CHAPTER IX

FORMATION OF DYNAMIC POLICY SIMULATIONS AND ITS DOMINO EFFECTS IN APPLICATION

9.1   Simulation Experiments

It is to be recalled that macroeconometric models are built for configuring the best alternative effective policy to uplift the economy as a whole. The most productive use of an econometric model is its use as a tool for forecasts and policy analysis. The policy makers want empirical evidences on the impact of fiscal, monetary, and exchange rate policies and the impacts of domestic and external shocks to the economy. The knowledge of the impact of various shocks and policy changes is essential for the policy making process. In this chapter, the impacts of changes in fiscal, monetary, and exchange rate variables have been demonstrated on the behavior of the major macroeconomic variables through changing interest rate, real total government expenditures, and exchange rate respectively. In this regard, the issue is-why and in what degree the policy shocks have been given. As the underlying objective behind running the policy simulation is to determine the fundamental factor that can accelerate economic development of Bangladesh, it is feasible to take the historical highest shock for giving the maximum expansionary policy shocks to the model to measure its aftermath effects. Therefore, based on the historical policy shocks, the following simulation experiments have been conducted respectively.

a) An increase in real total government expenditures at a maximum historical rate of 18.97 percent from FY 2001 to FY2010, i.e. Expansionary Fiscal Policy;

b) A decrease in interest rate at a maximum historical rate of 19.73 percent from FY 2001 to FY2010, i.e. Expansionary Monetary Policy;

c) An increase in exchange rate at a maximum historical rate of 22.15 percent from FY 2001 to FY2010, i.e. Depreciation under managed floating system;

Beyond the above individual policy shocks, the following policy mixes have also been simulated in order to identify- which policy shock/s would be the best alternative option/s for achieving the expected growth rate in real GDP of Bangladesh.

d) An increase in real total government expenditures by 18.97 percent and a decrease in interest rate by 19.73 percent from FY 2001 to FY 2010, i.e. expansionary fiscal and monetary policy mix;

e) A simultaneous increase in real total government expenditures by 18.97 percent and exchange rate by 22.15 percent from FY 2001 to FY 2010, i.e. expansionary fiscal and managed depreciation in exchange rate policy mix;

f) A decrease in interest rate by 19.73 percent and an increase in exchange rate by 22.15 percent from FY 2001 to FY 2010, i.e. Expansionary monetary policy and managed depreciation in exchange rate policy mix;

The impact of each change is evaluated by calculating the percentage difference between the shocked run and the corresponding baseline values of the relevant variables. It is pre-determined that in the case of a change in a variable from a negative value in the baseline run to a negative value in the shocked run, the difference is divided by the absolute value in the shocked run in order to make the direction of the change readily comprehensible.

9.1.1 Expansionary Fiscal Policy Simulation: An Increase in Real Total Government Expenditures

In this dissertation, fiscal policy has been experimented in light of changes in real total government expenditures (TGE). It is to be recalled that real total government expenditures is the summation of two components- real government consumption expenditures, and real government investment expenditures. There exists controversy over the impact of changes in government expenditures. While some researchers argue that increase in government investment expenditures crowds out private investment expenditures, other argue that in developing countries government

investment expenditures crowds in private investment expenditures. To shed light on this debate, real total government expenditures has been carried out.

To make a fiscal shock in the model, the maximum historical growth rate of total government expenditures has been computed. In this regard, TGE in the year 1989 has experienced with the highest expansion, which is 18.97%. Hence, the model has conducted a simulation to measure its impact on the macroeconomy by increasing 18.97% of total government expenditures from 2001 to 2010. After giving the shock by 18.97% to TGE, all production sectors including primary (i.e. agriculture), secondary (i.e. manufacture), and tertiary (i.e. services) sectors are worse off comparing to the macroeconomic situation having no shock. More specifically, service sector has remained unchanged while agriculture and manufacturing sectors have had negative trend after giving the fiscal shock. Precisely, by reversing to the conventional Keynesian theory, expansionary fiscal shock slows down the process of economic development of Bangladesh. Astonishingly expansionary fiscal shock has given negative impact extremely on primary and secondary sectors of the economy.

Figure 9.1: Effects of Fiscal Shock on Production Sectors of the Economy
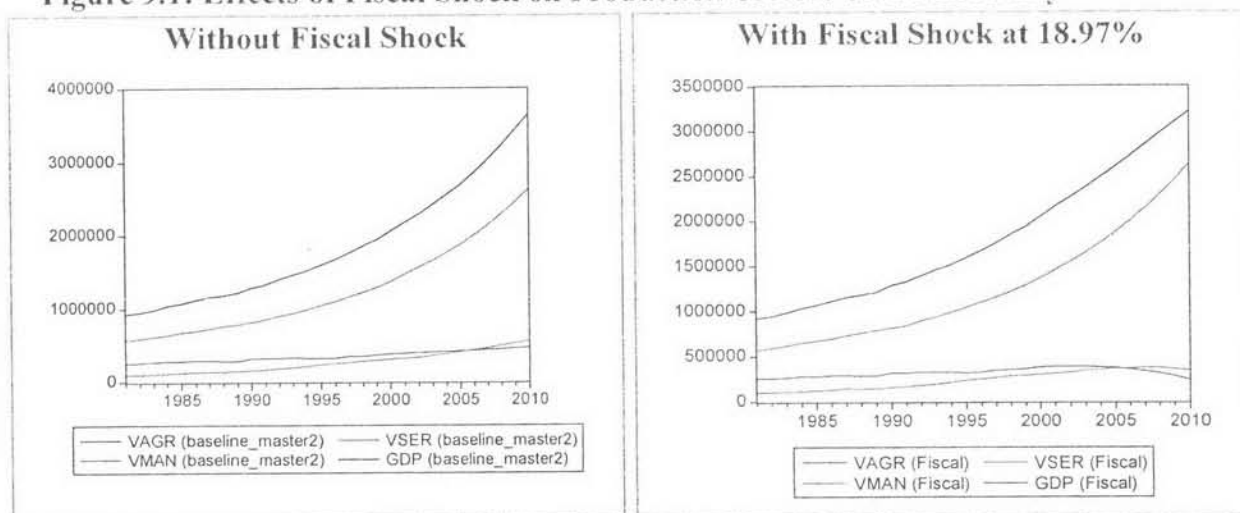
From the viewpoint of expenditures approach to measure economic growth, completely different results came up with the positive fiscal shock. Both private and government consumption as well as investment expenditures have lowered down due

to an increase in real government expenditures comparing to the baseline. On the contrary, total volume of exports has remained unchanged; whereas total volume of imports has declined drastically that put positive impact to the whole economy. However, the most important this in this context is that government investment expenditures has crowed out the private investment very strongly that has given a decreasing trend to the total investment. More specifically, the fiscal expansion crowds in government investment expenditures but crowds out more to the private investment expenditures in all sectors. The changes in private investment lead to changes in capital stock, which affects production negatively. Eventually, real GDP would be decreased consecutively with the time period. However, Gross Domestic Expenditures (GDE) would be increased due to the massive decline in total volume of imports expenditures. It is to be mentioned here that by theory real GDP and GDE have to be equal. However, due to the different data collection methods, BBS (Bangladesh Bureau of Statistics) has published data for GDP and GDE differently and thence defined their difference as statistical discrepancy.

Figure 9.2: Effects of Fiscal Shock on Gross Domestic Expenditures
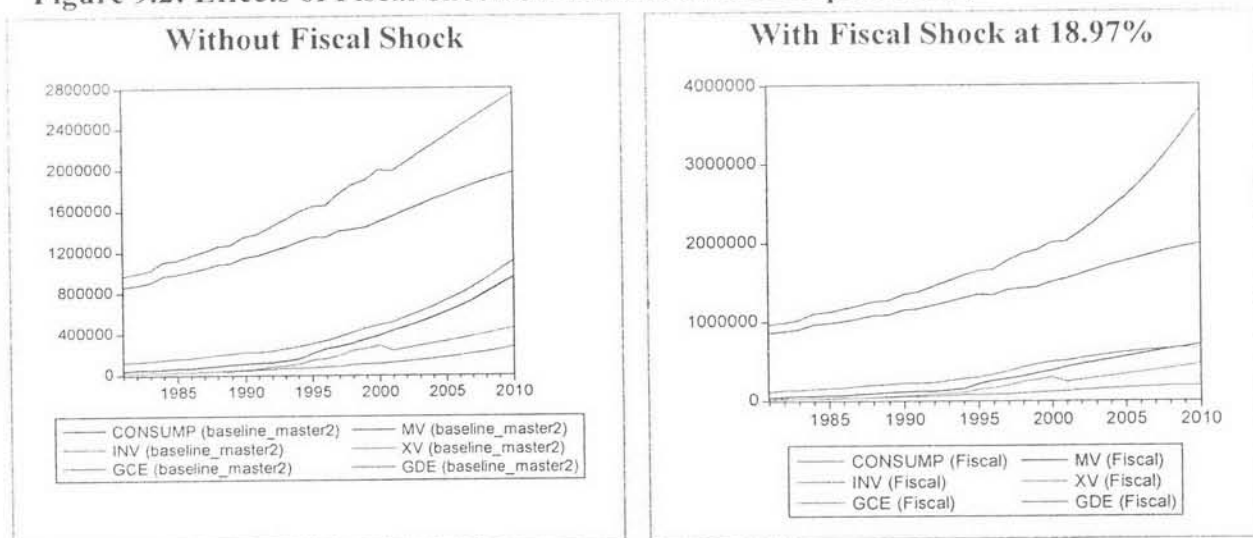
After that, government revenue has grown up with the real total government expenditures that are in line to the conventional theory of macroeconomics. The

combination of these changes results in increase in domestic component of budget deficit in the years of the shock.

Figure 9.3: Effects of Fiscal Shock on Government Revenues and Budget Deficits
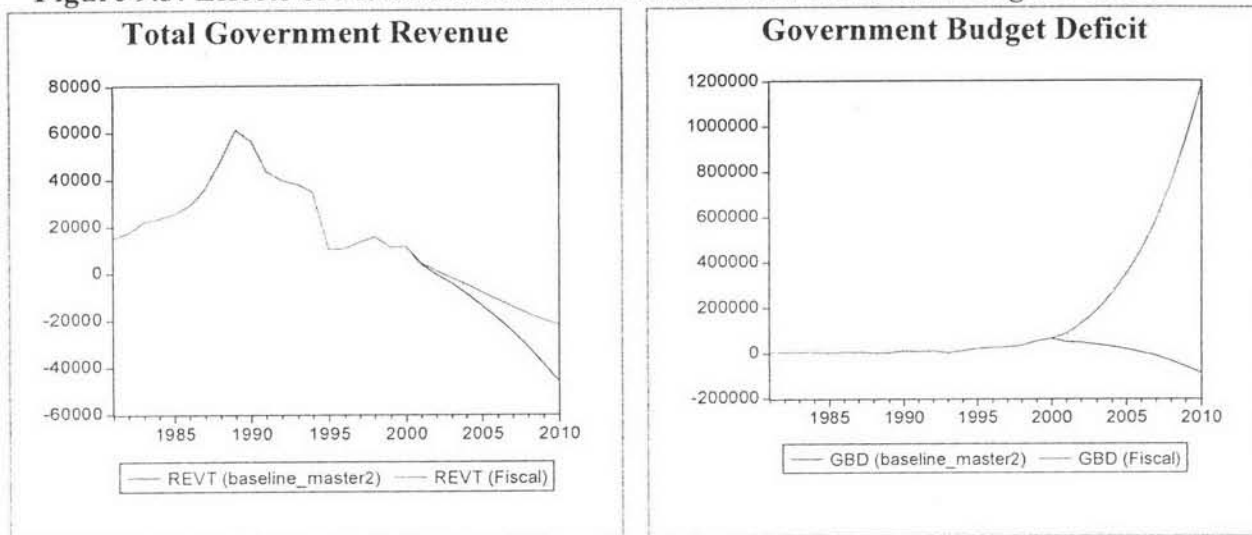
With the fiscal shock, the higher budget deficit expands the money supply in the economy. The ultimate effect of an increase in money supply has followed by an increase in foreign price level at the international market that leads to a decrease in total volume of imports in the economy.

Figure 9.4: Effects of Fiscal Shock on Money Supply and Imports
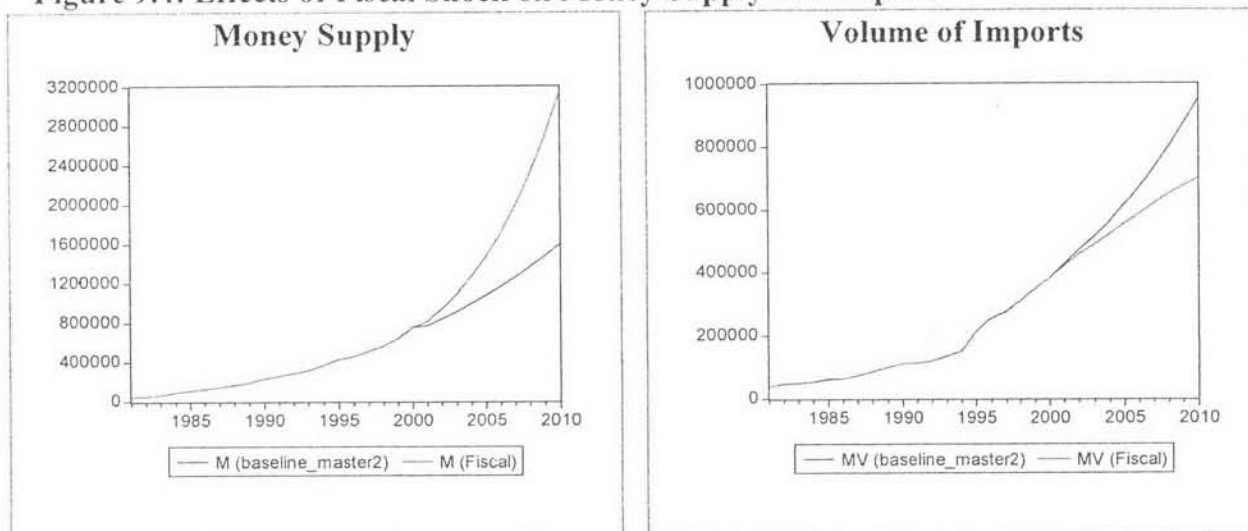
Thus, an expansionary fiscal policy has ended with a decrease in real GDP. It worsens the government budget deficit and expands government revenue too. Likewise, it also sharpens aggregate money supply to the economy that leads to a decrease in volume of imports. These results are in line to the monetarist tradition.

9.1.2 Expansionary Monetary Policy Simulation: A Decrease in Interest Rate

To run monetary policy simulation, the maximum historical record to decrease in interest rate has been selected. In 1993, interest rate of Bangladesh has been decreased from 8.11 percent to 6.51 percent, which has the highest negative change (i.e. -19.73%) in interest rate within the last 20 years. It is believed by the monetarists that an expansionary monetary policy can boost up real GDP of the economy. Whether this philosophy is suitable for Bangladesh has been experimented by giving a monetary policy shock to the model through a decrease in interest rate at 19.73% in each upcoming year.

Figure 9.5: Effects of Monetary Shock on Production Sectors of the Economy
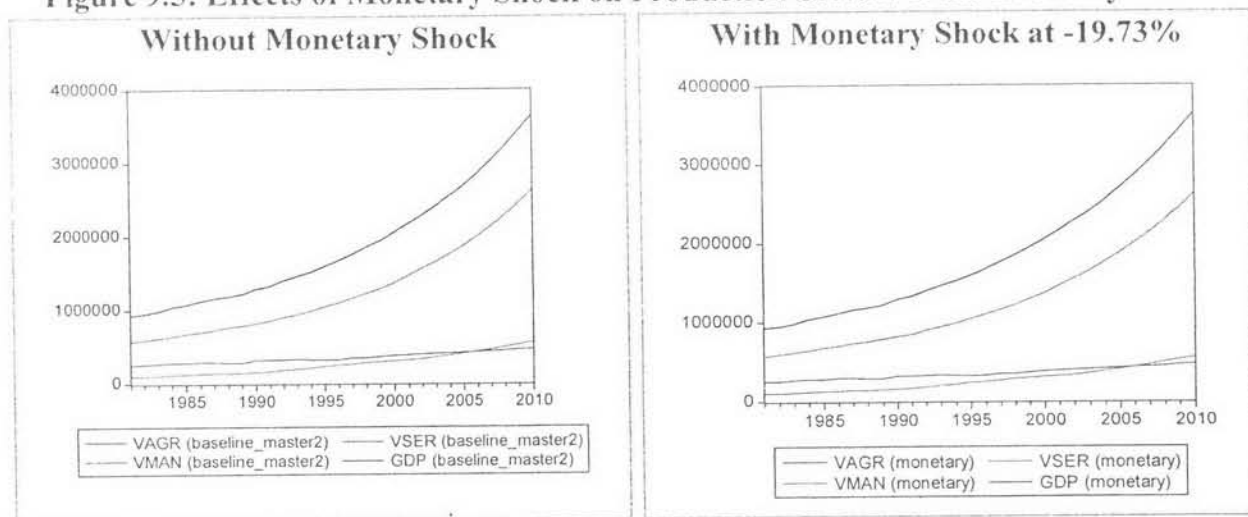
In Figure 9.5, it has been uncovered that- when interest rate has decreased at 19.73 percent, total production in all sectors (i.e. primary, secondary, and tertiary) has also reduced that leads to a minor decrease in real GDP. Similarly, from the viewpoint of expenditures approach to calculate economic development, it has been found in Figure 9.6 that a decrease in interest rate at 19.73 percent has resulted in a slight

decrease in gross domestic expenditures (GDE). Factually, aggregate consumption, investment, government consumption expenditures, and total volume of imports have been decreased followed by GDE due to an expansionary monetary policy. However, total volume of exports has unchanged after giving the monetary shock to the model, as exports has been determined by the factors outside the economy (e.g. international market price level, demand for domestic goods and services outside the country, etc.).

Figure 9.6: Effects of Monetary Shock on Gross Domestic Expenditures
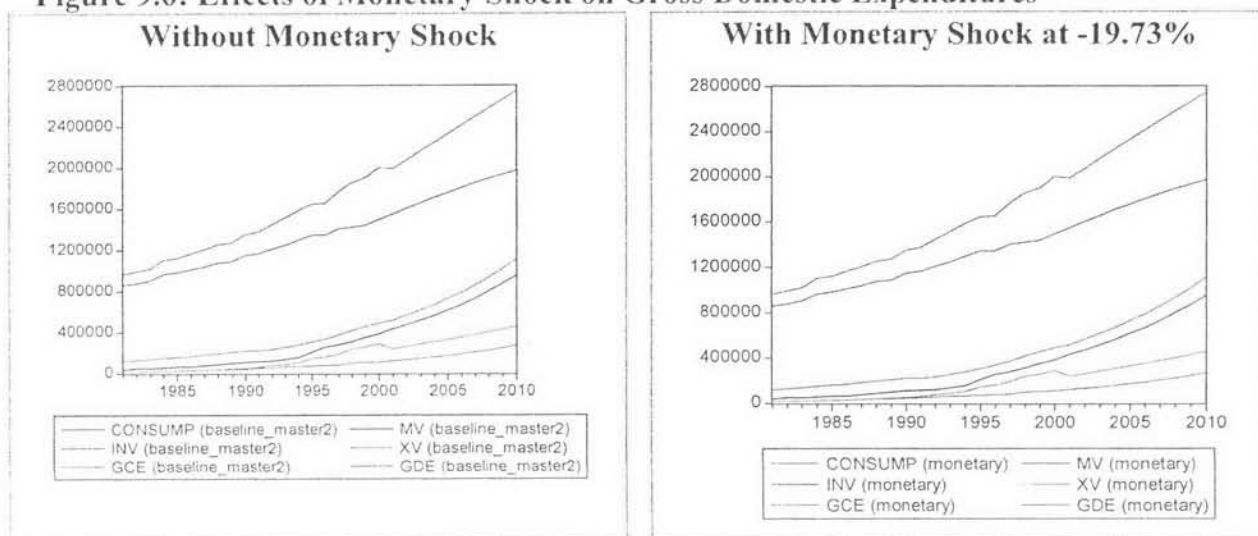
Parallel to the conventional macroeconomic theory, it has been visualized in the context of Bangladesh that a decrease in interest rate has ended up with an increase in money supply to the economy. Furthermore, an expansionary monetary policy has also speeded up the government budget deficit that is shown in Figure 9.7. Hence, the bottom line is that a decrease in interest rate has enhanced government budget deficit and the combination of these two effects has followed by an increase in total money supply in the economy.

Therefore, after giving an expansionary monetary policy shock by decreasing interest rate at 19.73 percent, it has been estimated that both real GDP and GDE have dampened slightly, which is reverse to the monetarist school of thought. At the end, this policy shock has experienced with a positive change in money supply and government budget deficit simultaneously.

Figure 9.7: **Effects of Monetary Shock on Money Supply and Government Budget Deficit**

Money Supply

Government Budget Deficit
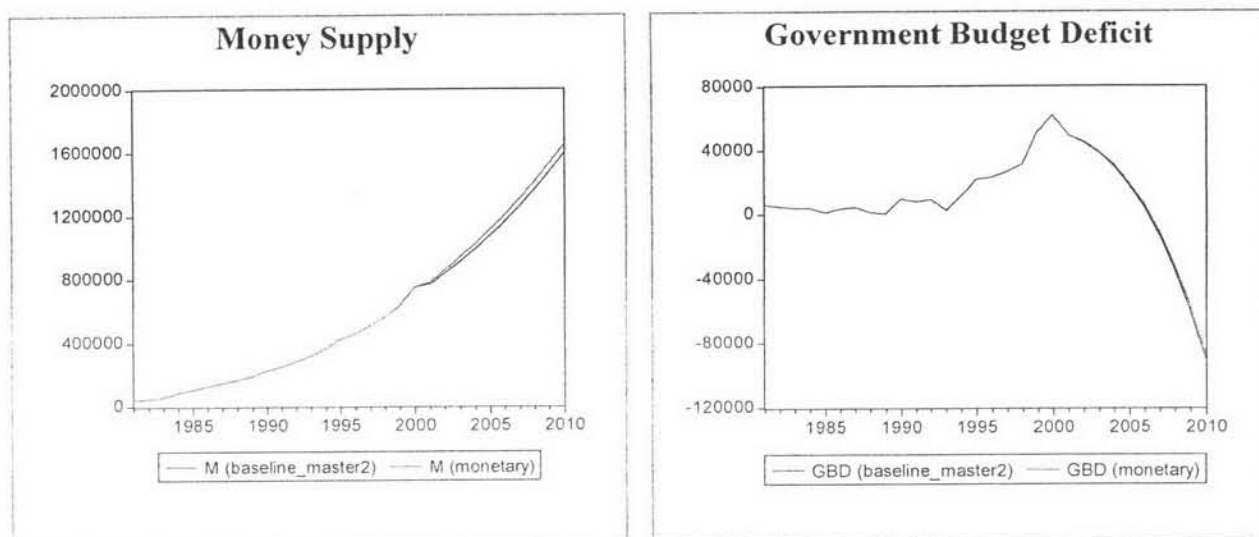
9.1.3 Exchange Rate Policy Simulation: Depreciation under Managed Floating System

There is a persistent claim by the World Bank and IMF that Taka remains overvalued during most of the time though Bangladesh Bank has often resorted to mini-devaluations of Taka (Hossain & Razzaque, 2003). There have been a sharp nominal devaluations[28] in the 1982 from 18.10 Taka against 1US Dollar to 22.11 Taka against 1USD (i.e. a change of 22.15%). From the passage of history, this change has the highest change ever occurred within the last 20 years. As a result, the thesis has conducted an experiment with the historical rate of 22.15 percent depreciation of nominal exchange rate of Taka vis-à-vis the U.S. dollar in each year under managed floating rate system.

A depreciation in Taka makes export supply of domestically produced goods more attractive. Conversely, it makes foreign produced goods relatively more expensive and hence less attractive to the Bangladesh economy to import.

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[28] Generally, if the central bank of an economy follows fixed exchange rate system to determine the value of currency, any decrease in domestic currency value is termed as devaluation; whereas under floating exchange rate system, it is named as depreciation.

In Bangladesh economy, after giving 22.15 percent depreciation of Taka vis-à-vis U.S. dollar, total volume of exports has risen initially but it declined after 2007. It is because the domestic goods and services for the foreigners became cheaper due to depreciation of Taka against USD until 2007. The expected positive impact on exports, hence, gradually strengthens in the following years. Consequently, there has been an improvement in the trade balance that squeezes trade deficit progressively, which is shown in Figure 9.8. It means that during the period, import has gone up rapidly after having the shock.

**Figure 9.8: Effects of Exchange Rate Shock on Exports and Trade Balance**
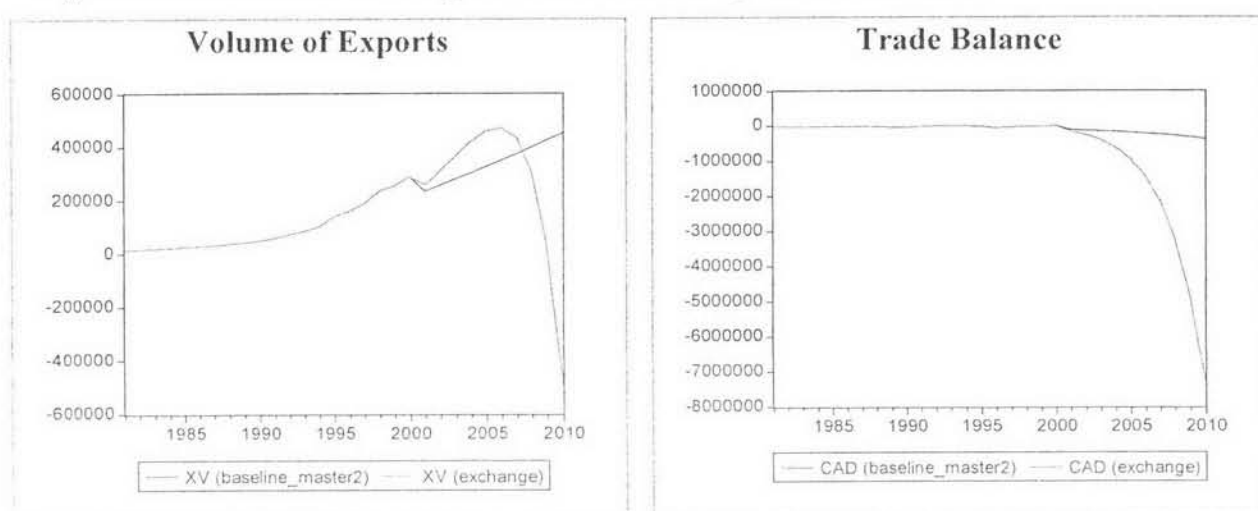
In Figure 9.9, it has been uncovered that- when exchange rate of Taka has been depreciated by 22.15 percent, total production in all sectors (i.e. primary, secondary, and tertiary) has hiked up that leads to a positive change in real GDP. Among all three sectors, primary sector has got the strongest upward push that has increased at 118.20 percent positive change from 2000 to 2010. After that, in secondary and tertiary sectors, due to depreciation total production has raised at 90.00 percent and 92.81 percent respectively in the next 10 years (i.e. 2000 to 2010). Therefore, by ameliorating all production sectors followed by trade balance, depreciation of exchange rate of Bangladesh has increased real GDP, which has been measured as 97.11 percent aggregately within the year 2010.

Figure 9.9: Effects of Exchange Rate Shock on Production Sectors
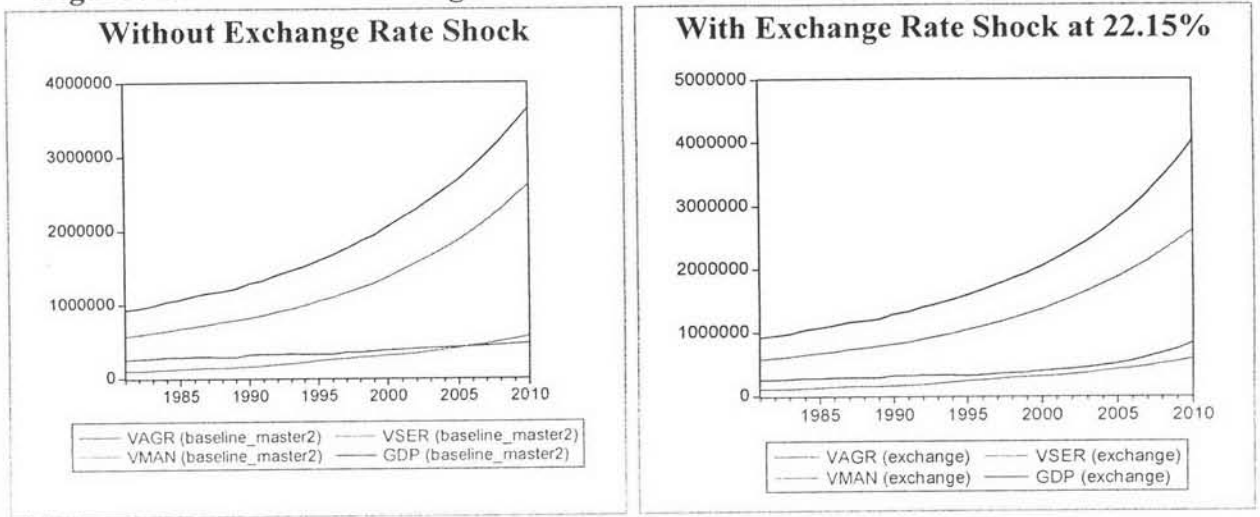

By convention, a depreciation in exchange rate has made domestic goods and services less expensive to the foreign consumers that has given positive incentives to the domestic producers to produce more by investing more. In this regard, by giving a depreciation shock to the model, it has been discovered that total investment of Bangladesh has increased by 132.62 percent in the next 10 years. Nevertheless, government consumption expenditures has also boosted up by 204.51 percent due to a continuous depreciation at 22.15 percent in each upcoming year.

Figure 9.10: Effects of Exchange Rate Shock on Investments and Government Consumption Expenditures
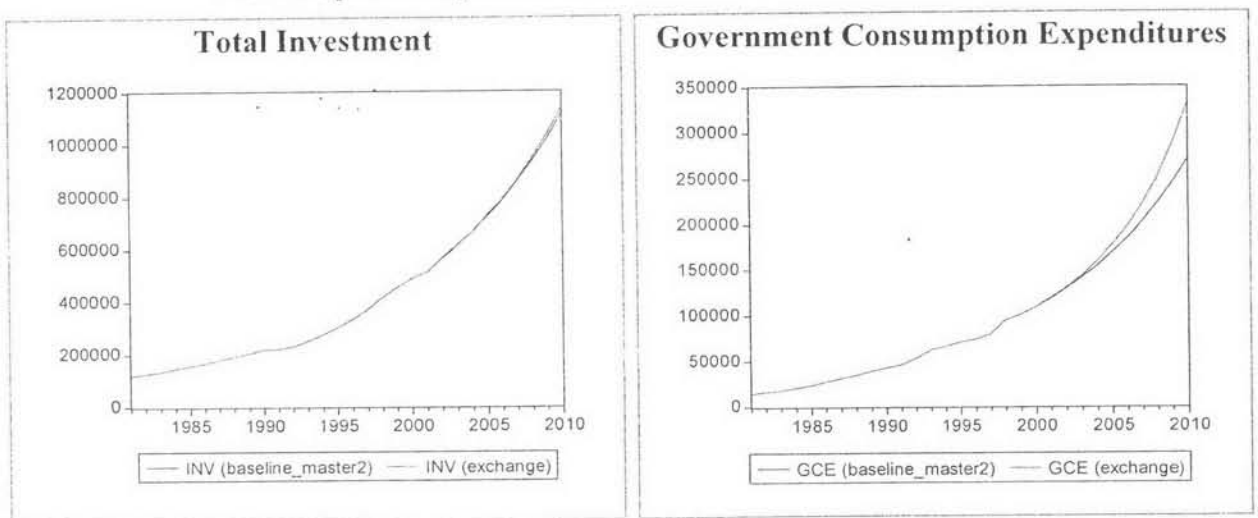
Thus, initially total volume of exports expansion leads to fall foreign trade deficit that ultimately directs to increase real GDP. The effect has made a synergy by increasing total investment in future that supported the government to expend more for consumption purposes. That is, an increase in GDP results in an increase in government consumption expenditures, and total investment due to the depreciation.

Figure 9.11: Effects of Exchange Rate Shock on Government Budget Deficit and Money Supply
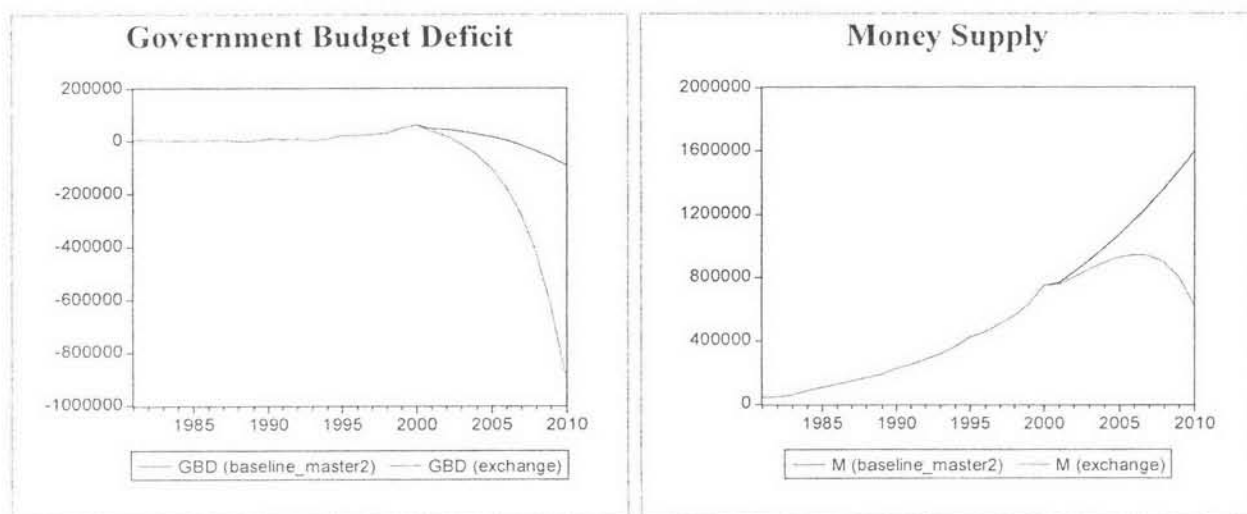

On the contrary, a contraction in budget deficit causes money supply to decrease. However, the decrease in money supply is not in line to an increase in real GDP. Perhaps it is because total investment in the private sector has increased dramatically that increases total production more than that of money supply growth.

9.1.4 Expansionary Fiscal and Monetary Policy: A Policy Mix

After analyzing fiscal, monetary, and exchange rate policy individually, this dissertation has attempted to interpret the impacts of different policy mixes on the aggregate economy. At first, a mix between fiscal and monetary policies has been simulated under the same macroeconometric model. To give the shock in the model, the maximum historical record of increasing real total government expenditures (i.e. 18.97%) and decreasing interest rate (i.e. 19.73%) have been selected simultaneously.

Total productions in all sectors including agriculture, manufacturing, and services have been affected with diminishing trends that lead real GDP to worsen. However, total production in agriculture has dampened very strongly due to the expansionary fiscal and monetary policy mix in the perspective of Bangladesh.

**Figure 9.12: Effects of Fiscal and Monetary Policy Mix on Production Sectors**
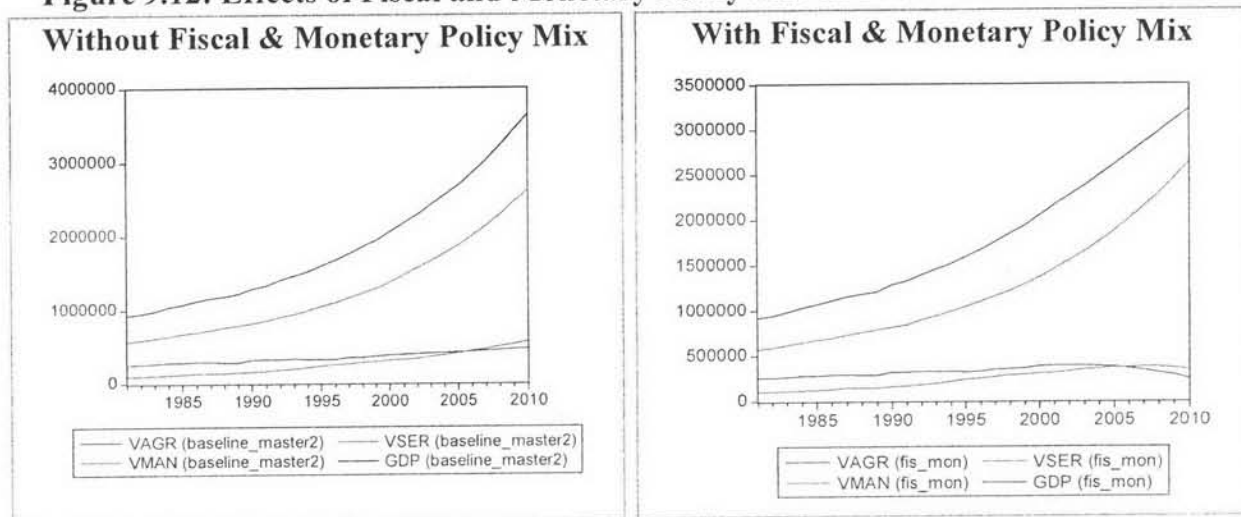
From the consideration of expenditure approach to measure economic development, it is observed that due to the ups and downs among consumption, investment, government expenditures, exports and imports, finally gross domestic expenditures (GDE) has been ended up with positive upward sloping trends that is plotted in Figure 9.13.

**Figure 9.13: Effects of Fiscal and Monetary Policy Mix on Gross Domestic Expenditures**
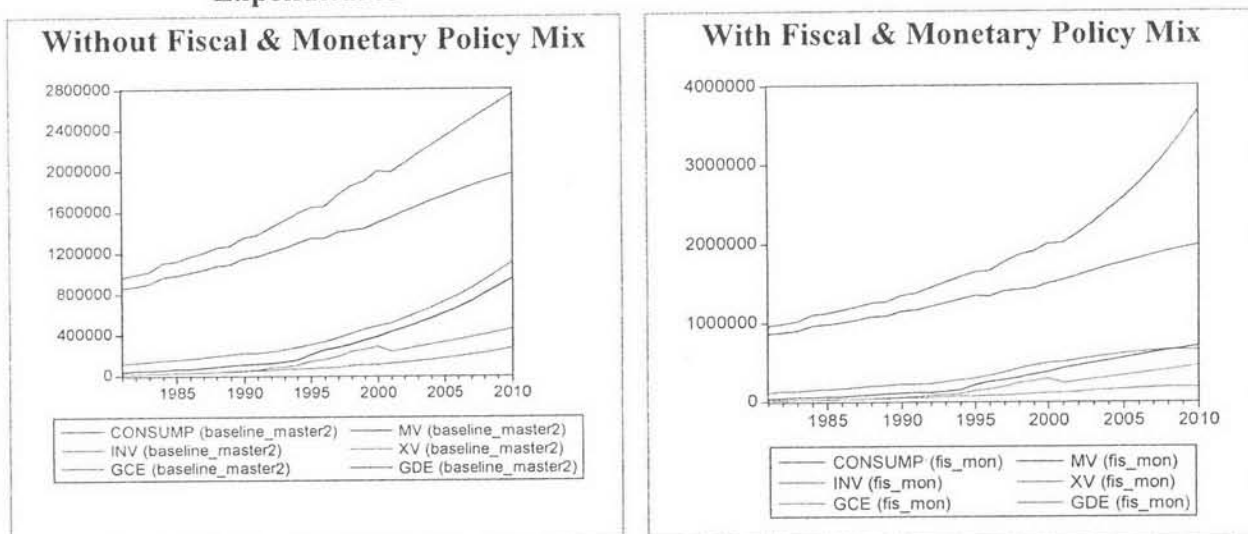
In conventional macroeconomic literature, an expansionary monetary policy tempts private investment increased that leads to increase total production of the economy. Hence, total government revenue would be increased in the long-run. This analysis has come up with the positive result that induces total government revenue. The positive incremental change in total government revenue has been stronger continuously that is supported by the monetarist thoughts. Nevertheless, in spite of having total government revenue increased, government budget deficit has been widened exponentially. It has indicated that total government expenditures has got a synergy effect due to the policy mix.

Figure 9.14: Effects of Fiscal and Monetary Policy Mix on Government Revenues and Budget Deficits
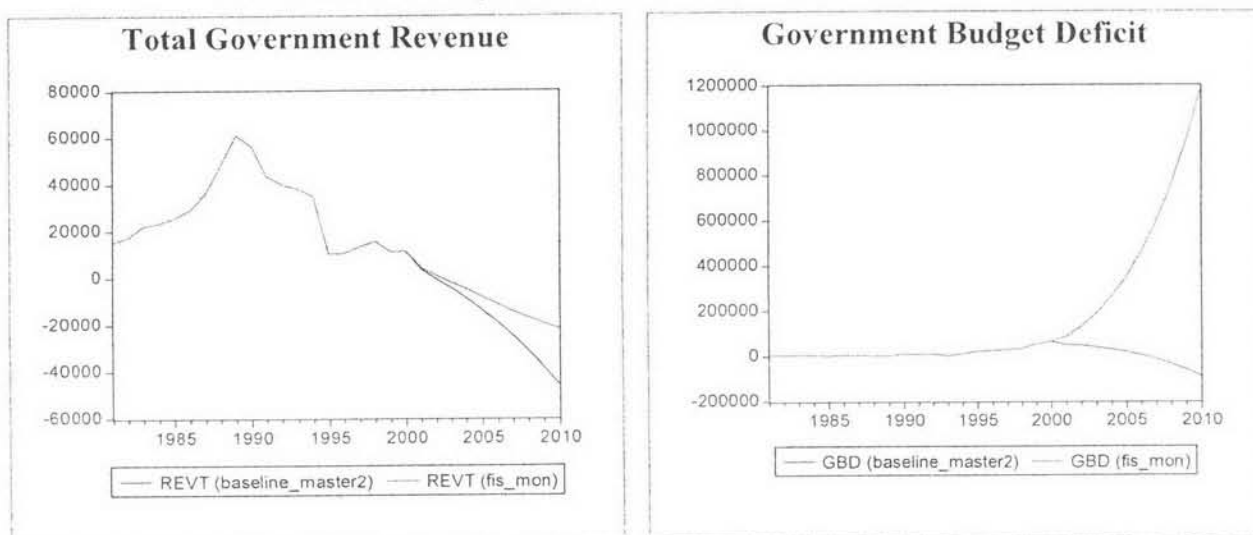

Lexically, the resultant effects of expansionary monetary and fiscal policies have attached to a sharp increase in money supply. In line to the theory, the model built in the thesis has experienced with an exponential growth rate of money supply due to the implementation of expansionary monetary and fiscal policies simultaneously. Furthermore, it is explained earlier in Figure 9.12 that real GDP has lowered down due to the policy mix. A decrease in real GDP has resulted in a further decrease in total volume of imports that is shown in Figure 9.15.

Figure 9.15: Effects of Fiscal and Monetary Policy Mix on Money Supply and Imports
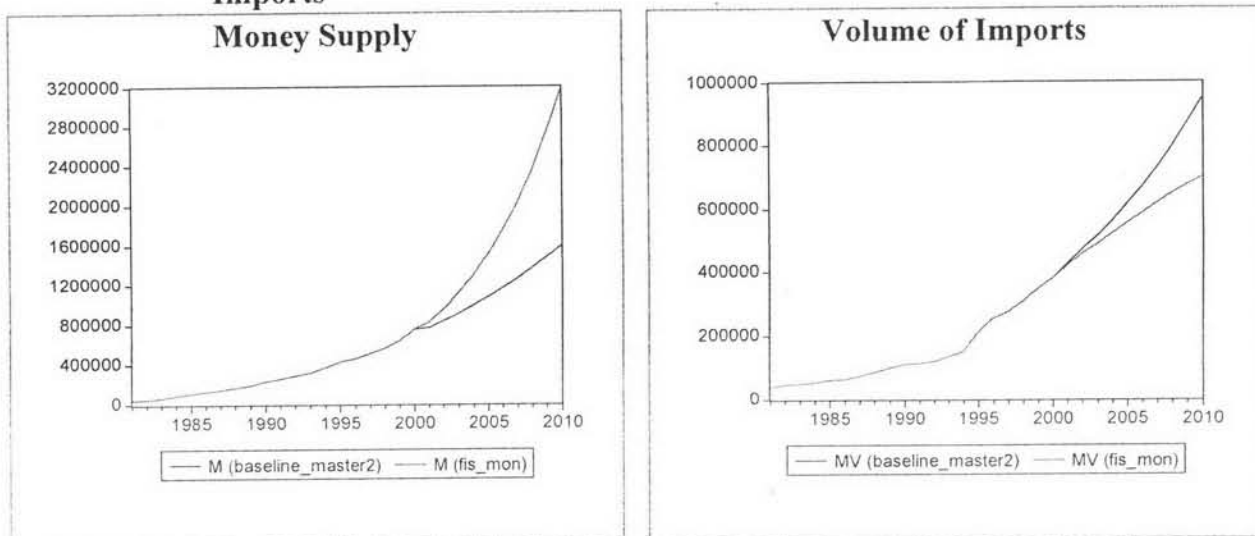
Private consumption has increased at a minor rate after giving a shock by changing fiscal and monetary policies at the same time. By default, as money supply speeds up in the economy, government budget deficit increases in general. This condition holds true in the context of the macro model for Bangladesh. More specifically, the growth rate of both money supply and government budget deficit has been stronger continuously that shaped as exponential paths.

**Figure 9.16: Effects of Fiscal and Monetary Policy Mix on Government Budget Deficit**
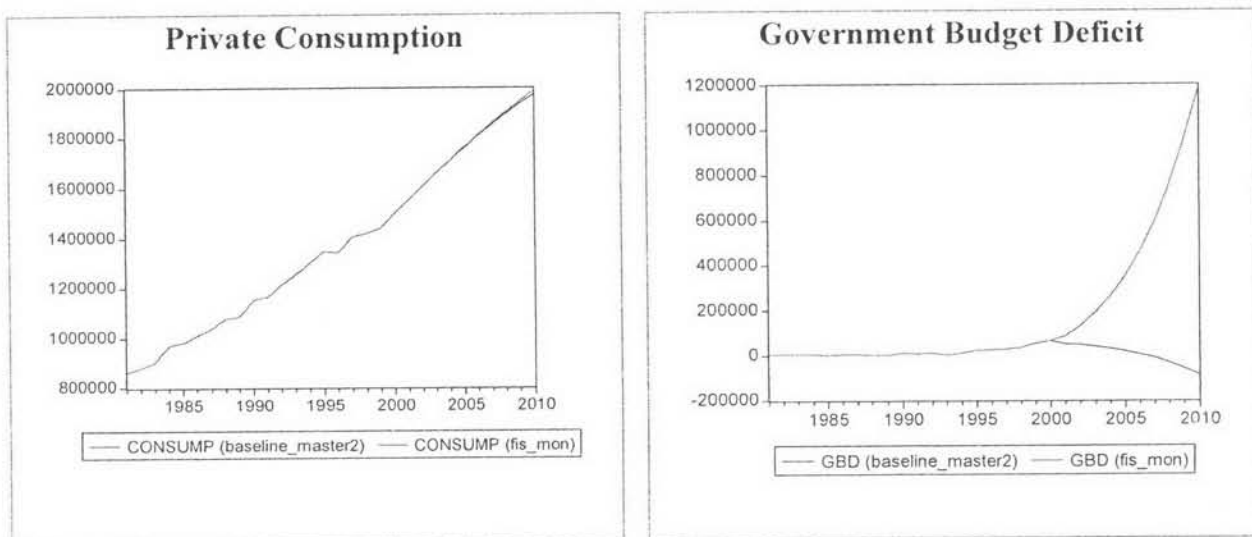
Therefore, an increase in total government expenditures together with a decrease in interest rate lead to a decrease in real GDP, exponential increase in government budget deficit and money supply, an increase in total government revenues, a decrease in volume of imports, and an increase in private consumption expenditures in the economy of Bangladesh.

9.1.5 Expansionary Fiscal and Depreciation in Exchange Rate: A Policy Mix

To make a fiscal shock in the model, the maximum historical growth rate of total government expenditures (TGE) has been used earlier. In this regard, TGE in the year 1989 has experienced with the highest expansion, which is 18.97%. Consequently, it has been uncovered that there has been a sharp nominal devaluation in 1982 from 18.10 Taka against 1US Dollar to 22.11 Taka against 1USD (i.e. a change of 22.15%). As a result, the thesis has conducted an experiment with the historical rate of 22.15 percent depreciation of nominal exchange rate of Taka vis-à-vis the U.S. dollar in each year under managed floating rate system.

Hence, the model has conducted an experiment with an increase in TGE by 18.97 percent along with depreciation in domestic currency by 22.15 percent to simulate its impact on the macroeconomy from 2001 to 2010. After giving the shock by 18.97% to TGE and 22.15% to exchange rate, all production sectors including primary (i.e. agriculture), secondary (i.e. manufacture), and tertiary (i.e. services) sectors are worse off comparing to the macroeconomic situation having no shock. Among all sectors, agricultural and manufacturing sectors have been dampened drastically due to fiscal and exchange rate policy mix. However, tertiary sector has lost its production at a negligible rate. Overall, by reversing the conventional economic theory, an expansionary fiscal and exchange rate policy mix has been regarded as a slowing growth rate in real GDP slightly that is scratched out in Figure 9.17.

Figure 9.17: Effects of Fiscal and Exchange Rate Shock on Production Sectors
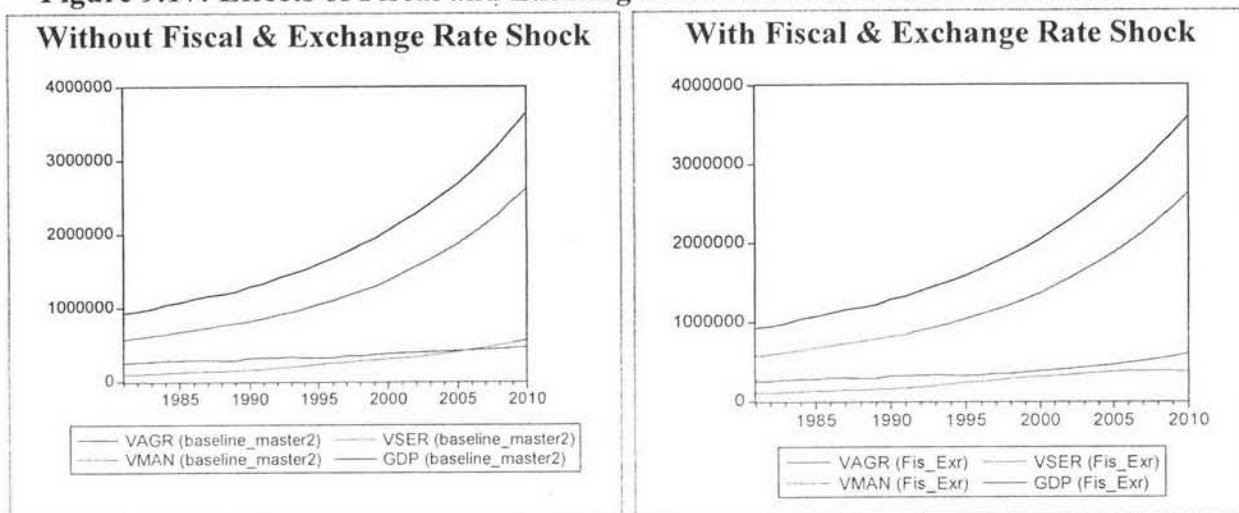
After that, by putting both fiscal and exchange rate policy shock in the model, it has been detected that money supply in the economy has been raised rapidly that has also experienced with an increase in the dispersion of government budget deficit exponentially. Basically, growth in money supply has resulted in an increase in government expenditures and an increase in imports followed by an increase in private consumption.

Figure 9.18: Effects of Fiscal and Exchange Rate Shock on Money Supply and Budget Deficits
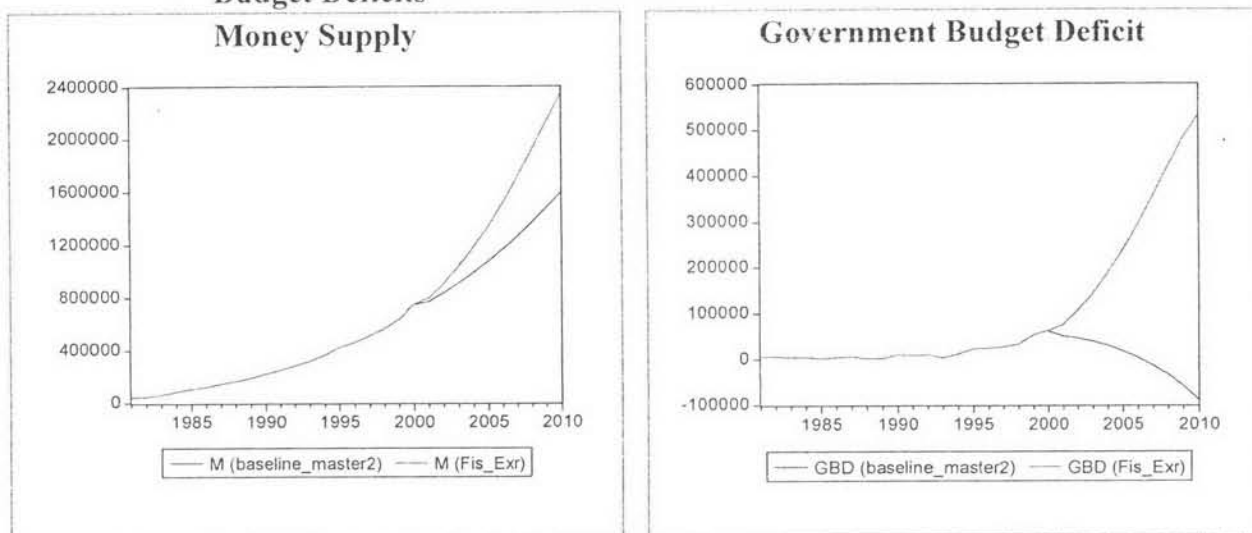
On the contrary, gross domestic expenditures has followed a downward trend due to the implementation of policy mix. The decrease in gross domestic expenditures has resulted in a dramatic increase in total value of imports.

Figure 9.19: Effects of Fiscal and Exchange Rate Shock on Gross Domestic Expenditures and Value of Imports
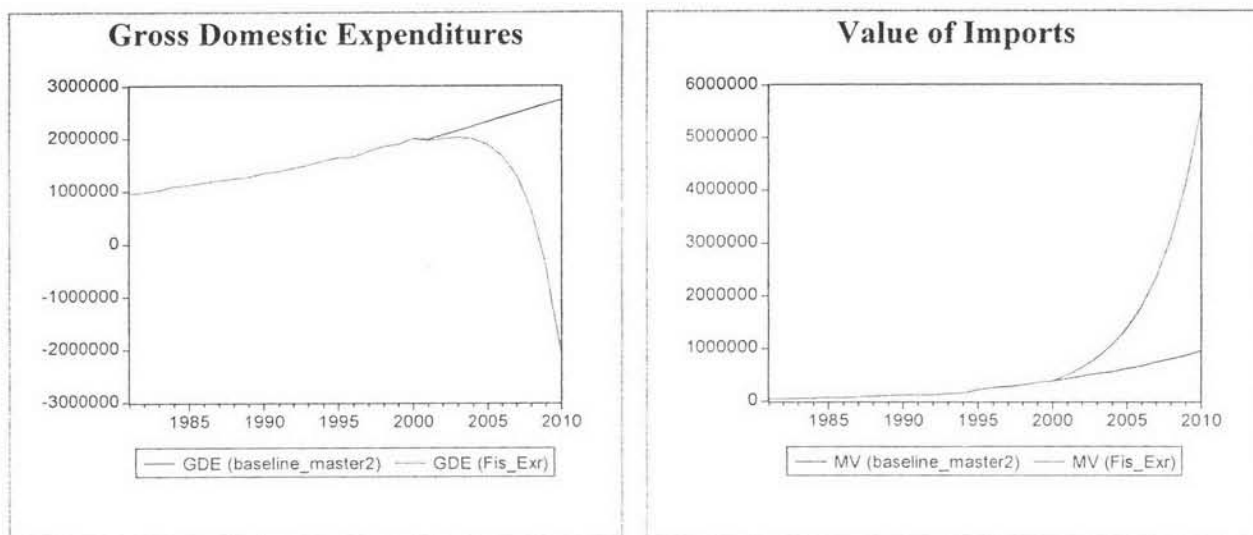

Consequently, total value of exports has increased that decreased overall trade balance of the economy in spite of experiencing a positive trend in value of imports. It is because the rate of positive change of exports is greater than that of imports, which induce overall trade balance favorable to the economy. Furthermore, when exchange rate depreciates, domestic goods and services would be cheaper to the foreign economies that give the incentives to the foreign consumers to buy more. This process leads value of exports increased that has come up true for the economy of Bangladesh under this macroeconometric model.

Figure 9.20: Effects of Fiscal and Exchange Rate Shock on Exports and Trade Balance
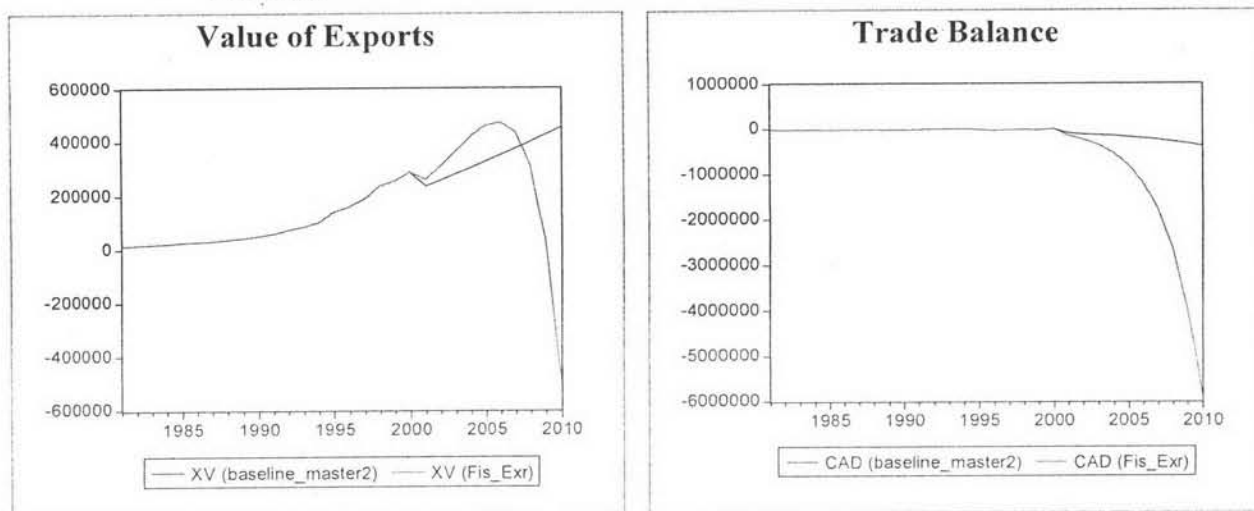
After having the shock fiscal and exchange rate policies, total investment has dropped down alarmingly that forced real GDP to diminish slightly at the end. However, the rate of change in real GDP with respect to total investment is very negligible, as real GDP is the resultant factor of many macroeconomic indicators.

Figure 9.21: Effects of Fiscal and Exchange Rate Shock on Investments and Real GDP
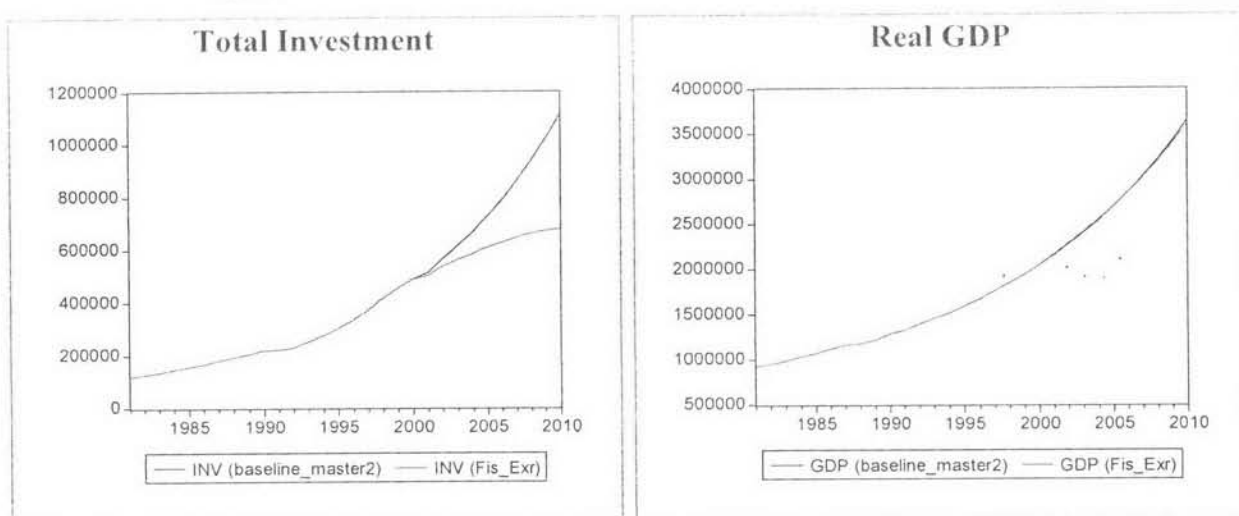
Therefore, an expansionary fiscal and exchange rate policy mix leads to a minor decrease in real GDP with a sharp decrease in total investments, an increase in money supply, an increase in government budget deficit, a decrease in gross domestic

expenditures, increase in values of imports and exports but resulting in deterioration in trade balance.

9.1.6 Expansionary Monetary & Depreciation in Exchange Rate: A Policy Mix

To run the simulation of monetary and exchange rate policy mix, the maximum historical record to decrease in interest rate has been selected. In 1993, it is to be recalled that interest rate of Bangladesh has been decreased from 8.11 percent to 6.51 percent, which has the highest negative change (i.e. -19.73%) in interest rate within the last 20 years. Moreover, it has been found that there has been a sharp nominal devaluation in 1982 from 18.10 Taka to 22.11 Taka against 1USD (i.e. a change of 22.15%). As a result, the thesis has conducted an experiment with the historical rate of 22.15 percent depreciation of nominal exchange rate of Taka vis-à-vis the U.S. dollar along with an expansionary monetary policy (i.e. a decrease in interest rate at 19.73%) in each upcoming year consecutively.

It is revealed by the monetarists that an expansionary monetary policy can boost up real GDP of the economy. Furthermore, a depreciation in Taka makes export supply of domestically produced goods more attractive. Conversely, it makes foreign produced goods relatively more expensive and hence less attractive to the domestic economy to import. Whether these philosophy is suitable for Bangladesh has been experimented by giving a monetary and exchange rate policy shock to the model through a decrease in interest rate at 19.73% and a depreciation by 22.15% in each upcoming year continuously.

Figure 9.22: Effects of Monetary and Exchange Rate Shock on Production Sectors of the Economy
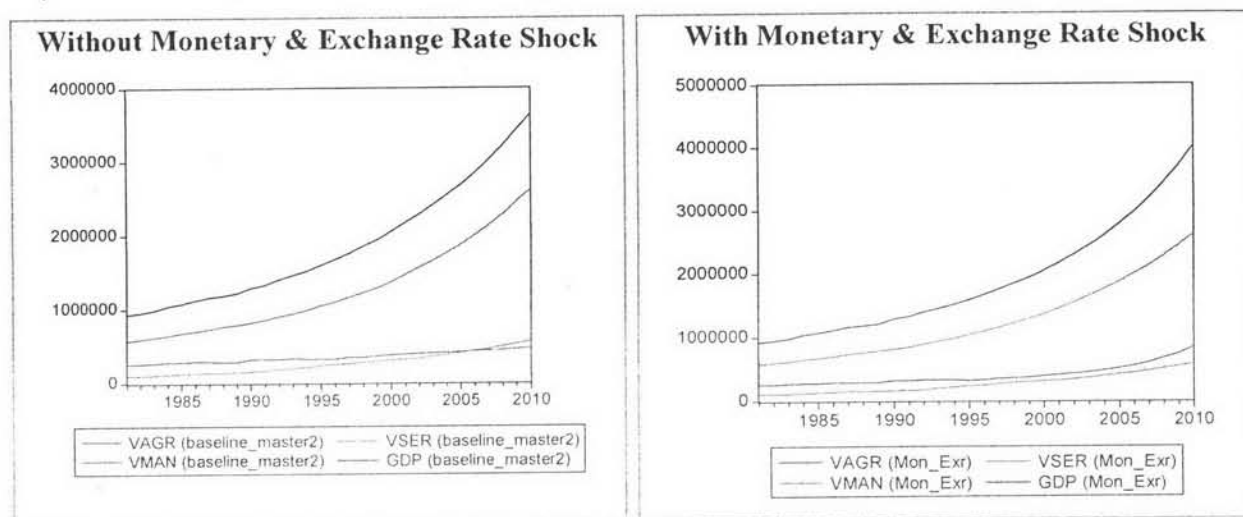
It is noticed that total productions in primary, secondary, and service sectors have been amplified together that lead real GDP to follow upward sloping path after having monetary and exchange rate policy shock at the same time. However, agricultural sector has made the biggest push to increase total production of the economy. The real GDP has yanked up 97.06 percent from 2000 to 2010 due to the policy mix.

Values of exports and imports both have increased at the same time, but value of imports has followed steeper upward path than that of exports. It means that- as exchange rate depreciates, the domestic consumers have been fascinated to consume foreign goods and services more than the foreign consumers to consume domestic goods and services at a cheaper price level. However, an increase in value of imports at a depreciated exchange rate is completely reverse to the theory. Perhaps it is because of the incentives given to the domestic consumers by decreasing interest rate at the same time period.

Figure 9.23: Effects of Monetary and Exchange Rate Shock on Exports and Imports
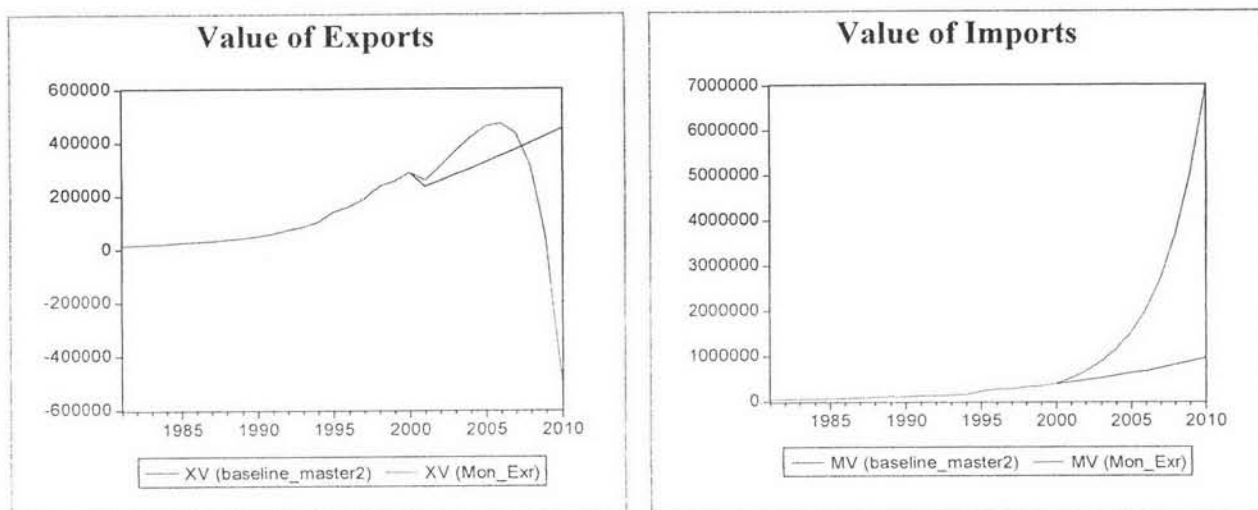

In cohesion to an increase in real GDP, total investment in the economy has hiked up at a minor rate. Factually, an increase in real GDP has resulted in an increase in total investment partially. That is, a decrease in interest rate has improved the overall investment situation in the economy. Moreover, government consumption expenditures has also risen slightly due to a joint shock of monetary and exchange rate policy. At the end, an increase in government consumption expenditures has amplified the aggregate demand for goods and services that lead to produce more resulting an increase in real GDP eventually of the country.

Figure 9.24: Effects of Monetary and Exchange Rate Shock on Investments and Government Consumption Expenditures
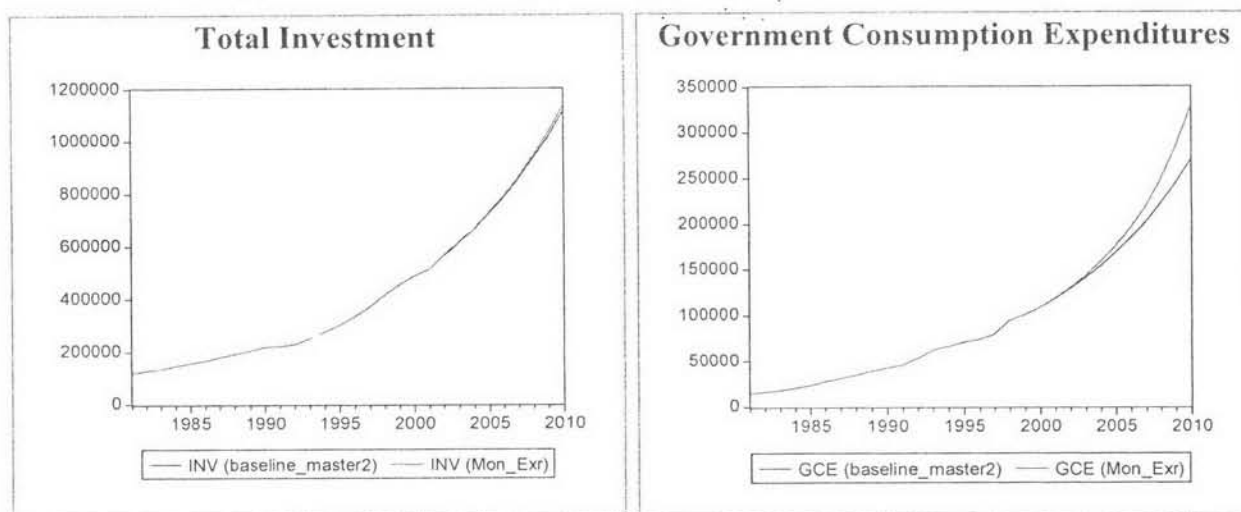
A decrease in interest rate has given an incentive to the producers and consumers to produce and consume more simultaneously. Hence, the borrowers have borrowed more at a lower interest rate than before. This behavior of the economy has raised money supply by theory. From the empirical simulation of monetary and exchange rate policy mix, this statement has come up with the negative result to the money supply but at an insignificant rate. Followed by this result, government budget deficit has also ended up with a minor decrease after having the policy mix shock in the macroeconometric model that is visualized in Figure 9.25.

**Figure 9.25: Effects of Monetary and Exchange Rate Shock on Money Supply and Government Budget Deficit**
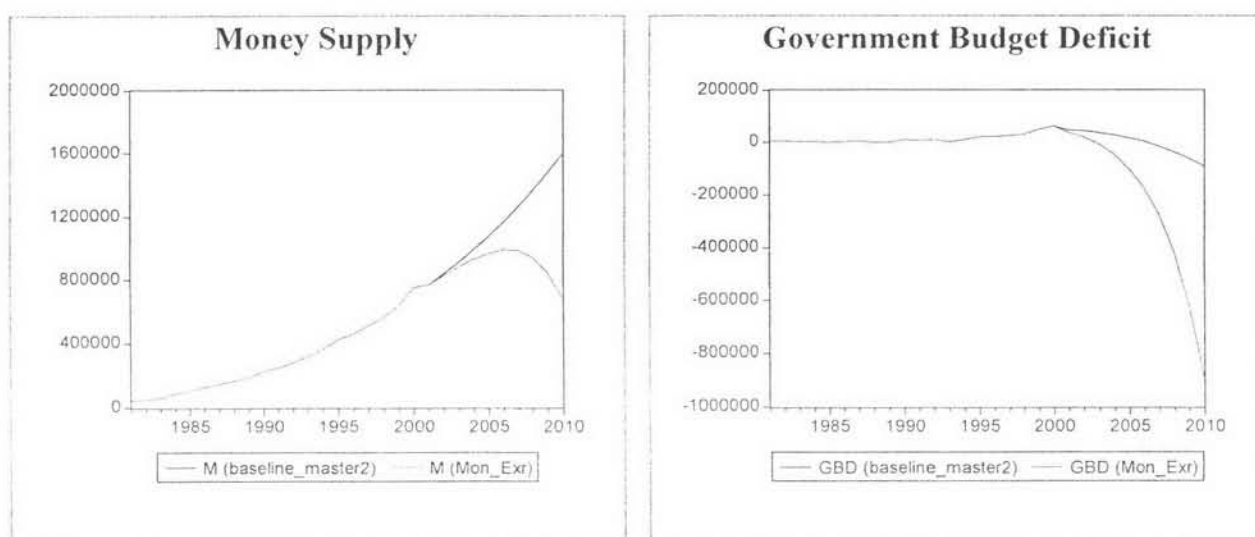
Therefore, after giving a shock by decreasing interest rate and depreciating exchange rate, it is noticed that the policy mix to the model has leaded to an increase in total investment, an increase in government consumption expenditures, increase in both values of exports and imports, increase in government budget deficit that has directed towards an increase in real GDP eventually.

9.1.7 Exogenous Shock Simulation: An Experiment

Government has tried to achieve higher agricultural growth through diffusion of HYV technology (Hossain & Razzaque, 2003). The technology is continued in an

input pack, where irrigation being major component of the input package. It has been argued that Bangladesh has under-utilized potential for expansion of irrigation. In this context, it would be interesting to carry out an experiment involving increase in irrigated area at a faster rate. In this additional experiment, it is assumed that irrigated area increases at a sustained rate of 4.26 percent from its maximum historical record in 1987.

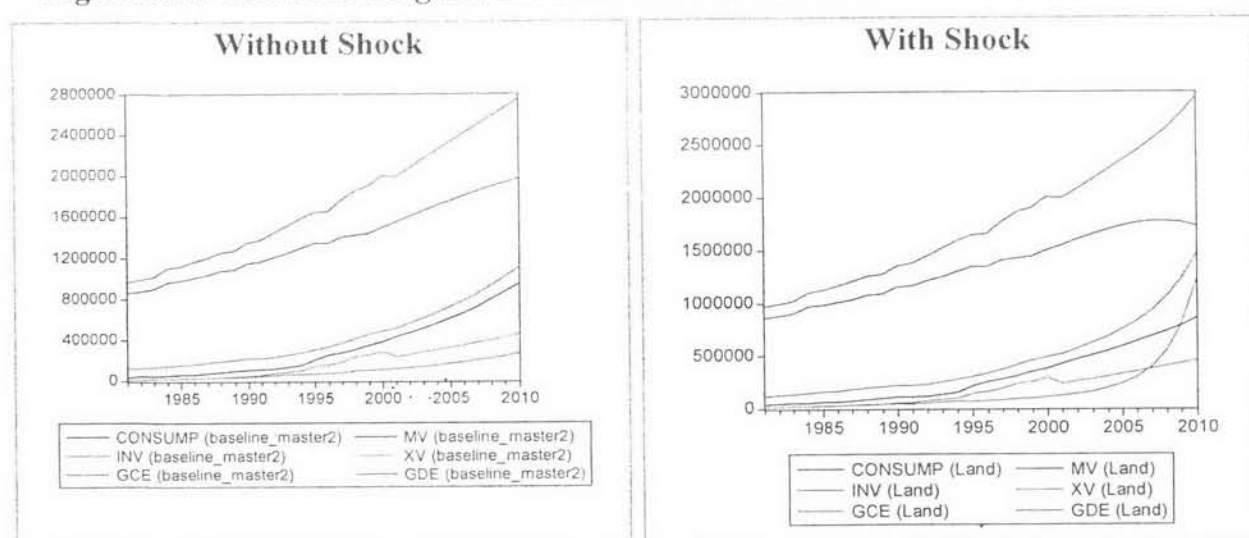**Figure 9.26: Effects of Irrigated Land Shock on Agriculture and Real GDP**
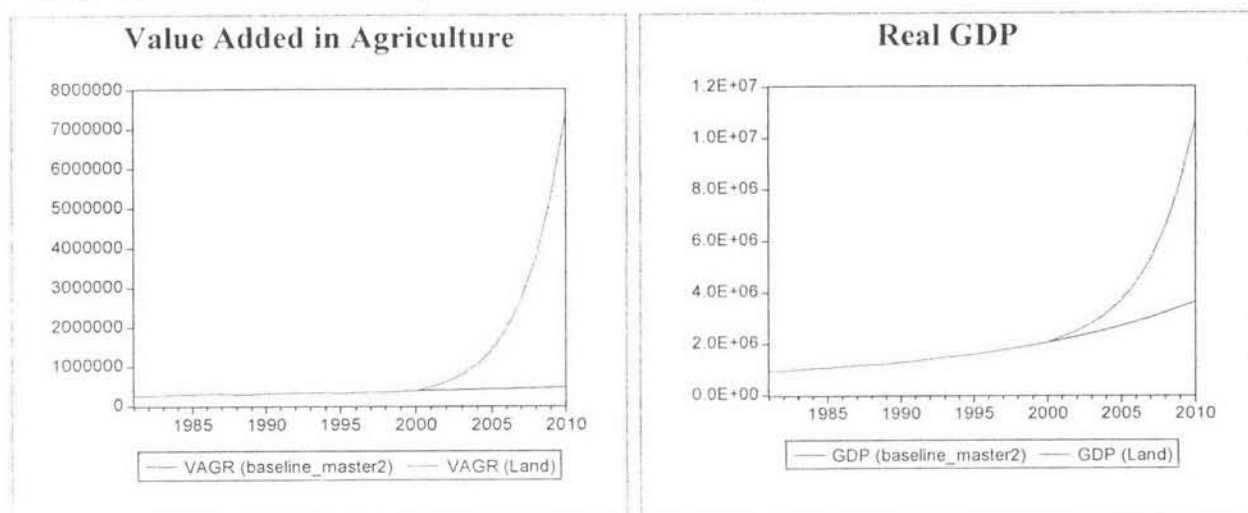
An increase in total irrigated area causes an exponential increase in agricultural income resulting in an increase in real GDP that is shown in Figure 9.26. The rate of growth increases gradually in the following years. However, the rate of change in real GDP is less than that of primary sector. It is because there is a very negligible change in the rest of the sectors (i.e. manufacturing and services), which has been visualized in Figure 9.27.

Figure 9.27: Effects of Irrigated Land Shock on Manufacture and Services
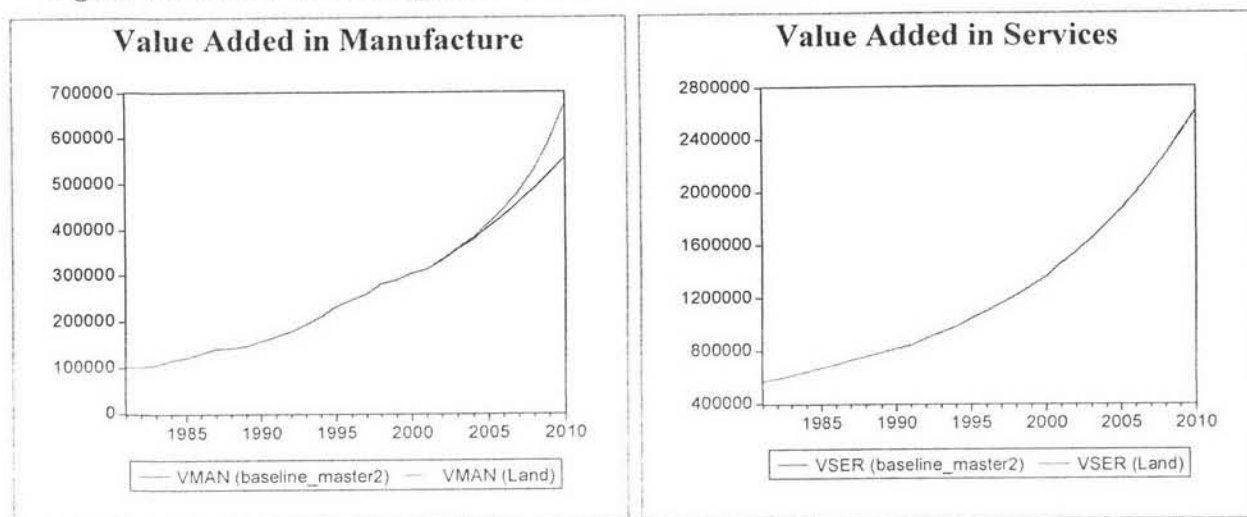
All expenditures including private consumption, investment, government expenditures, and exports and imports have gone up together that induced to raise the rate of growth in real GDP of the economy.
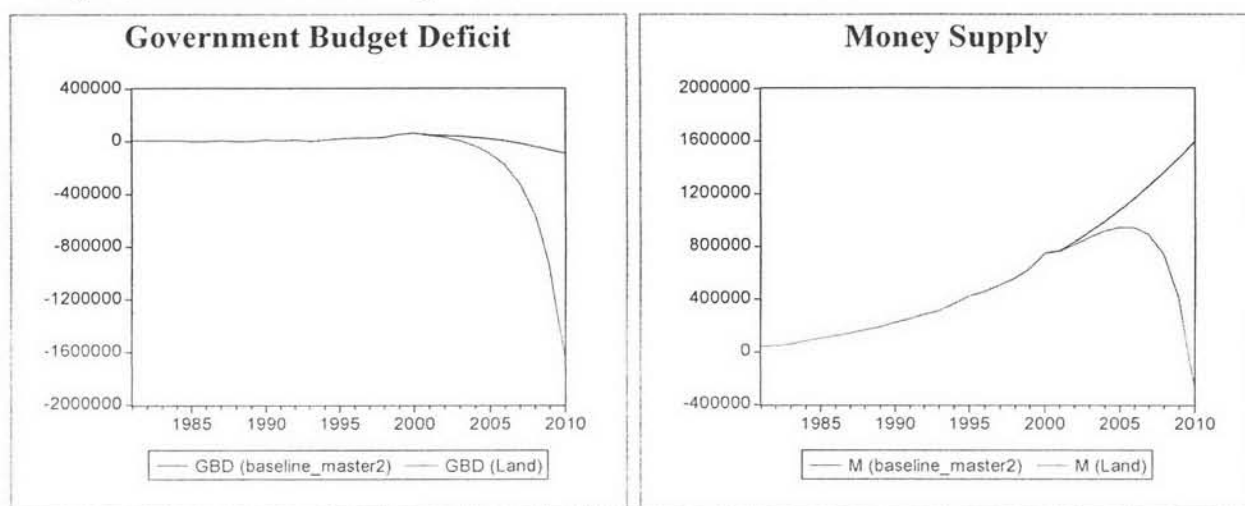
Figure 9.28: Effects of Irrigated Land Shock on Some Selected Indicators

A decrease in domestic component of government budget deficit has lowered down the overall money supply due to the positive change in irrigated land of the economy.

Figure 9.29: Effects of Irrigated Land Shock on Some Selected Indicators

In fine, it has been précised that an increase in total irrigated land leads to a sharp increase in productions in agriculture sector and minor increase in manufacture and service sectors at the same time. Moreover, all primal macroeconomic indicators including private consumption, investment, government expenditures, and exports and imports have gone up simultaneously followed an increase in real GDP of the country steadily.

PART V   CONCLUSION AND RECOMMENDATIONS