POLICY BRIEF
AKI RESEARCH GRANTS ON ECONOMIC ISSUES
Volume IX, No. 5, 2017
ISSN # 2094-3342

De La Salle University
AKI
Angelo King Institute
for Economic and Business Studies

Small Open Economy DSGE Model with Natural Disaster and Foreign Aid

The study has found that an exchange rate intervention by the central bank should be the monetary response to a natural calamity. The rationale is that an exchange rate intervention policy insulates the economy from any Dutch disease effects thereby stabilizing the economy faster than the common inflation targeting rule commonly practiced by central banks.Although the study concludes that an inflation targeting policy does stabilize inflationary pressure of natural calamities faster, its slow response to a real exchange rate appreciation causes fluctuations in the trade balance and, therefore, to the economy's final output. In addition, the study found that monetary policy response alone cannot mitigate the long-term real effects of natural calamities, as evidenced by the failure of consumption and final output to return to their pre-disaster states. Furthermore, an exchange rate intervention also requires that a post-calamity expansionary monetary policy, through a decrease in nominal interest rates, is needed for the real exchange rate to depreciate and counter the Dutch disease effect.

Written by
Dickson Lim
School of Economics,
De La Salle University

The study obtains these policy recommendations through the application of a dynamic stochastic general equilibrium (DSGE) model. DSGE models have several benefits which make them ideal for macroeconomic policy analysis. They are micro-founded in the sense that equations in the model are derived from optimizing behavior of economic agents. They thus describe the behavior of the economic agents in terms of parameters that are not expected to change as a result of changes in economic policy, thereby validating the analysis of alternative policies. The structural characteristic of DSGE models also allows policy interventions and their transmission mechanism to be clearly identified. This is because each equation in the model has an economic interpretation which assists in the discussion of alternative policies. DSGE models

are also forward-looking that requires economic agents form rational expectations on the evolution of the economy. Lastly, the stochastic nature of DSGE models permits the analysis of the effects of unanticipated random shocks to the economy. These features of DSGE models make them less susceptible to the Lucas critique and therefore are suitable for policy analysis.

The model used in the study closely follows Peiris and Saxegaard (2007) in introducing foreign aid to a small open-economy model and the work of Keen and Pakko (2011) in incorporating natural calamity shocks into a simulated economy. The basic structure of the small open-economy DSGE model consists of perfectly competitive final goods firms wherein their output is eventually consumed by both the domestic private and public sectors. The inputs used in the production of the non-tradable final good are either produced domestically or imported by monopolistically competitive intermediate goods firms. The domestically produced goods, which are produced using non-destroyed capital and labor, are sold either in the domestic intermediate goods market or exported abroad. The model assumes that the capital account is closed. The markets for capital and labor are assumed to be perfectly competitive. The public sector is composed of the government and a central bank which serves as the fiscal and monetary authority, respectively. The study assumes that the government commits to the fiscal rule of fully spending any foreign aid received, while the central bank follows a policy rule on foreign exchange intervention and open-market operations.

The small open-economy DSGE model is also structured in the tradition of New Keynesian models with market inefficiencies in the form of real and nominal rigidities. Three sources of inefficiency included in the model are: (1) monopolistically competitive intermediate goods market, (2) price rigidity in the domestic intermediate goods market, and (3) capital adjustment costs. These market inefficiencies provide a rationale for monetary and fiscal stabilization policy.

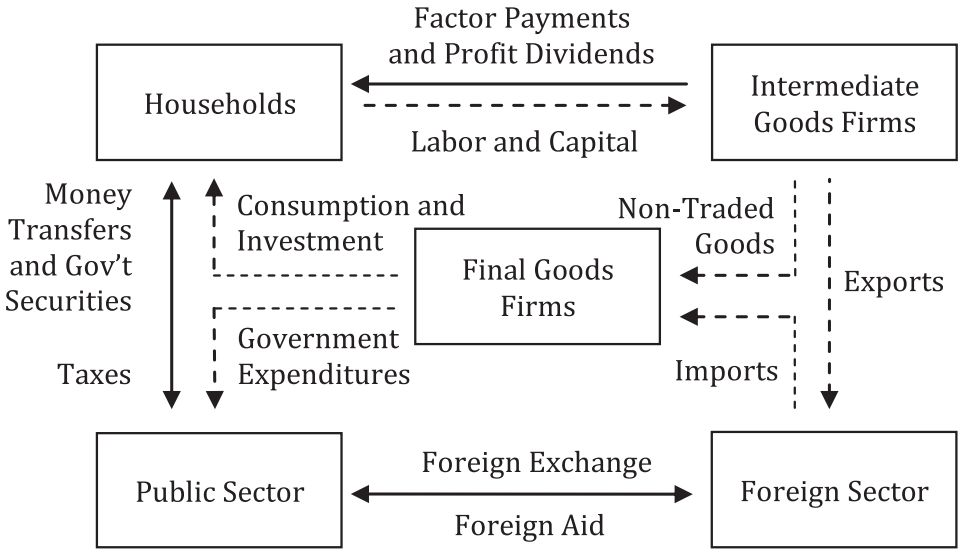

Figure 1.

Figure 1 provides a schematic diagram of the small open-economy DSGE model, which details the circular flow of the model economy. Solid lines illustrate the circulation of nominal variables, while dashed lines represent the flow of real variables.

Two alternative monetary policy rules, an exchange rate intervention and an inflation targeting rule, were considered in the study as a policy response to random shocks in the economy. Simulated shocks in the form of natural calamities were conducted by the study and the impulse responses of key macroeconomic indicators were studied. The impulse response graphs have shown that the small open economy contracts in the aftermath of an unanticipated natural disaster shock, as evidenced by an immediate decrease in final output production, household consumption, and investments. The impulse response graphs also reflect the adverse economic consequences of natural calamities, such as the inflationary nature of natural calamities, disruptions in employment or labor hours, as well as the increase in government expenditures in the form of rehabilitation and reconstruction expenditures. The rise in the overall inflation rate in the economy and along with the Dutch disease effects cause the real exchange rate for the country to appreciate as expected.

A welfare-based criterion was used to determine which policy response minimizes social welfare. Within the context of the small open-economy DSGE model developed in the study, inflation targeting is achieved through a Taylor rule andimplemented by the monetary authority by conducting open market operations, while exchange rate intervention follows a crawling peg rule and implementedthrough a sterilized accumulation or diminution of foreign exchange reserves. To determine the optimal monetary policy amidst natural calamity, welfare losses under alternative monetary policy rules were computed and compared. The table belowsummarizes the variances of total output, inflation, and real exchange rates as well as the welfare losses computed using equation in the previous section for each monetary policy regime.

Table 1

Description of the Table Below

Monetary Policy Rule	Y	π	ϵ	L
Inflation Targeting	6.78E-04	1.08E-06	4.00E-05	3.61E-04
Exchange Rate Intervention	2.14E-04	1.02E-05	3.36E-05	1.39E-04

Comparison of the variances of each macroeconomic indicator in Table1 shows that inflation targeting is better at stabilizing inflation, while exchange rate intervention is better at stabilizing the real exchange rate and final output. In accordance to the simulated results,comparison of the welfare losses amidst natural calamities and in an environment where natural calamities have economic consequences shows that an exchange rate intervention is the optimal monetary policy response in such situations. This result is due to the fact that exchange rate intervention as a selected monetary policy responds to the Dutch disease effectswhereas an inflation targeting policy does not.

In conclusion, while minimal consideration has been given on the monetary aspect of natural calamities, and most have analyzed developed countries with a disregard for open market considerations, the study contributes to the literature by incorporating features of developing countries, such as export reliance and receipt of foreign aid. The key contribution of this study to the literature is that it provides sufficient evidence that the optimal monetary policy response may vary in certain economic problems. As the results of this study have shown, occasional discretion on the part of the monetary authority may be necessary in times of calamity.

CONTACT INFORMATION

DLSU - Angelo King Institute for Economic and Business Studies (DLSU-AKI)
Room 223, St. La Salle Hall
2401 Taft Avenue
1004 Manila

Angelo King International Center
Corner of Arellano Avenue and Estrada Street
1004 Manila

+63-2-524-4611 loc. 287,
+63-2-524-5333, +63-2-5245347 (Fax)
http://aki.dlsu.edu.ph

This publication is based on a study under the AKI Research Grants on Economic Issues.