New Open Economy Macroeconomics: Evidence from an Empirical Test on South Asian Economic Data

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Abstract

This study first conducts a detailed survey on recently emerged new field in economics called new open economy macroeconomics and then carries out an empirical test of theoretical predictions of these models to observe transmission effects of Indian economic shocks in South Asia region. In the survey, the study starts with the seminal work of Obstfeld and Rogoff (1995) and then evaluates the subsequent evolution of this field. The survey reveals that the field is rapidly evolving with many dimensions added on it within a short period of time, making this field richer and betterable to perform better predictions. The estimation of Vector Autoregression model for South Asia region, on the other hand, uncovers that the effects of Indian shocks in South Asia region, have mixed results. Since the real, nominal, and financial shocks generated in India affect the economies of neighboring countries with varied extent.

Key Words: New Open Economy Macroeconomics, Vector Autoregression, Shock Transmission

JEL Classifications: E44, E52, E58, F15, F36, F42

I. INTRODUCTION

Globalization has altered the economic frameworks of both advanced and developing nations in ways that are difficult to fully comprehend. Although a complete understanding of the reasons remains elusive, globalization and innovation would appear to be essential elements of any paradigm capable of explaining the events of the past ten years. (Greenspan, 2005)

Former Federal Reserve chairman Allen Greenspan in the statement above proclaims that the economic policy-making of a country in the context of growing global integration has now become more challenging. The additional international dimension added in the formulation of economic policies has forced academia and professionals to think whether

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the inward-looking policy is optimal or not, especially when the shocks generated in other parts of the world can easily transmit effects to the domestic economic environment. The short-run trade-off between inflation and unemployment, for example, becomes more obscure in the open environment leading to a rather difficult task for central bankers to implement appropriate monetary policy. This may also make policy-makers to consider, and potentially react, the actions taken by other central banks and help design coordinated approach for better economic outcomes.

In consideration to this situation, a new branch of economics called New Open Economy Macroeconomics (NOEM) has recently emerged that addresses these new issues and offers appropriate policy guidelines. As is well known, monetary policy has an important role to play in the short-run to affect real sector of the economy, but the claim is valid only when there is a presence of nominal rigidities in the economy. The most promising aspect of the NOEM is that it introduces this nominal rigidity into standard real business cycle (RBC) models offering realistic predictions. The foremost objective of this study is to survey literatures in this new emerging field. Besides this, the study also conducts an empirical test of the predications of the NOEM in South Asia region by estimating a Vector Autoregression (VAR) model to identify Indian real, nominal and financial shocks and their transmission effects in South Asia region.

The survey reveals that the NOEM has substantially progressed over the years and has been one of the pioneering branches of economics to be capable of predicting macroeconomic variables in globally connected economies. Starting from a very simple model in 1995 proposed by Obstfeld and Rogoff (1995) it has taken a long stride incorporating new issues discovered throughout the evolution of the field, such as the introduction of incomplete exchange rate pass though, new approaches to consumer preferences, and various dimensions of nominal rigidities. No central bank in the present time can escape the knowledge accumulated in this area required to conduct better monetary policy.

The VAR estimation, on the other hand, shows that the transmission effects of Indian economic shocks in South Asia region have mixed results. While Indian economy reacts consistently to its own shocks, the outside effect is different for different countries. The potential reason for this is attributed to different economic regimes of those countries vis-à-vis India. The countries in the region, for example, have adopted different exchange rate regimes with India. Similarly, the extent of economic dependence to India differs country by country. Despite this, the results are capable of revealing the fact that the transmission effect of Indian shocks in South Asia region is significant.

The rest of the paper proceeds as follows: Section 2 provides a detailed survey on new open economy macroeconomics, Section 3 discusses the results from empirical analysis of transmission effects of Indian shocks on South Asia region, and Section 4 concludes.

II. SURVEY ON NEW OPEN ECONOMY MACROECONOMICS (NOEM)

Emergence of NOEM

Since one and half decade or so international macroeconomics has been one of the fast growing areas in economics. Macroeconomics took an international dimension particularly after Backus, Kehoe and Kydland (1992) extended closed-economy real business cycle models in international settings. International real business cycle models postulates that the shocks generated in an economy transmit effects to other economies and thus the key macroeconomic variables in different economies are interconnected to each other. Backus, Kehoe and Kydland's (1992) finding was in line with the predictions of international real business cycle models showing that consumption and income in different open economies were highly correlated.

The unifying assumption of real business cycle model (whether the closed-economy or open-economy models) is flexibility of prices and wages such that market always clears. Recent years, however, have witnessed a shift from real business cycle theory's market clearing assumption to market imperfections. This led to the emergence of so-called 'New Open Economy Macroeconomics' (NOEM) as a new field in macroeconomics. With a distinguished feature of nominal rigidities and market imperfections, such models assign a greater role for policymakers to pursue activist policy intervention to correct socially undesirable outputs as created by market imperfections. Based on analytical rigor of utility and profit maximizations, the models also present a policymaker an instrument to conduct a welfare analysis and then gauge the success or failure of the policy intervention. In addition, nominal rigidity is also considered to be an essential ingredient for identifying transmission mechanism of monetary policy.

Lane (2001) provides a detail survey on New Open Economy Macroeconomics prior to 2001. According to Lane (2001), the building block of NOEM is *Redux* model as propounded by Obstfeld and Rogoff (1995). Most of this model's ingredients are still found in recent literatures despite some important deviations from the seminal work. Redux model is a simple two country model where consumers derive utility from both domestically produced goods and foreign goods. The preferences are identical for both home and foreign households and law of one price holds, the assumptions that are mostly not found in recent extensions of the model and are considered to be the reasons why model's prediction and data does not match very well.

Redux model is quite simple to explain international transmission of monetary policy shock. To analyze the dynamic effects of a monetary policy shock, the model is log-linearized in a steady state and observed the response of different economic variables (domestic as well as foreign) to an unanticipated increase in the domestic money supply. The theoretical prediction of the model is such that the domestic monetary policy shock raises the level of domestic output and consumption. The foreign consumption increases due mainly to a fall in world interest rates. The model, however, has an ambiguous prediction for foreign output.

The most controversial result of Redux model is its non-neutrality of money in the long-run. This result is mainly attributed to its strict assumptions of law of one price and the absence of capital in the model. Also an interesting result of the model is the lack of exchange rate overshooting, which goes against the prediction of Dornbusch's (1976) dynamic Mundell-Fleming model (Mundell, 1963 and Fleming, 1962). Dornbusch (1976) finds that the nominal exchange rate immediately reaches to its long-run values following an unanticipated monetary expansion, which is famously known as exchange rate overshooting. As to the welfare effect of the Redux model, monetary expansion brings production closer to the efficient level but it is distorted in the steady state due to imperfect competition.

While Redux model opened the wave of researches in the area of international macroeconomics, the model is empirically unsuccessful. The failure is mainly attributed to the violation of law of one price. Redux model assumes a complete pass-through of the change in exchange rate but Feenstra et al. (1996) show that the complete exchange rate pass-through is empirically violated. Betts and Devereux (2000a) also develop a model that allows for incomplete exchange rate pass-through where domestic and foreign markets are segmented and domestic agents are unable to buy the domestically produced goods in the foreign country and foreign agents cannot do the same. Under this framework, monopolistically competitive firms discriminate prices for domestic sales and exports. This study finds that even though there is no international transmission of monetary expansion to consumption, the shock raises domestic consumption and output. Foreign output also increases. Exchange rate overshooting is restored as well.

Further Extensions to NOEM Models

The assumption of the law of one price was on the center of criticism of the Redux model. The model was then modified in a number of other specifications so that the model's predictions match with real world observation. Among others, the assumptions of price stickiness, consumer preferences and technology, and financial market structures are the areas where important deviations have been witnessed. International transmission and welfare effects of monetary shock have been found to be different with these different assumptions.

As stated above, price stickiness is a key element to generate real effects of a monetary policy shock. In Redux model, price stickiness enters into a model in a simple setup where firms adjust their prices simultaneously one period in advance. Such price adjustment may jump in a sudden and in discrete way that may not be a reflection of real world phenomenon. An alternative way of setting price permits gradual change in prices. Calvo (1983) pioneered in this framework. Under this staggered price setting, each firm faces a random probability that it re-optimizes its prices each period. Staggering comes from the fact that while making the decision of changing prices, firms must take into account the past and future price decisions of other firms. Across all firms, some may change the price when found appropriate to change, but others may not, depending on individual firm's optimal condition. This leads to gradual adjustment of prices rather than all of a sudden jump as in Redux model.

The models in international macroeconomics predominantly use micro foundations. Under this setting, alternative specifications of consumer preferences and technology have been suggested. Redux model uses a simple preference in which there is no distinction between the consumption of home and foreign goods. Svensson and van Wijnbergen (1989), however, assume a model where home and foreign goods are substitutable. Chari et al. (2002) goes further and uses a technology in which final goods are produced from intermediate goods, and make use of substitution between different varieties of a good as well as substitution between home and foreign-produced goods. Corsetti and Pesenti (2005) assume aggregate consumption as a Cobb-Douglas specification so that elasticity of substitution between home and foreign good is unitary. This indeed implies constant income shares of home and foreign agents. This further infers for a zero current account balance in equilibrium, and there is no long-run effect of a shock in this situation.

Another form of preferences takes into account consumption-leisure separability. Redux model takes consumption and leisure separately into preferences. Such preference is subject to criticism of going against balanced growth path. Chari et al. (2002), however, claim that balance growth is still possible in such preferences if there is a unitary intertemporal elasticity of substitution between consumption and leisure. They also argue that their preferences are capable of explaining high exchange rate volatility.

As to the technology, Redux model assumes labor as the only factor of production. But in reality, monetary shocks have important roles to affect investment through interest rates. Chari et al. (2002) advances an argument that positive monetary shock reduces interest rates and thereby raises investment. This, in fact, creates a current account deficit as opposed to the prediction of current account surplus in Redux model. On this situation, capital is considered as an important factor to explain monetary policy shocks and is to be included into the model.

There is a great deal of debate over traded and non-traded goods to be distinguished for the analysis. A number of explanations have been emerged with this distinction between tradable and non-trable goods. Hau (2000) used the same Redux model but assumed a fraction of goods as non-tradables. The presence of non-tradables raised a number of new developments into the analysis, such as that there was a sizable increase in initial exchange rate response to a monetary policy shock and domestic consumption increased relative to foreign consumption. Warnock (1998) introduces home bias for tradable goods where consumers gain higher utilities from consuming home produced goods. This is clearly in contrast to symmetric preferences in the Redux model. Home bias creates a higher welfare gain for home from a monetary policy shock.

The outcome of open economy macro models also depends on whether these models are assuming complete or incomplete financial markets. Complete market assumption is considered to be a simple in that these models rule out dynamic behavior of current account and net foreign assets. Chari et al. (2002) tested pricing-to-market model both for complete and incomplete markets and found that the persistence of monetary shocks remains almost similar with these two financial market structures.

Implication of Openness for Monetary Policy

Recent Contributions

Despite the prevalence of growing literatures on open economy models as detailed above, the implication of openness in formulating monetary policy in particular is being lately recognized. There is a growing acknowledgement that greater openness certainly affects the conduct of monetary policy. Increased globalization has laid out a number of questions for the central banks about how they can direct their policies to take account of increased openness.

Clarida, Gali and Gertler (2002) provide a seminal work on this area of research. To provide an analytical solution, the authors develop a variant of a dynamic New Keynesian Model applied to open economies where two countries face a short-run trade-off between inflation and output along with nominal rigidities. The authors find that under Nash equilibrium central banks can optimize their policy-making similar to the one when they operate in closed economy setup, but under cooperation they can gain due to the fact that the foreign economic activities affect domestic marginal costs of production. Nash equilibrium requires central banks to adjust interest rates to manipulate domestic inflation, whereas cooperative equilibrium requires the consideration of foreign inflation as well to control domestic inflation.

In addition, openness raises a question about whether to use consumer price index (CPI) inflation or domestic inflation as a target variable. Clarida, Gali and Gertler (2002) find that, to the extent there is perfect exchange rate pass-through, the central bank should target domestic inflation and allow the exchange rate to float, even though exchange rate fluctuation may impact the CPI. The change in foreign economic activities affect terms of trade, which ultimately affect domestic marginal cost of production and the domestic potential output. The central banks then secure benefit of this spillover from coordinating and improve welfare. The authors conclude that it is possible to implement the optimal policy under coordination by pursuing Taylor-type policy rule but this rule should be augmented also to respond foreign inflation.

On the ground of theoretical framework of Clarida, Gali and Gertler (2002), Woodford (2007) provides a testimony of three different possible channels by which globalization can affect the ability of central banks to control inflation. In the first channel, an argument is advanced to make a claim that under increased financial integration, nominal interest rate of a country may cease to be determined by the aggregate supply of liquidity of all central banks in the world rather than the liquidity from a national central bank alone. The second channel indicates towards the possibility of a determination of real interest rates by global balance between savings and investment rather than a balance in a single country that exert pressure on aggregate demand and inflation. The last channel develops a function where inflation in national economy is a function of global output gap rather than domestic output gap. The first, second and third channel seek for possible effects on

LM curve, IS curve and AS curve, respectively. In all of these tests, however, the author finds no solid ground to believe that the globalization can weaken in a substantial way the ability of central banks to control inflation.

Corsetti and Pesenti (2007) have made another contribution that discusses international transmission of real and monetary shocks. The authors also examine the role of exchange rate pass-through for optimal monetary policy and the welfare gains from macroeconomic stabilization and monetary coordination among interdependent economies.

The study tests international macroeconomic transmission for models with both flexible price and nominal rigidities in three different scenarios: local currency pricing (LCP), producer currency pricing (PCP) and dollar pricing (DP). Under flexible prices, assuming that productivity shocks occur in home country, higher productivity raises consumption in both countries. With increased supply of home goods, however, lowers prices in international markets. The terms of trade move against the home country. Foreign consumers also gain from productivity increase in home country, because the fall in international prices increases home country's real income. Lower import prices improve foreign terms of trade and lower CPI. While employment remains at natural level with increased consumption, there is an unambiguous gain in welfare of foreign country.

With nominal rigidities, an unexpected increase in home productivity does not affect nominal exchange rate, since it is only affected by monetary shocks. Since exchange rate is not affected, foreign economy is not affected, too. There will be no changes in CPI. Home productivity shocks, however, open output gap. This relationship holds for all specifications of nominal rigidities PCP, LCP, and DP.

International Monetary Policy Cooperation

A growing number of literatures are found recently in the area of international monetary policy coordination. Redux model has remained completely tight-lipped with this aspect. Redux model only predicts that monetary policy has positive spillover effects, but it does not say anything about the link between the conduct of one country's monetary policy with the other country's. Corsetti and Pesenti (2001) explains monetary policy coordination in terms of intertemporal and intratemporal elasticity of substitution between home and foreign goods. If the intertemporal elasticity is larger than the intratemporal elasticity, policies are interdependent where the home central bank responds to a foreign monetary expansion pursuing a contractionary monetary policy. The reason is that under this condition, the foreign expansion raises domestic output at a cost of higher home leisure, and then the optimal response would be to reduce output by reducing domestic money supply. In the contrary, if the intertemporal elasticity is less than the intratemporal elasticity, the foreign expansion reduces home output, and it is optimal for the domestic central bank to respond with an expansionary policy. Finally, if the intertemporal and intratemporal elasticities are equal, it is better for each central bank stay unresponsive.

Benigno (2000) extends Corsetti and Pesenti's (2001) model where the author coins a new term contractionary bias that comes into play from non-cooperation. Contractionary

bias emerges due to non-internalization of the gain to the other country from surprise monetary expansion. Both countries would reach a competitive output levels with an optimal cooperation by raising enough money supply jointly to arrive at this competitive output level. Benigno (2000) also considers the possibility of establishing supranational authority to conduct joint monetary policy to obtain mutual gains.

Betts and Devereux (2000b) also consider international policy coordination when the law of one price fails to hold. The authors show that the rationale for monetary cooperation emerges under pricing-to-market (PTM) mechanism. The PTM models predict that exchange rate depreciation can actually improve a country's terms of trade, as export prices are fixed in foreign currency and exchange rate depreciation raises the value of export revenues when converted into the domestic currency. With full PTM, monetary policy actually exerts a negative spillover effect, which is the situation that a domestic monetary expansion reduces foreign welfare by generating deterioration in the foreign country's terms of trade. If policy coordination takes place in this situation, the countries will reduce their monetary expansion and there will be costless decline in the world inflation rate.

Globalization and Inflation

The world is now witnessing disinflation throughout the world. Some of the economists have argued that this disinflation around the world is due to the fact that China is exporting disinflation. They claim that China's low wage workers are constantly creating pressure on wages and prices in the world market, and thus the world inflation has gone down. Rogoff (2006) claims that the effect transmits through favorable terms of trade shock that China is experiencing now. The counter argument on this claim is that the competitive Chinese exports only affect relative prices rather than the overall prices (Ball, 2006).

The effect of increased competition emanated from world integration on domestic inflation also works through Phillips curve trade off (Ball, 2006, Rogoff, 2004). Ball (2006) estimates Phillips curve by incorporating trade into the relationship, and found that trade has at most a very small effect. The increased competition makes wage and price more flexible making Phillips curve more steeper so that the expansionary monetary policy cannot produce output gains in a given inflation rate as much as it can produce in the case with price and wage rigidity. Taylor (2001) observes that Phillips curve become steeper only in the long-run, as the effect of globalization on domestic prices is offset by prevailing wage and price contracts in some of the goods in the economy.

Another branch of literature suggests central banks to look at world output gap as a driving force to affect domestic inflation. In today's integrated world, global excess capacity has definitely something to play with domestic inflation. Many evidences have been observed that global shocks have put excessive pressure on domestic inflation trends (e.g. oil price shock during 1970s). It is, therefore, imperative to look at world economic developments to formulate effective domestic policies (IMF World Economic Outlook,

April 2006 and BIS Report, March 2005). In another result in Ball (2006), the domestic output gap is highly significant but foreign output gap a barely significant.

While globalization has not significantly diminished central bank's ability to control domestic inflation, the story might be different for interest rates and asset prices (Rogoff, 2006). The reason behind this claim is that since the international financial market has now been more integrated, it is obvious that it can exert constant pressure on domestic interest rates and asset prices. Rogoff (2006) points out that the real interest rates on long-term US, German and Japanese government bonds have converged to a roughly similar rates. If such trend of global integration continues to progress, it would not be surprising for the central banks to lose their grip to control long-term interest rates. This turns out to be true as pointed out by Bernanke (2007) also, who claims that long-term interest rates are governed largely by global supply and demand factors.

While most of the economists do agree that globalization affects the conduct of domestic monetary policy, there is still debate about how international variables such as exchange rates, terms of trade, or the current account balance can be incorporated in monetary policy rule. Some economists doubt on whether or not such variables can fit in famous Taylor rule. Svensson (2000) claims that exchange rate cannot be directly included into the rule since output has already been included. Smets and Wouters (2002), however, find it worthwhile to include exchange rate in monetary feedback rule when the economy becomes more open. Obstfeld and Rogoff (1995) make aware of not including exchange rate into the rule as it can lead to the possible speculation. Moreover, exchange rates are more volatile and thus cannot be a good candidate for fitting it to the policy rule. For the same reason, including asset prices has also become questionable.

Empirics

The literatures on international macroeconomics are largely dominated by theoretical analysis. Some authors, however, have attempted to provide quantitative analysis to test implications of the theoretical models earlier developed.

Vector Autoregression (VAR) approach is a tool extensively used in evaluating how economy responds to a macroeconomic shocks (national as well as international). The earlier applications of VAR analysis in open economy macroeconomics were carried out by Clarida and Gali (1994) and Eichenbaum and Evans (1995). The VAR estimations in those studies show that real exchange rates response to a monetary shock in a consistent manner with sticky price models.

Recent works have also placed an emphasis on real shocks (such as fiscal shocks and technology shocks) instead of only nominal shocks in sticky price models. Gali (1999) and Basu et al. (2004) have stepped forward to this direction and applied this framework for a closed economy. As explained above, Corsetti and Pesenti (2007) has extended the idea to open economy models.

A number of studies have tried to find the relationship between openness and inflation. First of its kind was carried out by Romer (1993) who found that countries gain less from surprise inflation if they were more open economies. The reduced effect comes from negative impact on terms of trade from the rise in output resulting from surprise inflation. This relationship may not hold for small open economies since terms of trade is generally regarded as exogenous for these economies. Lane (1997), however, finds inverse relationship between inflation and openness even for small economies when country size is controlled.

Hau (2000) finds that if a country has a relatively larger non-traded sector, monetary shocks produce larger effects on real exchange rates. Hau (2000) further finds that the more the economy is open the more is the real exchange rate volatility, even with openness as endogenous and central bank independence and exchange rate regime are controlled. Obstfeld and Rogoff (1996) find a significant relationship between net foreign assets and the real exchange rate among OECD economies. Lane (1999) finds negative relationship between openness and average rates of nominal exchange rate depreciation.

III. TRANSMISSION OF INDIAN FINANCIAL, REAL AND NOMINAL SHOCKS TO SOUTH ASIA REGION

India is the largest economy in the South Asia region. India currently shares eighty percent of total GDP of this region (Table 1 in Appendix 1). This share is steadily rising over the years. It was, for example, nearly 75 percent in 1995 and increased to 80.4 percent in 2010. As being the largest country in the region, India is the engine of South Asian economic growth. The greater reliance of the countries in this region with India mostly comes from the fact that all of the countries are closely bordering with India. The development in Indian economy has tremendous externalities for the neighboring countries and the effects are immediately transmitted around the region. The World Bank, for instance, claims that the potential decline in regional economic activities in South Asia region in 2011 is attributed to decline in economic activities in India (Global Economic Prospects, World Bank, June 2011).

The region is also somewhat economically integrated in terms of trade as well. Most of the neighboring countries have some trade share with India. Because South Asian economies have largely similar export baskets, the economies could expand trade by promoting intra-industry trade in the region. For example, South Asian countries except India are largely commodity exporters, the region could gain greatly if South Asian countries cooperate strategically to enhance efficiency, improve product quality, and increase value (ADB, South Asia Economic Report, 2006).

A vector autoregressive (VAR) model is estimated to evaluate the transmission effects of Indian economic shocks in South Asia region. The model explores the effects of Indian financial, real and nominal shocks on the economic activity of other countries in South Asia. The study is now confined to the effects on real GDP only. The specification of the VAR model is in the section that follows.

The VAR Model

The South Asian economies are described by the following structural equation

$$K(L)x_t = e_t \quad \text{..... (1)}$$

where x_t is $n \times 1$ data vector which includes the variables described below and K(L) a matrix polynomial in lag operator L. e_t is a $n \times 1$ vector of structural innovations where Var(e_t) = Ω. Ω is a diagonal matrix with variances of structural innovations on the diagonal.

The following reduced-form model is estimated

$$x_t = Q(L)x_{t-1} + u_t \quad \text{..... (2)}$$

where Q(L) is a matrix polynomial in lag operator L and $Var(u_t) = \sum$.

Assuming that B be the contemporaneous coefficient matrix and $K_0(L)$ be the coefficient matrix in $K(L)$ without the contemporaneous coefficient matrix B, such that

$$K(L) = B + K_0(L) \quad \text{..... (3)}$$

Then the structural model is linked to the reduced-form model as

$$Q(L) = -B^{-1} K_0(L) \quad \text{..... (4)}$$

The structural innovations and reduced-form disturbances, and their variance-covariance matrices are linked as

$$Bu_t = e_t \quad \text{..... (5)}$$

$$B\Sigma B' = \Omega \quad \text{..... (6)}$$

The identification is achieved by Cholesky decomposition of variance-covariance matrix of reduced-form residuals $\sum$, which makes B matrix as triangular matrix.

In matrix form, the model is as follows:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 \\ b_{51} & b_{52} & b_{53} & b_{53} & 1 \end{bmatrix} \begin{bmatrix} RGDP\_I_t \\ DGDP\_I_t \\ FMV_t \\ R\_I_t \\ SP\_I_t \end{bmatrix} = K_0(L) \begin{bmatrix} RGDP\_I_{t-1} \\ DGDP\_I_{t-1} \\ FMV_{t-1} \\ R\_I_{t-1} \\ SP\_I_{t-1} \end{bmatrix} + \begin{bmatrix} e_{t,RGDP\_I} \\ e_{t,DGDP\_I} \\ e_{t,FMV} \\ e_{t,R\_I} \\ e_{t,SP\_I} \end{bmatrix} \quad \text{..... (7)}$$

Here, RGDP_I is real gross domestic product, DGDP_I is GDP deflator, R_I is policy interest rate, and SP_I is share price index, all for India. FMV stands for foreign macroeconomic variables comprising Real GDP of South Asian countries Nepal, Bangladesh, Bhutan, Maldives, Pakistan and Sri Lanka (denoted as RGDP_NEP, RGDP_BAN, RGDP_MAL, RGDP_PAK and RGDP_SRI, respectively). When estimating the model, the real GDP of each South Asian country are added sequentially into the specification.

Equation (7) indicates that the real sector reacts sluggishly to monetary policy and financial shocks (policy rate and share price index) (first and second equations in the matrix). It is a customary assumption that real GDP and prices respond to monetary

shocks with a lag (Christiano et al. (1996, 1998)). For instance, within the year firms do not change their output and prices in response to unexpected changes in monetary policy due to adjustment costs. The argument for the sluggish response of real sector to financial sector, on the other hand, comes from the fact that when the response of monetary policy to financial sector is not immediate. The real sector also responds sluggishly to the financial variables. This assumption is also consistent with the belief that monetary authority is reluctant to react financial sector developments promptly but rather wait for some time and appropriately respond when needed (Bernanke and Gertler (1999, 2001)). The financial variables as being an asset price or the proxy of asset prices, however, react immediately to changes in all the other variables in the system (third, fourth and fifth equations in the matrix).

Data

The major source of data is International Financial Statistics (IFS) published by International Monetary Fund (IMF). The study is confined only to South Asian region, and this confinement is relevant in the sense that the countries in this region have some economic ties (ADB, South Asia Economic Report, 2006). For the estimation, the annual data are used that ranges from 1980 to 2009.

Results

Figures 1, 2 and 3 in Appendix display the estimated impulse responses of real GDP of South Asian countries to unexpected temporary Indian real, monetary and financial shocks. The customary expectation is that there would be a rise in real GDP in all countries when there is a positive real shock, monetary and financial shocks in India. The results are not, however, completely consistent with the general expectation and demonstrate a few variations.

To begin with the real shock, the innovation to Indian real shock has expansionary effect on Indian real GDP as well as the real GDP of most of other South Asian countries. On contrary, however, the prediction is not consistent with Nepal, Bangladesh and Bhutan. There is no definite answer to explain this fact but the negative impact on Nepal and Bhutan can potentially be attributed to landlocked nature of these two countries and they are more trade dependent on India. The higher growth in India as resulted from positive real shock may come at the cost of higher imports of these countries leading to adverse effect on overall domestic production. Moreover, the fixed exchange rate regime of Bhutan and Nepal vis-à-vis Indian currency might have played some role to fuel this effect because the immediate adjustment on the exchange rate as can be observed from the disparity between the economic performance of two countries is absent for Nepal and Bhutan. For the case of Nepal, this argument is substantiated by the fact that the current account deficit of Nepal with India is increasing over the years while Indian economy is miraculously growing in recent years.

As far monetary shock in India, the results are also mixed (Figure 2). Indian economy briefly expands when there is a monetary shock, which is consistent with the prediction of

standard macroeconomic models. The economies of Nepal, Bhutan and Pakistan expand but the increase in real GDP does not last for long period of time. Nepal experiences a moderate 0.5 percent increase in real GDP resulting from a one time standard deviation increase in Indian monetary shock. Bhutan also observes the positive effects in its economy from monetary shock in India. The positive effect of monetary shocks on these two countries is potentially attributed to fixed exchange rate of these two countries with India, which allows for direct absorption of monetary shock occurred in India.

The financial shock in India also does not exert any definite impact in all other countries. The real GDP of India and Pakistan increase but it decrease in other countries in response to financial shock in India. The results with India and Pakistan, however, are consistent because these countries are more advanced in financial markets as compared to other countries in the region. The primitive capital markets in other countries may fail to react the development in Indian financial markets.

To sum up, one can advance an argument that the effects of Indian economic shocks on South Asian countries are not straightforward. The reason could possibly be the fact that the world economies are increasingly integrating in recent years and the growing trade diversification of South Asian economies with other countries outside the region may have contributed to this observation.

IV. CONCLUSION

The literatures surveyed on this study show that the new open economy macroeconomics has become one of the fastest growing areas in economics. This new field primarily focuses on how proper economic policies can be formulated for better outcomes in the context of growing integration of the world economies. The growing concern for central banks in increasingly integrated environment is whether or not the traditional inward-looking policies should be revised to account for global effects. How are the shocks in a country spread over rest of the world? Do optimal policies of central banks change when an economy becomes more globalized? Is it required coordination among central banks in formulating monetary policy in such an integrated world? These are the frequent questions the central banks nowadays are constantly exposed to answer. New open economy macroeconomics is devoted to answer these questions in more subtle ways by offering appropriate policy measures that a country can pursue for macroeconomic stability and growth.

The survey in this study documents the evolution of New Open Economy Macroeconomics with thorough discussion of burgeoning literatures in the field. During its short period of progression the field has incorporated many dimensions into it and performed better forecasting results. In the earliest version, for example, the model lacked incomplete exchange rate pass through, which is one of the important ingredients of any open economy macroeconomic model. Betts and Devereux (2000a), however, brought this issue up into the analysis and offered better prediction of the model reflecting real world situation. Corsetti and Pesenti (2007), on the other hand, extended this analysis by introducing nominal rigidities in three different scenarios: local currency pricing (LCP),

producer currency pricing (PCP) and dollar pricing (DP). Woodford's (2007) contribution to account for the role of globalization to determine domestic inflation was another noteworthy contribution into the field.

In addition to the survey on new open economy macroeconomics, this study also diagnoses the effects of Indian economic shocks on its neighboring economies. The empirical results suggest that while some predictions are consistent with the general predictions of the model, others are mostly mixed, indicating that the transmission effects of Indian shocks in neighboring countries are ambiguous. As an example, the innovation to Indian real shock has expansionary effect on Indian real GDP as well as the real GDP of most of other South Asian countries but not the real GDP of Nepal, Bangladesh and Bhutan. The positive financial shock in India, on the other hand, increases real GDP of India and Pakistan but decreases real GDP in other countries. As far monetary shock in India, Indian economy briefly expands when there is a monetary shock along with the expansion in the economies of Nepal, Bhutan and Pakistan.

While this study provides a prima facie account of explaining transmission effects of Indian real, monetary and financial shocks in South Asia region, the study is not free of shortcomings. The effects of Indian shocks on other international macroeconomic variables through terms trade, exchange rate regimes and interest rate differentials have been ignored in this study. By addressing these issues, a realistic transmission mechanism of the effects of shocks from India to neighboring countries is expected.

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Appendix

Table 1

Percentage Share of GDP in South Asia Region

(US$ at constant 2000 prices)

Year	India	Bangladesh	Bhutan	Maldives	Nepal	Pakistan	Sri Lanka
1995	74.7	7.9	0.1	0.1	0.9	13.6	2.8
1996	75.2	7.7	0.1	0.1	0.9	13.3	2.7
1997	75.4	7.8	0.1	0.1	0.9	13.0	2.7
1998	75.8	7.8	0.1	0.1	0.9	12.6	2.7
1999	76.4	7.7	0.1	0.1	0.9	12.2	2.7
2000	76.2	7.8	0.1	0.1	0.9	12.2	2.7
2001	76.6	7.8	0.1	0.1	0.9	11.9	2.5
2002	76.6	7.9	0.1	0.1	0.9	11.9	2.5
2003	77.2	7.7	0.1	0.1	0.8	11.6	2.5
2004	77.4	7.6	0.1	0.1	0.8	11.5	2.5
2005	77.8	7.4	0.1	0.1	0.8	11.4	2.4
2006	78.3	7.3	0.1	0.1	0.7	11.1	2.4
2007	78.9	7.1	0.1	0.1	0.7	10.8	2.3
2008	79.1	7.2	0.1	0.1	0.7	10.5	2.4
2009	79.8	7.0	0.1	0.1	0.7	10.0	2.3
2010	80.4	6.9	0.1	0.1	0.7	9.6	2.2

Source: World Bank

Figure 1: Responses of Real GDP to Indian Real

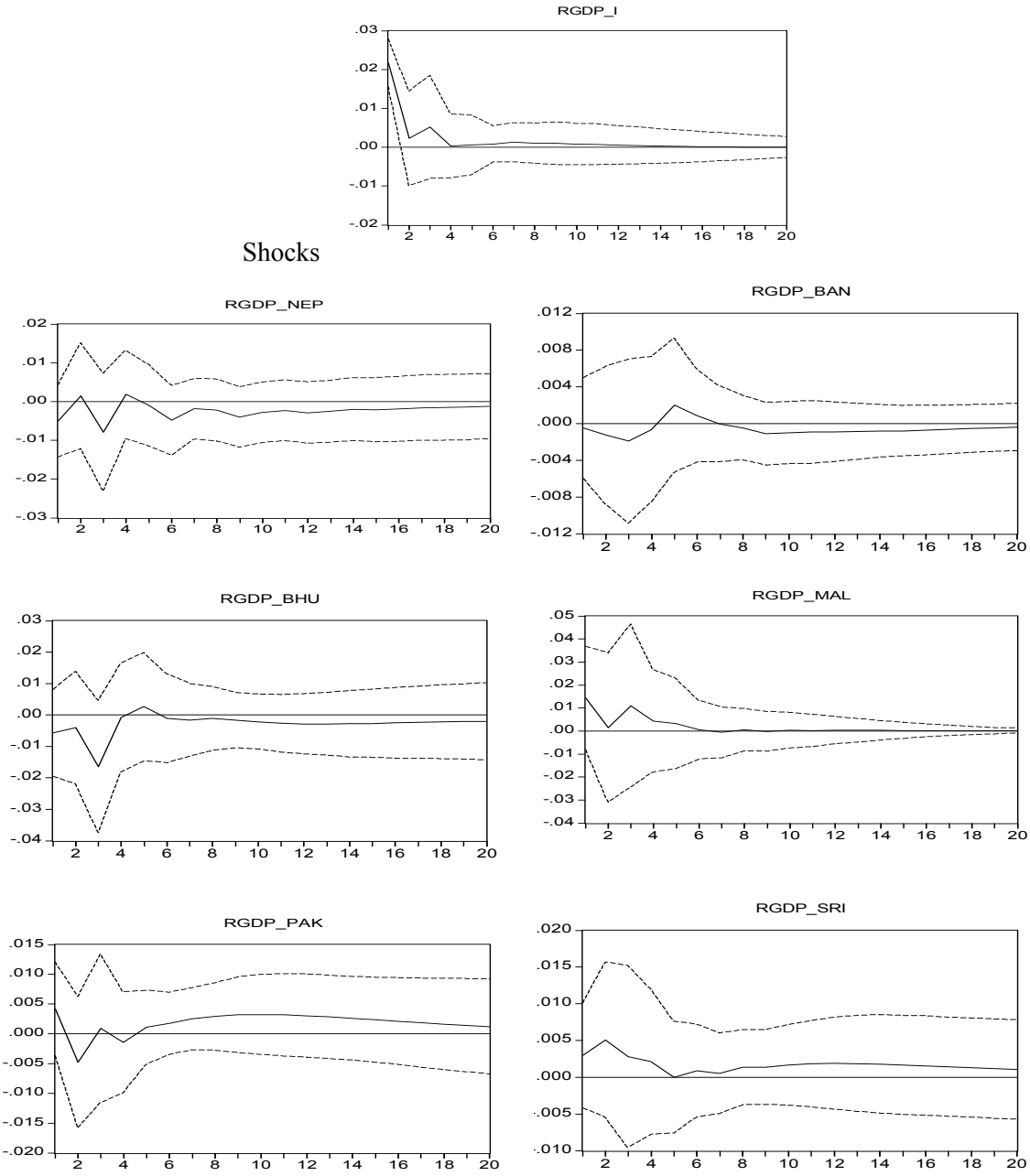

Figure 2: Responses of Real GDP to Indian Monetary Shocks

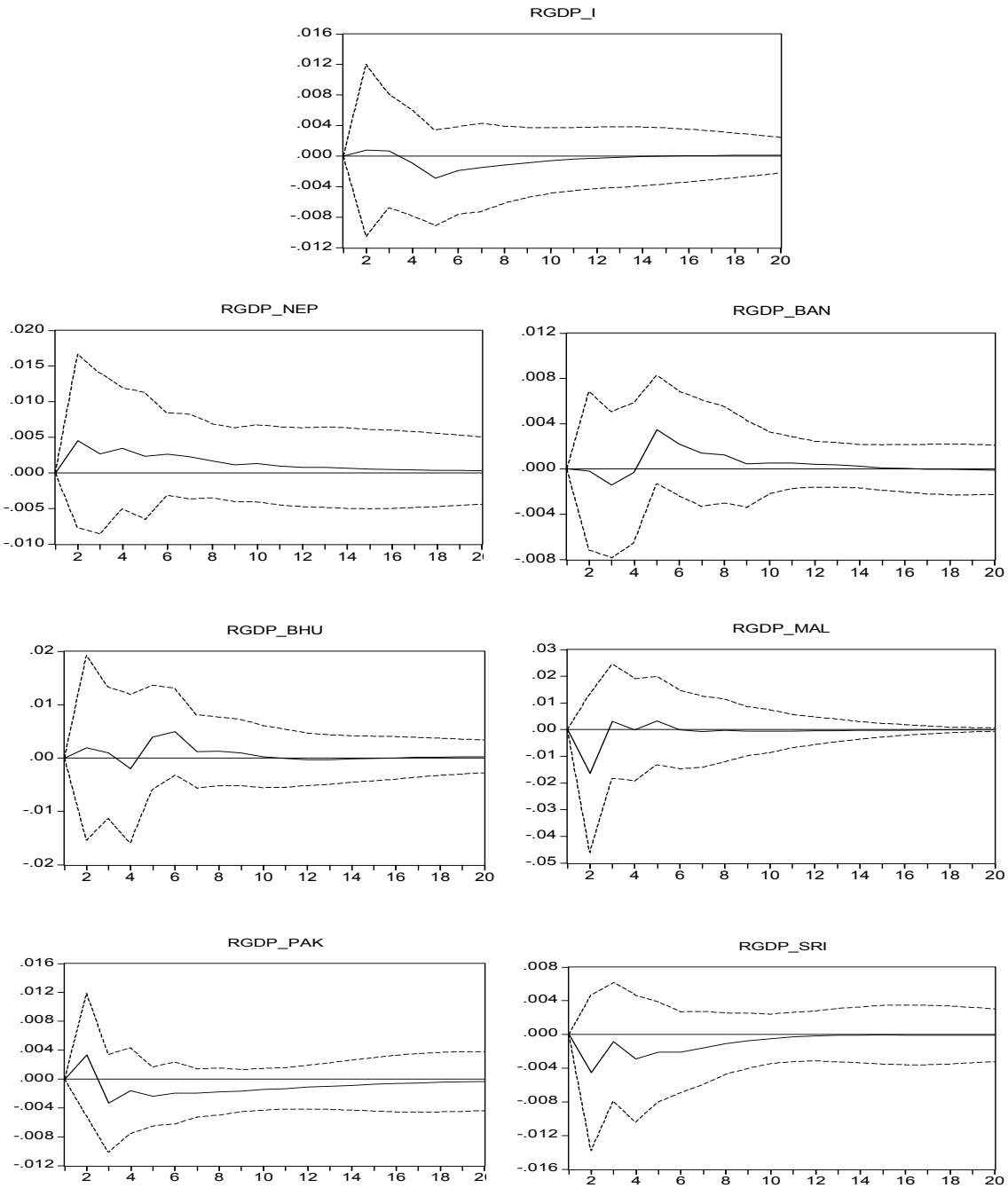

Figure 3: Responses of Real GDP to Indian Financial Shocks