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Monetary policy in a two-sector dependent economy ☆

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ABSTRACT

In this paper we examine the effects of monetary policy in a two sector dependent economy. The households consume both tradable and non-tradable goods with inelastic labor supply. The economy produces both goods with labor and capital as inputs. Factors of production are mobile across sectors. The effects of monetary policy very much depend on the role of money in the economy as well as relative capital intensities. For example, when the nontraded sector is more capital intensive and households need cash for purchasing tradable goods, higher inflation will generate more investment in the economy leading to a higher level of capital stock and a lower level of net foreign assets in the long run. However, the long run effects are completely opposite if households need real balances for purchasing nontradable goods instead. All other possible cases are examined. We also calibrate the model with standard parameter values for quantitative analysis.

1. Introduction

The key objective of monetary policy for most central banks is to control inflation while achieving desirable long term economic growth. Price instability, such as inflation or hyperinflation, creates uncertainty in the economy which leads to lower economic growth. As a result, over the past few decades, inflation targeting has been adopted by many developed and developing countries as a framework for their own monetary policies. However, in modeling the effects of monetary policy in a small open economy setup, most researchers assume a standard one-sector framework, and focus exclusively on the effects of changes in the aggregate level of economic variables. This precludes analysis of the full impacts of monetary policy shocks on various sectors and their effects on different parts of the economy and especially on real exchange rates. The main objective of this study is to evaluate the effects of monetary policy not only on the aggregate economy but also on different sectors such as tradable and non-tradable. In doing so we will also be able to comment on the effects of real exchange rates; one of the most important variables in an open economy.

Why do we care? It is an undeniable fact that with increasing globalization, each country has become more open to, and integrated with, other countries. As the volume of international trade gradually increases among countries, so does the distinction between the traded and nontraded sector. The impact of various government policies vary between the economic sectors because of production technology differences and other structural differences. Policy shocks alter the long run allocations of sectoral resources such as labor and capital through changes in the relative price of goods. The presence of nontradable goods plays an important role in the exchange rate behavior. Government policy affects the price of goods, and consumers adjust their consumption patterns accordingly. As a result, we observe the reallocation of consumption and inputs for the production of goods between sectors.[1] Such important transmission mechanism can only be modeled if we introduce both traded and nontraded sectors.[2]

There exist a number of studies in the literature that pay attention to the dynamics of real exchange rates within a two-sector open economy framework. Important studies include Turnovsky and Sen (1995), Brock (1996), and Cardi and Restout (2007). To generate realistic exchange rate dynamics within the neoclassical framework (flexible prices and wages), Chen and Hsu (2009), Steigum and Thørgesen (2003), and Morshed and Turnovsky (2004, 2011) either used adjustment costs involving investment or adjustment costs involving sectoral labor

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[1] If both goods are tradable, the relative price of a small open economy is completely exogenous. Since the small open economy is a price taker, it cannot influence the international relative price (real exchange rate) through domestic policies.

[2] At the empirical level, Dotsey and Duarte (2008) study the relationship between nontraded sector and real exchange rates to find that nontradable goods play an important role in accounting for real exchange rate fluctuations compared to the model without consumption of nontradable goods. Similarly, Dedola and Lippi (2005) measure the effects of monetary policy on 21 industries from five industrialized countries using a structural VAR from 1975-1997. They find that monetary policy shocks have a different impact on sectoral outputs and are systematically related to the durability of the industry output, financing requirements, borrowing capacity and firm sizes.

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mobility. None of these studies included money or monetary policies in their models to evaluate the real exchange rate dynamics. On the other hand, the studies that introduced money or monetary policy used models with new-Keynesian type price stickiness.[3] Our objective is to evaluate the effects of monetary policy on real exchange rates within a two-sector dependent economy with flexible prices and wages.[4]

To introduce money in our model we adopt relatively popular cash-in-advance (CIA) approach. This approach relies on the transaction technology of demand for money. In the open economy literature, important references include Helpman and Razin (1984), Calvo (1987), Calvo and Vegh (1995), Mansoorian and Mohsin (2006). However, since these studies deal with a one-good economy, they could not elevate the effects of monetary policies in the sectoral adjustment process. In this paper we will be able to address this. As we will see later, the alternative role of money will play a pivotal role in evaluating the effects of monetary policy.

Further discussion on the modeling feature is warranted here. For the dependent economy the price of tradable goods is exogenously given by the world market, while the relative price of nontradable goods is endogenously determined by domestic market equilibrium. In our model, the representative household consumes both tradable and nontradable goods. All prices are flexible and the production factors, capital and labor, are perfectly mobile between sectors. Labor supply is perfectly inelastic and the allocation of capital between sectors is variable in the long run. Both goods are produced with unique constant returns to scale production functions. It is important to note that the effects of an increase in inflation depend on the structure of demand for money in the economy. An increase in the long run inflation rate could change the relative price between two consumption goods, as one could be “a cash good” and the other could be “a credit good” (e.g. Lucas and Stokey, 1987).

The existence of two sectors allows for non-uniform monetization between sectors. The use of cash varies across sectors because goods have a various degree of credit rationing. In this study, all possible alternative specifications will be considered. To do so, we generalize CIA constraints so that we have three possible polar cases. From our initial modeling results, we find that this has significant bearing on the effect of monetary policy in the economy as a whole. First, we consider the case where households need real balances for consumption expenditure on tradable goods only. We may think about tradable goods as cash goods and the nontradable goods as credit goods. If the nontraded sector is more capital intensive, then a permanent increase in the inflation rate increases the relative demand for the nontradable goods (credit goods), and increases the relative price of the nontradable goods. It causes resources to shift from the traded to the nontraded sector and capital stock starts to rise. As the capital stock increases the current account deteriorates. Real wages of both sectors fall and returns to capital rise. Capital owners are better off and laborers are worse off. The appreciation of real exchange rate will increase domestic costs of producing tradable goods and decrease the country's international competitiveness. It will alter trade patterns as imports rise and exports fall. As a result, it shrinks exportable sectors.

On the other hand, with the reversal in capital intensity, the economy experiences capital decumulation with a current account surplus which exhibits opposite results from the previous case.[5] Consequently, investment falls and the capital stock decreases in the economy, but the relative price remains intact. Second, we consider another case where households need real balances for nontradable consumption only. Results are expected to be significantly different. The results are also expected to be sensitive to sectoral capital intensity. Third, CIA constraints are applied to both the tradable and nontradable goods jointly. In this case, the relative price will not be affected by a permanent increase in inflation. We expect the super-neutrality of monetary policy to hold. We show that a positive monetary shock does not necessarily increase output across different sectors. The interesting feature of this dynamic behavior comes from the nature of the production functions. The transitional dynamics of the economy depend on the distinction of two different production processes and the relative capital intensities of the two sectors.

Finally, the model is calibrated with standard parameter values for a detailed quantitative analysis. When the sectoral capital intensity of the nontraded sector is greater than that of the traded sector, a permanent increase in the inflation rate from 4% to 8% will increase the steady state total capital stock and output by 0.42% and 0.13%, respectively. Under the same conditions, the steady state labor and output in the traded sector fall by 1.88% and the steady state labor and output in the nontraded sector increase by 1.7%. The steady state consumption of the tradable goods falls by 1.87%, while that of nontradable goods rises by 1.7%. So, the steady state total consumption rises by 0.0024% and the current account decreases by 1.78%. If we look at the overall changes in output and consumption, they are small relative to the sectoral changes. The effects of the change in consumption and output are more pronounced with a higher inflation rate. With the reversal in capital intensity, the steady state labor and output of the traded sector now fall by 2.45%, while those of the nontraded sector rise by 1.7%. The steady state total capital stock falls by 0.4%, and the steady state net foreign position increases by 2.3%, which is a current account surplus.

The rest of the paper is organized as follows. Section 2 presents the basic structure of the model, Section 3 describes the equilibrium dynamics, Section 4 presents the real effects of inflationary shocks, Section 5 summarizes the calibration results. The model with alternative CIA constraints, and other issues involving temporary shocks and the effects of fiscal policies are discussed in Section 6 and concluding remarks are given in section 7.

2. The model

The model is that of a small open economy with an infinitely lived representative household that consumes both the tradable goods C_T and the nontradable goods C_N. The household supplies one unit of labor ($L = 1$) in order to receive the wage bill w_t. The economy is small and takes the world interest rate, r, as given. Representative firm produces the tradable goods that can be consumed domestically and exported and the nontradable goods that can be either consumed or invested domestically. The basic framework follows closely to that of Turnovsky and Sen (1995). The domestic nominal price of the tradable goods is equal to the exchange rate times the foreign currency price of goods, that is, $P = EP^*$. For convenience, we may set $P^* = 1$. With

[3] For details see e.g. Betts and Devereux (2000), Bergin and Feenstra (2001), Chari et al. (2002), and Ng (2003). In addition, Hau (2000) employs sticky factor price and Carvalho and Nechio (2011) introduce firm's price stickiness in a multi-sector framework. Devereux and Engel (2002) explore price formation on local currency pricing.

[4] The only paper that incorporates money and monetary policy in a two sector open economy framework is by Uribe (2002). In the main model, outputs in both sectors are produced by labor only. In the extended model, tradable sector uses both labor and capital while non-tradable sector uses only labor to produce output. In our model, we follow Turnovsky and Sen and assume both labor and capital as inputs in both sectors. These sectors could be different in terms of capital intensity (capital-output ratio) in their respective production functions.

[5] It is important to note that capital intensity (capital–output ratio) plays an important role in identifying the overall effects on aggregate capital stock and the current account balance of the economy. The reasons are as follows. With a particular policy shock, we observe labor movements between sectors. When labor moves to a particular sector, the demand for capital in that sector also goes up. However, the opposite will happen in the other sector. The drop of labor reduces the marginal product of capital and, as a result, the demand for capital drops. The capital intensity dictates the net effect on aggregate capital. If labor migrates to more capital intensive sector, the total demand for capital in the economy will be higher. Similarly, the opposite will be evident when labor migrates to less capital intensive sector. Now, due to inter-temporal solvency condition imposed (see the model), capital and foreign bonds are negatively related.