alternatively, the profitability of these improved technologies would be so high that increase in prices would not alter the decision to choose foreign machines.

(c) Contingent imports : These goods would be imported to meet shortfalls in domestic output, (say) foodgrains, edible oils etc. Both the quantity of such imports and its timing would be determined by non-price factors rendering thereby, aggregate imports less sensitive to prices.

(d) Consumer goods : Large developing countries have potentially large markets for consumer goods from developed countries. Certain range of goods may not be domestically available or foreign goods would be superior in quality and would also have, net of duties, sizeable price advantage. Large scale unauthorised imports of such goods in many developing countries would indicate the presence of all these factors. It is for the same reasons import of consumer goods are banned or subject to quota restrictions in several developing countries. As income levels increase the demand for such goods is likely to increase further.

(e) Intermediate goods : Either domestic non-availability or insufficient availability or price/quality advantages would render imports of intermediates profitable. These are necessary to meet domestic demand for goods manufactured from these intermediates.

The differences in elasticities of domestic demand for imports and foreign demand for exports has implications for efficacy of expenditure switching policies. Adoption of exchange rate policies so as to avoid over-valuation of domestic currency is a widely prescribed policy in this regard. Exchange rate changes are expected to switch domestic expenditure to import substitute goods away from imported goods and both domestic and foreign expenditures on exportables. The expenditure switching policies could help increase exports and reduce imports. But if price elasticity of exports is large i.e. more than price elasticity of imports and not necessarily (1) policy of devaluation could be successful in promoting exports but its success in reducing imports would be limited if at all. If other policies are not geared to moderate imports and the initial situation is of trade deficit, it would be difficult to meet the BOP difficulties by means of expenditure switching policies alone. In the case of developing countries trade deficit would be major factor in current account balance. In short/medium term external borrowings, either through official/multilateral agencies or commercial sources, would enable financing of current account deficit while expenditure switching policies are pursued. But over time the interest payment and debt repayment obligations would render the current account balance more critical. There would therefore be a role for trade policy or import policy

which would be moderate the increase in imports prioritize import as of essential commodities and discourage competitive imports. The effective policy need not be through tariffs, because it may not be effective in moderating the quantum of imports. Quota-based system which is flexible enough to change with improvements in exports could be one alternative. If it is a question of liberalisation of protected trade regime it could be phased over different segments of industry over time. The pace at which export promotion strategy becomes effective could be one consideration to determine the pace of import liberalisation. Industrial policy (which sectors are to be promoted/modernised etc.) would perhaps help in sequencing of import liberalisation over different sectors of industry.

Exports based on imported intermediate/capital goods is another factor which limit the gains from expenditure switching policies. If the import content of exports increases considerably the beneficial effects of devaluation on BOP shrink. When a policy of continuously adjusted peg is followed stockpiling of imported intermediates would be profitable because for delayed sale of processed final goods could fetch a still favourable exchange rate.

Many of the above mentioned factors, which makes imports less responsive to price changes, may be seen as inevitable ill effects of protective trade regimes pursued by many developing countries. Policies which limit internal as well as external competition would create sheltered markets wherein there are no incentives for cost reduction, product improvement etc. The suggested policies in an open economy framework would be to revamp industrial and trade policies which have sheltered the domestic producers for long and change the environment which breeds inefficiency in resource use, negligence of product development etc.

Certain types of import controls can be justified in the context of developing countries viz., restrictions on import of consumer goods which would be necessary to maintain saving/investment levels. Even if the need for policy reforms is accepted sequencing of trade policy particularly export policies and import policies is an important aspect of any liberalisation package. Given the composition of imports, it would be desirable to start correcting what is termed as the anti-export bias by making export production more profitable. Stress on higher export orientation would be the first step. As exports begin to respond to these policies the second stage viz., import policy reforms could be initiated. Success on export policy would enable to finance the necessary increase in imports which could be an inevitable, or even desirable, outcome of liberalisation of import controls.

Timing of the liberalisation measures is also important. Krugman and Taylor (1978) have stressed the importance of initial trade balance in the context of devaluation strategy. It is argued that balanced trade account would enhance the chances of success. Timing is also particularly relevant in the context of strategy of export promotion. If the strategy of export promotion is through the route of import liberalisation, the heightened importance of initial trade balance is very clear. In this context the initial Saving - Investment gap is also important as any imbalance between domestic saving and domestic investment would be reflected in BOP situation.

Liberalisation of imports of goods and technologies could be pursued to modernise domestic producer units, to make them cost effective and competitive which would ultimately help increase exports. If the imports are non-competitive (i.e., for which no domestic substitutes are available) the benefits are very clear. But even when these are competitive (i.e., domestic substitutes are available) it is argued that liberalisation of imports will force domestic producers to be competitive. Large scale injection of capital goods are seen as sure way to improve the performance of non-tradeable sectors which are also crucially important for export production. While several countries have adopted policy of liberalisation of imports as a strategy of export promotion, the timing and sequence of the different measure cannot be overlooked. Japanese experience would indicate that (a) the state of Government budget is important. Surplus on current account increases Government's ability to provide fiscal incentives for particular sectors (b) low inflation makes the task of exchange rate management easier (c) export profitability could be maintained not through liberalisation of imports but through exchange rate adjustments and fiscal incentives. Decontrol of imports did not occur till well after success of export promotion measures. 4/.

In the context of large developing countries where imports are largely 'uncompetitive', strategy of export promotion through import liberalisation needs to be well structured and phased in a planned manner. Policy of import liberalisation, unless it is phased sectorally and linked with industrial policy, would soon lead to a hardening of Balance of Payments situation. This could happen if industrial policy favours wider use of imported intermediate/capital goods through choice regarding sectors/products/production techniques. Industrial policy in such a situation would stimulate imports; if this effective stronger than import reducing effect of expenditure switching policy the overall effect could lead to a sustained increase in imports which would bring BOP under strains.

It may be objected that the 'elasticity approach' is narrow as it concentrates on commodity trade alone and ignores the other element of current account and the capital account of Balance of Payments. Expenditure switching policies would affect other segments of BOP as well besides their effects on commodities trade. In large developing countries balance of trade will have sizeable influence on current account of the BOP, other elements in current account viz., insurance, transportation would depend primarily of institutional/infrastructural factors. Similarly receipts from travels and private transfers are largely influenced by non-price factors. Factors like net investment income would reflect cumulative effect of past current account positions in the past which itself would reflect the cumulative effect of overall BOP. As regards capital account, while the short term capital flows would be sensitive to interest rate differential and expected changes in exchange rates, the influence of exchange rates may, in practice, be minimised by allowing foreign currency denominated assets (viz., bank deposits). Official and multilateral flows too may be related to exchange rate policies in that such lending, could be conditional on 'appropriate' policy stance. Private long term capital flow would however be linked not only to expenditure switching policies but to the entire gamut of policy which will influence private profitability. Our contention, however, is that the capital account of BOP could only provide temporary respite

from difficulties on current and trade account. The imbalance could, therefore, be corrected only through trade and current account. Primacy of trade/current account stems from the fact of underdevelopment. Only the leading country can attract surplus funds world over and finance its deficit for a sustainable long period. Moreover, the disequilibrating forces would more often than not emanate from trade account. These, in the case of large developing countries would, more often, be internal. Natural shocks would necessitate large imports of food articles and deceleration in industrial sector would result in slow down of industry related imports; while the effects of such factors would primarily be on current account it would also set the pace for necessary changes on the capital account.

The important arguments may be recapulated :

- (a) Large sized countries are likely to exhibit a lower degree of openness than smaller sized countries.
- (b) Sizeable portion of developing country imports would be non-competitive in the sense that domestic substitutes for them would not be available.
- (c) Price elasticity of developing country exports would be more than the price elasticity of imports. Expenditure switching policies are likely to be successful in promoting exports rather than moderating imports.
- (d) Initial trade balance would be crucial for success of devaluation strategy.
- (e) Strategy of outward orientation could begin from export promotion and the import liberalisation stage could be initiated after the anticipated beneficial effects of export promotion strategy are stabilised.
- (f) Export promotion through liberalisation of imports could be phased over sectors and linked with industrial policy.

These arguments could be seen in the light of recent Indian experiences.

Section 3

The degree of openness of the Indian economy is low; in 1970-71 exports were 3.8% of GNP, this ratio rose to 5.5% in 1980-81 and further to 5.9% in 1988-89. The increase in the degree of openness is however small. The increase in imports has been faster but import GNP ratio in 1988-89 would be about 8.1% which is still lower in relation to other countries. Though imports are small relative to national income their importance becomes clear from its commodity composition.

Composition of Imports

Table 1 below highlights certain aspects of commodity composition in recent years. Cereals, edible oil, petroleum oil and lubricants (POL), fertilisers and capital goods accounted for 53.6% of total imports in 1970-71. These categories formed 52.7% of imports in 1987-88. While the relative importance of various components depict different trends, their crucial importance is not clear from composition of total imports.

Table 1 : Composition of Imports
(% to Total)

Year	Cereals	POL	Fertilise- rs	Capit- al Go- ods	Edible oil	Total (Rs.Cr)
1970-71	13.03	8.35	6.11	24.7	1.4	53.59 (1,634.2)
1975-76	25.50	23.27	10.13	18.37	0.27	77.54 (5,265.2)
1980-81	0.80	41.96	6.51	15.22	5.44	69.93 (12,549.2)
1985-86	0.56	25.38	7.3	21.80	3.73	58.77 (19,657.7)
1987-88	0.14	18.22	2.17	28.05	4.10	52.68 (22,399.0)
1988-89	2.24	15.51	3.29	24.61	2.58	48.23 (28,194.0)

Source : Economic Survey 1988-89. Figures in brackets indicate total imports in Rs. crores

There are year-to-year variations in imports of food, edible oil etc. Table 2 brings this out clearly wherein commodity composition of *incremental* imports is considered.

In most of these years incremental imports in the above mentioned 5 commodities/commodity groups have dominated the incremental imports. Incremental imports are affected primarily by 'shock' elements and the capital goods imports have borne the initial brunt. As a result, capital goods imports have shown low increases in the years when critical imports viz., POL, cereals, fertilisers, edible oils have increased e.g., 1974-75, 1977-78, 1978-79 and 1984-85. On the other hand in the years of decline in these imports capital goods imports have increased at a faster pace e.g., 1976-77, 1982-83, 1986-87, 1987-88. The contribution of capital goods to incremental imports is sizeable and increasing particularly since 1980-81. If the primacy of sensitive imports is accepted it would indicate price insensitivity of aggregate imports.

Effect of Expenditure Switching Policies

Studies on foreign trade sector or foreign trade sector of the studies on macro models of Indian economy have till recently not included exchange rate as an explanatory variable. ^{5/} This is partly because the policy of managed floating was adopted from 1975 onwards. Traditionally, researchers have used terms of trade as an independent variable in export/import functions. Ideally expenditure switching policies are aimed at avoiding distortions of 'true' terms of trade that would result because of under-valued/over-valued exchange rate. It is therefore, difficult to interpret the evidence on effect of terms of trade on imports/exports in the context of expenditure switching policies.

Kannan (1989) while studying the relevance of the monetary approach to BOP for India has also made a comparison with the elasticity approach. His findings regarding elasticities are rather mixed. In merchandise import function exchange rate of the rupee against US was found to be significant and negative. The exchange rate variable fails to enter the merchandise exports functions. It was found that a dummy variable capturing "the incomplete adjustment process" following second oil shock has negative effect in export function and positive effect on import function. The dummy variable would actually have captured the effect of trade policies during the first half of 1980s.

Effectiveness of expenditure policies could be studied through its effect on real exports/imports. Findings of our earlier work indicate that effect of Real Effective Exchange Rate (REER) on imports is not very significant 6/. The effect is significant at 10% level of significance during the later period (1977-78) while it was not significant for a longer period (1969-87). Effect of REER on exports was significant at 5% level of significance in both periods and during the later period, the B coefficient had a larger magnitude. The co-efficient of REER in import function was found to be lower than its coefficient in export function. Thus the exchange rate policy seems to be more effective in regard to exports than its effect on imports. The exchange rate policy become active since later half of 1980s and this is reflected in the results for later period. That the co-efficient of REER in import function remains weakly significant reflects perhaps the effect of simultaneously adopted policy of import liberalisation.

BOP Scenario

Indian experience of adjustment to the first oil shock in early 1970s is widely acclaimed. The higher level of remittances from Indians abroad particularly helped to whither the storm and by 1976-77 India had a small surplus on trade account; with sustained remittances the BOP position turned comfortable. The second oil shock lead to sharp rise in trade deficit and in the years to follow the higher level of trade deficit was generally maintained. Current account deficit as proportion of exports and invisibles touched 17.07% in 1981-82 and declined during 1983-84 (Table 3). From 1984-85 it has increased sharply reaching a peak in 1985-86 and despite declines thereafter the ratio remains at a higher level of 24.5% in 1987-88. Alongwith higher level of trade deficit, decline in net invisibles is partly related to higher outgo as interest payments on FC loans which reflects cumulative effects of past deficits. This effect seems to have become prominent in the later years.

Thus, an effective way to reduce current account deficit could be through management of imports. It is in this context trade policy assumes importance. With the policy of maintaining real exchange rate or allowing a steady depreciation of the rupee and exempting export profits from tax there seems to be little further scope for adopting macro-economic policies for exports promotion.

Trade Policy

The international trade policy was given a new orientation from mid-1980s. Though measures to promote exports in the form of export market development allowance etc., have been in force for quite sometime, from mid-1980s export promotion is sought to

Table 2 : Composition of India's Incremental Imports

YEAR	Incremental Imports (Rs. Crore)	Per cent contribution from					Total (1) to (5)
		capital goods	cereals	edible oils	POL	fertilizers	
		(1)	(2)	(3)	(4)	(5)	
1971-72	190.3	41.36	-42.98	-12.14	30.58	5.99	22.81
1972-73	42.9	158.74	-117.48	36.13	23.08	80.19	180.66
1973-74	1,088.0	11.28	36.06	3.25	32.75	7.45	90.79
1974-75	1,563.0	3.19	18.60	-2.47	38.17	19.56	77.05
1975-76	746.8	32.73	77.53	0.25	9.21	0.17	119.89
1976-77	-191.4	-58.36	248.28	-45.14	-98.07	142.42	189.13
1977-78	946.4	7.29	-78.74	64.56	14.54	8.11	15.76
1978-79	794.1	19.86	14.32	-21.97	17.11	13.88	43.20
1979-80	2,207.5	5.62	1.52	-4.86	71.58	3.04	76.90
1980-81	3,527.4	13.61	-4.80	7.18	56.68	8.57	81.24
1981-82	1,058.4	17.55	23.32	-5.44	-7.28	-11.25	16.90
1982-83	685.1	90.51	3.80	-35.24	63.11	-48.21	73.97
1983-84	1,538.4	39.39	28.29	22.33	-51.33	3.63	42.31
1984-85	1,302.7	-11.86	-43.49	14.86	44.30	70.77	74.58
1985-86	2,523.5	44.29	-5.22	-7.39	-16.63	3.55	18.60
1986-87	543.0	217.66	-11.64	-22.60	-403.81	-121.97	-342.36
1987-88	2,198.4	37.19	-0.65	14.01	58.50	-13.05	96.00
1988-89	5,795.0	11.28	10.32	-3.33	5.02	7.62	30.91

Source : Economic Survey - various issues.

Table 3 : India's Current Account Of Payments

(Rs. Crores)

Year	Balance of Trade	Net invisible income	Current account balance	CA to-mer. exp+invisi.	Net invest. income	Private transfers	BOT/CA
1970-71	-317.7	-13.7	331.4	-17.52	-225.7	123.2	95.87
1971-72	-438.2	36.7	401.5	-19.16	-227.4	162.2	109.14
1972-73	-251	-0.6	-251.6	-10.39	-256.1	154	99.76
1973-74	-378.6	1680	1,301.4	28.25	-262.9	191.3	-29.09
1974-75	-977.2	-332.8	-644.4	-15.80	-165.2	273.7	151.64
1975-76	-566.5	860.7	294.2	5.08	-169.3	527.8	-192.56
1976-77	316.2	1,209.6	1,525.8	20.94	-125.7	738.8	20.72
1977-78	-107.5	1,842.2	1,734.7	21.05	-95.8	1,022.8	-6.20
1978-79	-1,842	2,015.3	173.3	1.99	8.5	1,052.5	-1,062.90
1979-80	-3,374.3	3,139.8	-234.5	-2.18	264.2	1,624.2	1,438.93
1980-81	-5,967.2	4,310.6	-1,656.6	-13.29	483.9	2,257.2	360.21
1981-82	-6,121	3,803.7	-2,317.3	-17.07	339.1	2,220.6	264.14
1982-83	-5,776.1	3,479.7	-2,296.4	-15.07	-282.6	2,526.9	251.53
1983-84	-5,870.8	3,608.4	-2,262.4	-13.26	-543.8	2,774.5	259.49
1984-85	-6,721.1	3,848.5	-2,852.4	-14.12	-946.1	3,101	235.63
1985-86	-9,586	3,630.2	-5,927.3	-30.47	-949.9	2,820.6	161.73
1986-87	-9,353.9	3,523.9	-5,830	-27.00	-1,249.5	2,975.8	160.44
1987-88	-9,296.1	3,003.5	-6,292.6	-24.51	-1,733.6	3,498.4	147.73

Source : RBI, Reports on Currency and Finance

be achieved through import liberalisation; allowing import of raw material, intermediate goods, capital goods and technologies were allowed freely and in many cases on chapter terms so that Indian exporters are able to compete in overseas markets and raise exports. Similarly, though the policy of import liberalisation was initiated in mid-1970s, when the balance of payments position was comfortable, the policy became more intensive from mid-1980s by which time BOP position had become strained. Various discretionary controls were removed and more reliance was placed on tariffs. Golder and Ranganathan (1990) have expressed doubt as to whether the policy to expand the list under Open General Licence (OGL) has led to higher imports of items of capital goods and intermediates categories which are included in the OGL. It may be noted that import promotion would result even from industrial policies viz., priority for a particular sectoral composition of investment, policy towards foreign technology and collaboration etc. It would therefore be difficult to analyse sources of import growth and ascribe them to different policy tools. In any case this highlights possibility of industrial/trade policies would have significant BOP effects which could run counter to the intended effects of expenditure switching policy.

Thus in general, it would be necessary to consider industry/trade policies together with expenditure switching policies. In the case of large developing countries given the price inelastic nature of imported commodities, adoption policy of expenditure switching policy alone is unlikely to moderate import growth. When expenditure switching policies are accompanied by import liberalisation measures the import restrictive effect of the former could be swamped by the import stimulating effects of the later. The Indian experience can be said to corroborate this proposition.

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Notes

1. See Prachowny, (1984).
2. While any policy affecting the relative attractiveness of exportables/importables in domestic market could be termed as expenditure switching policy in the policy literature this term has generally been used restrictively i.e., for exchange rate policy. In this paper also the same usage is adopted.

3. Harberger A.C. in Dornbush and Helmers (eds), (1988) pp. 249-263. A small developing economy is defined in terms of population size viz., less than 20 million in 1983. The difficulties of establishing an impersonal government in small countries where educated elite is limited to a few thousands are discussed.
4. Sachse I.D. (1987), Trade and Exchange Rate Policies in Growth Oriented Adjustment Programmes in Corbo et. al. (ed) (1987), pp. 291-325.
5. See for example Rao, (1982); Pani, (1984).
6. Datar (1989), The coefficients of REER in export functions (in long form) were -0.51 and -0.92 respectively for the longer and the later period. Both the coefficients are statistically significant. In import function, coefficient were 0.1 and 0.62 for corresponding period. Only the later period coefficient was significant at 10% level of significance.

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The Monetary Approach to the Balance of Payments and Exchange Rate : Empirical Evidence Relating Specifically to India

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I. An Outline of the Monetary Approach

The theory of balance of payments, which is basically concerned with the analysis of policies for maintaining balance-of-payments equilibrium, is one of the most controversial subjects in what is today known as International Macroeconomics. The rediscovery of the monetary approach to the balance of payments by Mundell (1968) and Johnson (1972) has led to a series of fresh discussions on this subject. This is evident from the growing number of research papers in academic journals of international stature.

The analytical results of the monetary approach are diametrically opposed to those of the traditional approaches. For instance, one conclusion derived from the Keynesian open-economy multiplier approach is that the balance of payments tends to worsen in the process of economic growth. The monetary approach in this situation predicts an exactly opposite kind of payments behaviour 1/. Until the advent of the monetary approach, it was believed that what happened "below the line" (balancing transactions) was the result of what happened "above the line" (regular transactions). The monetary approach offers here an exactly opposite view. That is, the build-up of liquid liabilities (assets) is not necessarily the result of a deficit (surplus) in trade, services, gifts and private lending. It could be opposite! The analytical results of the monetary approach appear to be controversial. However, in spite of its controversial nature, the monetary approach has become popular among researchers and policy-makers. One important reason for the popularity of this approach is the loss of faith in the efficacy of the so-called traditional policy prescriptions such as devaluation, tariffs and quotas. Another important reason is the simplicity of this approach.

The monetary approach views the balance of payments as essentially (but not exclusively) a monetary phenomenon and regards the relationship between the demand for and supply of money as the critical determinant of the balance of payments of an economy. This approach identifies disequilibrium in the balance of payments with disequilibrium in the money market and assets that the inequality between the demand for and supply of money, under fixed exchange rates, is reflected in the payments disequilibrium. According to the monetary approach, any disparity between the actual and desired money balances, under fixed exchange rates,

is removed by an automatic adjustment of the balance of payments. A surplus in the balance of payments, for instance, indicates an excess demand for money at home. Whenever an excess demand for money balances is not satisfied from the domestic source, funds will be attracted from abroad by generating a payments surplus. In the opposite situation where the supply of money exceeds the demand for money, funds will be sent abroad through a payments deficit. In short, the monetary approach to the balance of payments under fixed exchange rates looks upon the items "above the line" as "windows" through which excess money demands and supplies are cleared.

The monetary approach can be easily converted into a theory of exchange-rate determination. This approach looks upon the exchange rate as the relative price (value) of two national currencies (domestic and foreign) and maintains that a discrepancy between money demand and money supply, under floating exchange rates, is removed and monetary equilibrium resorted by an automatic adjustment of the exchange rates.

This approach assumes the existence of a stable money demand function which implies that this approach is essentially a long-run approach. Though "money" occupies a prestigious place in this approach, it does not mean that only "money" plays all the role. This approach does not deny the role of real factors such as income, interest rates and so on. It only says that these real factors operate through monetary channels. This approach is basically meant to handle payments disturbances that have origins in the monetary sector of an open economy. It does not directly consider disturbances caused by structural changes such as change in tastes, technology, trade policy and so on. It may also be noted that though this approach is a long-run approach, efforts are being made to modify/extend the approach so that it could be applied to explain short-run payments/exchange-rate disturbances. In this short-run model, money-demand functions are replaced by assets-demand functions and emphasis is placed on the role of financial markets in the short-run determination of exchange rates. This approach is known as the "asset-market approach" ^{2/}. Theoretically, the various propositions of the monetary approach appear to be sound and consistent and hence this approach has emerged as a general approach which can be applied to all open economies, developed and developing, operating under different exchange-rate regimes such as fixed, floating managed floating.

Researchers, in their attempt to test the empirical validity of the basic propositions of the monetary approach, have constructed different models under different sets of assumptions. This is because no single model can be expected to be applicable to all economies and at all times. Different countries are characterised by different institutional arrangements and, therefore, no single model would fit all economies equally well. However, all these models inherently exhibit the spirit of the monetary approach. For convenience, we may classify the various models of this approach into the following six categories:

- 1) The Non-Reserve Currency Country Model or the Standard Reserve-Flow Equation;
- 2) The Global Model which is an advanced variant to the Standard Reserve-Flow Equation;

- 3) The Reserve-Currency Country Model;
- 4) The Standard Exchange-Rate Equation based on the Purchasing Power Parity (PPP) doctrine;
- 5) The Capital-Flow Equation as developed by Kouri and Porter (1974); and
- 6) The Exchange-Market Pressure Equation as developed by Girton and Roper (1977).

Most of the empirical studies undertaken to test the basic propositions of the monetary approach are confined to industrial countries only. The few studies that have been carried out for different "groups" of developing countries are mainly cross-sectional studies 3/. Such studies are bound to be less useful as compared to time-series individual-country studies from the point of view of policy analysis for any individual country. As regards testing of the monetary approach in the Indian context, we find at least four good reasons which explain or justify our efforts.

First, the Indian economy is a relatively small open economy which has no control over international prices and exchange rates indicating near absence of feedbacks of our monetary and financial policies. We, therefore, think that it would be an academically rewarding exercise to put some suitable models of the monetary approach to empirical tests and see how far the empirical evidence substantiates the thesis of this approach 4/.

Second, the generalized floating that came into operation after the breakdown of the Bretton Woods system in August 1971 gives us a good opportunity to test the so-called PPP doctrine in the Indian context via the Exchange-Rate and Exchange-Market Pressure equations. Such an opportunity was not available during the Bretton Woods era characterised by fixity of exchange rates.

Third, the empirical testing of the monetary approach in the Indian context, we hope, may enable us to assess how far the Indian economy is "open" and, hence, immune from or susceptible to internal as well as external monetary disturbances.

Finally, we believe that the world economy is becoming more and more integrated. The questions of payments imbalances, inflation, exchange-rate instability and capital flows have become global issues and cannot be analysed in isolation. The monetary approach exhibits, besides simplicity, enough analytical potentiality and seems to be a useful starting point in macroeconomic analysis of balance of payments. We look upon our exercise as an initial but vital first step which can be used as a base for more intensive investigations into this important area. In the following sections, we present the results of our empirical exercise and suggest some directions for further research.

II. Empirical Test of the Monetary Approach Under Fixed Exchange Rates

For this purpose, we use the Standard Reserve-Flow Equation (RFE) the econometric form of which is :

$$gR (R/H) = a_0 + a_1 gP + a_2 gY + a_3 g_1 + a_4 gm + a_5 gD \left(\frac{D}{H} \right) + e$$

where,

P = price level;

Y = real income;

i = rate of interest;

m = money multiplier;

R = foreign component of the monetary base;

D = domestic component of the monetary base;

H = monetary base (R+D);

g = growth rate of the variable in question. Growth rate of variable x, for instance, is defined as :

$$gx = \frac{dx}{dt} \frac{1}{x}$$

e = error term.

The pattern of signs in the above equation is expected to be as follows:

$$a_1 > 0, \quad a_2 > 0, \quad a_3 > 0,$$

$$a_4 < 0, \quad \text{and} \quad a_5 < 0.$$

The standard RFE embodies some of the fundamental propositions of the monetary approach under fixed exchange rates. One important implication of this equation is that the weighted growth rate of the country's international reserves [$gR (R/H)$] is equal to the negative weighted growth rate of the domestic component of the monetary base [$gD (D/H)$] if the rate of growth of prices (gp), real income (gr), the rate of interest (gi) and money multiplier (gm) is zero. This further implies that, in the long run, the country's monetary authority has no control over its money supply. Another important implication of this equation is that the growth rate of international reserves is positively related to the growth rate of the (domestic) real income. This implication is contrary to the traditional Keynesian view that the balance of payments tends to worsen in the process of economic growth.

We estimate the Standard RFE with annual data for the period 1953-72. In this estimation, we use alternative definitions of some of the explanatory variables (money stocks, interest rates and international reserves) and, thus, obtain eleven different estimates of the equation. The overall performance of this model is good.² The general fit of the regression equations, as judged by the R^2 s is quite good. While the lowest value of R^2 is 0.65, the highest is 0.84. Likewise, the overall statistic F is also quite good. The high statistical significance (1% level of significance) of the domestic component of the monetary base (D), accompanied by the correct (expected) sign of this variable suggests the usefulness of this approach in explaining Inida's balance of payments in terms of her domestic component of the monetary base during the observation period. The estimated coefficient of gY is also statistically significant at the 5% level of significance. The estimated coefficient of gi is statistically significant in only two equations. This result is not totally unexpected, however. As we know, observable interest rates in a developing economy like ours do not, in general, reflect money-market conditions; in most cases interest rates are institutionally fixed, that is, they are administered rates and, therefore, are not determined by the forces of demand and supply. The estimated coefficient of the price variable, though bears the expected sign, is statistically insignificant. The money-multiplier variable also does not play any significant role in this equation. The

results of this specific exercise are mixed and corroborate, in general, the results arrived at by Aghevli and Khan (1977) who estimated the standard RFE for 39 developing countries. Despite all this, however, the high explanatory power of this model in the face of several economic controls suggests the robust nature of this approach.

In addition to explaining the rate of growth of international reserves in India during the observation period (1953-72), this exercise also yields an important policy implication which can be useful even in the present situation of managed floating. In all the eleven estimates of the standard REF, the estimated coefficient of the weighted growth rate of the domestic component of the monetary [$gD (D/H)$] is around (-0.60) and, hence, less than minus one. This implies that, other things remaining the same, an increase in the domestic component of the monetary base would not completely leak out through the balance of payments. This further implies that the monetary authority in India did have some control over its money supply during the sample period. At the same time it is important to note that, as the value of the estimated coefficient is significantly different from zero at the 1% level of significance, there would be some leakage of the domestic component of the monetary base 5/.

III. Empirical Test of the Monetary Approach Under Floating Exchange Rates.

This is done through the estimation of the Standard Exchange-Rate Equation (ERE) based on the PPP doctrine. The econometric form of this equation is :

$$\ln E = b_0 + b_1 (\ln M - \ln M^*) + b_2 (\ln Y^* - \ln Y) + b_3 (\ln i - \ln i^*) + u$$

where,

- ln = natural logarithm;
- E = exchange rate;
- M = domestic money stock;
- M* = foreign money stock;
- Y = domestic real income;
- Y* = foreign real income;
- i = domestic rate of interest;
- i* = foreign rate of interest; and
- u = error term.

The signs of all the three coefficients, viz., b_1 , b_2 and b_3 are expected to be positive.

We estimate the above equation for rupee-dollar, rupee-sterling and rupee-composite-currency rates with annual (1970-82) data. At the same time, however, we observe that the "generalized floating" that came into existence after the collapse of the Bretton Woods system in August 1971 is too young to give us a respectable number of annual observations. Besides, we want to examine whether or not India's exchange-rate policy underwent a 'structural' change in September 1975 when the rupee was delinked from the Pound Sterling and pegged to a basket of currencies. We, therefore, decide to estimate the ERE with quarterly (1970 II-1980 IV) data as well. It is not possible to examine the question of structural change with annual data on account of a small number of annual observations.

Our results of this exercise are mixed. While, in particular, the results obtained with the annual data are positive, those obtained with the quarterly data are negative. This is not totally unexpected, however. The coefficients of all the three explanatory variables (money stocks, real incomes and interest rates) have their expected (positive) signs in the equations estimated with the annual data. Besides, the estimated coefficients of the more important explanatory variables, viz., money stocks and real incomes, are highly statistically significant in the said equations. Furthermore, the "goodness of fit" as judged by \bar{R}^2 's is respectable. The respective values of \bar{R}^2 's in the rupee-dollar, rupee-sterling and rupee-composite-currency equations (estimated with annual data) are 0.57, 0.60 and 0.61.

As compared to the above results, the results obtained with the quarterly data are poor. We attribute the poor results to (1) the long-run nature of the monetary approach, (2) the arbitrary nature of our management of rupee rates, and (3) the structural change that took place in our exchange-rate policy in September 1975. The last is confirmed by the Chow Test for parameter stability.

A major finding of this exercise is that one can impose purchasing power parity (PPP) as a long-run proposition, but one must allow for short-run deviations of exchange rates from PPP. This result corroborates the similar results arrived at by other researchers for other countries.

IV. Empirical Test of the Monetary Approach Under Managed Floating

Since the late 1970s, many developing have been following mixed exchange-rate policies which contain elements of both fixed and floating rates. This hybrid system is commonly known as "managed float". Under this system, monetary authorities intervene to buy and sell foreign currencies and thereby influence the exchange rate. The central proposition of the monetary approach under managed floating is that a disequilibrium in the domestic money market caused, for example, by an excess of domestic money supply will be removed and the domestic monetary equilibrium restored by some combination of currency (exchange rate) depreciation and an outflow of foreign reserves. In the opposite situation where there is an excess of domestic money demand, the domestic monetary equilibrium will be restored by some combination of currency appreciation and an inflow of foreign reserves. This central proposition represents a middle-way between the two polar cases of rigidly fixed exchange rates and freely floating exchange rates.

In order to test the monetary approach under managed floating in the Indian context we use the Exchange-Market Pressure Equation (EMPE) originally developed by Girton and Roper (1977). This equation combines the monetary approach to the balance of payments under fixed exchange rates and the monetary approach to the exchange rate. This equation is becoming increasingly popular among researchers because most countries today have adopted some kind of managed floating under which the exchange market pressure (defined below) is alleviated partly by exchange-rate adjustments and partly by reserve movements 6/. The econometric form of the EMPE is:

$$r + e = c_0 + c_1 gp^* + c_2 gy + c_3 gm + c_4 gD (D/H) + v$$

where,

- r = weighted growth of reserves ($g^R R/H$);
 e_* = $-g^E$;
 p = foreign price level;
 v = error term; and others as defined earlier.

The expected pattern of signs is as follows:

$$c_1 > 0, \quad c_2 > 0, \quad c_3 < 0 \text{ and } c_4 < 0.$$

We estimate the above equation for rupee-dollar, rupee-sterling and rupee-composite-currency rates with quarterly (1976 II - 1983 I) data, and, thus, obtain eight different estimates of the same.

Our results of this exercise are positive in terms of (1) the signs of the estimated coefficients, (2) the statistical significance of the estimated coefficients, and (3) the "goodness of fit" of the estimated equations. In this exercise, we also examine whether or not the exchange-market pressure, $(r+e)$, was sensitive to its composition; that is, whether the monetary authorities absorbed the pressure in international reserves or in the exchange rate. This examination has an important policy implication. If the exchange-market pressure happens to be insensitive, then it means that the monetary authorities can determine the volume of official intervention necessary to achieve various exchange-rate targets. In our exercise, however, we have found the exchange-market pressure, $(e+r)$, sensitive to its distribution between e and r . This implies that the monetary authorities in India would not be able to determine the volume of official intervention that would achieve a given exchange-rate target. This result goes against the findings of other researchers who have done similar exercise for other countries. Our results, in general, are good despite the fact that the money-market equilibrium condition and purchasing power parity are imposed on the quarterly data. One could, therefore, hope to obtain still better results with annual data. All this suggests the superiority of the girton-Roper model over the standard reserve-flow and exchange-rate equations.

V. Concluding Remarks

Our results, though admittedly based on unsophisticated methodology, conform to our expectations. Among the three equations, the overall performance of the Exchange-Market Pressure Equation is the best; while our findings are tentative and could be modified as the study is further extended, they do highlight the role of and real income in the determination of India's balance of payments and exchange rates. There are certain factors which, we suspect, have weakened our results. They are:

1. The unit of time chosen in the estimation of the Standard Reserve-Flow Equation is one year and we expect that the postulated adjustments would be complete in this one year time period. However, in a developing country like India, where there is absence of a resilient and well-developed money market, the so-called "speed of adjustment" is likely to be slow and, therefore, the postulated adjustments may take a longer time for their completion this is especially true for the period 1953-72 during which the India economy was much less developed.

2. A second factor is the simultaneous equations problem that can creep into any econometric exercise in various guises and can weaken the Ordinary Least Squares Method. The Standard Reserve-Flow Equation, for example, explains growth of reserves in terms of growth of prices, real income, interest rates, domestic component of the monetary base and so on. But it does not tackle the question of the determination of these variables. It is implicitly assumed that these variables are exogenous. We, however, know that most of these variables are determined together. All the three equations employed in our exercise are reduced-form equations and, therefore, they do not take into account feedback effects. In this situation, estimation of full-fledged structural equations, instead of single equations, would prove to be more fruitful. Such an exercise, however, would be costly and time consuming. The single equations of the monetary approach provide a quick and low-cost alternative to large-scale structural models. This is a methodological issue and views can differ. It is true that with better specification, improved data and truer proxies we shall be able to improve upon the results presented here. Our agenda for future research should aim at unification of the various competing approaches to the balance of payments and exchange rates.

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Sources of Data and Derivations of Equations

Data Sources :

The major source of data for estimation of all the three equations mentioned above is the International Financial Statistics (various monthly issues and Year Books) of the I.M.F. Besides, we have also taken data from various publications of the Reserve Bank of India (Bulletins, Occasional Papers, and Reports on Currency and Finance). Quarterly data on India's real income have been obtained from Prof. Vikas Chitre's (then unpublished) study prepared for the Chakravarty Committee.

Derivations :

For derivation of the different types of reserve-flow equations see, for example, Johnson (1972), Kemp (1975), Wilford

and Wilford (1977), and Aghevil and Khan (1977). Derivations of the standard exchange-rate equation may be found in Kreinin and Officer (1978), and Humphrey and Keleher (1982). Kim (1985) derives the simple exchange-market pressure equation based on the Girton-Roper (1977) model.

Notes

1. See, for example, Johnson (1972, p. 240).
2. See, for example, Murphy and Duynne (1980) for a good summary of various short-run models of exchange-rate determination.
3. See, for example, Kreinin and Officer (1978).
4. There are number of alternative methods of measuring the degree of "openness". The conventional method viz., the ratio of imports to GNP is only a rough indicator of openness. In countries that impose various quantitative restrictions on imports, actual imports will deviate significantly from their potential levels. In the Indian context, we observe that the policy-makers here, ever since the inception of the First Five Year Plan, have always pursued the policy of import substitution. For this purpose, all types of policies-monetary (interest rates), fiscal (tarrifs) and physical interventionist (quotas, licensing etc.) have been used. There is, therefore, no wonder if the ratio of imports to GNP in India happens to be much low as compared to the ratios in Korea, Mexico, Philipines, Canada, U.K. or Netherlands. If we measure the degree of openness on the basis of income elasticity of demand for imports we can say that the Indian economy was more open (or less close) in the 1970s as to the 1960s. The rising value of the income elasticity of demand for imports (in India) indicates increasing openness of the Indian economy. See, for example, Aggarwal (1984).
5. The coefficient of $gD (D/H)$ is known as "offset" coefficient. It is possible to regress $gD (D/H)$ on $gR (R/H)$ and see how far it is possible for monetary authorities to "sterilize" inflows or outflows of foreign reserves. The coefficient of $GR (\frac{R}{H})$, in this equation, is known as "sterilization" coefficient, complete sterilization is possible when this coefficient is equal to minus one. No sterilization is possible when its value is zero. However, the question of sterilization of foreign reserves may not arise in case of a small open economy because in this economy the causation is expected to be from the domestic source to the foreign source.
6. In the Indian context, we observe that with the Smithsonian realignment of major currencies in December 1971, the rupee was delinked from the U.S. dollar and pegged to the pound Sterling. However, on account of highly volatile circumstances, this link between the rupee and the Pound Sterling could not last long and the same came to an end on September 24, 1975 when the Government of India, on

a review of the exchange-rate situation, took a decision to peg the rupee to a basket of currencies with immediate effect. Under this new arrangement, the external value of the rupee is determined with reference to the daily exchange-rate movement of a selected number of currencies of the countries that are India's major trade partners. However, the Pound Sterling continues to be the intervention as well as the numeraire currency. What is important to note here is the fact that the frequent adjustments of the rupee-sterling rates in recent years have actually converted India's so-called "managed floating" into an exchange-rate arrangement that is more akin to a "floating arrangement, if not "independently floating arrangement".

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Transmission of World Growth Cycle to the Indian Economy

Vikas Chitre

Introduction

Our earlier studies of the short-run economic fluctuations in India have led us to the following main conclusions:

(a) The Indian economy has not been free from substantial short-period fluctuations in economic activity. A large number of key economic processes such as industrial production, factory employment, fixed capital formation, stock changes, money credit, interest rates, commodity and security prices, profits of public limited companies, exports, imports, etc., show more or less synchronous movements around their respective long-term trends. These movements appear to be sufficiently pervasive, temporally cumulative and self-reversing to justify our viewing them as reflecting the growth cycle in India's overall economic activity, that is, business cycle adjusted for long-run trends in the economy. (Chitre [1982]).

(b) While deviations of India's agricultural income and agricultural production from their respective exponential trends do not show the presence of serial auto-correlation and are thus random with respect to their time-sequence those of India's non-agricultural income, industrial production, gross fixed investment and gross total investment by the public sector, quantum index of exports and the index of the gross domestic product of the world show positive serial auto-correlation, that is, exhibit a cumulative behaviour over time (Chitre [1988]). Furthermore, by decomposing the growth-cyclical fluctuations in non-agricultural income between those originating from fluctuations in agricultural income and those originating in other impulses, it has been shown that even if the other impulses had been absent, the random, serially uncorrelated deviations from trend in agricultural income would have produced a cyclical movement around the trend in non-agricultural income (Chitre and Paranjape [1987]), a result reminiscent of the well-known work of Ragnar Frisch (1933) on the role of random shocks in generating business cycles.

(c) Decomposing the growth-cyclical fluctuations in non-agricultural income further into those originating from fluctuations in agricultural income, those originating from fluctuations in gross fixed investment by the public sector and those origi-

pating from other impulses, it has been observed that those caused by other impulses show a very close relation to the deviations from trend of the index of industrial production in North America. The turning points of the latter consistently precede by one year, or coincide with, those of the former (with a single exception of the peak of 1973-74 when the former follows the latter by one year) (Chitre [1988]).

We have re-computed for the period covered by the present paper the contribution to cyclical fluctuations around the trend, in India's non-agricultural income due to influences other than those attributable to fluctuations around the trend in agricultural production and gross public sector fixed investment. This has been done on the basis of dynamic simulation based on equation (1) in Appendix 2 computing the deviations around the trend in non-agricultural income year after year using the residuals from that equation also to represent all other influences at work. These values of the deviations in non-agricultural income computed from the above mentioned dynamic simulation experiment have been shown in Chart 1. Charts 2 and 3 show the deviations around the trend in the index of industrial production, for the U.S. and for the market economies respectively. Matching the peaks and troughs of the graph in Chart 1 with those of the graph in Chart 2, we observe that while the correspondence (marked just above the graph in Chart 2) is close, the turning points of the growth-cycle in the index of industrial production for the U.S. show a somewhat larger number of lags, which is hard to explain. On the other hand, comparing these turning points on an inverse plan, that is, matching peaks of the graph in Chart 1 with the troughs of the graph in Chart 2 and the troughs of the graph in Chart 1 with the peaks of the graph in Chart 2, (as shown just below the graph in Chart 2) one observes that the growth cycle in India's non-agricultural income due to causes other than fluctuations in agricultural production and public sector investment appears to be moving in the opposite direction of the growth cycle in the index of industrial production for the U.S. after a lag. A similar observation can be made by comparing the graph in Chart 1 and that in Chart 3 for the growth cycle in the industrial production for the market economies 1/.

Equation (2) in Appendix 2 examines this question through regression analysis. (The notation used, data sources and notes on data adjustments are explained in Appendix 1.) It is seen from that equation that deviations from trend in India's non-agricultural income can be explained in terms of those in agricultural income gross fixed capital formation by the public sector and the index of industrial production for the market economies. Growth cycle in the industrial production of the market economies causes growth-cyclical fluctuations in India's non-agricultural income in the opposite direction after a lag of one year 2/. That is, the growth cycle in India's non-agricultural income moves contra cyclically to the industrial cycle in the market economies of the world. An expansion in the world industrial production of the market economies of the world has tended to exercise a contractionary influence of India's non-agricultural income. Similar results also obtain when we use world industrial production or world gross domestic product in place of the index of industrial production for the market economies.

The purpose of the present paper is to examine the channels through which the world growth cycle may be getting transmitted

to the Indian economy.

Possible Channels of Transmission of World Growth Cycle

Growth-cyclical fluctuations in gross domestic production or industrial production of the world may be expected to influence industrial production and non-agricultural income in India relative to their respective trends through demand, production, investment and monetary linkages. The effect of an increase in exports on aggregate demand via the multiplier is well-known. On the other hand, in the context of the labour-surplus economy such as India's, it has been argued that increased exports of agricultural commodities, whether raw materials or cash crops, would reduce the surplus of foodgrains marketed to the domestic non-agricultural sector; and as this surplus constitutes demand for non-agricultural commodities, the production of the latter would decline. Thus, in this case, it is argued that exports could have a negative effect on domestic non-agricultural output (Mihir Rakshit [1982]). As regards the production effect of foreign trade, if domestic production of agricultural or non-agricultural sectors is dependent on the imports of raw materials, intermediate goods or capital goods which are not domestically produced, reduction in the capacity to import would adversely affect domestic production in the short-run. Availability of external assistance and loans and increase in the foreign exchange reserves increase domestic investment in the short-run. But the interest and amortisation payments on external assistance and loans and repatriation of profits on foreign investment increase future burden of debt servicing and endanger future prospects of domestic investment and growth and lead to external debt crisis unless exports can increase sufficiently rapidly over time. Finally, changes in foreign exchange reserves would lead to changes in domestic money supply in the same direction unless counteracted by appropriate monetary policy.

The present paper is a preliminary study of the above linkages. It focuses attention on the short-run effects and mainly studies demand and investment linkages.

Empirical Assessment of the Linkages with the External Sector

In order to assess the quantitative strength of these linkages we have re-estimated an earlier model due to Rangarajan (1982) for the more recent 22 year period from 1962-63 to 1983-84 with modifications and extensions necessary for studying the linkages with the world economy. The notation used and the equations estimated by us are given in Appendices 1 and 3 respectively.

The production of manufactured consumption goods (ICI) is determined by the demand for these goods modified by supply side factors. The demand for manufactured consumption goods depends upon lagged national income, the lagged value of the ratio of the average price of agricultural commodities to that of manufactured finished products and the quantum of exports. The only supply-side factor taken account of here is the import of raw materials and intermediate goods. The estimated equation is given as equation (1) in Appendix 3.

The negative coefficient (statistically significant at 10 per cent level) for the lagged domestic price terms of trade between agricultural and manufactured commodities TT_1 that is,

(P_{ag}/P_{mfg}) needs explanation. This price ratio is a weighted average of the domestic price terms of trade between foodgrains and manufactured commodities and that between non-foodgrains and manufactured commodities. An increase in the former leads to a substitution effect in favour of the manufactured products and an income effect, which is likely to lead to a greatly reduced demand for manufactured products on the part of net buyers of foodgrains and increased demand for manufactured products on the part of net suppliers of foodgrains. The increase in the domestic price terms of trade between non-foodgrains and manufactured commodities will lead to an income effect causing the demand for manufactured products on the part of net sellers of non-foodgrains to increase. That is, except for the income effect on the demand for manufactured products on the part of net buyers of foodgrains, all other effects will tend to increase the demand for manufactured products. In addition the effect of an increase in the terms of trade of agricultural commodities relative to manufactured products could involve an increase in the marginal cost of production of manufactured products, relative to their prices, hence leading to a reduced production of manufactured products. The statistically significant negative coefficient of the domestic terms of trade variable suggests that the income effect of the net buyers of foodgrains and the cost effect on the production side appear to be dominant. The quantum of exports exerts a statistically significant negative influence on the production of manufactured consumption goods. However, this influence is numerically rather small. A 10 per cent increase in the quantum of exports around the mean leads to a reduction in the index of production of consumer goods by about 3.01 per cent of its average value.

Imports of raw materials and intermediate goods show a positive effect on the production of manufactured products. The regression coefficient of this variable, however, is not statistically significant which is possibly due to the high correlation of 0.92 between the quantum of exports and the imports of raw materials and intermediate goods. An increase in imports of raw materials and intermediate goods by 10 per cent of its average value during the period is associated with an increase of 0.71 per cent in the index of production of manufactured consumption goods above its average during the period. Thus, this influence is quite small.

The production of basic and capital goods is linked with the external sector through the demand for exports and through the domestic fixed investment by private and public sectors which is influenced by changes in the foreign exchange reserves. Furthermore, imports of capital goods may be expected either to increase production of capital and basic goods if these imports consist of required capital goods and basic goods which cannot be currently domestically produced or to decrease the production of capital goods and basic goods if they compete with capital goods and basic goods which are currently being domestically produced.

Equation (2) in Appendix 3 shows that the quantum of exports has a positive influence on the production of capital and basic goods. Quantitatively, this effect is of about the same magnitude, but in the *opposite* direction, as that exercised by the quantum of exports on the production of manufactured consumption goods discussed above. Thus, exports have tended to exercise an influence on the structure of our domestic industrial production, rather than on the level of it. Since the weightage of basic and capital

goods is higher in the general index of industrial production than that of consumption goods as seen in equation (3) in Appendix 3, the overall effect of an increase in export demand on the general index of industrial production will be positive.

From equation (2) in Appendix 3, it may be seen that imports of capital goods have on the whole aided rather than competed with the domestic production of capital and basic goods. This effect, however, is quite small. A 10 per cent increase in the imports of capital goods in relation to the average level during the period is associated with 0.54 per cent increase in the domestic production of basic and capital goods.

Gross capital formation in the public and the private sectors and, therefore, the domestic production of basic and capital goods are stimulated when the accretion to the foreign exchange reserves (deflated by the unit value index of imports) over the year is larger. It can be seen from equations (5) and (6) in Appendix 3 that for the average increase in foreign exchange reserves which was Rs. 63.4 crores (at constant import prices), the increase in gross capital formation (at constant prices) by the two sectors together would be around Rs. 38.56 crores, or about 0.51 per cent of the average gross fixed capital formation during the period, at constant prices. This would stimulate the production of basic and capital goods. The resultant increase in the general index of industrial production would be of 0.3 percentage points or around 0.44 per cent of the average level of the general index of industrial production during the sample period. Thus increase in the foreign exchange reserves appears to exert a moderate influence on the domestic industrial production by stimulating domestic fixed investment. Perhaps this calculation exaggerates the influence of changes in foreign exchange reserves on gross fixed capital formation in the country. For, if we consider an increase in the accretion of foreign exchange reserves equal to 10 per cent of the average accretion in them during the period, we see that this would increase gross capital formation by merely Rs. 3.856 crores with a correspondingly smaller impact on industrial production. However, the large year to year fluctuations in the change in foreign exchange reserves would cause correspondingly large fluctuations in gross fixed capital formation and industrial production.

Equation 5 (alt.) in Appendix 3 uses the variable external borrowing of the government (deflated by unit value index of imports) instead of the change in foreign exchange reserves to take account of the influence of the external sector on gross fixed capital formation by the public sector. It shows that an increase in the external borrowing of the government equal to 10 per cent of its average value (of approximately Rs. 554 crores) during the period would have increased gross fixed capital formation of the government by Rs. 20.34 crores in comparison with Rs. 18.77 crores in response to an increase in foreign exchange reserves equal to its average over the period.

In order to further examine whether the world economic activity led to growth cycles in India through the impact of it on our gross fixed capital formation on account of inflow of foreign exchange, we considered the total receipts from abroad (consisting of receipts from merchandise exports plus receipts on invisible account plus private receipts and government receipts

on capital account) separately from total payments (consisting of payment for merchandise imports plus payments on invisible account plus payments on capital account (private) plus payments on capital account (government) plus amortization payments plus repurchase of Rupee from IMF) both deflated by the unit value index of imports. Equations (1) and (2) in Appendix 4 show that both receipts and payments decrease with an increase in world GDP. However, since receipts decrease slightly more than payments, $(R_t - P_t)$ shows a minor decline which in turn leads to a small decline in gross fixed capital formation in the private sector. (Gross fixed capital formation in the public sector shows a statistically insignificant decrease in response to an increase in $(R_t - P_t)$). Deflating receipts and payments by wholesale price index rather than by unit value of imports gives a slightly larger effect on $(R_t - P_t)$. $(R-P)$ relative to its (linear) trend as well does not show a statistically significant movement in response to the movement of GDP of the world or industrial production of market economies relative to their respective trends.

Conclusion

The growth cycle in India's non-agricultural income shows a statistically significant but inverse relation to the world industrial cycle. The transmission of the world cyclical impulse probably takes place through the influence of it on gross domestic fixed investment via changes in net receipts or external assistance and loans and changes in foreign exchange reserves. But at the level of aggregation that we have examined the question, it is not possible to demonstrate that transmission through this channel has taken place in sufficient strength suggested by the close but inverse relation between the world industrial cycle and our industrial cycle which we have observed.

CHART 1 : GDPNA

Gross domestic product originating in non-agricultural sector for India; Deviations from trend due to influences other than GDPA and GCFPU

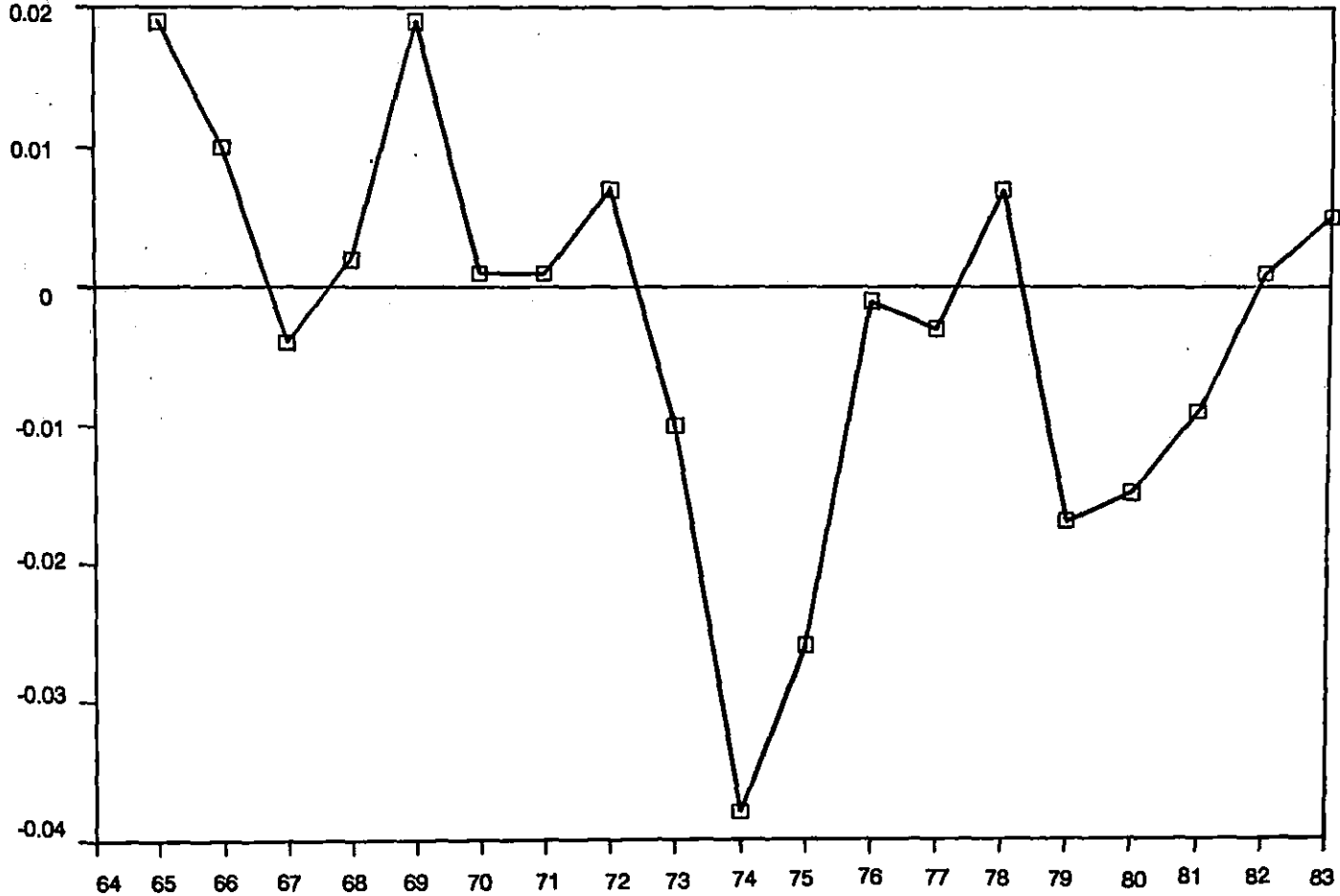


CHART 2 : USIIP

Index of Industrial Production for the U.S.A., deviations from trend.

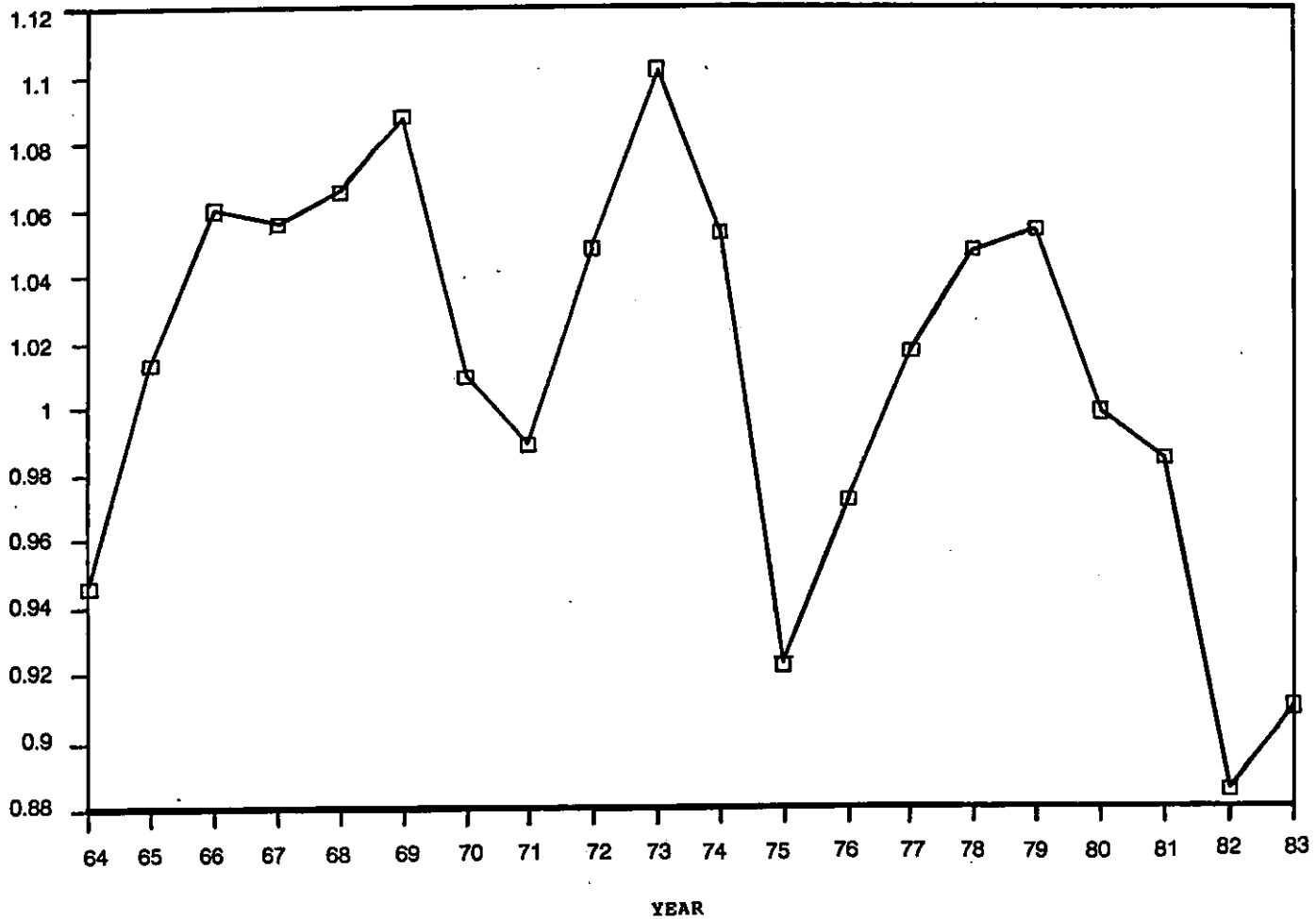
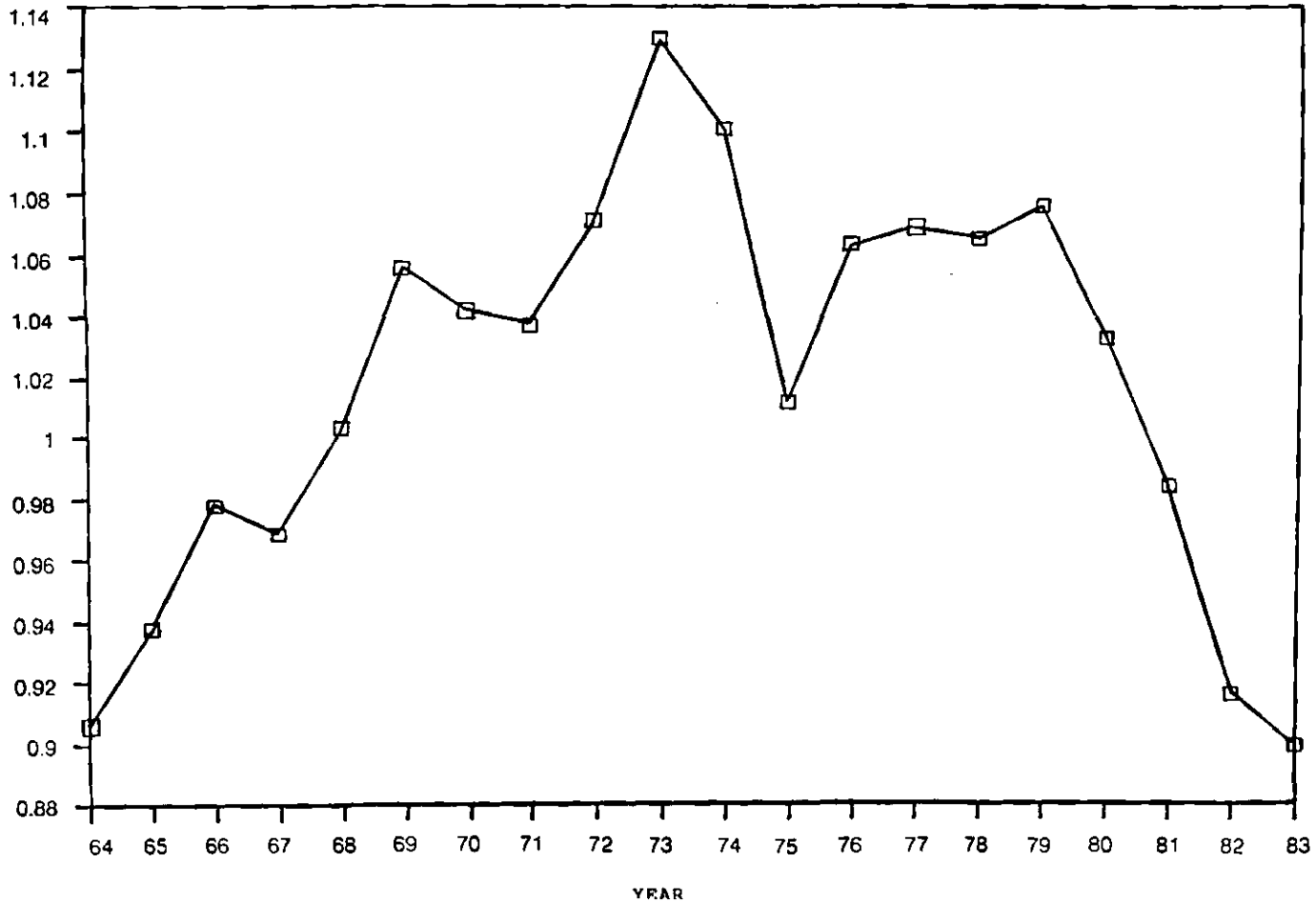


CHART 3 : MIIP

Index of Industrial Production for market economics, deviations from trend.



Appendix 1

Vari- able	Definition	Sources	Notes
1. NYI	Index of National Income. base 70-71 = 100	Economic Survey	----
2. ICI	Index of Industrial Production, Consumer Goods. base 70-71 = 100	Report on Currency and Finance	
3. IBKI	Index of Industrial Production, Basic and Capital Goods. '70-71=100	Report on Currency and Finance	Weighted average of indices of production of basic and capital goods. IBKI = .6791 BI + .321 KI
4. IQI	Index of Industrial Production, General	---	The available data used different weightages for the four categories of industrial production, IBI, IKI, III (i.e., index of industrial production, intermediate goods), ICI. We calculated IQI using uniform weights. IQI is thus = .3112 ICI + 0.2095 III + 0.1525 IKI + .3228 IBI.
5. MKI	Imports of Capital Goods (Rs. Crores)	Economic Survey	Deflator used is Unit value index of machinery transport equipment. Currency Finance Report. ('70-71 = 100)
6. MRMI	Imports of Raw Materials Intermediate Goods (Rs. Crores)	Economic Survey	Deflator was calculated a weighted average of unit value indices of 'Inedible crude material, except fuel', 'Mineral fuels and lubricants', 'Animal and vegetable oils', 'Chemicals and related products', 'Manufactured goods'. (We assumed that a major part of the 'manufactured goods' category consisted of intermediate goods.) Deflator had (1970-71) as base.

Appendix 1 (Contd...)

	Vari- able	Definition	Sources	Notes
7.	X	Total exports (Merchandise) (Rs. Crores)	Report on) Currency) and) Finance)	Deflators used were unit value indices of exports and imports respectively. Base '70-71=100
8.	M	Total imports (Merchandise) (Rs. Crores)	Report on) Currency) and) Finance)	
9.	GCFPU	Gross fixed Capital Formation, Public Sector (Rs. Crores)	Report of Working Group on Savings appointed by Dept. of Statistics	The figures upto 1981 were given in the working group report at constant (that is 1970-71) prices. For years '82-83 and '83-84, the source was National accounts statistics, deflator used was wholesale price index of machinery and construction equipment GCFPS= Gross fixed capital formation of household sector + Gross fixed capital formation of private corporate sector.
10.	GCFPS	-do-	-do	
11.	GCF	Gross fixed Capital Formation (Rs. Crores)	-do-	-do
12.	GDPA	Gross domestic product, agricultural sector (Rs. Crores) (70-71 prices)	National accounts statistics.	---
13.	GDPNA	Gross domestic product, non-agricultural sector (70-71 prices) (Rs. Crores)	National Accounts Statistics	Calculated: GDPNA = GDP (total) - GDPA. Figures for GDP and GDPA at constant (that is 1970-71) prices.
14.	FER	Foreign exchange reserves	R.B.I. Bulletin	FER = SDRs + Gold + Foreign Currency reserves. Deflated by unit value index of imports.

Appendix 1 (Contd...)

Variable	Definition	Source	Notes
15. IBG	Internal borrowings of the Government (Rs. Crores)	International Financial Statistics	Deflated by wholesale price index of machinery and transport equipment.
16. EBG	External Borrowings of Govt. + foreign aid	-do-	Deflated by unit value index of imports.
17. P	Total payments made by India to rest of the world. (Rs. Crores)	Economic Survey	Imports + Payments for Invisibles + Payments on capital account, Private + Payments on capital account, Govt.+ amortization payments + Repurchase of Rs. from IMF. Deflated by unit value index of imports; Alternatively deflated by wholesale price index.
18. R	Total Receipts of India from rest of the world.	Economic Survey	Export receipts + receipts on 'invisibles' + private receipts and Govt. receipts on capital account. Note: Data for R and P for many years is preliminary .
19. WGDG	Index of World Gross Domestic Product, (70-71)=100	International Financial Statistics, U.N.	---
20. WIIP	Index of Industrial Production World (70-71) = 100	Industrial Statistics, Year book, U.N.	---
21. MIIP	Index of Industrial Production, Market Economics (70-71) = 100	-do-	---

Appendix 1 (Contd...)

Vari- able	Definition	Source	Notes
22. PX/WPI	Ratio of Export prices to Wholesale price Index of India	Report on Currency and Finance, (Px) and Economic Survey (WPI)	Ratio of Unit Value index of exports, base (70-71)= 100 to Wholesale price index (70-71) = 100
23. PM/WPI	Ratio of Imports Prices to Wholesale Price Index	Report on Currency and Finance (Pm) and Economic Survey (WPI)	Ratio of unit value index of imports base (70-71)=100 to wholesale price index (1970-71=100)
24. TT	Terms of Trade, Ratio of wholesale price index of agricultural products to wholesale price index of manufactured products	Economic Survey	Indices are with base 70-71 = 100.
25. FGTT	Foodgrain Terms of Trade, ratio of whole-sale price of foodgrains to wholesale price of manufactured products	Economic Survey	Indices are with base 70-71=100.
26. NFGTT	Non-foodgrain terms of trade, ratio of wholesale price of non-foodgrains to manufactured products	Economic Survey	Indices are with base 70-71=100.
27. AQI	Index of Agricultural Production (1970-71)=100	Economic Survey	---
28. T	Time trend		

Appendix 2

1. $\text{gdpna}_t = 0.1793482 + 0.8523376 \text{gdpna}_{t-1} - 0.2329049 \text{gdpna}_{t-2}$
 (3.4948) (-1.1050)
 $+ 0.1762703 \text{gdpna}_t + 0.04015144 \text{gcfpu}_{t-1}$
 (2.4899) (1.3947)
 $\bar{R}^2 = 0.5537$ DW = 2.0876
2. $\text{gdpna}_t = 0.6878213 + 0.09993359 \text{gdpna}_t$
 (2.246)
 $+ 0.040221 \text{gcfpu}_{t-1} - 0.2339862 \text{miip}_{t-1}$
 (1.2786) (-3.1487)
 $\bar{R}^2 = 0.4823$ DW = 1.7877
3. $\log(\text{GDPNA}_t) = 9.442711 + 0.1006269 \log(\text{GDPA}_t)$
 (1.6567)
 $+ 0.05199293 \log(\text{GCFPU}_{t-1}) - 0.2601882$
 (1.2741) (-3.182)
 $\log(\text{MIIP}_{t-1}) + 0.0500057 (T)$
 (10.4969)
 $\bar{R}^2 = 0.9931$ DW = 1.4379

NOTES : (i) Variables denoted in lower case letters denote deviations of the corresponding variables from their respective semi-logarithmic trends, corrected for serial auto-correlation of residuals when required.

(ii) Equations 1 and 2, which showed serial auto-correlation of residuals from OLS regressions have been re-estimated by using the Cochrane-Orcutt procedure.

(iii) Equation 3, which showed serial auto-correlation of residuals from OLS regressions has been re-estimated by using the Cochrane-Orcutt procedure till 6th iteration, but still there is no significant change in the D.W.

Appendix 3

$$1. \quad ICI_t = 16.25732 - 0.1904974TT_{t-1} + 0.0059274 MRMI_t$$

(-2.0961) (1.5997)

$$- 0.018013 X_t + 1.308031 NYI_{t-1}$$

(-3.3819) (6.4360)

$$\bar{R}^2 = 0.9853 \quad DW = 2.3627$$

$$2. \quad IBKI_t = -24.00192 + 0.0140941 GCF_t + 0.01840044 X_t$$

(6.3709) (2.9304)

$$+ 0.0117928 MKI_t$$

(2.3108)

$$\bar{R}^2 = 0.9886 \quad DW = 2.10$$

$$3. \quad IQI_t = 3.643024 + 0.3777389 ICI_t + 0.5547107 IBKI_t$$

(6.4146) (15.7971)

$$\bar{R}^2 = 0.9958 \quad DW = 2.0147$$

$$4. \quad GCF_t = GCFPU_t + GCFPS_t$$

$$5. \quad GCFPU_t = 3126.125 + 36.07488 NYI_{t-1}$$

(10.8036)

$$- 26.52028 TT_{t-1} + 0.2960795 \Delta FER_t + 0.1772924 IBG_{t-1}$$

(-4.3914) (1.8916) (3.0761)

$$\bar{R}^2 = 0.9691 \quad DW = 1.3767$$

$$5(alt.) \quad GCFPU_t = 534.6246 + 40.79556 NYI_{t-1} - 19.66855 TT_{t-1}$$

(8.8561) (-2.2979)

$$+ 0.1356712 IBG_t + 0.3673557 EBG_t$$

(1.5656) (1.3355)

$$\bar{R}^2 = 0.9422 \quad DW = 1.8718$$

$$6. \quad GCFPS_t = -1919.289 + 37.06013 NYI_{t-1} + 22.50067 TT_{t-1}$$

(17.6466) (3.9139)

$$+ 0.3120469 \Delta FER_t$$

(1.8525)

$$\bar{R}^2 = 0.9413 \quad DW = 2.1876$$

Note : (i). Equation 3 which showed serial auto-correlation of residuals from OLS regressions has been re-estimated by using the Cochrane-Orcutt procedure.

(ii) Equations 1 and 5 which showed serial auto-correlation of residuals from OLS regressions have been re-estimated using the Cochrane-Orcutt procedure till 6th iteration, but still there is no significant change in the D.W.

Appendix 4

$$1. \quad R_t = -195.4888 - 68.30258 \text{ WGDP}_t + 0.3836814 \text{ GDPNA}_t + 0.9907155 \text{ GDPA}_t$$

(-3.8902)
(5.5429)

(1.7999)

$$\bar{R}^2 = 0.8855 \qquad \text{DW} = 1.7493$$

$$2. \quad P_t = 3444.986 - 67.86414 \text{ WGDP}_t + 0.4595637 \text{ GDPNA}_t - 0.07197298 \text{ GDPA}_t - 1669.683 \text{ (PM/WPI)}$$

(-6.9284)
(11.7815)

(-1.3865)
(-7.0451)

$$\bar{R}^2 = 0.9692 \qquad \text{DW} = 2.1714$$

$$2.\text{(alt.)} \quad P_t = 2800.304 - 69.87946 \text{ WGDP}_t + 0.4376157 \text{ GDPNA}_t - 1616.668 \text{ (PM/WPI)}$$

(-7.2793)
(12.1269)

(-6.7975)

$$\bar{R}^2 = 0.9668 \qquad \text{DW} = 1.8566$$

$$3. \quad \text{GCFPU}_t = 3200.017 + 0.1454428 \text{ GDPNA}_{t-1} + 0.07198379 \text{ GDPA}_{t-1} - 32.59267 \text{ TT}_{t-1} - 0.1686319 (R_t - P_t)$$

(4.5082)
(0.8725)

(-4.2432)
(-0.7377)

$$\bar{R}^2 = 0.9416 \qquad \text{DW} = 1.5164$$

$$4. \quad \text{GCFPS}_t = 184.1152 + 0.1704593 \text{ GDPNA}_{t-1} - 0.08665441 \text{ GDPA}_{t-1} + 19.68485 \text{ TT}_{t-1} + 0.4335499 (R_t - P_t)$$

(10.23535)
(-2.0401)

(4.8756)
(3.6473)

$$\bar{R}^2 = 0.9730 \qquad \text{DW} = 2.2688$$

Note : (i) Equations 1 and 2, which showed serial auto-correlation of residuals from OLS regressions have been re-estimated by using the Cochrane-Orcutt procedure.

(ii) Equations 3 and 4, which showed serial auto-correlation of residuals from OLS regressions, have been re-estimated using the Cochrane-Orcutt procedure till 6th iteration, but still there is no significant change in the D.W.

Acknowledgement

I am grateful to Miss Smita Phadke and Mrs. Vidya Tikhe for valuable research assistance.

Notes

1. Commenting on the paper at the Workshop, Professor John Williamson observed that the similar appearance of Chart 1 and Charts 2 and 3 is largely due to the common influence of the first oil shock on the economies of India and North America and on the market economies rather than due to the transmission of the world growth cycle to the Indian economy.
2. In his comments on the paper of the Workshop, Professor Nachane pointed out that since any polynomial trend has a corresponding weighted moving average representation in terms of the observations, the detrending process will introduce spurious cycles a la Slutsky-Yule. He maintained that this argument also applies to detrending by an exponential function. Furthermore, a weighted moving average trend distorts the true lead-lag relationship between the detrended variables. This problem arises if the chosen moving average period exceeds the time lag. In this context, it should be pointed out here that results similar to those reported in this paragraph of the text are obtained if undetrended variables are used along with time as an additional explanatory variables.

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The Transmission of Fluctuations in Economic Activity from Abroad : Some Evidence from India

Smriti Mukherjee

I

Theory of transmission of macroeconomic disturbances from abroad has come into the forefront ever since the publication of Mundell-Fleming model in the sixties. Withdrawal of capital controls and adoption of floating exchange rates have directly contributed to the recent upsurge in interest in this particular area of international economics. Specific models relating to transmission of monetary and fiscal policy influences from one country to another have been developed and put to empirical testing. Notwithstanding the hi-tech nature of the models, all of them have one basic point in common i.e., they all stress the international aspect of cyclical fluctuation in economic activity. Fluctuations in economic activity in a major industrial country are capable of generating similar cycles abroad. Sometimes the cyclical movements may synchronise, sometimes they appear with a lag. As to the channel of this transmission, current account of balance of payments provides a major channel if there is restriction on free flow of capital. On the other hand if we have an integrated capital market, capital account transactions assume major proportions while speed of adjustment in the goods market becomes slower. The purpose of the present paper is to focus on the sensitiveness of Indian economy in the face of changes taking place in the rest of the world. To have a proper understanding of the nature of this sensitiveness relevant theories, their applicability to India, modifications attempted and results obtained are being discussed in the following sections.

The mechanism of transmission of macroeconomic disturbances from abroad through the current account is quite simple. Under a system of fixed exchange rates and zero mobility of capital the system will operate like this. For the sake of simplicity the world is divided into two countries - home(H) and foreign(F). Any decrease in aggregate expenditure in F will lead to decrease in import demand and H will experience a deficit in balance of trade. The deficit can be corrected by real depreciation which in the face of given nominal exchange rate implies a fall in price. Now a fall in price can come about only from a fall in income or output. Thus the interdependence in fluctuation of real output between F and H is established.

In the case of flexible exchange rate the adjustment process is a bit different. A reduction in aggregate expenditure in F as before generates a trade balance surplus for F and deficit for H. Excess demand for foreign currency will lead to an increase in nominal exchange rate until the gap is eliminated. Here adjustment will be achieved through exchange rate changes without there being any need for aggregate output to come down. Increase in real exchange rate will reduce home for both exportables and importables and encourage foreign spending in favour of home goods. In the process a redistribution of domestic output can result with aggregate quantity remaining the same. Exchange rate changes will act as a buffer and absorb the changes originating in the rest of the world. It is comparable to an expenditure switching policy which attempts to control trade deficit by switching expenditure in favour of domestically produced goods while treating GDP as constant.

Transmission through the current account need not be confined to unanticipated changes in index of economic activity abroad. Any change in current economic policy, e.g., removal of tariff barriers, may result in changes in output and employment in partner countries. A common shock like the oil price rise may impart instability throughout the world almost simultaneously. And here the impact will primarily come through either a change in internal price level or exchange rate. Inflationary tendencies from abroad can be imported via current account in the form of higher import prices, which can subsequently push up the internal price level.

So far transmission through the current account has been discussed in general terms like a change in aggregate activity abroad. Sources of change in such activity like shift in monetary or fiscal policy has not been touched. But it is true that a change in budgetary policy of a government can very well affect the current account balance of its major trade partners. An increase in budget deficit by a government is capable of generating excess demand for non-tradables produced in the economy. If commodity market equilibrium is still to be preserved, excess supply of tradables is necessary and that can come about through a fall in $\frac{P}{P^*}$ or real appreciation. It is equivalent to real depreciation for the foreign country which will enjoy some relief in the current account. Internally however this will imply lower demand for tradables so that the foreign country also will experience some redistribution of output with aggregate quantity remaining the same.

Keeping in mind the theoretical background of transmission of macroeconomic disturbances from abroad as applies to the current account, some regression estimates were obtained for the Indian economy during the period 1950-51--1980-81. Before we report those results, some clarification on the construction of relevant variables probably is necessary. The dependent variable was defined as a ratio of actual value to trend (exponential) value in volume index of exports of SITC 0+1, 2+4, 5+6+7+8 and aggregate exports. Since we were mainly interested in fluctuation of exports ratios to trend rather than actual values were selected. The two explanatory variables chosen were ratios to trend in aggregate economic activity of developed market economies and real effective exchange rate as experienced by India. Aggregate economic activity was measured by both GDP and index of industrial production. Real effective exchange rate was obtained as the nominal rupee-dollar exchange rate divided by a ratio of consumer price index in India

period : 1950-51 -- 1980-81

1.	$Y = 3.2308 - 1.8478X_{16-1} + 2.9489X$	$\bar{R}^2 = .4529$
	(4.9255) (-2.7161) (2.9925)	DW = 1.3152
2.	$Y = 2.3848 - 1.0650 X_2 X_{2t-1} + 2.4366X$	$\bar{R}^2 = .4252$
	(6.0617) (-2.4311) (2.2147)	DW = 1.3624
3.	$Y_1 = 1.2521 - .1710 X_1 X_{1t-1} + .0916X$	$\bar{R}^2 = .2440$
	(5.5897) (-.7336) (2.2776)	DW = 1.1757
4.	$Y_1 = 1.2726 - .1847X_2 X_{2t-1} + .0973X$	$\bar{R}^2 = .3145$
	(10.2869) (-1.5301) (2.7295)	DW = 1.1986
5.	$Y_2 = 1.6976 - .4308X_1 X_{1t-1} + .2040X$	$\bar{R}^2 = .3505$
	(6.1356) (-1.0102) (2.1135)	DW = 1.1986
6.	$Y_2 = 1.6419 - .3979X_2 X_{2t-1} + .1837X$	$\bar{R}^2 = .2197$
	(4.3529) (-.8321) (1.1325)	DW = 1.1125
7.	$Y_3 = 1.3488 - .2929X_1 X_{1t-1} + .0603X$	$\bar{R}^2 = .2087$
	(6.6656) (-1.3003) (1.1044)	DW = 1.2270
8.	$Y_3 = 1.2098 - .1351 X_2 X_{2t-2} + .0814 X$	$\bar{R}^2 = .1948$
	(11.0633) (-1.1693) (1.6973)	DW = 1.2664

Where Y = Ratio to trend, quantum index of exports of India, 1970-71 = 100

Y_1 = Ratio to trend, quantum index of exports of India for SITC 0, 1, 1970-71 = 100.

Y_2 = Ratio to trend, quantum index of exports of India for SITC 2,4, 1970-71 = 100.

Y_3 = Ratio to trend, quantum index of exports of India for SITC 5,6,7,8, 1970-71 = 100.

X_{1t-1} = Ratio to trend, index of GDP of developed market economies, 1970-71 = 100, one period lag.

X_{2t-1} = Ratio to trend, index of industrial production of developed market economies, 1970-71 = 100. one period lag.

X = Real effective exchange rate.

Figures in parentheses give the t ratios.

and those of her four major import trade partners. The later variable was of course an weighted average, weights being equal to relative shares enjoyed by them in India's import trade. The four countries chosen were, U.K., U.S.A., Iran and Japan. USSR has been deliberately left out as official data do not indicate any inflation in that country. The results are shown in the next page (They have already been reported in *Margin*, Vol.20, No.2, Jan-Mar 1988).

Constant terms in all the equations come out very significant indicating that major explanatory variables have been left out. This is to be expected because internal demand and supply variables have not been taken into account. Our primary purpose was to catch the influence of changes in the world economy on India's export fluctuations. The world activity variable with one period lag consistently comes out with a negative sign indicating that favourable ratios to trend in world GDP or industrial production are mostly accompanied by unfavourable ratios in India's exports. The negative coefficient is not always significant but its significance increases with longer period lags. Real exchange rate however proves to be a very good choice. Real depreciation of the currency is capable of bringing unanticipated increases in export volume, most of the results show that. Excess demand in the world economy leading to rate of inflation higher than India's internal rate benefits the export sector more than that compared to the direct influence of higher aggregate demand in the world economy. If world aggregate demand lies above the trend but inflation rate is moderate, favourable effect upon India's exports will be less. An overall inflationary condition in the world economy confers some benefits on the country which to some extent compensates for the failure to take advantage of higher aggregate demand in the rest of the world.

II

Role of capital account of balance of payments as an agent of propagating changes from the rest of the world is being increasingly emphasized in recent years. The trend towards deregulation of capital flows and integration of financial markets since the late seventies has directly contributed to the increasing attention being given to capital account behaviour. Monteary theory of balance of payments developed by Mundell and Johnson has often been empirically tested to explain the short-term flow of capital from one country to another. The essence of the monetary approach, as is well known by now, lies in the fact of looking upon balance of payments as a monetary phenomenon. Any disequilibrium between demand for and supply of money in the internal market produces balance of payments disequilibrium and the process of adjustment is facilitated by inflow or outflow of capital if the economy is having fixed exchange rate. Assuming a stable demand function for money explanatory variables are generally restricted to level of income, price level and rate of interest. Any increase in domestic supply of money produces excess supply in the money market, interest rate become lower than the rest of the world rate and this leads to an increased demand for assets dominated in foreign currencies. Withdrawal from international reserves lowers the foreign component of monetary base and money supply again becomes equal to demand.

When it was decided to explain the behaviour of India's capital inflow within the framework given by monetary model of balance of payments, several problems had to be resolved immediately. The first such problem related to the fact that India is not a fully open economy. Internal nominal interest rate is often administered which means Indian capital market is not integrated with the rest of the world capital markets. Added to it is stringent restriction on capital mobility. Limited capital market prevents the sale of substantial amount of public debt to non-bank sector. Financing of the budget deficit is mainly done through monetisation of public debt and the difference between and monetary and fiscal policies becomes very thin. Government's borrowing requirements may largely determine the amount of increase in net domestic assets of the central bank rather than it being a decision variable of the central bank as in developed countries. These basic impediments in the way of testing the relevance of monetary model in explaining India's capital account behaviour had to be resolved and it was done in the following way.

Net capital inflow was disaggregated into official and private flows in both nominal and real terms. Since perfect mobility of capital is not there and whenever capital comes in it is in response to payments requirements, interest differential between home and abroad was not taken into consideration. Instead the monetary-fiscal policy mix suggested the inclusion of central government budget deficit as the prime explanatory variable. An increase in the budget deficit will raise internal price level due to monetisation of public debt, correct account deficit will increase and hence more outside capital will come in this was thought to be the mode of working of the model. Higher budget deficit was expected to affect commodity market by creating excess demand rather than disturb money market by creating excess supply of money and lower rate of interest. Money and commodities have been taken as substitutes and not money and financial assets. Direct foreign financing of government deficit might also be partly responsible for increased capital inflow. Increase in net domestic assets of the central bank was also supposed to affect capital inflow mainly through its impact on the current account in the form of unfavourable relative prices. India's GDP and index of industrial production were included as demand variables on the supposition that higher aggregate activity at home would mount pressures on the current account and this will be reflected in capital account transactions. World GDP and industrial production likewise were treated as supply variables, an increase in world activity variable might augment the flow of funds for India. The country has engaged itself into commercial borrowing in the recent past. In view of that three month Euro-dollar rate was included as an explanatory variable in a few equations covering a shorter span of time. Most of the results of this study on capital account behaviour have already been reported in periodicals (*Asian Economic Review*, Vol. XXIV, No.3, December 1987, *The Indian Journal of Economics*, Vol. IXX, No. 278, Jan. 1990) only a few of them are being reproduced below :

Abbreviations Used in the Equations

NCF	=	Net capital inflow
Off GCF	=	Official gross capital inflow
Off NCF	=	Official net capital inflow
Pvt GCF	=	Private gross capital inflow

GDP, W = Index of world gross domestic product, 1970=100
 P = GDP deflator India, 1070-71 = 100.
 Ind, W = Index of world industrial production, 1970=100
 GDP, I = Index of gross domestic product, India, 1070-71=100
 BD = Budget deficit at current prices
 Δ NDA = Annual change in net domestic assets of RBI
 r = Three month Euro dollar rate
 CA/C = Current account deficit
 PM = Import price index of India, 1970-71=100
 Pvt. DA = Private development assistance, World.

Empirical Results

$$\begin{aligned}
 \text{NCF (money)} &= 10.2876 + .3341 r + 10.1530 \text{ Ind. } W_{t-1} + \\
 &\quad (2.3336) \quad (.5038) \quad (2.3022) \\
 &\quad \quad \quad .6119 \Delta \text{ NDA} \\
 &\quad \quad \quad (2.8622)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .6627 \quad F = 7.20(3)(11) \\
 \bar{R}^2 &= .5707 \quad DW = 1.2518 \\
 \text{St. error} &= .4232
 \end{aligned}$$

$$\begin{aligned}
 \text{NCF (real)} &= -7.6723 + .2229 r + 7.6493 \text{ Ind } W_{t-1} + \\
 &\quad (-1.7938) \quad (.3465) \quad (1.7877) \\
 &\quad \quad \quad .6574 \Delta \text{ NDA} \\
 &\quad \quad \quad (3.1694)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .6514 \quad F = 6.85 (3)(11) \\
 \bar{R}^2 &= .5563 \quad DW = 1.1145 \\
 \text{St. error} &= .4106
 \end{aligned}$$

$$\begin{aligned}
 \text{Off GCF (money)} &= .1178 + .3285 \text{ BD} + .5917 \text{ GDP, } W_{t-1} \\
 &\quad (.0401) \quad (3.5210) \quad (.2026)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .3961 \quad F = 6.56 (2)(20) \\
 \bar{R}^2 &= .3358 \quad DW = 1.0832 \\
 \text{St. error} &= .3303
 \end{aligned}$$

$$\begin{aligned}
 \text{Off GCF (real)} &= -7.4777 + .0991 \frac{\text{BD}}{P} + 8.3740 \text{ GDP, } W_{t-1} \\
 &\quad (-1.7585) \quad (2.2403) \quad (1.05550)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .4210 \quad F = 3.63 (2)(20) \\
 \bar{R}^2 &= .3051 \quad DW = 1.0329 \\
 \text{St. error} &= .2359
 \end{aligned}$$

$$\begin{aligned}
 \text{Off NCF (money)} &= -3.8659 + 4.3449 \text{ GDP, } W_{t-1} + .4333 \text{ CA/C} \\
 &\quad (-1.3743) \quad (1.5787) \quad (4.1492)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .5873 \quad F = 8.81 (2)(14) \\
 \bar{R}^2 &= .4941 \quad DW = 1.1421 \\
 \text{St. error} &= .2319
 \end{aligned}$$

$$\begin{aligned}
 \text{Off NCF (real)} &= 10.8057 + 10.8472 \text{ GDP, } W_{t-1} + .0149 \frac{\text{CA/C}}{\text{PM}} \\
 &\quad (2.4321) \quad (2.4198) \quad (1.8989)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .3526 \quad F = 5.52(2)(20) \\
 \bar{R}^2 &= .2879 \quad DW = 1.9686 \\
 \text{St. error} &= .4590
 \end{aligned}$$

$$\begin{aligned}
 \text{Pvt. GCF (money)} &= .1193 + .2122 \text{ CA/C} + .5483 r \\
 &\quad (1.2346) \quad (2.0928) \quad (3.9592)
 \end{aligned}$$

$$\begin{aligned}
 R^2 &= .7455 \quad F = 20.30 (2)(20) \\
 \bar{R}^2 &= .7201 \quad DW = 2.0020
 \end{aligned}$$

St.error = .2459

$$\text{Pvt.GCF (real)} = .0016 + (.0283) \text{ 1.9612 GDP, } I_{t-1} - .8491 \text{ Pvt. DA} \text{ PM} \text{ (-2.5839)}$$

$R^2 = .9021$ F = 92.13 (2) (20)
 $\bar{R}^2 = .8923$ DW = 2.5800
 St.error = .1824

$$\text{Pvt.NCF (money)} = -7.3384 + (-1.1632) \text{ .7066 BD}_{t-1} + 7.4345 \text{ Ind, } W_{t-1} \text{ (1.2149)}$$

$R^2 = .2929$ F = 3.93 (2)(1)
 $\bar{R}^2 = .2184$ DW = 1.7869
 St.error = .8785

$$\text{Pvt.NCF} = .0124 - (.0483) \text{ .0553 } \bar{P}_{t-1} + 1.1964 \text{ Ind. } W_{t-2} \text{ (2.5897)}$$

$R^2 = .4348$ F = 7.28(2) (19)
 $\bar{R}^2 = .3742$ DW = 1.5085
 St.error = .6653

N.B : (i) Figures in parentheses give t ratios.
 (ii) Excepting Euro dollar rate, all variables in terms of ratios to trend.

An important point to note about the estimates is that values of R^2 have consistently been satisfactory. One equation relating to real official gross capital inflow shows presence of autocorrelated error while three others fall in the inconclusive range. Increase in net domestic assets of the central bank does not result in a negative inflow of reserves which would be consistent with the monetary theory prediction. In defence it can be pointed out that increased current account deficit owing to new money creation is not being met by drawing down international reserves, rather it gives rise to larger external borrowing, and that is being indicated by positive coefficient of Δ NDA. Inclusion of budget deficit whether nominal or real proves to be wise choice as the coefficient comes out with desirable sign and statistical significance. Fluctuations in world GDP or industrial production with one or two period lags mostly proves to be a satisfactory variable in explaining fluctuations of capital inflows to India.

Testing of the monetary model in a situation of fixed exchange rate and then adjustable peg coupled with imperfect mobility of capital necessitated some changes in the given framework. Being unable to explain capital inflows in response to monetary policy changes we had to direct attention to the factors governing current account position as major part of capital flows arises in response to that. What we have actually achieved is that the same variables specified for a monetary model have been retained but a different mechanism has been used to explain the movement of capital. In the process, influence of fluctuations in world economic activity established itself as an important variable in explaining variability in India's foreign capital inflow. In six out of ten equations reported here the world activity coefficient comes out with significant positive coefficient. Although India's linkage with international capital market is rather poor, official capital flows fluctuate more or less in conformity with variations in world activity.

Next in order to find out there is any linkage between

fluctuations in outside capital inflows and domestic investment, domestic fixed investment was disaggregated into public and private investment at 1970-71 prices. It was then regressed with respect to gross official and private real capital inflow over the period 1962-63, and 1980-81. The estimated equations are shown below:

$$1. \text{GFPI} = 1.0912 + .2528 \left(\frac{\text{Off GCF}}{\text{PM}} \right)_{t-1} + .5781 \text{GDPI} \\ (1.1810) (1.9110) \quad (.7975)$$

$$-.9551 \text{CS}_{t-2} \\ (-2.6983)$$

$$\bar{R}^2 = .4870$$

$$F(3)(13) = 4.80$$

$$\text{St. error} = .0725$$

$$\text{DW} = 1.4992$$

$$2. \text{GFPI} = 1.3167 + 1.0961 \text{Ind, I} - .0450 \left(\frac{\text{Pvt GCF}}{\text{PM}} \right) - .4317 \text{CS}_{t-2} \\ (\text{Price}) (.7735) \quad (3.2518) \quad t-1 \quad (-.6770) \quad (-1.9313)$$

$$\bar{R}^2 = .4842$$

$$F(3)(10) = 5.38$$

$$\text{St. error} = .0696$$

$$\text{DW} = 1.6877$$

$$3. \text{GFPI} = .1344 - .5691 \text{Ind, I} + .0064 \left(\frac{\text{Pvt GCF}}{\text{PM}} \right)_{t-2} \\ (.3828) \quad (1.6654) \quad t-1 \quad (.0985) \quad t-2$$

$$+ .2362 \text{RRCO}_s \\ (2.5610)$$

where GFPI₁ = Gross fixed public investment
 GFPI₂ = Gross fixed private investment
 CS = Capital Stock
 RRCOs = Real average return on corporate ordinary shares
 GDPI = Gross domestic products, India
 Ind, I = Index of industrial production, India.

In the case of gross fixed public investment official capital inflow is found to exercise significant influence; fluctuations in both the variables seem to move in the same direction in a statistically meaningful way, current year's investment is carried on the basis of aid committed which may be realised next year-this was the functional relationship postulated and it came off well. In the case of fluctuations in private gross domestic investment however dependence on variations in outside capital inflow could not be proved. Other traditional demand and supply variables performed better compared to external capital movements.

III

After examining the responsiveness of different components in India's balance of payments to fluctuations in economic activity in the rest of the world, in this final section we would like to report the results that were obtained in our effort to relate India's internal inflation rate with the rest of the world. A higher inflation rate abroad can affect the domestic economy in several ways. First there is the direct channel through imports. If world prices are increasing, a country will have to pay more while importing and this sets off an inflationary trend at home.

Higher world prices may affect export revenues as well and depending upon the share of foreign sector in national income aggregate, demand may go up putting pressure upon prices. If world inflation persists for some time anticipation of inflation also might affect the current inflation rate in the country concerned. Anticipated higher inflation leads to higher depreciation of currency and demand for both commodities and assets might change in the process. Thirdly, higher world income might result in higher remittances from abroad, expand the foreign component of monetary base, increase money supply and lead to higher inflation rate. It is not that this gives us an exhaustive list of the channels through which inflation can be transmitted; on the contrary it just gives an idea about the possible sources through which outside inflation may affect the internal inflation rate of a given country.

The model that we applied to analyse India's rate of inflation is a simple monetary model combined with at least one transmission variable in each equation. The internal variables chosen were percentage increase in real GDP with one year lag, percentage increase in money supply (M_t) with one year lag and actual cost of holding cash. An increase in real GDP will increase demand for real balances which in the face of given money supply can come about only through a decline in the price level. So inflation rate and real GDP increase was supposed to be associated in the inverse way. About money supply it was thought that increase in nominal supply of money with demand for real cash balances remaining unchanged will be consistent if price level adjusts upward. It is true that this effect may not work out instantaneously. It may require some time before full impact of monetary increase can be felt. Since we did not know the exact lag structure it would have been advisable to try a distributed lag pattern extending upto three four periods like $M_{t-1} + M_{t-2} + M_{t-3} + M_{t-4}$, etc. We experimented with M_t , M_{t-1} and M_{t-2} and after that coefficients were quite insignificant. Finally only M_t and M_{t-1} were retained. In a standard monetary model the third internal variable chosen is obviously the rate of interest because money is assumed to be a substitute for assets. Given the nature of the Indian economy we thought that money should better be conceived as a substitute for commodities and expected rate of inflation immediately suggested itself as a suitable variable. Here compromise was made and actual change in inflation rate between periods $t-1$ and $t-2$ was finally selected. It can be termed as a price acceleration variable (Harbarger has used that term) As inflation rate becomes higher cost of holding cash increases, people try to reduce their money balance creating further inflation pressure in the commodity market. Inflation rate and price acceleration variable are supposed to move together in the same direction.

Along with these three internal variables, three external variables have been chosen to represent the import of inflation from outside. These relate to rate of inflation in import prices, an import price acceleration variable as defined earlier and change in foreign exchange assets of the RBI.

The present study chose as its dependent variable the rate of inflation (1960-61 - 1982-83) rather than the level of prices. The dependent variable has been defined in terms of GDP implicit deflator, wholesale and consumer price indices. To measure the overall rate of inflation GDP implicit deflator is an obvious

choice. About wholesale price index it can be said that since it concentrates more on commodities and hence includes a greater proportion of tradables it might be very suitable for analysis of inflation caused by international forces. Consumer price index is much favoured in monetary approach to inflation because change in household demand for money affects consumer expenditure and through it, the inflation rate. Apart from exploring the mechanism of interaction with the outside world of a price index of aggregate nature we tried to investigate how this interaction affects different components of a general index. It is true that not all components respond in the same way to forces of inflation-- some may be more sluggish than others in responding to the same set of chosen forces. Supposing that to discuss such differences in response pattern should be of interest, inflation rate was calculated in regard to wholesale price index and its four components as well namely primary articles, food, fuel, power, light and manufactured products. Inflation rate in consumer price index was studied for industrial workers (general and food) agricultural labourers (general and food) and urban non-manual employees. The empirical results obtained will be published shortly in a journal. Some selected results are being reproduced below.

Of the three variables tested for bringing in outside inflationary impulses into the country, results containing only one have been reported here. F ratios indicate that excepting one equation (wholesale price index, food) values of R^2 are satisfactory. Performance of the two internal variables GDP and M_1 is however not at all satisfactory, coefficients are mostly insignificant and very often come out with signs which go against the prediction of monetary model. The positive coefficient of GDP may be explained by the fact that instead of affecting transaction demand for money, it primarily affects demand and supply of commodities. Higher real output implies greater demand and supply as well and depending upon the relative strength of the impact, we get a positive or negative sign. Unsatisfactory performance of money supply variable also merits some comment. In the monetary framework the basic Walrasian proposition that excess supply of money is equivalent to excess demand for commodities is very much present. But in those cases where change in money supply has important output effects by bringing into use hitherto unutilised resources, relationship between change in money supply and inflation rate may not be positive always. In the Indian economy, where deficit financing is undertaken to keep up the tempo of investment and output generation, output effect may be quite strong if not stronger than the price effect.

About transmission of inflationary tendencies from abroad it can be said that there is strong evidence in support of transmission through the first channel. Direct price linkage emerges as the overwhelmingly dominant mechanism whereby inflation is transmitted to India. For one point increase in inflation rate in import prices, domestic inflation rate on an average goes up by 15, the absolute value of the coefficient being dependent on the share of traded goods in production and consumption. It may also point towards the presence of lags in the price interrelationship; an increase in the rest of the world inflation rate may require some time before its full impact can be felt on domestic inflation rate.

Dependent Variable	Constant term	GDP _{t-1} % increase	Mit % increase	Ex-post inflation rate between t-1 and t-2	PM _t % increase		
GDP deflator	-6.0359 (-1.3076)	-6.5560 (-1.8252)		4.6062 (3.7200)	.3342 (1.8107)	R ² = .4564; R ² = .3605 F = 4.76(3) (17); DW = .6435 SEE = .4366	
Wholesale Price Index (all commodities)	7.4540 (2.9203)	-.2721 (-.7857)	.0180 (.0961)	.1459 (.9188)	.1740 (2.7391)	R ² = .4800; R ² = .3577 F = 3.92(4) (17); DW = 2.3369; SEE = 5.5312	
Wholesale Price Index (fuel, power, light)	.0818 (.0918)	-.6929 (-1.0123)	.6869 (1.6726)	.3342 (1.0596)	.2320 (2.4390)	R ² = .5262; R ² = .3908 F = 3.89(4) (14); DW = 1.9973; SEE = .0912	
Wholesale Price Index (food)	-.1971 (-.3312)	-.2718 (-.4544)	.0029 (.8941)	.7437 (2.8581)	.0831 (.9985)	R ² = .4572; R ² = .3021 F = 2.95(4) (14); DW = 2.1868; SEE = .0763	
Wholesale Price Index (mfg. goods)	5.1573 (2.3441)	-.2559 (-.8573)	.1941 (1.2017)	.1919 (1.4016)	.1530 (2.7953)	R ² = .5610; R ² = .4577 F = 5.43(4) (17); DW = 2.3242; SEE = 4.7677	
CPI for Industrial Workers (general)	6.2166 (2.4985)	-.1787 (-1.0571)	.4472 (1.3312)	.6884 (3.4734)	.1576 (2.8940)	R ² = .6423; R ² = .5681 F = 763 (4) (17); DW = 1.5704; SEE = 4.7547	
CPI for Industrial Workers (food)	6.2892 (2.0345)	-.1798 (-.8563)	.4362 (1.0450)	.9034 (3.6686)	.1487 (2.1974)	R ² = .6298; R ² = .5427 F = 7.23 (4) (17) DW = 1.5569; SEE = 5.9073	
CPI for Agricultural Labourers (general)	8.4482 (1.7009)	.0024 (.0041)	-.2412 (-.7000)	.9729 (2.7653)	.1644 (1.7649)	R ² = .6956; R ² = .5549 F = 6.28 (4) (11); DW = 1.7210; SEE = 1.7428	
CPI for Agricultural Labourers (food)	9.6088 (1.7200)	-.1303 (-.1937)	-.2759 (-.7119)	1.0733 (2.7123)	.1712 (1.6342)	R ² = .6979; R ² = .5880 F = 6.35 (4) (11); DW = 1.7903; SEE = 8.7089	
CPI for Urban Non-manual Employees	6.5914 (2.9125)	.1318 (.5627)	-.0877 (-.5412)	.2910 (2.0175)	.1093 (2.4557)	R ² = .5540; R ² = .4351 F = 4.66 (4) (15) DW = 1.3833; SEE = 3.7295	

Inter - Relatedness of Stock Markets : A Spectral Investigation of USA, Japanese, and Indian Markets - A Note

B. S. R. Rao and Umesh Naik

I. Introduction

As a recurrent theme in the investigation of the existence of international portfolio diversification (Grubel, 1968), several studies have sought to examine the extent of the inter-temporal relationship amongst national stock price indices in an effort to discover the degree to which national capital markets are integrated (Granger and Morgenstern, 1970, Hilliard, 1979, Agmon 1974).

Further, significant developments in world capital markets during the decade of the eighties have contributed to renewed interest in this area. The event of October, 1987, in which many international markets witnessed virtually simultaneous price collapses in sympathetic resonance, and the various measures for deregulation of national capital markets which have possibly reduced the extent of capital market segmentation have been the subject of study by various authors (Gultekin et.al. (1989), Furstenberg and Jeon (1989), Eun and Shim (1989).

It is generally argued that changes in movements in stock prices are influenced by flow of market information. One possible information source is movements in other stock markets of the world. It is also possible that one stock market may be opening while another may be closing, so that a lag relationship between stock price movements in the two markets through transmission of information may perhaps exist. There are others of course who contend that stock prices in any two markets do not move together as small price fluctuations in one market are not very relevant for the other market.

In general, the earlier pre'80 stream of studies has documented a surprisingly low degree of correlation between various national capital markets, leading to the conclusion that the then prevailing high level of international capital market segmentation can be attributed to domestic factors which work to impede the international flow of capital across national boundaries. Using spectral methods, Granger and Morgenstern (1970), concluded that "in almost all cases the price indices on the various markets moved independently of one another, although this would not be likely

to be the case if a world-wide financial crisis occurred or a war began".

Hilliard (1979), also used spectral analysis and concluded that there did not seem to be a common world-wide financial market factor which would induce significant co-movement in national stock price indices. In terms of a market model, this implies that there is a considerable degree of unsystematic risk in national capital markets and virtually no systematic risk, related to a common world-wide factor. Moreover, as a consequence of the low estimates of correlations, the question of leads and lags was not deemed to be very significant.

The recent studies by Furstenberg and Jeon (1989), and Eun and Shim (1989), suggest that there is considerable inter-dependence amongst international stock markets. These studies also indicate that the U.S. market plays an important role in the international transmission of stock market influences. Eun and Shim (1989), further conclude that the Japanese stock market acts like a follower in international stock markets. Furstenberg and Jeon (1989) came to the conclusion that international capital markets have become more integrated after the 1987 crash.¹ They also suggest that the Japanese market is able to transmit more of an originating impulse in its own market to other markets after the crash, than before it.

The present study uses spectral methods to examine monthly stock indices for Japan, USA and India, for the period January 1971 to December 1988. The findings are that, in general the inter-relationships among the three markets as measured by the coherences of the monthly indices are, on average, quite low. Also, contrary to the suggestion of Eun and Shim (1989), that Japan acts like a follower in international markets, the findings point to the possibility that the Japanese market probably acts more like an independent factor in relation to the US and Indian stock markets.

II. Methodology

The approach of the study is essentially atheoretical. Cross-spectral analysis is used for the three pair-wise sets of data, for the Indian, Japanese and American stock markets so that the data may be characterised by stylised facts over the period of analysis. An alternative approach is to specify and estimate an *a priori* model, calculate the theoretical spectra, and compare with the estimated spectra. Whereas such an approach would have a stronger theoretical underpinning, it may lead also to a severe specification bias.

Spectral analysis is based on the Cramer Decomposition theorem which enables a discrete stationary series (X_t) ,

$t = 0, 1, 2, \dots$, with mean μ to be represented as

$$X_t - \mu = \int_0^{\pi} \exp(i\omega t) dZ(\omega)$$

where $\omega = 2\pi f$, ω is angular frequency, $f = \text{cycles/time unit}$, the period is $T = 1/f = \text{time units/cycle}$, $dZ(\omega)$ is an independent increment to the stationary process. Consequently, any stationary process can be decomposed as a linear sum of an infinite number of different sinusoids representing different cycle lengths, and

the presence of significant cycles can be detected on the basis of the spectral estimate of each sinusoidal component of the time series. Usefully, the theorem generalises to multivariate stationary processes, and for bivariate processes we can compute various statistics which characterise the inter-temporal relationships between two stationary time-series. The coherence between a pair of series at various frequency levels yields information analogous to the R^2 statistic in regression analysis, at each frequency level. Thus, the coherence statistic measures the association between distinct cycles of the same period. The phase angle, measures the time displacement between cycles of the same period, whereas the gain statistic is analogous to the regression coefficient in a linear regression of the form.

$$X_t(w) = R_{xy}(w) \cdot Y_t(w) + Et(w)$$

Where $R_{xy}(w)$ is the gain at frequency w , and measures the extent of influence of the 'independent' frequency variate $Y_t(w)$ on the corresponding 'dependent' frequency variate $X_t(w)$.

III. Data

The data used in the study are monthly indices of stock prices for the Bombay, New York and Tokyo exchanges, for the period January 1971 to December 1988. The period covered by the data includes the episode of the October 1987 world market crash, as well as the Indian stock market boom of 1985-86 and 1986-87 and subsequent fall in 1987-88.

It also includes the enactment of the Foreign Exchange and Foreign Trade Control Law in 1980 in Japan which eliminated almost all capital controls. Unfortunately, since the frequency of data is monthly, there are not enough observations on the post '87 period to enable differences in behaviour to be detected. This could be remedied by the use of weekly or daily data.

All the series are first differences in the monthly indices and constitute a total of 216 observations for the period. It may be noted here that first differencing the raw data amounts to a linear transformation which acts to filter out low frequencies and amplify high frequencies. The Indian and Japanese data are heavily time-averaged since they are calculated as monthly averages. Because this form of time-averaging is a kind of smoothing operation on the data, it tends to filter out the high frequencies.

IV. Measures of Bivariate Relationships

The spectral estimates of the three individual series are shown in Figs. 1,2,3.

The coherence values are calculated over set of 19 frequency estimates and are shown in Tables 1 to 6. As can be seen, the pair-wise average coherences are fairly low, and compare with similar results obtained by Granger and Morgenstern (1970) and Hilliard (1979).

The average coherence between the New York and Tokyo exchanges is 0.206 (inclusive of zeroth frequency) and 0.182 (excluding the zeroth frequency). Thus, the estimates are higher than the Granger and Morgenstern (GM) and Hilliard (H) studies but still fairly

low. The GM study, using weekly data on ten national stock markets for the period August 9, 1961 to September 2, 1964, found that the pair-wise coherences do not exceed 0.29, which is the highest average coherence statistic reported, between New York and Amsterdam. The average coherence between Sydney and Tokyo reported by GM is 0.10. The Hilliard study using daily data for the period July 7, 1973 to April 30, 1974, which included the OPEC oil embargo, for ten stock exchanges reported a maximum average coherence of 0.433 between New York and Toronto, and a lowest average coherence of 0.056 between Sydney and Tokyo, which is lower than the value reported by GM. The average coherence between New York and Tokyo reported by Hilliard is 0.105. The peak coherence between New York and Tokyo reported by Hilliard is 0.35. The peak coherence in the present analysis (excluding the zeroth frequency) is 0.48 at a frequency of 0.36 or 2.78 months.

The average coherence (including zeroth frequency) for India and USA is 0.177 and 0.161 (excluding zeroth frequency) which is lower than the corresponding average coherence between USA and Japan. This result is, of course, not surprising. However, the peak coherence is 0.58 at a frequency of 0.25 (4 months). That is, the association between the US and Indian markets is stronger at an individual frequency (0.25), a frequency which is lower than the frequency (0.36) for the peak coherence between the USA and Japanese markets. This also suggests that the transmission of impulses between USA and India is slower than that between USA and Japan. Further, for USA and India, the next important frequency is 0.11 (9 months) with a coherence value of 0.48, whereas for USA and Japan the frequencies next in order of importance are 0.30 (3.3 months) with coherence 0.41, 0.03 (3.3 months) and 0.44 (2.27 months) with coherence 0.36 and 0.33 (3.03 months) with coherence 0.35. This pattern with many frequencies having an equal importance in terms of the coherence value may perhaps result from more complicated feedback structure between the Japanese and US markets which bears further investigation.

The relationship between the Japanese and Indian markets is poor, as expected, and has an average coherence of 0.107 (including zeroth frequency) and 0.101 (excluding zeroth frequency). The peak coherence value is 0.30 at a frequency of 0.11 (9 months). The low coherences, and the insignificance of high frequency coherences reflect the institutional fact that both the Indian and Japanese markets have been characterised by heavy controls throughout the seventies, and have been relaxed only in the eighties in case of Japan and marginally only in case of India. Any relationship will therefore be likely to be formed only at a low frequency.

The gains estimates have been used to suggest which markets should be considered as 'independent' in a bivariate relationship. For the USA and Japan series set, it appears that Japan should be considered as 'independent' as the gain estimates are consistently greater when Japan rather than USA is made the 'independent' series, at all frequencies except 0.16 (6.25 months) and 0.19 (5.26 months). This may seem to go against the notion that Japan is a follower in international stock markets (Eun and Shim 1989).

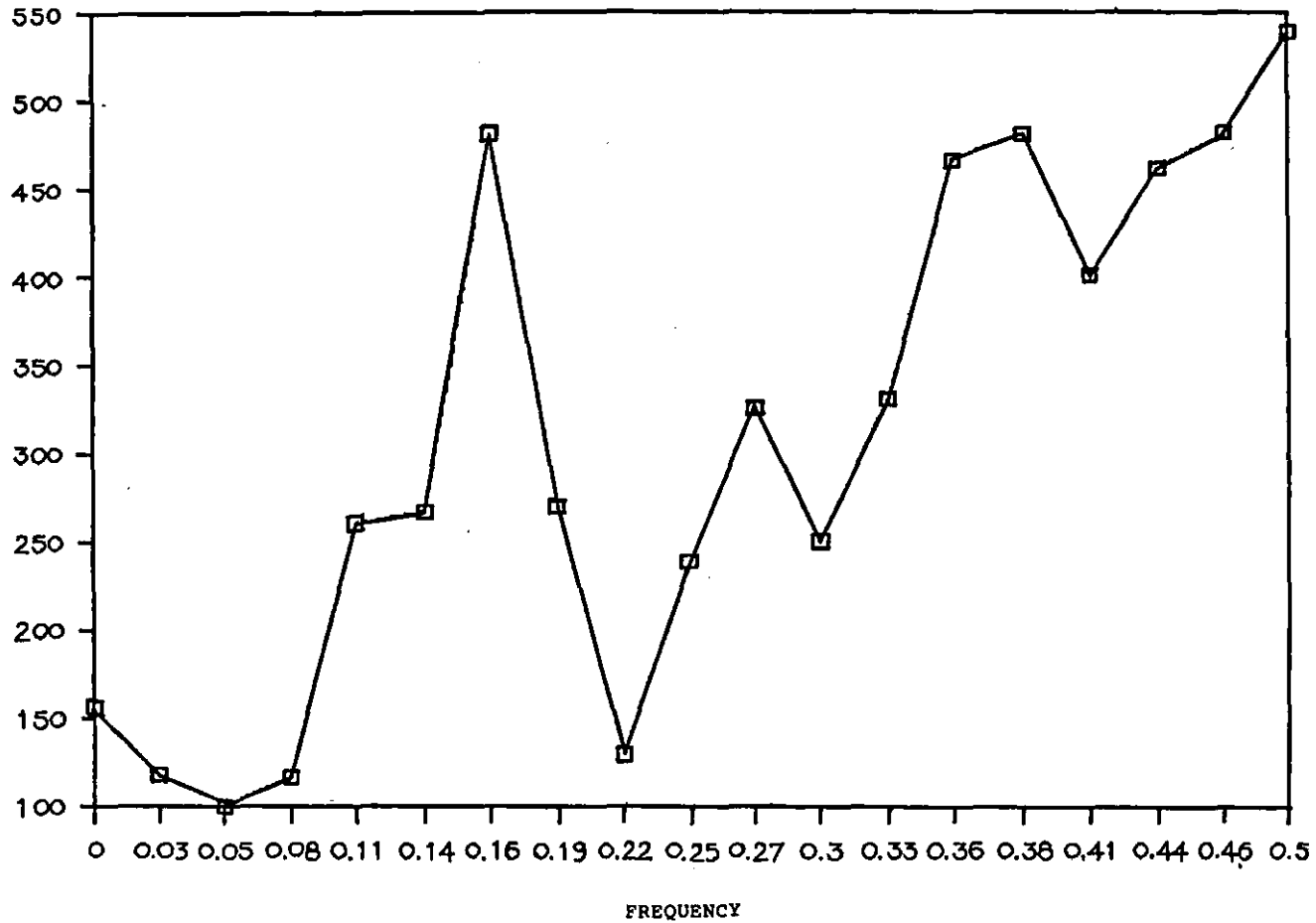
For the USA and Indian series set, it appears more reasonable to consider USA as the 'independent' series as the gains estimates

suggest because the frequencies for which the gains estimates suggest India should be considered 'independent' have insignificant coherences. For the Japan and India series set, the gain estimates suggest Japan should be an 'independent' series. Thus, the three bivariate sets of gains estimates suggest the following 'causal' structure for the inter-temporal relationships between the national capital markets studied here.

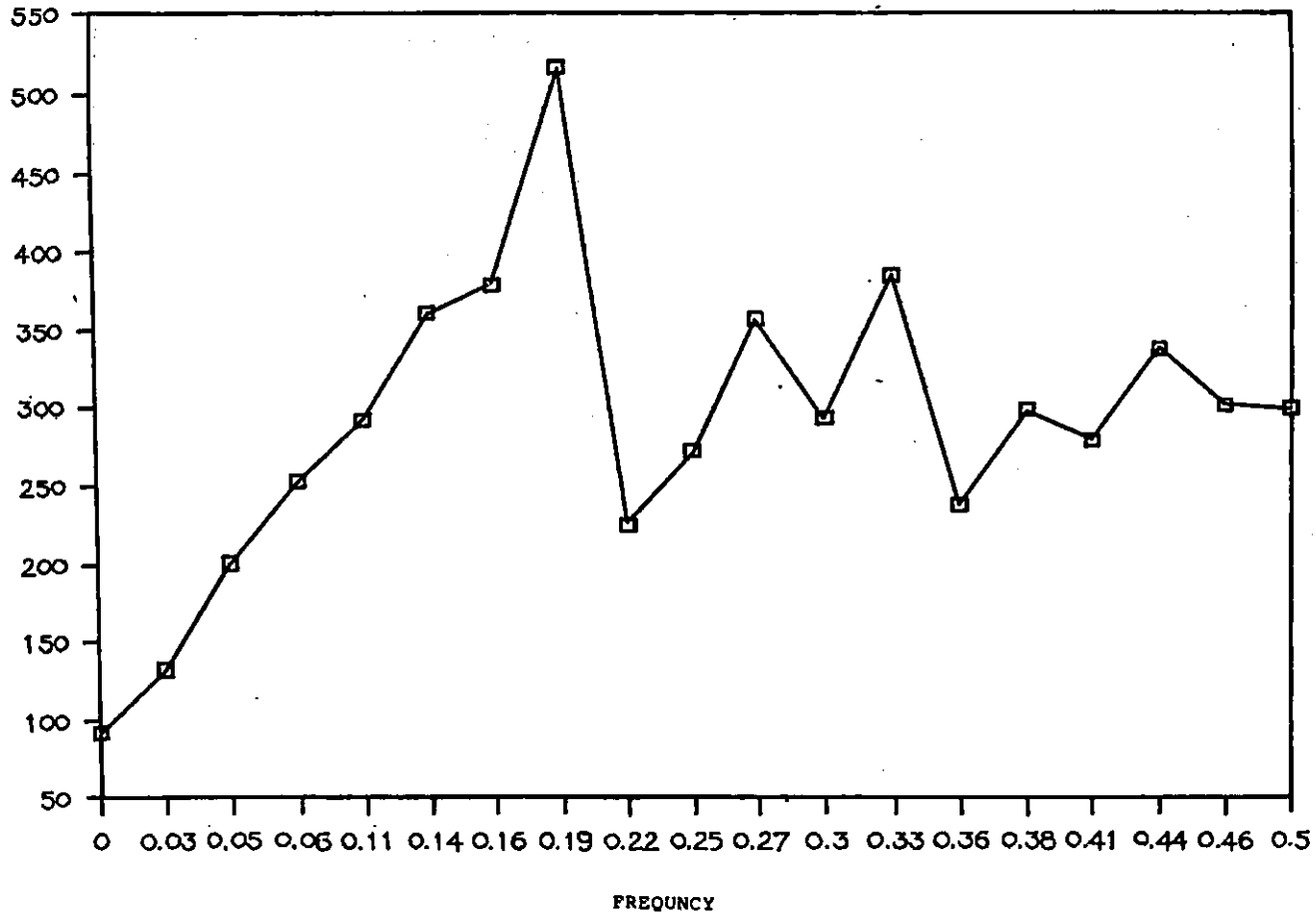


In the above figure, the direction of the arrow points out the direction of influence, and shows that USA influences the Indian market independently, but also amplifies disturbances from the Japanese market. This conclusion seems consistent with studies like Eun and Shim (1989) and Furstenberg and Jeon (1989) which accord similar status to USA both as an originator and amplifier of disturbances. What is perhaps at variance from such studies, and bears further investigation, is that it appears to be the case that it is the Japanese market which influences the American market, and not vice-versa, over a period of several months, the quickest detectable influence being two months.

SPECTRAL ESTIMATE INDIA



SPECTRAL ESTIMATE U.S.A.



INTER-RELATEDNESS OF STOCK MARKETS
SPECTRAL ESTIMATE

SPECTRAAL ESTIMATE JAPAN

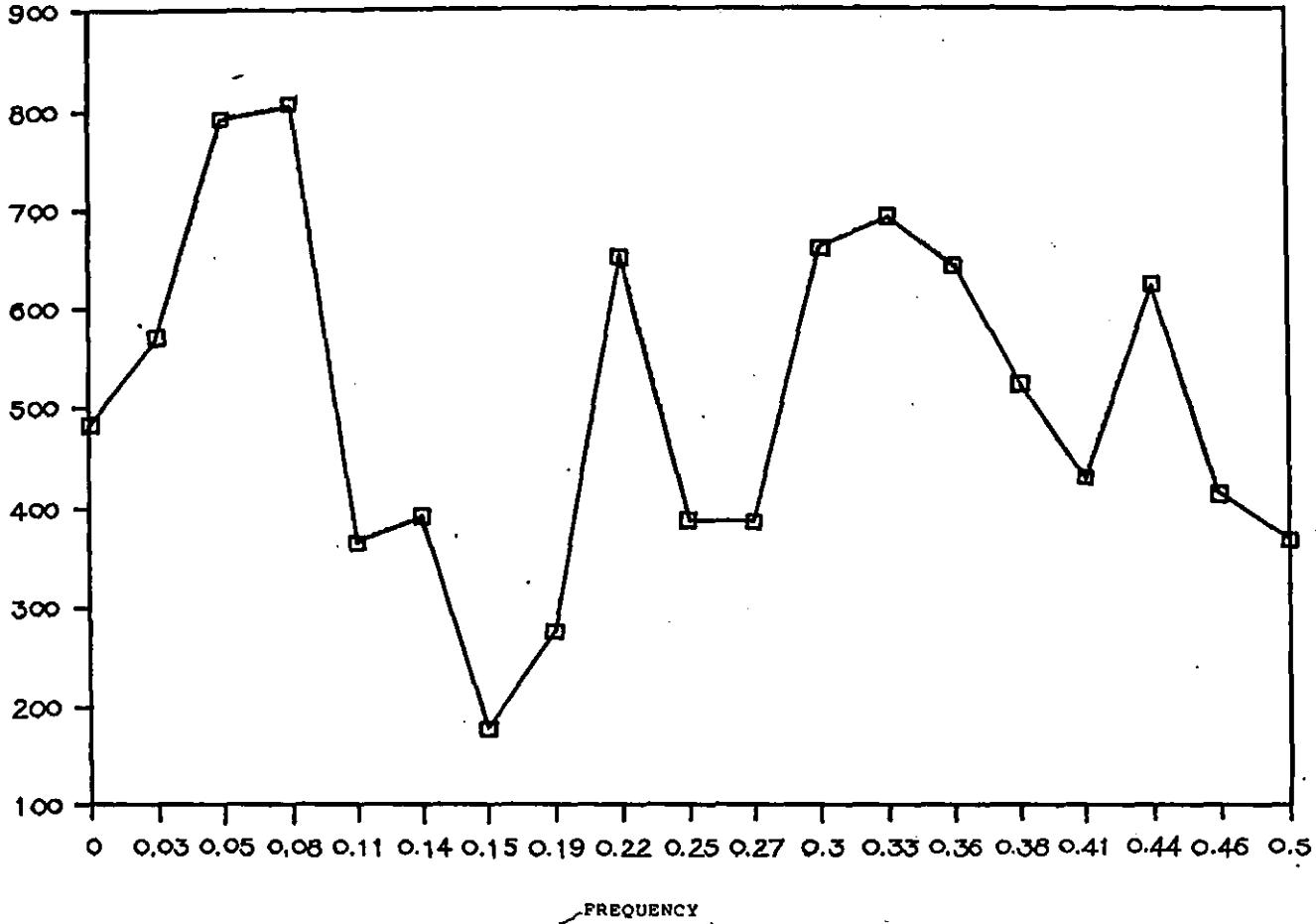


TABLE : 1
INDIA - U.S.A.

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.48	.41	.53
.03	.22	-.48	.49
.05	.13	-.16	.51
.08	.11	.46	.50
.11	.48	-.24	.73
.14	.12	.51	.40
.16	.21	-.70	.41
.19	.02	1.38	.17
.22	.24	1.48	.65
.25	.58	-.33	.82
.27	.03	.48	.19
.30	.29	1.29	.59
.33	.01	-1.39	.09
.36	.04	.00	.14
.38	.08	.28	.23
.41	.01	-.94	.10
.44	.02	-.86	.13
.46	.23	.84	.38
.50	.07	.59	.19

TABLE : 2
U.S.A. - INDIA

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.48	-.41	.90
.03	.22	.48	.44
.05	.13	.16	.26
.08	.11	-.46	.23
.11	.48	.24	.65
.14	.12	-.15	.30
.16	.21	.70	.52
.19	.02	-1.38	.09
.22	.24	-1.48	.38
.25	.58	.33	.71
.27	.03	-.48	.17
.30	.29	-1.29	.50
.33	.01	1.39	.08
.36	.04	.00	.28
.38	.08	-.28	.37
.41	.01	.94	.14
.44	.02	.86	.18
.46	.23	-.84	.60
.50	.07	-.59	.34

TABLE : 3

U.S.A. - JAPAN

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.64	-.05	1.83
.03	.36	.25	1.25
.05	.15	.14	.78
.08	.07	.10	.47
.11	.18	.37	.47
.14	.14	1.05	.39
.16	.14	-.82	.25
.19	.24	-.27	.35
.22	.16	-1.39	.67
.25	.07	-1.19	.32
.27	.02	.37	.15
.30	.41	.14	.96
.33	.35	.28	.79
.36	.48	-.63	1.14
.38	.04	.82	.28
.41	.01	.94	.13
.44	.36	.48	.82
.46	.08	-1.53	.33
.50	.01	-.59	.09

TABLE : 4

JAPAN - U.S.A.

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.64	.05	.35
.03	.36	-.25	.29
.05	.15	-.14	.20
.08	.07	-.10	.15
.11	.18	-.37	.38
.14	.14	-1.05	.36
.16	.14	.82	.54
.19	.24	.27	.66
.22	.16	1.39	.23
.25	.07	1.19	.23
.27	.02	-.37	.14
.30	.41	-.14	.43
.33	.35	-.28	.44
.36	.48	.63	.42
.38	.04	-.82	.16
.41	.01	-.94	.08
.44	.36	-.48	.44
.46	.08	1.53	.24
.50	.01	.59	.07

TABLE : 5
INDIA - JAPAN

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.15	1.20	.67
.03	.21	.31	1.01
.05	.26	-.05	1.42
.08	.00	.66	.02
.11	.30	.46	.65
.14	.06	.38	.30
.16	.13	1.16	.22
.19	.06	-.60	.25
.22	.22	.42	1.04
.25	.03	-1.03	.20
.27	.00	1.10	.04
.30	.11	.86	.55
.33	.10	1.07	.46
.36	.04	-.13	.25
.38	.12	.20	.36
.41	.07	-.69	.28
.44	.07	-.30	.30
.46	.05	-1.00	.21
.50	.09	-.28	.25

TABLE : 6
JAPAN - INDIA

FREQUENCY	COHERENCE	PHASE	GAIN
.00	.15	-1.20	.22
.03	.21	-.31	.21
.05	.26	.05	.18
.08	.00	-.66	.00
.11	.30	-.46	.46
.14	.06	-.39	.21
.16	.13	-1.16	.58
.19	.06	.60	.25
.22	.22	-.42	.21
.25	.03	1.03	.13
.27	.00	-1.10	.04
.30	.11	-.86	.21
.33	.10	-1.07	.22
.36	.04	.13	.18
.38	.12	-.20	.33
.41	.07	.69	.26
.44	.07	.30	.22
.46	.05	1.00	.25
.50	.09	.28	.37

Footnote :

1. We may recount certain facts here. On Monday, 19th October, 1987 (commonly referred to as "Black Monday"), there was a very sharp decline in share prices on the Wall Street. Specifically, the Dow-Jones average of 30 blue chip industrial stocks, a barometer of the New York Stock Market conditions, fell by 508 points, the single steepest decline of the index on any single day in absolute terms. This Wall Street plunge exceeded even the 1929 stock market crash. The loss in share value on 19th October which was over 22.5 per cent was the worst percentage loss for the Dow-Jones since 24 per cent fall registered on 12th December 1914. Moreover, the volume of trading on the New York Stock Exchange was a record, with 604 million shares changing hands on that eventful day.

The New York market collapse had spread rapidly to other major markets around the globe - Tokyo, London, Sydney, HongKong and Frankfurt Exchanges. The share prices on world's largest stock exchange, Tokyo exchange, nosedived wiping out about 15 per cent of investors' portfolio values. The loss in stock values on Sydney market was a whopping 25 per cent while it was nearly 11 per cent on the London Exchange.

The Indian stock markets, however, were not perceptibly affected because of their insulation from the global markets, what with the foreign exchange and stock market regulations. From a level of 212.4 on October 10, 1987, the RBI Index of Ordinary shares prices (with base 1980-81 = 100) declined marginally to 211.1 on 17th and further to 211.1 on 17th October, 1987.

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East Europe's Reforms and Developing Countries' Trade Prospects : A Medium Term Perspective

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1. Introduction

After years of grim dullness, the European polity is producing so many sensations - totally unpredictable developments - that it is hard to pick the biggest. Who would have thought, for instance, death of communism in the Eastern block and rebirth of democracy? Who would have thought that Soviet empire in the East? Who would have thought that Soviet Union and its Warsaw pact - cousins would begin their journey to a common European home? Who would have thought that the great communist countries like the Soviet Union would uphold the sanctity of market? And yet, we are curious witnesses to spectacle of developments happening in the central and eastern Europe at break-neck-speed - Tearing the East-West division and the post-1945 order of political stability.

While no one could fail to welcome the happenings in Europe, there is increasing concern in the developing world from the erosion of polarisation. They perceive three kinds of dangers from the altered geopolitics. First, the air is already thick with the feeling that this will affect the developmental aid flowing to the poor in Africa, Asia and Latin America, because the size of pie has not increased, but the number of claimants for a slice has, if the countries of the East are added; and given the fact that the latter has thrown off its communist yoke, and given the close religious and ethnic ties between East and West, economic aid to the former will be politically more popular than aid to the developing countries of the South. In all probably, South would then be only at the margin with the usual, though not the necessary, "take it or leave it" attitude. Second, there remains the twin issues of indebtedness and investment. Much of the capital and technology, which might have been transferred to the South, will now be slipping through to the East. Third, it will hurt South's trade opportunities, especially of the countries of Asia, because the latter has gained some comparative advantage in the very sectors where East has gained - machinery and transport equipment, textiles, manufactured goods, to name a few.

Despite the clear indications provided, no study has yet

drafted a systematic analysis of the potential threat. In the pages that follow we make a modest beginning. However, it should be mentioned that it has not been possible for the present writers to study all the three issues raised at the beginning in equal depth, because a full investigation of all these would be beyond the scope of a single paper. What we propose to do therefore, is look carefully into the implications of the new realignment in Europe from the perspective of South's trade - whether the changes in the Eastern horizon will hurt South's trade opportunities.

Presumably thinking that we are right in this political speculation, it seems to us that there are two sets of questions that the readers might reasonably ask: First, what is happening in the East block, and why are things as they are? and second, why should the changes in the East hurt more the South than the North? These questions are intimately interrelated; nevertheless it may be useful to address them sequentially.

2. What is Happening in the East Block?

Reflecting on the development in the East block which led to the collapse of communist rule, one is provoked with three questions; Why did things come to such a pass? Where do they stand in their resurrection business? and what the West is doing towards its Eastern neighbours? Such broad questions can, no doubt be treated briefly and incompletely, but at least it may help to organise our discussion.

How did things come to such a pass?

A major factor that is believed to have worked strongly is the economic stagnation throughout the Eastern block, and the falling living standards. For instances, Czechoslovakia, after doing rather well in income per head by comparison with both France and Austria in the 1950's, is believed to have fallen in the 1960's and further down in the 70's and 80's. Similarly, the gap between East Germany's income per head, and that of West Germany seems to have been more or less constant until 1970's, but the gap has since then continued to widen. Both Romania and Bulgaria, when compared with Spain and Greece, the two relatively poor capitalist countries turn out to have lost ground for the latter. The obvious fact appears to be that the centrally planned economies of the East did tolerably well in the first decade at the communist rule - probably when they were shifting the surplus labour from land to a few easily organisable industries; but since then, economic progress in the region has been less than spectacular, especially when the test came to improve labour productivity, absorb new techniques, make a wider range of products, and even make them better. The great borrowing of money from the West was an attempt to arrest the continuing deceleration. But it failed, and things got worst, with a mounting debt burden, which cost countries like Poland and Hungary nearly 50 per cent of their hard currency earnings, deterioration in their terms of trade with the Soviet Union, and the ability to obtain imports from the West due to constraints in expanding exports, everything appeared to be on the brink of disaster - they are in a deep structural crisis. There have been other problems too. For instance, fulfilment of targets in the farm sector has tended to lag behind in most centrally

planned economies, thus causing serious difficulties in the supply of essential items like food. Again, the introduction of advanced technology in consumer goods industries was purposely held back, probably because the planners stuck rigidly to the social welfare function introduced in the immediate post-war years. But with changing incomes and changing social compositions, the texture of needs too tended to change in the planned economies; and in the wake of a consumerist culture, the discontent started breeding.

The immense psychological impact of this growing discontent is difficult to estimate. It led to a feeling that their position is hopeless; that they have been beaten not only by their Western neighbours, but also by the new economic miracle makers like South Korea and Taiwan; and to catch up with them, there should be a crossing over to the efficiency of free-market. This tide of dissatisfaction - euphoria over gaining the 'freedom of choice' - became widespread especially after the Gorbachev revolution. The unprecedented 'flare up' in the winter of 1989 - country after country presenting a picture of carnival shading off into near chaos - culminated finally in the overthrow of the communist rule, and the beginning of new journey towards restoration of political and economic democracy.

Where do they stand in the resurrection business ?

While 1989 has been a year of miracles, the forthcoming years are likely to be less brilliant, more difficult and confused. There are a host of problems to be solved, if they have to succeed. Prices are distorted, inflation rates - are very high, and no less challenge is the process of reversing back from totalitarianism to capitalist democracy. A thorny question here is : should a reforming communist country concentrate first on political or economic reform ? Most people seem to believe that economic pluralism inevitably leads to political pluralism - people free to choose how to run factories and farms, will insist on choosing their governments too. Nearly all of them have therefore, begun with economic reforms ; and all have also set times for an election. Hungary, for instance, goes to polls in March; Romania has set April; East Germany has fixed it for May and Bulgaria for June. Only Poland seems to have stuck in an agreement to preserve Solidarity - Communist - Peasant - Democrat coalition for a four year term.

Here is an account of where the main countries stand in their resurrection business.

1) *Reviving the Private Sector :*

Poland has been doing the best here. Already there is a law in her statute book promising equal treatment to private companies along with state enterprises; and in principle can employ as many public as they like. Hungary too has enacted a similar law permitting private enterprises. Czechoslovakia allows only family business. In Soviet Russia, a law was passed in 1988 permitting the establishment of co-operatives outside the agricultural sector and about 20,000 manufacturing enterprises were transferred to a system of self financing. The intention is that the enterprises should not only make profits, but also finance their own investment

ii) Opening up the Public Sector :

For the economic survival, it has been felt essential in nearly all these countries to break up huge inefficient public sector industries into smaller units, and make them compete. Poland for instance, has created several hundred enterprises out of a relative handful of old conglomerates. Hungary has been following the same, but at a slower pace. Czechoslovakia is still cautious.

iii) Price Reform :

No real competition is possible between companies - private or public - until most of the prices of what they buy and sell are set by the market. Here the prospects are seen to be better. In Poland, they say that 90% of all their country's prices should be free by 1993. The Hungarians claim that they have liberated nine tenths of their producer prices. The Czechs say that they will move from the present 10% of their free prices to 80-85% by 1995. Yugoslavia has already something close to a free market system. In Soviet Russia, about 60% of the wholesale trade is to be freed over the next few years.

iv) Money Market :

While they wrestle with prices, subsidies and inflation, the reformers have to create a more flexible banking system, which lends money to firms. Both the Hungarians and Poland have already broken up their old banking system. In law, their central banks are now confined to a central bank's proper job; and the lending functions have been transferred to several commercial banks that can compete with each other, and even decide for themselves what interest rates to charge on the money they lend. Both Yugoslavia and Czechoslovakia plan to introduce a similar reform later this year.

v) Western Investment and Technology :

One possible stimulus to the growth of East European Economies is to bring in Western help. But vast flows of credit from the West, like that of the 1970s, are unlikely to work. Nearly all of these countries would like to promote joint ventures. The Hungarians have so far been the most energetic on this. The Western partners can now buy up to 100% of a Hungarian company, send his money home, and get some handsome tax break. Similarly there have been moves towards acquiring Western technology with a view to restructuring production to make it internationally competitive.

vi) Foreign Trade :

Efforts are on the way to end the state monopoly of foreign trade. Enterprises may now negotiate directly with foreign suppliers and customers. The disintegration of COMECON - the Soviet common market - is also on the way. In its recent Meeting, the group has decided to move to a market based trading system.

These six things are the skeleton on which the flesh of a market economy might eventually grow. They of course, do not include other normal issues of economic management, above all

inflation. Inflation is abnormal in all these countries in the sense that the system has allowed an extraordinary amount of inflationary pressure to build up; but it will have to be brought under control by the methods so painfully familiar elsewhere.

What the West is Doing ?

Swept under the alluring carpet of liberal reforms, the East-West relations have already thickened. The West's spokesman have called for an elaborate strategy to help the economic recovery of the East.

America's imaginative Ambassador to Hungary, Mr. Mark Palmer, writes in his book, "between the extremes of passivity and force there is an extraordinary terrain, and the thrust of Western policies should be to build so many links - between governments, parties, businesses, churches, environmentalists, students - that East West borders become swamped". This requires, he adds, "an explosion of effort from every element of Western society".

A powerful actor in mending the East West divide is the European Economic Community (ECC). The Community, already in the process of welding itself into a single market of some 320 million people, wants to embrace as many as possible of the 140 million people of the East, partly to increase its own power in the region and partly in the hope that a united Europe would have major political significance. Stalking across this wild imagination, the Community is in a hurry to help the East's resurrection business; and is seen to think in terms of giving better access to East's products in the West's markets, making it easier for Western firms to invest in the East, encouraging joint ventures, collaborating in scientific research, and helping to train East's managers in the West to run factories. Already, it has promised in its trade treaties, with Hungary and Poland, to end all quotas on manufactured imports into the Community by 1995. Also there is evidence that the Community would reward East Europeans who are trying to be more capitalists and democrats with more attractive treaties than their retrograde neighbours. For instance, in the agreement with Poland, the Community has broken further ground by lowering down customs duties on Polish farm exports. Promises of more attractive agreements with Hungary and Romania are also there. In short, the Community offers to extend trade pacts to East - Europe with alacrity.

3. Why should East's Changes Hurt South's ?

Suppose things go as well in the next three or four years. Both Poland and Hungary, already ahead in reforms, move over to democracy more or less smoothly. Czechoslovakia and Romania follow them. Yugoslavia is already close to a market economy. Bulgaria does whatever Russia does; and the latter might have loosened its grip over 70 per cent of the economy. Albania remains a blur in the corner of everybody's eye. By 1993, even on a fairly cautious estimates, the destabilization in Europe will be considerable - the old order of post-1945 stability will have been broken at the heart of the region.

For the sake of argument, one can also perceive that political considerations will be upper most in the West's attitude towards the East's i.e., West's Eastern neighbours could get more favourable treatment than producers elsewhere. It seems then most likely that the EC will grant Generalised System of Preferences (GSP) to a wide variety of East European goods in order to soften the impact of the Community's common external tariff as well as abolishing quantitative restrictions on imports. This could mean significant access for East European products ranging from agricultural products to textiles, and manufactures in West's markets. On similar grounds, one can expect European Free Trade Area (EFTA) to provide wider access to East's products. Given this endless web of temptations, one can expect the East to "spread out" its trade, and the COMECON - another pillar of post-war co-operation disintegrates. The questions before us are : How the proposed changes might affect the South's trade ? An effort has been made in the remainder of this paper to place this perspective.

From the perspective of this analysis, some examination of the structure and pattern of East's trade should be a necessary preliminary to more detailed study. As a first step, we look therefore, at the structure and pattern of East's trade in a comparative framework, where comparisons are made with the trade structures of both the South and North. The *raison d'être* is to go beyond the trade structures, delineate the broad changes that have taken place over the past couple of years, and look carefully the emerging competitiveness of complementarity without which one will be poorly equipped to predict the implications of the on-going reforms.

Structure and Pattern :

Logically, the first proposition to be investigated is " What is the significance of East's trade in the global context and whether there are striking changes in its relative position over the past couple of years. To know this, we co-ordinated data relating to distributive shares in the world trade under the traditional three-fold grouping of countries - developed market economies of the North, developing countries of the South, and the centrally planned economies of the East - for the period 1970 to 1980. The received trends for both exports and imports are displayed in Figure 1A and 1B. The graphs reveal an extremely inequitable distribution of the world trade. At one extreme, we have the North with an overwhelming share in world trade. To the other extreme lie the East with a slender margin, as low as 10 per cent in the global trade. Between the two titters the South with some ups and downs in its fortunes varying between 20 and 30 per cent share in the world trade.

Is there something qualitatively different about East's trade - say about its trading ties as compared to trade flows of the South and North ? To gauge this, we present in Table 1 the distribution of each regions' exports between intra and inter-regional destinations. The data applied to 1990, 1985 and 1987. Reading across the rows, and down the columns, the table gives an insight into the important aspects of intra-regional and inter-regional trading ties. The table discloses, for instance, that

a significant proportion, of East's trade is within the region. The share was 51 per cent in 1980, and climbed to 58 per cent in 1987. Compensating trade, especially in the trade with North, where the latter's share in the former's exports dropped from 31 to 21 per cent. Contrastingly, South has very weak trading ties with the own region. Much of its ties are with the North. For instances, in 1987, North's share alone in South's exports was 66 per cent. South as a whole has also weak trading ties with the East; the former's share in the latter's market was less than 5 per cent. Like the East, the North has again strong trading ties with the own region. Almost 80 per cent of North's exports in 1987 found way to its own region; and of the remainder, roughly 80 per cent went to South, with East remaining only at the margin.

The years 1980, 1985 and 1987 in the preceding analysis were selected for reasons of statistical convenience, and not to represent any historical watershed. However, if one wants to know whether the reforms following the Gorbachev revolution had any perceived effects upon this trade pattern, it would be intelligible to update this data to a year of latest vintage. To bring this precision in our analysis we updated the data to 1988 and the trends in both intra-East trade and East-South trade are displayed in Figures 2A and 2B. A revealing indication from the two figures is the oblique indication of a relative decline in intra-trade and also in East-South trade beginning from mid-eighties. What one might infer from this is that the East as a group are already in the process of redirecting their trade.

Two major questions in this connection are : Which are the commodities presently undergoing (or not undergoing) this redirection ? Have all the countries of the East partaken in this change? We take next these questions sequentially.

In Tables 2.1 to 2.10 we have displayed the commodity composition of exports originating from each region and flowing to different destinations under ten commodity headings. The tables reveal that intra-East trade is mainly concentrated in four commodity groups viz., machinery and transport equipment, manufactured goods, mineral fuels, and textiles. For machinery and transport equipment, the proportion is as high as 70 per cent. In textile also more than half of East's exports are destined to own region; and of late, this proportion has been rising. The same story can be repeated for both mineral fuels and manufactured goods. At the other end are the non-ferrous metals, iron and steel, and chemicals in the manufactures, and agricultural raw materials and food items in the primary commodities. Most of these products show declining trends in intra-trade and rising trends in inter-regional trade; the notable decrease was noticed in the case of non-ferrous metals and iron and steel. The category of fertilisers and crude minerals also witnessed a drastic fall in intra-East trade, though the proportion traded internally was still a little more than 50 per cent in 1987. Now if we try to compare this pattern of the East with the revealed patterns of South, one could draw two casual observations :

i) East appears to be pushing down the South's trade not only in the markets of North, but also in South's own markets. Signs of this happening can be seen from the experiences in

commodities like iron and steel and non-ferrous metals. In the former, East's export share in the South increased from 13 to 24 per cent between 1980 and 1986, while South's share in its own market declined from 49 to 36 per cent. In the latter case South's share in North's market dropped from 77 to 69 per cent, and that of the East climbed from 50 to 66 per cent.

In machinery and transport equipment, and textiles also East's share in the South increased, while intra-South trade in these products tended to decline.

ii) Any further redirection of East's trade will be at the cost of disturbing her intra-trade which is predominated by textile machinery and transport equipment, mineral fuels and manufactured goods. The continuing influx of these exports from the East is likely to cut South's opportunities further because these are the items in which South has gained comparative advantage in the recent years.

It is idle to pretend that all the countries of the East have partaken in this change. The countrywise experiences, displayed in Figures 3.1 to 3.7 tell a different story. The experiences of Hungary, Poland, and to some extent Soviet Russia are seen to be quite different from the rest. All the three indicate trends of diversion of trade from intra to inter regional destinations after 1986. Hungary, for instance, is seen sending only declining proportion of its exports to other countries of the East after 1986. For Poland, it dates from the early 80's; and for Soviet Russia, it starts from 1986. On the other hand, Romania, East Germany, Bulgaria and Czechoslovakia have been sending an increasing proportion of their exports to the region. East Germany sells 80 per cent of her exports to other countries of the East. For Bulgaria and Czechoslovakia, this proportion is again as high as 75 to 80 per cent.

The countrywise picture educates us in another way - it sheds light on the intensity of each country's trade with the South. The general picture emerging from the figures is an overall decline in their trade with South. There are, of course, some notable differences Poland, for instance, has been receiving a steady flow of imports from the South. One can recite almost the same story for Soviet Russia. East Germany provides a different experience - South's share in both exports and imports has remained without any major change.

Before concluding this general review of the structure and pattern of East's trade, two further points will be briefly touched upon. The first is about the historical trends in their foreign trade - exports and imports. This is illustrated in Table 3 which gives the annual growth rate in the value of their aggregate export and imports for individual countries of the East as well as for all the three regions separately. What can be seen is the relative slow down in the 80's as compared to the 70's; all the countries of the East accelerated their trade during the seventies and slowed down the pace in the eighties.

The second point concerns the distribution of East-South trade across different geographical regions of the South Africa,

Latin America, Asia and Europe. Table 4 gives these details. The gross impression conveyed by the table is that the Asia region constitutes the single largest market for the East in the South, if one takes out Cuba, a communist country from Latin America.

To encapsulate the discussion, we have so far established the broad structural changes which have taken place in the foreign trade of the East European Countries during the recent past. What has emerged unmistakably is the picture of a relative shift in the pattern of their trade - from intra to inter regional beginning from mid-eighties, a period when major economic reforms started in the region. Of course, it cannot be conclusively determined how the reforms have already worked in practice to affect the trade but from oblique indication of relative shift after 1987, one can roughly conclude that a change has occurred in the particular economic relations.

Presumably assuming that we are right in our speculations, we can predict that with the present transformation in the East, this shift is likely to gather further momentum. The development in the next twelve months would indicate when this phase would arrive; and then one can witness the curious spectacle of East grouping for markets abroad. This brings us to the final phase of our enquiry, namely the potential disposition of the South by the East. To form some clear expectation on this, we need a prior information on (a) which are the kinds of products that will be facing competition from the East (b) who will be its potential competitor in these products and (c) which is the potential market where it will be seeking to expand exports.

Regarding the first, there are already some clear expectations. With the progressive disintegration in COMECON, the intra-trade will be the prime target to get affected. From our discussion on the pattern of their intra-trade, it was discovered that this trade is mainly concentrated in four product groups - textile, manufactured goods, machinery and transport equipment, and mineral fuels. It is obvious then that these are the products categories which will be flowing from the region to markets abroad.

As far as the second and third questions are concerned there are reasons to believe that South will be marginalised in the process of finding outside market for the intra-East Europe exports. The export structures of both intra-East and South seem to be more convergent than the structures between intra-East and North. One simple way to test this proposition is to work out similarities/dissimilarities between the export structure of intra-East vis-a-vis South and North. We use chi-square statistic to test the homogeneity of two distributions; here, between the structure of intra-East exports (by products) and the structures of other combinations of intra and inter regional export flows. The estimates for these different sets are arrayed in Table 5. Though the statistical of significance do not clearly confirm our hunch, there is a tendency for export structures becoming more similar over the years in the case of intra-East and the South, while in the case of intra-East and the North dissimilarity is growing.

A highlight of the result is that for both 1980 and 1986, export flows from East to South were as similar as the flows within

the East. On the other hand, intra-East trade was not similar to that of either East-North or East-EEC. The corollary of this could be that East Europe may try to increase its exports to the South if its intra-trade would have to find the outside market. Supposing South becomes the target - market for the East, it is the South - South trade which will be adversely affected, and not the flows from the North to the South. The chi-square estimates presented in the table bring out that the export structures of intra-East flows and intra-South flows tended to become more competitive over the years, while that of intra-East and North South grew more dissimilar. It then appears that South-South trade is going to face more hurdles in the coming years than before.

South, however, can not become a sole market for the East in view of the fact that the latter would have to depend on the North as well for technology and hard currency earnings. In that case again, South would have to compete with the East in the Northern market. The export structure of intra-East flows turned out to be more competitive over the years to the export flows from South to North, while the intra-North trade flows and intra-East flows tended to grow more dissimilar.

Going by these tentative estimates, the tendencies are thus towards more of a competition between East Europe and South, rather than between East and North. South may stand to lose both in its own market and in the market of the North.

4. Conclusion :

Countries of the poor and developing South have been hoping against hope that the 1990's would not turn out, like that of the 1980's, to be a lost decade. But, viewed against the backdrop of changes in the geopolitical environment in the past couple of months, they can no longer afford to draw comfort. Tittering already on slender margin of life, they can expect to encounter further problems in expanding their trade. In the own region, the continuing influx of exports from the East - block will pose a threat. They will encounter problems to penetrate the preferred markets of Europe after the integration there. Across the Atlantic the supposedly greatest champion of free trade is using its muscles to bulldoze the poor developing countries of Asia, Africa and Latin America in the international trading arena. On the top of this, it is also embarking on a free trade agreement with Canada which will be one day another fortress. And, in a tussle between the two fortresses, the developing world would be brought to its knees as a supplicant for petty favours.

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Figure 1.A
DISTRIBUTION OF WORLD EXPORTS (%)

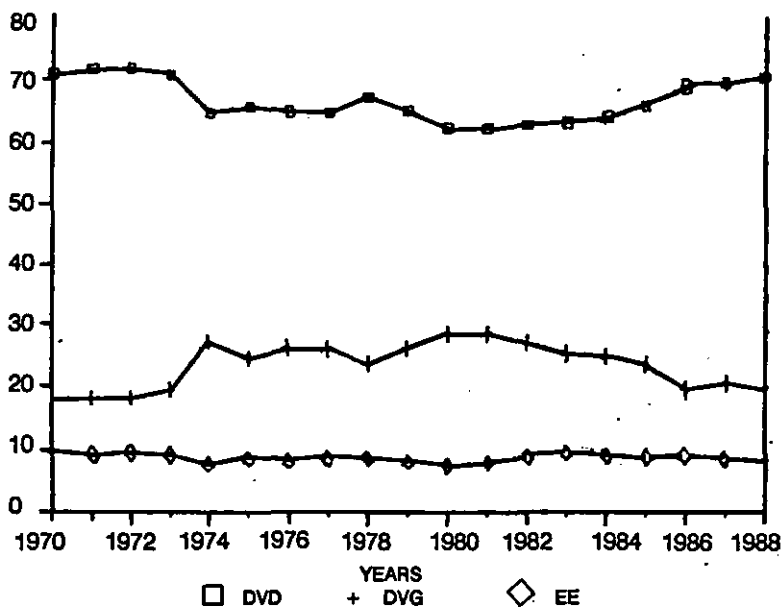


Figure 1.B
DISTRIBUTION OF WORLD IMPORTS (%)

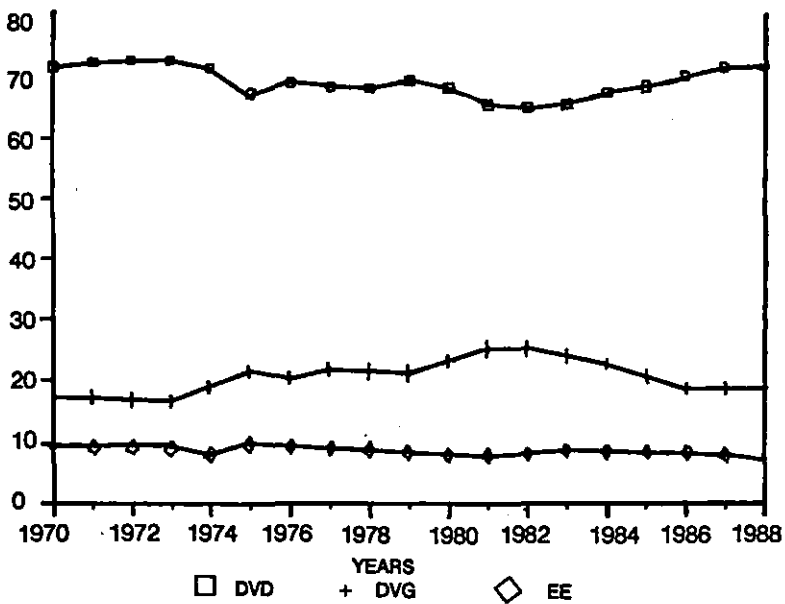


Figure 2.A

EAST EUROPE EXPORT TO EAST & SOUTH
 (% in total East Europe Export)

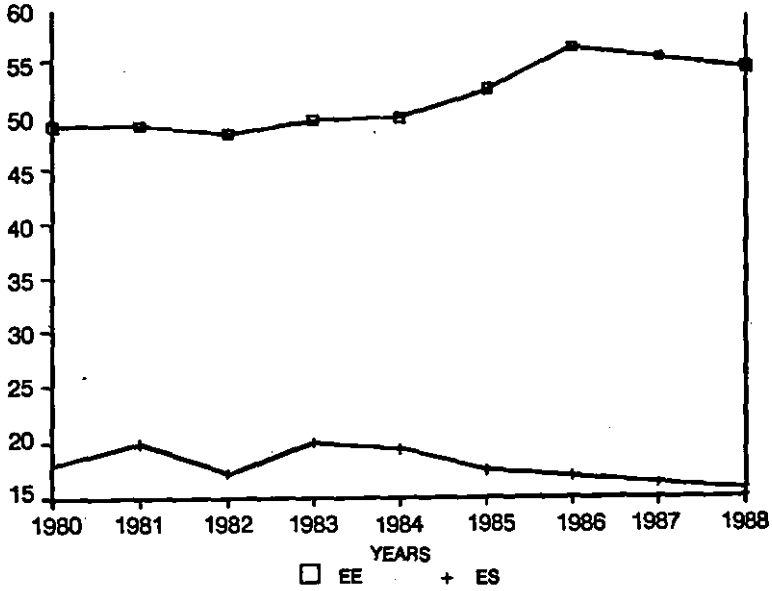


Figure 2.B

EAST EUROPE IMPORT FROM EAST & SOUTH
 (% in total East Europe import)

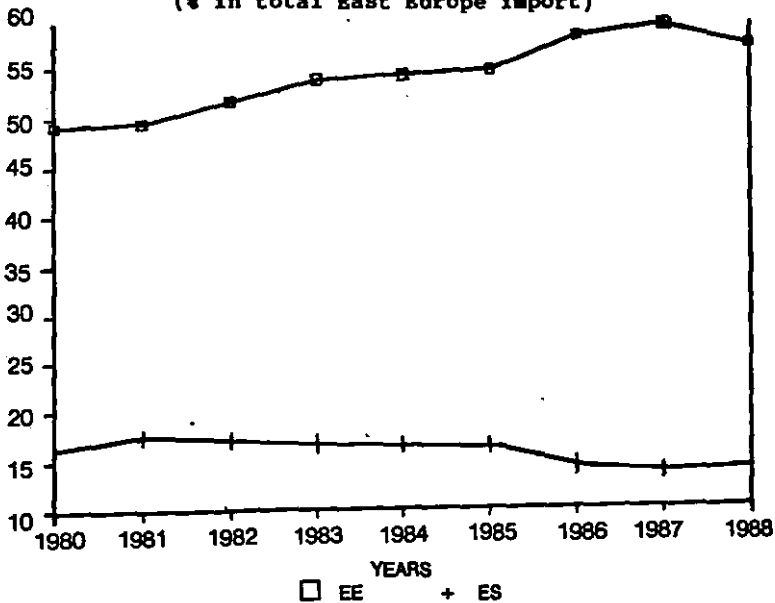
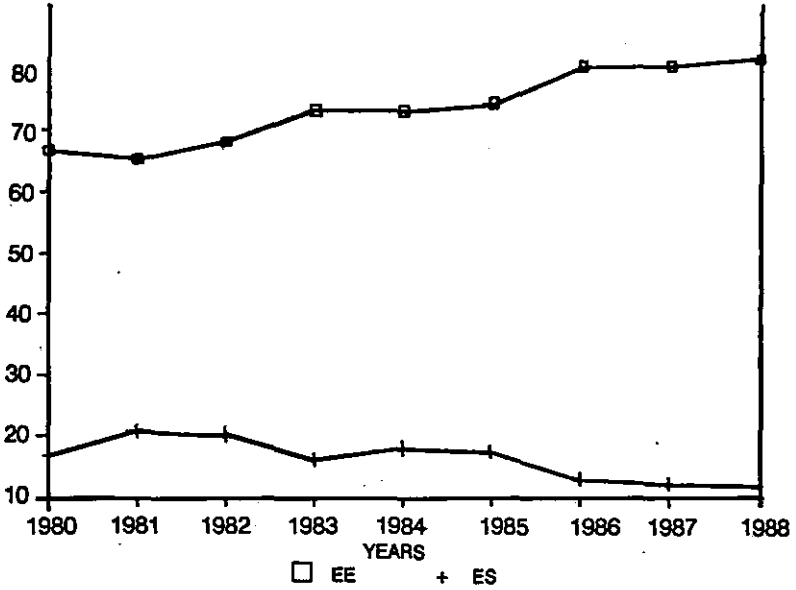


Figure 3.1

BULGARIA EXPORT WITH EAST & SOUTH
 (% in total Bulgaria export)



BULGARIA IMPORT WITH EAST & SOUTH
 (% in total Bulgaria import)

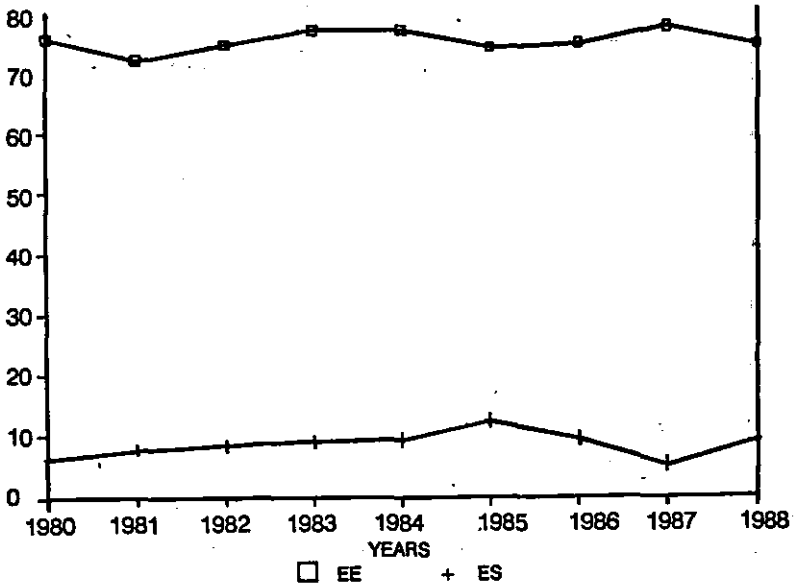
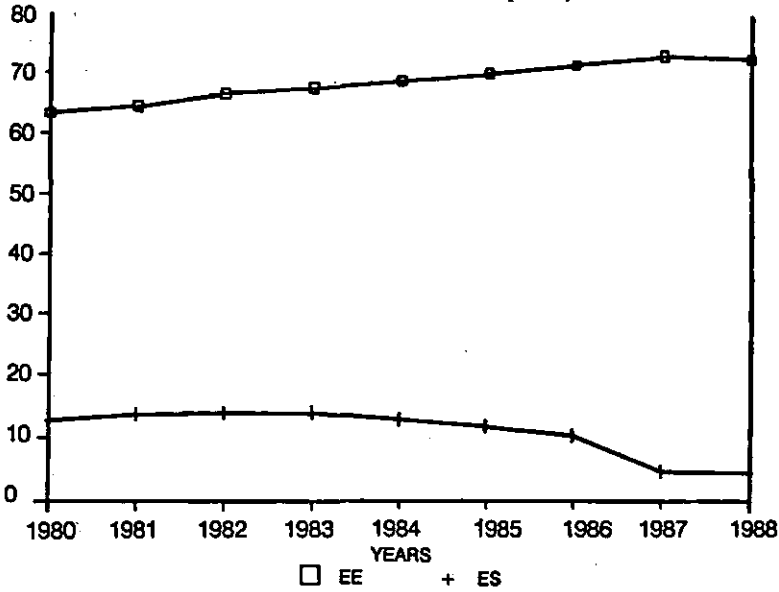


Figure 3.2

CZECH. EXPORT WITH EAST & SOUTH
 (% in total Czech. export)



CZECH. IMPORT WITH EAST & SOUTH
 (% in total Czech. import)

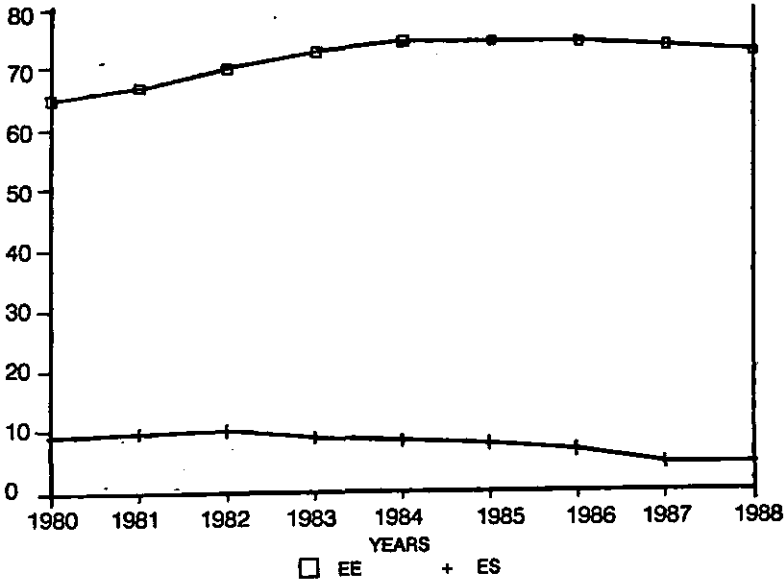
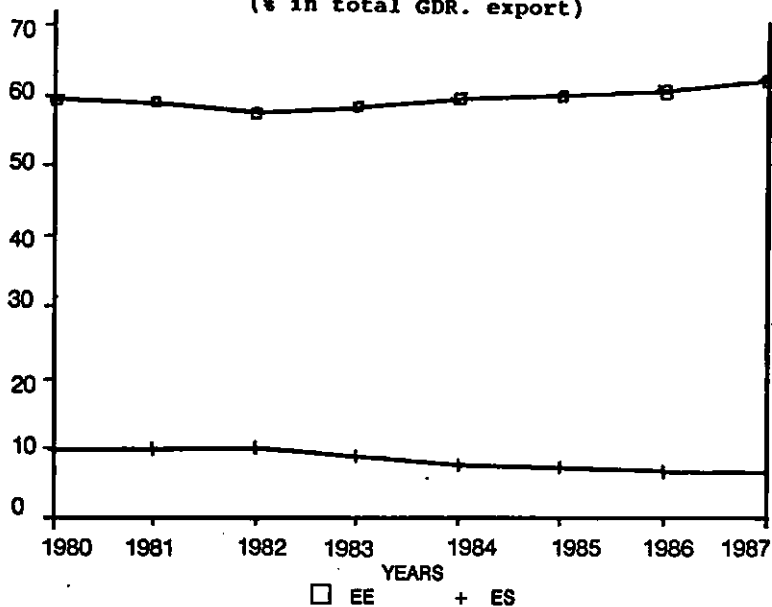


Figure 3.3

GDR. EXPORT WITH EAST & SOUTH
(% in total GDR. export)



GDR IMPORT WITH EAST & SOUTH
(% in total GDR import)

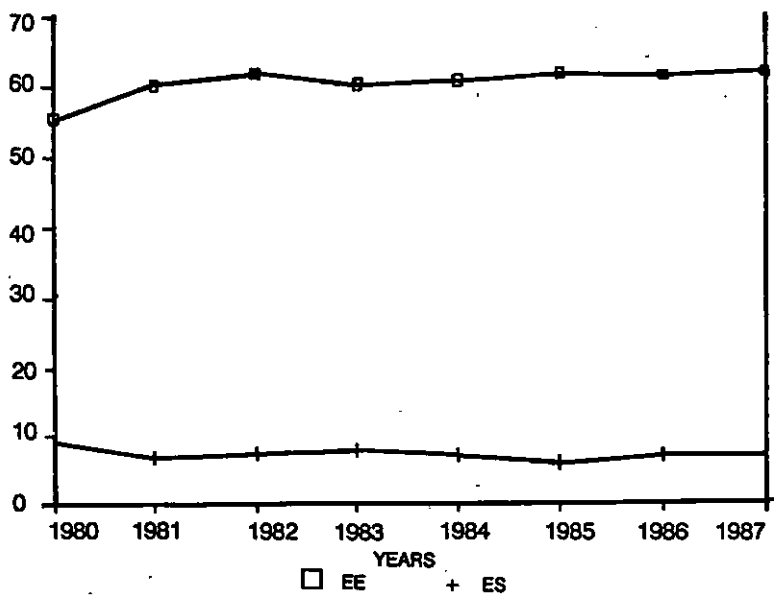
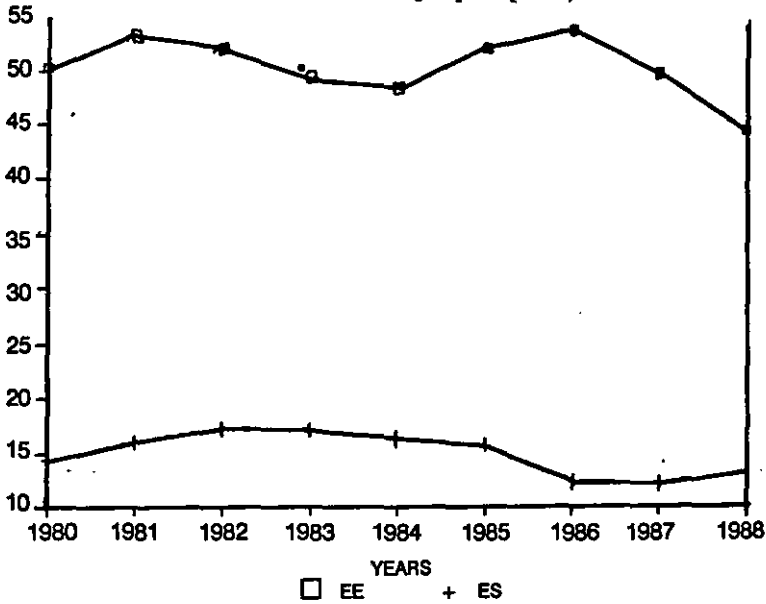


Figure 3.4

HUNGARY EXPORT WITH EAST & SOUTH
(% in total Hungary export)



HUNGARY IMPORT WITH EAST & SOUTH
(% in total Hungary import)

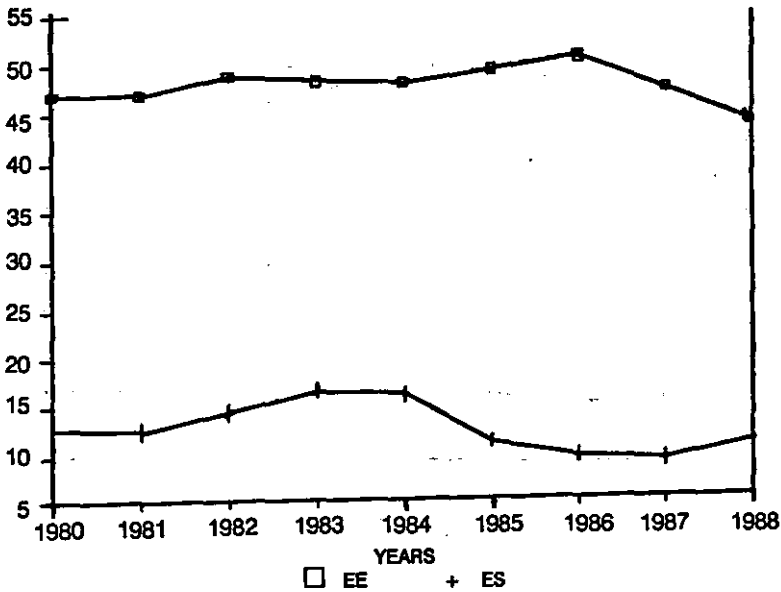
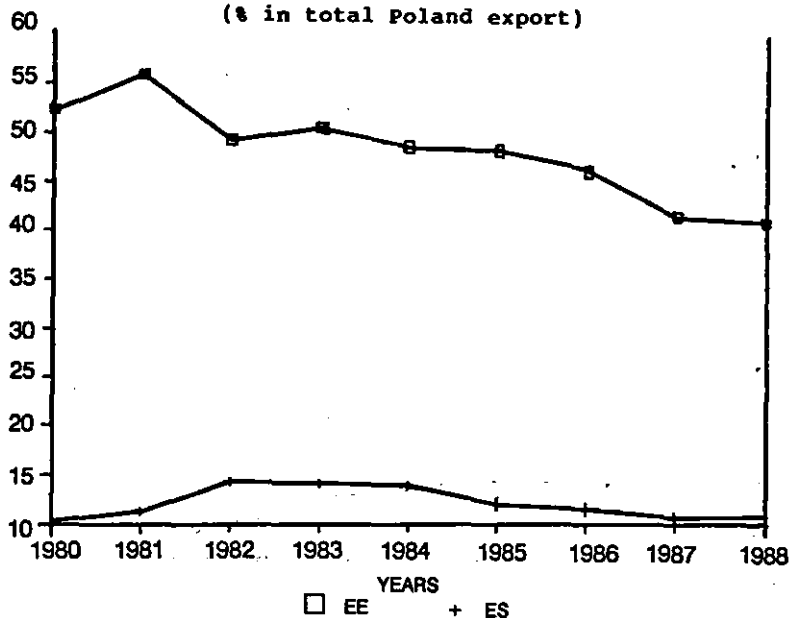


Figure 3.5

POLAND EXPORT WITH EAST & SOUTH
(% in total Poland export)



POLAND IMPORT WITH EAST & SOUTH
(% in total Poland import)

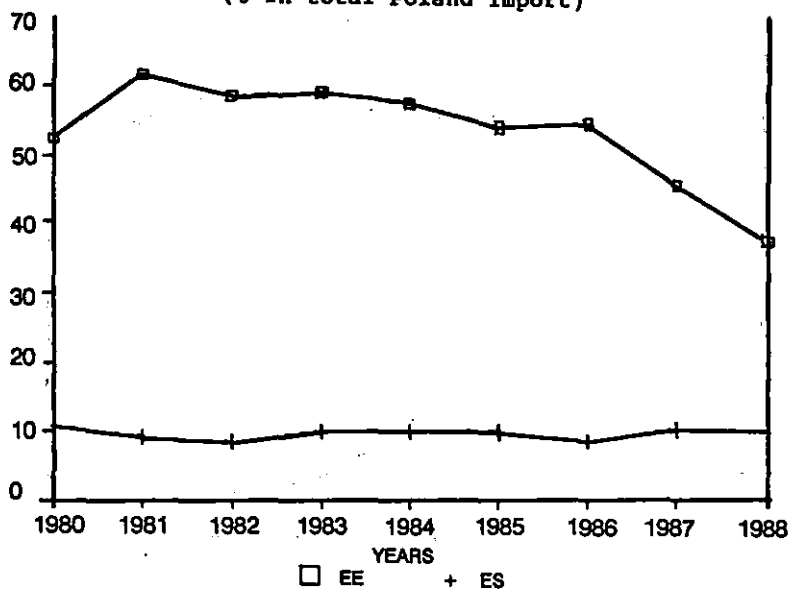
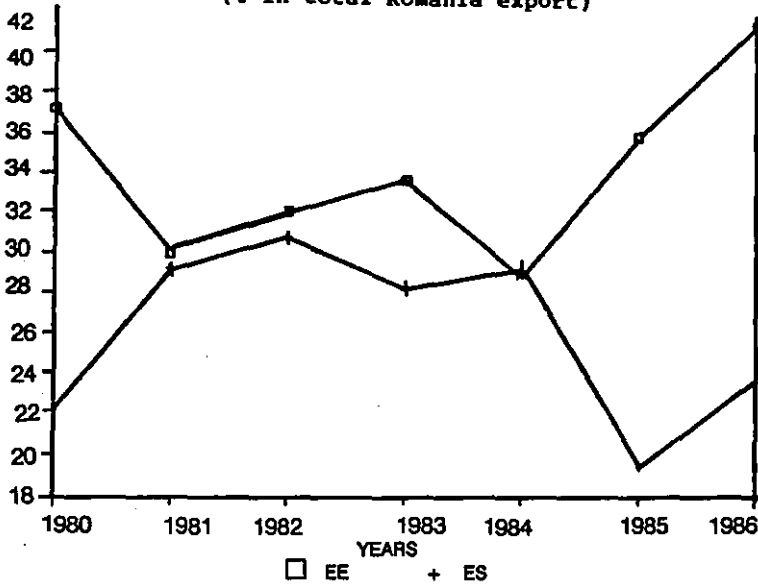


Figure 3.6

ROMANIA EXPORT WITH EAST & SOUTH
(% in total Romania export)



ROMANIA IMPORT WITH EAST & SOUTH
(% in total Romania import)

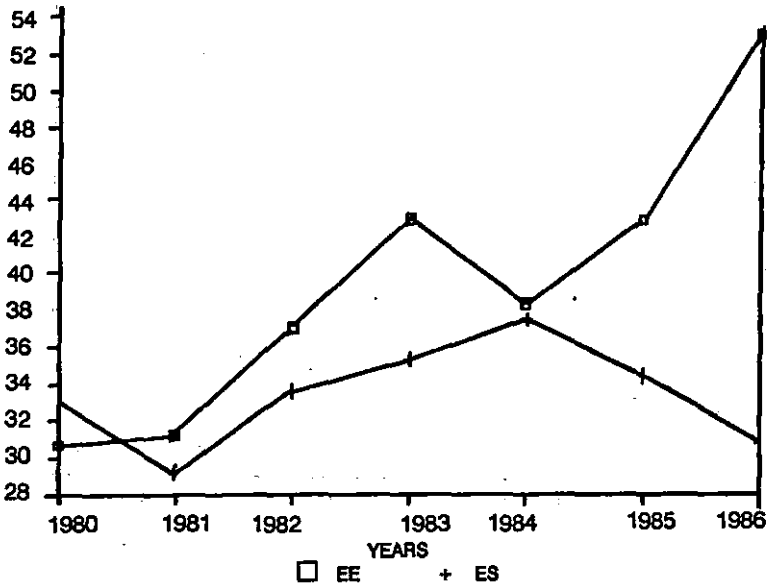
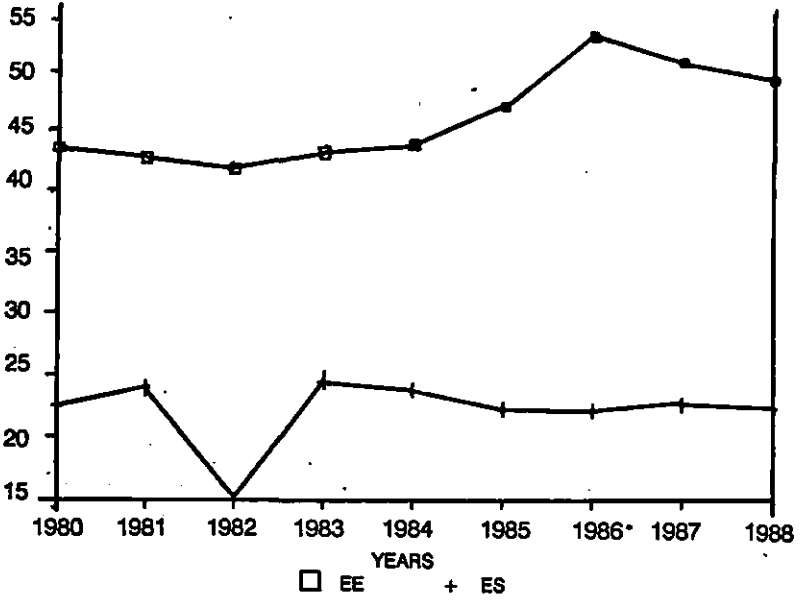


Figure 3.7

USSR EXPORT WITH EAST & SOUTH
(% in total USSR export)



USSR IMPORT WITH EAST & SOUTH
(% in total USSR import)

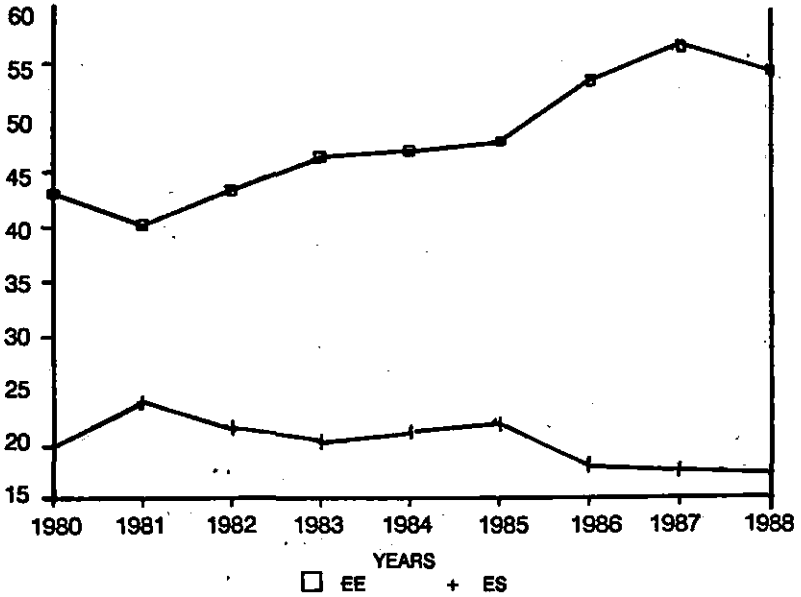


Table : 1 World Exports by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC.. ASIA	USSR	EEC	USA	JAPAN
EAST EUROPE	1980	30.71314	14.85726	50.70205	2.699270	17.36700	17.92916	1.130121	1.130121
	1985	24.53367	17.73037	53.20971	3.678947	19.03760	15.80698	0.979697	0.849813
	1987	21.47361	11.92549	58.11958	3.941950	20.35795	14.29604	0.857264	9.349798
DEVELOPED COUNTRIES	1980	70.93564	23.27859	3.698384	1.154455	1.925283	40.37620	9.653631	3.188995
	1985	73.98734	20.25400	2.662809	1.971591	1.646545	37.16424	16.96352	3.455061
	1987	77.85401	17.88934	2.180762	1.302102	1.185649	43.28226	14.86107	3.670024
DEVELOPING COUNTRIES	1980	70.27976	24.80508	2.845434	0.725412	1.674069	26.19701	20.90339	13.91190
	1985	62.63236	29.18543	4.717661	2.494703	2.921701	20.14793	22.35521	12.93600
	1987	65.77845	25.70565	4.467994	3.231648	2.769399	23.28753	25.76765	11.68165
USSR	1980	35.29280	18.52607	42.14705	3.200826	N.A	21.08371	0.304778	1.915002
	1985	25.63846	22.31167	46.81712	5.114620	N.A	17.73832	0.449536	1.600899
	1987	21.18314	14.65312	51.52791	6.033291	N.A	14.86180	0.400717	1.407898

Table : 2.1 World Export of Food Items by Regions (% Share of exports to world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC. ASIA	USSR	ECC	US	JAPAN
EAST EUROPE	1980	30.46231	19.56783	46.41206	3.286432	26.82412	16.73366	2.793969	1.306532
	1985	25.60077	26.79151	45.10716	0.995886	15.04654	2.533015		1.656202
	1987	28.61681	23.45901	44.94810	1.154416	32.92734	16.98792	2.827790	2.149968
EVELOPED COUNTRIES	1980	66.31985	24.41449	6.556634	1.834325	3.75918	344.00501	4.978585	6.712629
	1985	69.76723	23.69026	5.388522	0.656715	4.22139	244.82846	7.939769	7.562507
	1987	75.68887	19.73548	3.386481	0.595663	2.31774	953.21521	7.641938	1.864151
DEVELOPING COUNTRIES	1980	59.18696	24.45431	13.33670	1.406692	10.29572	28.68703	16.54522	6.592486
	1985	58.50065	25.01163	14.22954	1.799155	11.34382	25.44015	17.89365	8.141942
	1987	63.86623	22.33701	11.20778	1.669083	8.21853	3630.04803	18.08047	10.39212
USSR	1980	16.41983	39.98712	29.23374	13.97295	N.A.	6.761107	1.159047	4.443013
	1985	16.61539	66.84615	11.30769	4.615384	N.A.	5.923076	2.076923	4.538461
	1987	21.93211	60.44386	12.33681	4.960835	N.A.	7.702349	2.872062	7.898172

Table : 2.2 World Export of Agricultural Raw Material by Regions (% share in exports in world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC. ASIA	USSR	EEC	US	JAPAN
EAST EUROPE	1980	49.51550	8.430232	37.54152	3.599114	4.720376	25.33222	0.401439	10.46511
	1985	33.78427	23.47349	35.72212	4.917733	5.521023	16.74588	0.347349	6.051188
	1986	37.19126	19.39518	36.14629	6.333122	5.335655	19.15769	0.395820	7.203926
DEVELOPED COUNTRIES	1980	77.78885	14.53517	4.131551	3.535758	1.570726	43.88066	9.344194	10.19130
	1985	76.37146	16.52603	3.405549	3.694412	1.776257	39.52869	14.27594	10.29013
	1986	78.18851	16.17401	2.839933	2.761851	1.276073	45.05075	13.16675	10.21974
DEVELOPING COUNTRIES	1980	58.83113	28.42079	6.973389	5.570753	3.496642	24.57597	6.928624	19.11464
	1985	57.78236	30.19972	7.706611	4.001377	3.808539	23.66391	9.814049	16.83884
	1986	55.61952	31.97697	7.745649	4.304592	4.579353	27.09668	8.975533	15.96231
USSR	1980	47.69642	7.383792	43.08926	1.604278	N.A.	22.35705	0.061703	15.36404
	1985	26.72112	24.88331	42.06534	6.096849	N.A.	12.39789	0.262543	9.159859
	1986	31.75903	19.37349	40.69879	8.144578	N.A.	15.83132	0.337349	10.65060

Table : 2.3 World Export of Crude Fertilisers and Minerals by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DEVD	DEG	EAST EUROPE	SOC. ASIA	USSR	EEC	US	JAPAN
EAST EUROPE	1980	27.89458	3.223997	68.32071	0.560695	2.943650	13.14830	0.448556	1.934398
	1985	24.09408	30.19707	44.94596	0.762873	2.606484	13.85886	0.031786	2.225047
	1986	18.04511	28.59927	52.35310	0.612642	2.896129	10.69340	N.A.	2.032859
DEVELOPED COUNTRIES	1980	83.43311	10.59242	2.378061	0.552648	0.577768	44.04856	8.561858	15.16014
	1985	75.31522	13.52570	1.585838	1.202715	0.412221	38.64209	7.061105	14.17555
	1986	74.04160	16.59732	1.901931	1.287766	0.851906	41.73353	7.350173	13.67013
DEVELOPING COUNTRIES	1980	80.86069	11.25345	6.190549	0.728751	2.109542	30.33138	12.84903	26.74133
	1985	71.54150	17.19367	9.308300	1.798418	4.051383	30.16798	8.527667	22.63833
	1986	70.20400	19.67438	7.983522	1.657512	3.520988	32.15967	8.866222	24.36249
USSR	1980	20.33527	2.587463	78.82653	0.400874	N.A.	8.272594	0.327988	2.514577
	1985	1.51447633	1.4031	51.18040	0.311804	N.A.	7.216035	N.A.	20.40089
	1986	12.06896	29.49775	57.75862	0.412293	N.A.	6.971514	N.A.	2.548725

Table : 2.4 World Export of Mineral Fuels by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC. ASIA	USSR	EEC	USA	JAPAN
EAST EUROPE	1980	55.89926	6.62564	34.74710	0.982225	1.091098	34.60036	0.222479	0.740810
	1985	42.41453	12.02794	43.88821	1.684210	0.804843	28.90172	0.601769	0.666977
	1986	30.87169	9.634513	57.13432	2.209114	0.869380	21.47235	0.643843	0.684324
DEVELOPED	1980	86.22746	8.058974	0.773376	0.057457	0.151687	56.47717	11.62018	4.446053
	1985	87.6178	7.889798	0.767436	0.064532	0.215438	53.71655	16.62546	5.388930
	1986	86.44203	9.039086	0.829642	0.086978	0.263612	54.77646	14.27252	6.160763
DEVELOPING COUNTRIES	1980	75.96178	21.64778	1.034736	0.032326	0.254282	26.98800	22.03599	16.71799
	1985	64.66871	32.03524	2.016706	0.104979	0.455579	21.79851	15.53843	19.82901
	1986	62.35562	32.73702	3.068038	0.288756	0.791824	23.08698	16.33203	19.68657
USSR	1980	53.62597	7.249163	36.77814	0.897435	N.A.	33.64269	0.055741	0.769230
	1985	37.23862	12.91815	47.91869	1.911558	N.A.	27.45161	0.017299	0.735214
	1986	26.71106	9.662002	61.18547	2.434963	N.A.	19.99870	0.056224	0.726596

Table : 2.5 World Exports of Chemical Products by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DVD	DVG.	EAST EUROPE	SOC. ASIA	USSR	EEC	US	JAPAN
EAST EUROPE	1980	28.75975	17.02291	46.43542	3.711762	21.60501	17.16370	2.201459	0.959938
	1985	28.67640	22.41651	41.99609	6.166868	19.78420	14.65910	3.181099	1.237094
	1986	24.64667	20.79455	48.06963	5.661840	23.18166	12.83178	2.524991	1.077214
DEVELOPED COUNTRIES	1980	67.56048	24.87173	5.185454	1.364756	2.346668	41.20696	5.628749	3.174357
	1985	71.21134	22.85457	3.718659	1.752462	42.50392	42.50392	8.769411	4.404817
	1986	73.19918	21.56865	3.418400	1.327128	1.525633	47.23221	8.070319	4.413580
DEVELOPING COUNTRIES	1980	48.42703	46.05236	1.593261	1.704891	0.923482	16.42987	10.64542	15.14105
	1985	38.56892	46.01418	6.064535	7.216416	3.402242	13.83782	13.57082	6.552750
	1986	36.84871	48.97816	5.893841	7.253958	3.354955	13.40587	12.26895	7.470182
USSR	1980	38.52140	16.67593	41.80100	2.390216	N.A.	21.06725	6.448026	1.445247
	1985	32.25108	20.20202	37.26551	10.28138	N.A.	13.67243	7.034632	2.164502
	1986	26.42393	18.92573	44.01586	10.67051	N.A.	11.96827	4.866618	1.730353

Table : 2.6 World Exports of Iron And Steel by Regions (% share in exports to world)

Origin/ Destin .	YEAR	DVD	DVG	EAST EUROPE	SOC. ASIA	USSR	EEC	US	JAPAN
EAST EUROPE	1980	25.87609	13.29291	58.49474	2.321454	8.442998	12.80496	0.946325	0.073931
	1985	16.82055	26.45523	47.22333	9.139569	6.690753	9.353673	1.538873	0.307774
	1986	16.10619	24.70132	48.55088	10.38716	9.557522	9.513274	0.796460	1.061946
DEVELOPED COUNTRIES	1980	59.52162	29.10599	8.204992	3.083295	5.607549	34.53914	10.04874	0.513882
	1985	59.71672	23.42290	8.031242	8.509604	6.655953	31.86710	3.219597	0.728754
	1986	64.76482	20.97311	7.568633	6.633560	6.306020	40.68712	1.968760	0.799478
DEVELOPING COUNTRIES	1980	43.7825	49.81363	2.214426	2.565226	1.447051	12.82613	18.00043	8.989256
	1985	43.68389	39.57219	3.172905	12.71538	1.568827	8.318478	20.47534	10.81402
	1986	46.9717	36.81610	3.410460	11.12316	1.916124	10.83393	19.41431	12.77416
USSR	1980	7.120933	23.87968	64.42602	9.699201	N.A.	1.749539	0.276243	2.117863
	1985	1.780233	23.87968	64.42602	9.699201	N.A.	0.767341	N.A.	0.092081
	1986	3.394077	26.19589	58.92938	11.36674	N.A.	0.1366742	N.A.	0.706150

Table : 2.7 World Exports of Non-Ferrous Metals by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC ASIA	USSR	EEC	US	JAPAN
EAST EUROPE	1980	50.30800	4.038329	44.38740	0.205338	1.368925	27.17316	2.156057	7.905544
	1985	65.57886	6.837606	22.06682	4.351204	1.243201	52.21445	2.253302	2.408702
	1986	66.94915	5.225988	21.68079	4.519774	1.694915	50.49435	2.754237	2.259887
DEVELOPED COUNTRIES	1980	85.12856	10.71129	2.683704	0.548761	0.807463	48.51050	12.65548	4.949304
	1985	8.096824	13.21504	1.457187	2.276102	0.730600	43.12151	19.38501	6.499136
	1986	83.20328	13.55460	1.135655	1.469025	0.410301	47.05645	17.81148	5.597684
DEVELOPING COUNTRIES	1980	76.89005	18.90050	2.454732	1.418704	1.820048	40.59174	16.30576	14.84972
	1985	71.02015	20.10995	4.605986	4.202810	1.624923	32.33964	19.16921	16.76237
	1986	68.68553	23.81645	3.226659	3.834964	0.555408	28.32583	22.03120	15.81592
USSR	1980	37.74011	2.937853	59.26553	0.056497	N.A.	13.50282	2.824858	10.33898

Table : 2.8 World Export of Manufactured Products by Regions (% share in export by world)

Origin/ Destin.	YEAR	DVD	DVG	EAST EUROPE	SOC. ASIA	USSR	EEC	US	JAPAN
DEVELOPED COUNTRIES	1980	75.95674	20.23796	2.975890	0.626367	1.606193	9.005645	9.005645	1.814370
	1985	77.53753	18.83336	2.279974	1.065840	1.259131	41.50242	15.49928	2.183329
	1986	80.54734	16.12579	2.086416	0.883673	1.088389	46.97834	14.12942	2.327277
DEVELOPING COUNTRIES	1980	64.76439	31.30139	1.726549	1.311973	0.914457	24.35936	25.34548	5.763128
	1985	67.93341	23.9990	3.354425	3.990796	2.287816	16.37664	28.11869	5.400158
	1986	70.65040	22.02157	2.801543	3.981763	18.84306	37.85882	6.089582	6.089582
EAST EUROPE	1980	32.24379	11.18122	53.88888	2.103559	29.20711	22.01725	2.238403	0.512405
	1985	28.37052	12.71170	55.56710	2.133904	32.06970	18.63038	2.066646	0.330174
	1986	26.03514	10.62271	59.16446	2.188528	37.99323	17.33667	1.687763	0.296749
USSR	1980	48.71244	10.33619	36.12303	4.822326	N.A.	42.16738	N.A.	N.A.
	1985	2.78536335	22.665	45.05734	10.92299	N.A.	5.843801	0.491534	0.327689
	1986	8.78642833	31.883	47.75989	9.917355	N.A.	7.003044	0.521966	0.217485

Table : 2.9 World Exports of Machinery And Transport Equipments by Regions (% share in exports to world)

Origin/ Destin.	YEAR	DEVD	DEG	EAST EUROPE	SOC. ASIA	USSR	EBC	USA	JAPAN
EAST EUROPE	1980	7.832762	14.92822	71.46419	4.345751	33.69258	3.235459	0.529123	0.078067
	1985	4.915135	15.73968	73.15858	4.778547	41.63302	3.135482	0.295269	0.076328
	1986	4.975395	15.09324	73.08202	5.198743	38.55205	3.077844	0.277823	0.074449
DEVELOPED COUNTRIES	1980	66.52693	29.26977	2.880456	0.994933	1.458763	32.82000	12.17489	1.488053
	1985	72.57737	22.62607	1.803482	2.438792	1.040260	29.13396	23.13306	1.630509
	1986	75.40311	20.42229	1.945690	1.874142	1.081491	34.70658	22.66328	1.650050
DEVELOPING COUNTRIES	1980	51.49278	45.73096	0.183614	1.792075	0.128529	14.24846	N.A.	N.A.
	1985	59.63169	28.86693	4.289631	6.423551	3.199970	12.93609	N.A.	N.A.
	1986	64.90586	26.91275	3.712671	4.058572	2.653555	14.02546	41.33353	3.831266
USSR	1980	5.838347	27.72808	55.43990	10.45698	N.A.	1.707594	0.056919	0.073182
	1985	3.665763	35.42160	47.45174	13.43548	N.A.	2.040298	0.076193	0.084659
	1986	4.349927	33.44610	48.58799	13.60905	N.A.	2.181868	0.117378	0.075951

Table : 2.10 World Exports of Textiles Fiber And Textiles Yarns by Regions (% share in export to world)

Origin/ Destin.	YEAR	DEVD	DEG	EAST EUROPE	SOC. ASIA	USSR	EEC	USA	JAPAN
EAST EUROPE	1980		37.13130	51.77421	2.350651	28.71687	22.35364	2.156011	2.066177
	1985		28.64162	50.49928	4.200348	31.32033	18.38643	1.933745	0.824219
	1986	29.67289	11.43561	53.45275	4.335410	33.82658	19.02907	2.076843	0.973520
DEVELOPED COUNTRIES	1980	73.89119	18.66593	4.842479	2.527606	2.549999	49.12597		
	1985	76.10071	17.92640	3.779205	2.122312	2.086630	48.42222	7.577026	3.011263
	1986	79.32634	15.90213	3.143810	1.547451	1.538673	53.74448	7.050060	2.673555
DEVELOPING COUNTRIES	1980	65.10966	26.56064	4.283571	3.243141	2.171467	29.04142	18.95894	7.111166
	1985	66.12907	23.48815	4.880870	4.640015	2.951663	20.34994	30.60757	6.526719
	1986	67.45311	23.06574	3.908334	4.909807	2.434993	22.60582	30.22339	6.572293
USSR	1980	33.49633	6.907090	53.11735	6.356968	N.A.	15.28117	N.A.	7.518337
	1985	6.814814	30.22222	42.14814	13.77777	N.A.	0.222222	N.A.	N.A.
	1986	11.47943	27.68569	45.91774	14.67157	N.A.	6.629834	N.A.	N.A.

Table 3 : Average Annual Growth in Exports and Imports by Countries and Regions

	Growth Rate of Exports (Log E = $\alpha + \beta T$)		Growth Rates of Imports (Log M = $\alpha + \beta T$)	
	1973-81	1981-88	1973-81	1981-80
Bulgaria	16.74	6.75	15.04	6.55
Czechoslovakia	12.42	7.70	11.89	7.90
GDR	12.16	6.66	11.71	6.83
Hungary	8.80	1.89	9.84	1.35
Poland	10.91	0.75	9.44	-1.10
Romania	15.12	2.88	16.66	0.20
USSR	18.05	4.34	16.52	4.96
East Europe	15.04	4.79	13.86	4.54
Developing	19.86	-0.36	20.86	-0.01
Developed	15.12	7.63	15.46	7.14
World	16.35	5.48	16.46	5.43

Table 4 : East-South Trade According to Geographical Regions-1988
(US Million \$)

Countries	Eastern Europe	
	Exports to	Imports from
<u>Developing Countries</u>	35524	29790
1. Africa	3942	4156
	(8.282)	(13.951)
1.1. Libya	673	869
	(1.895)	(3.105)
1.2. Egypt	602	673
	(1.695)	(92.259)
1.3. Algeria	362	436
	(1.019)	(1.464)
11. <u>Latin America</u>	8557	10682
	(24.088)	(35.858)
11.1. Cuba	6814	6807
	(19.181)	(22.850)
11.2. Brazil	231	867
	(0.650)	(2.910)
11.3. Argentina	80	1107
	(0.650)	(3.7160)
111. <u>Asian Market Economies</u>	9504	9120
	(26.753)	(30.61)
111.1. India	2172	2195
	(6.114)	(7.368)
111.2. Iraq	1033	2185
	(2.907)	(7.335)
IV. <u>Europe</u>	4770	5585
	(13.42)	(18.75)

Table 5 : Competitiveness between Intra-East Trade and Trade Flows in Alternative Direction

(Chi-Square Results for Test of Homogeneity of Two Distributions)

Intra-East Trade <u>Vs</u>	<u>Calculated Value of Chi-Square</u>	
	1980	1986
1. South-World	348.9	71.0
2. North-World	37.7	120.1
3. East-North	178.2	143.9
4. East-EEC	276.6	153.0
5. East-South	14.7	15.3
6. North-South	126.5	285.3
7. South-South	162.3	63.67
8. South-North	508.2	80.5
9. North-North	27.2	103.7

Note : (1) Chi-square statistic is computed by using data on 10 categories of exports (1/2 digit SITC level). In case the calculated value of Chi-square is less than table value of Chi-square, the hypothesis that there is no difference in the distributions of export of intra-East and other regional groups is accepted.

(2) Tabulated value of Chi-square (at 9 d. f.) for 1% level of significance is 21.7.

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The European Currency Unit

Ganti Subrahmanyam

1. Introduction

Integration of larger areas provides greater resources and variety of demand for accelerated growth via greater efficiency and productivity. As economic blocks emerge in Europe, the Pacific Rim and the Gulf, the countries of the South Asia Association for Regional Cooperation (SAARC) can benefit substantially by working through liberalized trade and factor mobility. Exchange rate stability as a policy tool can provide the necessary flexibility for an efficient and orderly growth of trade and economic development. This has been well confirmed by the success of the European Monetary System (EMS) and other attempts to move back to managed flexibility. Exchange rate stability, however, depends on the convergent character of economic fundamentals and similarity of inflation preferences of the countries concerned. If the countries cannot stabilize their own currencies, the next best thing is to use someone else's. Or national pride can be salvaged by pegging one's own currency irrevocably to a common currency through a central rate without the need for a nominal (outside) anchor. The positive experience of the EMS as an adjustable peg is an explorable example for the SAARC countries to study. This paper just attempts to do that in terms of an investigation of the salient features of the EMS, the background of its success and the scope for the European Currency Unit (ECU) to become the EMS's bancor.

The international monetary relationships are still wandering in a non-system even after fifteen years of the collapse of the Bretton Woods system of fixed exchange rate parities. The conflict between the roles of international reserve currency and anchor to the system performed by a single currency, between the need for international liquidity to expand in line with trade and the necessity of preventing excessive growth in the supply of the reserve currency from leading to crises of confidence still remains largely unresolved. It was this conflict that led to the collapse of the Bretton Woods system.

Ever since its birth on 13 March 1979, the EMS has been constantly striving to resolve this conflict in a regional sense. Disillusioned by the prospects for global monetary reform and by the performance of the non-system the EMS came into being to achieve a zone of monetary stability to the largest possible part of the European Communities by a return to more nearly fixed exchange rates system. Such a system works in the interest of protecting the intra-European trade flows against the sharp shifts in competitiveness and towards convergence of national inflation rates to lower and more stable levels. Its grand strategy is to aim at 'lasting growth and stability, a progressive return to full employment, the harmonization of living standards and the lessening of regional disparities in the community'. Ten years of functioning of the system has amply demonstrated its ability to restore reasonably rapidly the adjustable stability of real exchange rates among member currencies at competitive levels but consonant with the overall surpluses and deficits of their international accounts.

The EMS consists of three components : (i) the European Currency Unit (ECU), (ii) an exchange rate mechanism (ERM), and (iii) the European Monetary Cooperation Fund (EMCF). The objective of this paper is to study the prospects for the ECU to evolve from a basket into a currency a *bancor* of the EMS. The rest of the paper is organized as follows : Section 2 makes a brief presentation on the anatomy of the ECU, ERM and the EMU, the three components of the EMS; Section 3 consists of three parts : in the first part, a financial innovation approach is employed to examine the optimum currency basket properties of the ECU; in the second part the success story of the ECUs in the international money and bond markets is emphasized; and the third part presents the outlines of a scheme for transforming the ECU into a real currency in its own right - a European *bancor*. The final section concludes with a brief discussion of the performance of the EMS in the past and the prospects of realizing its commitments towards a monetary union (EMU).

2. The Three Components

2.1 The ECU

The European Currency Unit is at the centre of the EMS. It is a composite monetary unit made up of a basket of specified amounts of each member country's currency. It is used as (i) the numeraire for the exchange rate mechanism, (ii) the basis for divergence indicator, (iii) the denominator for interventions and credit operations and (iv) a means of settlement between member countries' monetary authorities. To serve as a means of settlement an initial supply of ECU was provided by the European Monetary Cooperation Fund (EMCF) against the deposit of 20% of gold and 20% of dollar reserves by the central banks. At the beginning of each quarter, these central banks make the necessary adjustments (through renewable three-month revolving swaps) with the EMCF such that each banks' deposits always represent at least 20 per cent of its gold and dollar reserves. Moreover, the quantity of the ECU issued is adjusted according to changes in the market price of gold or in the exchange rate of the dollar.

The amount of each currency component of the ECU basket is

calculated in two steps : In the first step, each currency is assigned a weight which reflects that currency's importance in the basket. In the second step, each such weight is then converted into a quantity using the current exchange rate of that currency in US dollars. In equational form it can be written as:

$$C_i = ECU_o \cdot W_{io} \cdot E_{io}$$

where

$$C_i = \text{amount of currency } i$$

$$ECU_o = \text{US dollar/ECU at time 'o'}$$

$$W_{io} = \text{weight of currency 'i' at time 'o'}$$

and $E_{io} = \text{exchange rate of currency } i \text{ in terms of US dollars at time 'o'}$.

Employing (1), the dollar value of the ECU at time 't' is then obtained by summing actual amounts of each currency which have been converted into the dollars. Thus, the value of ECU at time 't' is given by

$$ECU_t = \sum_{i=1}^m C/E_{it}$$

The individual currencies in the ECU are assigned weights in accordance with the economic significance of those countries concerned. The economic significance of a country is measured by the share of that country in the intra-community trade, the national product of the community and the quotas in the monetary support arrangements. On the other hand, since the amounts of individual currencies are fixed in the ECU, the relative values of individual currencies will change as exchange rates change and therefore the weight of each currency changes over time. The formal position of the EC is that it is obliged to review the definition of the ECU every five years. Any redefinition of the ECU takes into account three important considerations: (i) changes in the member's relative economic importance, (ii) cumulated exchange rate changes for restoring the weights, and (iii) the inclusion of new currencies¹. The fact is that while the impact of (i) and (ii) will not be significant in the short-run, that of (iii) will be considerable especially if a newly joining country forms a significant share of the EC's national product etc. Judging by the numbers reported in Table A. 1, however, both peseta and escudo appear to be weak currencies in the latest (second) revision of the ECU basket in September 1989.

Both the correction of weights of the existing currencies and the inclusion of new currencies will alter the ECU-related interest rates. Theoretically the effect of a recomposition of the basket is immediately transmitted to the interest rates. In principle, it is possible to create a synthetic ECU asset corresponding to any existing ECU asset. For example, a synthetic term deposit can be replicated by depositing those amounts of

individual currencies as specified in the ECU basket. The theoretical return on the deposit is then calculated by simply converting the proceeds from each currency deposit into ECU with the help of (forward) the exchange rate as shown below:

$$\text{recu} = \sum_{i=1}^n W_i r_i \quad \dots (3)$$

$$W_i = (C_i E_i) / \sum_{i=1}^n (C_i E_i) \quad \dots (4)$$

Where

W_i = weight of currency i

C_i = amount of currency i in the ECU basket

E_i = forward exchange rate of currency ' i ' in a common currency denominator.

r_i = return on the relevant component currency deposit

and recu = ECU deposit return.

Experience suggests that ECU deposits are of good value in reality because the synthetic deposit returns computed this way appear to exceed bid rates for these deposits (Bank of England Quarterly, 1988).

However, the computation of a similar synthetic return on bonds and securities runs into informational problems. The calculation of weights becomes less reliable as the forward exchange rates look less transparent due to the markets becoming less liquid for longer than one year. In addition, there is the problem of choosing appropriate yields for longer maturities. Notwithstanding this problem, the popularity of ECU bonds as portrayed in the next section has led to the practising of three different formulae : (i) the Paribus formula, (ii) the SBCI methods, and (iii) CSFS method. The first formula by the Banque Paribus Capital Markets research team involves the estimation of coupon payments of a bond issued at par in the component currencies and then discounting them by an appropriate interest rate to derive a theoretical yield. This method however has to resolve the problem of choosing appropriate yields for longer maturities. The second method by the Swiss Bank Corporation of Investment banking tries to surmount the above problem by dropping from the formula currencies for which liquid debt markets in the relevant maturities are not available. Thus, the SBCI method is also called ECU-4 model because only four currencies in which the relevant debt instruments are available are considered in the calculations. The third method is by the research department at Credit Suisse First Boston (CSFB). It is claimed to be built upon the Paribus formula and is stressed to be an arbitrage calculation². Despite these differences in the methods, some statistical tests of their comparative performance suggest that there is little to choose between them (Oneil, 1988) with this portrayal of the ECU as a numeraire currency, we turn now to the other two components of the EMC.

2.2 The ERM

The main instrument of preservation of stable exchange rates in the EMS is the Exchange Rate Mechanism. This mechanism operates in two aspects : firstly it maintains bilateral central rates between participating currencies and the parties will be required to compulsorily intervene in the foreign exchange market to limit the deviations from the central rate to lie within accepted bands, and secondly it establishes presumption of action, based on a divergence indicator, for the concerned country whose currency rate exceeds certain limits fixed in terms of the ECU. Around the bilateral central rates margins of authorized fluctuation range to ± 2.25 per cent and are bounded for each currency vis-a-vis another by the intervention limits. However, the UK (a member of the ERM since October 3, 1990) and Spain (alongwith Portugal recently joined the EMS) have opted for ± 6.0 per cent band of fluctuations.

Intervention is made compulsory whenever a currency reaches its intervention limit relative to another. The central bank of the strong currency purchases the weak currency of the other country and vice-versa in order to keep their currencies within their fluctuation margins. The divergence indicator shows the extent to which a given currency is nearing its maximum spread and it is done by comparing the premium or the discount in the market rate of the ECU in terms of that currency with the maximum spread. If the ratio of the former to the later called the divergence indicator which lies between 0 and 100 reaches 75 per cent the concerned currency is said to reach its divergence threshold which signals to the concerned central bank the time to get ready for intervention. The ERM is operated as an integral aspect of the EMU, retaining the fixed but adjustable exchange rate grid of the member currencies, with the ECU as the numeraire.

2.3 The EMCF

The European Monetary Co-operation Fund (the Fund) was set up by the member states of the EEC to administer community exchange rate arrangement. The Bank for International Settlements (the Bank) continued to perform the functions of Agent for the Fund since June 1973 ^{3/}. As the Fund's Agent, the Bank performs two sets of functions; those connected with the operation of the EMS and those relating to the execution of financial operations in connection with the Community borrowing and lending for the purpose of balance-of-payments support for EEC member countries. The bank records in ECU's in the Fund's books, the debts and claims vis-a-vis the Fund of the member countries participating in the ERM that arise from interventions carried out by their central banks in other member countries' currencies and also handles the settlement of these debts and claims. The Bank carries out operations associated with the creation, utilisation and remuneration of ECU's. In its function as Agent of the Fund the Bank is responsible for carrying out payment connected with borrowing and lending operation, keeping a check on the due dates of contracts for payment of interest and repayment of the principle and informing the Commission of the European Communities of the operations carries out for the EEC account. In accordance of the provisions of an agreement on April 1987 with the ECU Banking Association, the Bank is also performing the function as Agent for the private ECU clearing and settlement system.

3. The ECU as a Financial Innovation

3.A.1 Taxonomy of Financial Innovations

Financial innovations take many forms. For analytical convenience, they can be classified, in one way, as "aggressive" or supply-lending and "defensive" or demand following (Dufey and Giddy, 1981) innovations. While the former refer to new financial products or services offered in response to a perceived demand that is currently not satisfied, the latter follow the demand for them as a result of changes in tastes or relative costs. A second and popular classification of innovations is to characterise them as "product" or "process" innovations. Many new financial products like, currency options; zero coupons bonds stock index futures etc., provide some examples of product innovations. According to this classification, the ECU can be clearly defined as a product innovation aimed at providing a single common currency instrument for all the EMS countries towards achieving a monetary union among them. However, since the ECU is given a key role in the stabilization of European exchange rates it is also considered as part of a process innovation. Viewed from a third angle, the ECU exhibits portfolio properties for optimizing risk. Any basket of currencies that are not perfectly correlated will exhibit diversification properties, that is variance of the basket will be less than the weighted sum of variances of the components. For risk-averse agents, ECU-denominated transactions become preferable to those of other units of account, other things being equal.

3.A.2 The ECU as an Optimal Currency Basket

A typical way to define a "basket" as optimal is to derive optimal weights for the components of the basket. The difficulty in applying this approach to deriving optimal weights of the ECU currencies lies in specifying an objective function for all the EMS countries together and minimizing the variance of this function with the real or nominal exchange rate as the target variable. Instead, if several sets of weights can be derived and evaluated for sensitivity of the ECU composition, their derivation of optimal weights can be circumvented. Thus, following Edison (1987) we have tried to verify whether or not the ECU is sensitive to changes in its composition. The experiment was carried out with the help of equations (1) and (2) reported in the earlier section. The provision for redefining the ECU composition every five years or when new members join the EMS was exploited for this purpose. We know that exogenously chosen initial weight of a member country currency is used to derive the quantity of that currency which in turn goes into the calculation of the ECU basket. We also know that once these currency quantities are derived they are not changed again until the basket is redefined. Furthermore both the initial values of the ECU exchange rate (ECU) and the i th currency exchange rate in terms of the US dollar (EC_i) are known. Thus employing, the September 1984 initial weights and the corresponding member currency amounts we calculated on the basis of formula (2) the ECU daily exchange rates for the period October 5, 1986 to September 20, 1987, 4/. For comparative statistical analysis, we constructed a modified ECU which we name as 'DBF' 5/. differentiate it from Edison's (1987) Pongo 6/. Using the four

sets of initial weight and the corresponding initial quantities of currencies based on the country shares in exports, imports, GNP (nominal) and GNP (real taken) from Edison (1987), four separate sets of daily exchange rates of 'DBF' were computed. In these computations we employed formula (2) once again and the initial value of the ECU exchange rate was used for all the four series of exchange rates. Our objective is to determine whether the ECU exchange rates differ significantly from each of those four sets of exchange rates of the 'DBF'. Student 't' tests were conducted to verify the null hypothesis that the mean of each of those 'DBF' exchange rates is not significantly different from that of the ECU mean value. The results of the experiment are reported below along with those from Edison (1987) for comparative purposes.

Table 1 : Test of Mean Differences between ECU and DBF Exchange Rates

Type of	Oct 5 1986	Sept 17 1984	Mar 21 1983	Mar 13 1979	Dec 2 1979
DBF	Sept 20 1987	Dec 12 1985	Sept 14 1984	Dec 31 1982	Mar 20 1981
GNPR	1.0356 (.598)	.7490 (.2951)	.836 (2.36)	1.208 (.182)	1.370 (.735)
GNPN	1.0891 (.684)	.7482 (.4917)	.840 (1.33)	1.210 (.448)	1.366 (1.000)
EXP	1.0643 (.913)	.7499 (.0909)	.845 (.01)	1.209 (.328)	1.370 (.631)
IMP	1.0697 (.825)	.7485 (.4131)	.840 (.14)	1.210 (.327)	1.370 (.813)
ECU	1.0713	.7503	.845	1.207	1.368

- Note : 1. The first four are 'DBF' (Edison's Pongo) means based respectively on real GNP (GNPR) nominal GNP (GNPN), exports (EXP) and imports (IMP) share weights.
2. The first column of numbers is from our experiment whereas the rest of the numbers are reproduced from Table 11-1 of Edison (1987) for comparative purposes.
3. Numbers in parentheses are computed t-values.

The first column of numbers in the table represents the result of our experiment for a sample period between October 5, 1986 and September 20, 1987. The values without parentheses, give the mean values of the 'DBF' exchange rates based on the four selected sets of weights - shares in real GNP, nominal GNP, exports and imports respectively. Numbers in parentheses are the computed t-values for differences between the averages of each 'DBF' exchange rate and the ECU rate. These results clearly cannot reject the null hypothesis that the hypothetical compositions of the 'DBF' baskets do not significantly differ from that of ECU basket. The failure to reject the null hypothesis may have been due to small mean differences between EDFs and the ECU; or it may have resulted from very little exchange rate volatility of the currencies of the ECU over the sample period. The relevant results reproduced from Edison (1987) also confirm that our DBF'(Pongo) means are not identical to that of the ECU, but they are not statistically significantly different from the ECU mean. It is popularly said that 'one swallow does not make a summer.' It is similarly true that one small experiment does amount to a concluding evidence. Nonetheless, the general pattern of statistical results appear to point in the direction of the ECU offering an optimal currency basket.

3.B. *The Development of ECU Markets*

The ECUs exist in both official and private sense and their currency compositions are identical. But they can be created and utilized in quite distinct ways. While private ECUs are created by bundling up the component currencies, the official ECUs are held mostly by the central banks of the EMS countries ^{8/}. Of course, official ECUs are not fungible with private ECUs. A number of researchers have argued that the growing use of the ECUs can be attributed to three important factors. They are : (i) the inherent basket properties of the ECU, (ii) the economic policy commitment of the participating countries of the ERM towards maintaining stable exchange rates, and (iii) the ECU as a financial innovation. The use of the ECU for denominating financial obligations in Europe has created growing demand for ECU denominated financial instruments. These uses have given a filip to the development of ECU markets. The stability of the ECU in foreign exchange markets is a major attraction to borrowers and investors and their use in banking and eurobond markets is now well established. Although the ECU has an established and growing role notably in Italy and France, it is confined mostly to inter-banking business in Belgium, UK and Luxemburg in addition.

International banks' assets in ECUs stood at ECU 90 billion at the end of March 1988, whereas they were a small ECU 7 billion only at the end of 1982, Inter-bank ECU assets, however, increased from a low of 5 billion in 1982 to a high of 70 billion during the same period. In fact it was only since end-1985, the inter-bank market grew in importance as a source of ECU funds. The market is well balanced and the banks had a net asset position of ECU 0.5 billion by end-March 1988. The growth of banks' assets was stronger during 1986-1987 probably benefiting from a more favourable outlook for stable exchange rate relationships among the constituent currencies. There was, however, little change in non-banks' ECU deposits with international banks during 1987-

1988 (March). But there was notable growth in these deposits in the earlier years mostly due to larger number of banks offering foreign exchange facilities.

Table 2 : ECU Assets by BIS-Area Banks

	Amounts Outstanding in ECU billions				
	1982	1984	1986	1987	March 1988
Total International Assets	7.3	39.8	70.7	82.4	90.5
Of which Banks	4.8	28.6	54.9	62.1	69.6
Non-banks	2.5	11.1	15.8	20.3	20.9

In cross-border lending, the ECU ranks sixth among international currencies in March 1983, accounting for 2.6 per cent of outstanding lending.

Table 3 : Currency Composition of Cross-border Lending by BIS-Area Banks

(Percentages)

	1985	1986	1987	March 1988
US dollars	30.5	58.8	47.3	51.7
Yen	24.1	16.4	29.5	13.5
Deutschemarks	16.2	6.9	9.0	12.8
Swiss francs	10.1	2.8	0.5	6.0
Sterling	4.0	4.5	3.3	4.1
ECU	7.7	1.9	2.4	2.6

These percentages are imprecise because they exclude lending the offshore banking centres for which currency detail is not available.

The role of the ECUs in commercial transactions is growing rather slowly. Mostly borrowers in France, Italy and Greece find the ECU borrowing attractive because the ECU has a lower nominal interest rate than the domestic currency. These borrowers have successfully used the ECU for short-term trade financing. In fact borrowing in the ECU, rather than in the domestic currency, has been actively promoted in Italy and France. Some European companies even publish their accounts in ECUs and ECU invoicing accounts for one per cent of all foreign trade in Italy and France. Increasingly Middle Eastern and North African traders are also switching invoicing of their exports and imports from the US dollar to the ECU. ECU invoicing has entered the travel industry too. The International Air Transport Association has started offering the ECU, beginning 1989, alongside the US dollar and sterling as a means of settling payments between airlines. The ECU holds good deal of appeal for US firms also because of its use as a hedge against the US dollar. It excludes the US dollar and therefore the ECU denominated debts contain considerably less foreign exchange risk than those denominated in US dollars. However, lack of demand has stifled the initial development of ECU travellers cheques although in certain countries notably in Belgium and France demand is picking up slowly. It will take some more time before the ECU commercial activity picks up significantly because corporate treasurers and the public at large in many countries are still undergoing an educational process in the use of the ECU.

3.C. How to make the ECU a European Bancor?

No new product has any chance of success if it is not better than the ones it is intended to replace. At present, the ECU lacks most of the characteristics of a real currency. It exists in only definition but not in any form nor in function. It is simply a book-keeping entry and therefore it may also vegetate like the SDR unless until it is freed from its present non-existent form. By its basket nature it may be better than the weakest of currencies but certainly not as good as the best.

1. A real European currency (bancor) has to be at least as good as the strongest of the member currencies both by design and preference. The ECU will become a European bancor if it were defined in terms of a parity grid vis-a-vis other currencies with a proviso that the strongest currency could not appreciate against it and was given a legal tender status in every member country thus ensuring its full convertibility. This would certainly provide the basis for the ECU development into a bancor with the advantage that it cannot depreciate against the strongest of the member currencies. The EMCF can be entrusted with the task of supplying the new ECU before a European central bank would eventually become responsible for the function. This can be phased in two steps. First, the new ECU should be created on a permanent basis rather than in temporary swaps as is done currently. The other step

is to introduce periodic increase in the supply of those ECUs linked to the potential growth of the whole area. Member countries central banks will be issued the new ECUs in exchange for their contribution to the EMCF of gold and dollar reserves thus making it an international reserve currency in the EMS. If the new ECU is periodically revalued against the strongest currency of the system it would become an attractive asset also in the stronger currency countries.

2. A second possible approach is to transform the present ECU into a constant purchasing power ECU. Without the need for a prior agreement - which may be difficult to obtain immediately - among the member countries of the system, a consortium of the European may be entrusted with the responsibility for putting the new currency unit in circulation among themselves. Creation of consortia of banks for specific purposes is, after all, very much common place in banking these days

For creating the constant purchasing power ECU all that is required is to vary each day the sums of member currencies such that the increase (decrease) of these sums exactly reflects the rise (decline) in the price index in the country of origin of each such component currency. However, since the data on price index movements are available at least on a weekly basis, the daily variation for the following week can be derived as - 1/7 per cent for calculating the ECU value on a daily basis. Thus calculated the ECU will become a constant purchasing power currency which will be able to purchase a European basket of goods and services which will not vary either in its dimensions or its composition. This will be a remarkable property. It opens up for the ECU a potential future that is rich in possibilities. The constant purchasing power property is something which is impossible for a national legal tender currency. Such a constant purchasing power ECU would provide an excellent standard of reference for strictly extranational circulation only to start with. Once it is recognized and its use well understood, it can be introduced for use in financial markets between the member countries soon to be followed by the use in the markets as a result of the preference for it over the individual national currencies. Thus, if ECU were to be preferred to the dollar it must be better than the dollar and that can be achieved only by exploiting this special property of the basket currency which is excluded from circulation within member countries.

By way of criticism it may be argued that the constant purchasing power ECU would be inflationary in nature. The point is that an extranational currency which does not circulate for use in direct payment within the member countries is free from such a criticism; when the final exchange of money for goods and services comes, it will be affected in individual national currencies and therefore the inflation argument finally devolves upon the national currency concerned not on the extranational currency.

4. The EMS and the EMF

4.1 *The Success of the EMS*

It is very well known that the EMS has a twofold ambition: the creation of an area of exchange rate stability and the achievement of a European monetary zone. The EMS appears to have achieved remarkable success in creating exchange rate stability of the member countries currencies (Giavazzi, 1988) especially when compared with the fluctuations that have been witnessed in the dollar's exchange rate since 1979. The realignments of the ten central exchange rates have successfully absorbed the change in the economic fundamentals without any reversals in direction and the total cumulative changes have been comparatively moderate. It is encouraging to know that the stability of the inside system was not achieved at the expense of more instability vis-a-vis outside currencies (Artis and Taylor, 1988). In an international environment of historically low inflation and output well below the target, the individual member countries, in the absence of the EMS, might have tried to stimulate their economies by allowing their currencies to depreciate. Such a process of competitive depreciation would have led to more inflation than has actually occurred in the EMS framework. Therefore, the EMS has the merit of limiting such inefficiencies that result from non-cooperative use of national instruments.

That said about the EMS achievements, it is somewhat embarrassing to know also that one cannot be firmer in one's conclusions about its convincing success. There is weak evidence to suggest that the obliged success of the EMS might have been due, partly, to the gradual evolution of the EMS itself, and the general disinflationary environment also in the non-EMS industrial countries in the first half of the 1980s. Moreover, the difficulty of constructing the counterfactual scenario without the EMS also makes it impossible to ask for more. Some of the more visible weaknesses of the EMS are : (i) there has been less adequate coordination of economic, monetary and fiscal policies in the participating countries, (ii) there has been less adequate coordinated interventions particularly in intramarginal ones which are bilateral, (iii) the interventions have been not well synchronized with appropriate interest rate adjustments thus rendering the interventions relatively ineffective acts wasteful of reserves. All these weaknesses and some more are to a large extent attributable to the fact that the activities of the EMS are not entrusted to one single authority which could act promptly and rationally.

4.2 *The Tasks of the EMF*

There is, thus, the need to build on the progress made by the EMS so far and create an institutional framework sufficient to address the issues to be faced and which could develop into a European Central Bank. Such an institution could be a European Monetary Fund (EMF). It should be created with roots in the history of the EMS and made operationally independent from the European National Governments and other EC bodies. The EMF should not replace but provide an institutional centre for the EMS. The member central banks will be responsible for the management of the Fund. The EMF will take over and bring under its control all of the now dispersed responsibilities and activities within the EMS.

The Fund should pursue the following objectives towards the progress of the EMS into a zone of monetary stability and common currency area :

(1) The EMF should work towards market convertibility of the ECU so that it would be impossible to refuse to acknowledge a monetary and foreign - exchange character for the ECU. Besides expanding the use of official ECU, its role as a substitute for domestic currency for borrowing and lending should be encouraged. The high substitutability between the ECU and each currency in the EMS would increase capital mobility within the EC. In this connection the recent measures by some of the EMS countries towards liberalisation of capital movements will be a positive step in this direction.

(2) With the participation of the central banks concerned, the Fund should aim at concerned interventions in the exchange markets of the area and use intramarginal interventions for combating speculation.

(3) The Fund should aim at securing a reduction in the foreign exchange margins from the present -2.25 percent (in some cases - 6 percent) to a one percent and prepare the ground for an irrevocable fixing of the parities of the European currencies.

(4) Above all the Fund should aim at promoting monetary, interest rate and fiscal convergence of the member countries.

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Table A. 1 : ECU Composition and Weights (January 18, 1989)

Currency	Amount	Dollar exchange rates	Dollar values	Weights (%)	Weight on Sept 13, 1984	Weight on Sept 21, 1989
Bfr/Lfr	3.850	38.96	0.0988	8.82	8.5	7.90
Dkr	0.219	7.215	0.0304	2.71	2.7	2.45
DM	0.719	1.862	0.3861	34.46	32.0	30.10
Ffr	1.310	6.352	0.2062	18.40	19.0	19.00
IR	0.00871	0.696	0.0125	1.12	1.2	1.10
Lit	140.0	1,364	0.1026	9.16	10.1	10.15
Fl	0.256	2.102	0.1218	10.87	10.1	9.40
UK	0.0878	0.568	0.1547	13.80	15.0	13.00
Dr	1.15	154.3	0.0075	0.67	1.3	0.80
Pta	6.885					5.30
Esc	1.393					0.80
US \$ per BCU			1.1207	100	100	100

Note : Bfr/Lfr = Belgian franc/Luxemburg franc
 Dkr = Danish Knoner,
 DM = Deutschmark,
 Ffr = French franc,
 IR = Irish punt,
 Lit = Italian lira,
 Fl = dutch guilder,
 UK = Pound sterling,
 Dr = Greek drachma,
 Pta = Spanish peseta, and,
 Esc = Portuguese escudo.

Table A. 2 : Initial Weights (W_{i0}) and Amounts (C_i) for ECU and BDF Baskets - September 17, 1984.

Currency	ECU		GNPR		GNPN		EXP		IMP	
	W_{i0}	C_i	W_{i0}	C_i	W_{i0}	C_i	W_{i0}	C_i	W_{i0}	C_i
Bfr/Lfr	.082	3.71	.041	1.85	.035	1.58	.088	3.95	.093	4.19
Dkr	.027	.219	.025	.202	.025	.202	.027	.22	.028	.22
DM	.32	.719	.287	.64	.281	.63	.294	.66	.257	.57
Ffr	.19	1.31	.235	1.62	.225	1.54	.167	1.14	.168	1.15
IR	.012	.008	.007	.005	.008	.005	.017	.012	.016	.011
Lit	.102	140	.137	189	.160	291	.126	174	.142	196
Fl	.101	.251	.058	.146	.057	.144	.112	.283	.104	.263
UK	.150	.0878	.194	.114	.194	.114	.161	.094	.176	.103
Dr	.013	1.15	.014	1.22	.015	1.31	.008	.70	.016	1.40

Note : Bfr/Lfr = Belgian franc/Luxemburg franc
 Dkr = Danish Knoner,
 DM = Deutschmark,
 Ffr = French franc,
 Ir = Irish punt,
 Lit = Italian Lira,
 Fl = Dutch guilder,
 UK = Pound sterling,
 Dr = Greek drachma.

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Notes

1. Table A. 1 in the appendix illustrates the calculation of ECU weights and the composition of the "basket" as on September 21, 1989.
2. For more details on the methodology and comparisons of the three formulae see Frank (1988).
3. Detailed description of the functions is recorded in the Annual Report 54 of the BIS.
4. The choice of the sample period is simply arbitrary.
5. DBF stands for 'DIGBIGFUN' where each letter stands for the first letter of the EMS countries except that Luxemburg is clubbed with Belgium and 'G' is taken for West Germany.
6. For the readers' convenience these values are reproduced in Table A.2 of the appendix.
7. To a minor extent, the official ECUs are also held by a few other central banks and international monetary institutions when they are accorded the status of 'other holders'. For instance, Australian National Bank has been accorded this status from July 1989 (BIS Review, 12 July, 1989).

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ERRATA

Page	Line	Printed as	Correction
4	5	quaantitative	quantitative
4	9	sell	see
10	7	Brenson	Branson
10	17	impluses	impulses
13	9 from below	testes	tastes
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29	9	result it	result in
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73	12	long form	log form
73	14	coefficient	coefficients
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165	5 from below	principle	principal
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