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Optimal exchange rate policy for a small oil-exporting country: A dynamic general equilibrium perspective

Almukhtar Saif Al-Abri *

Department of Economics and Finance, Sultan Qaboos University, PO Box 20, PC 123 Al Khod, Oman

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ABSTRACT

This paper examines the choice of optimal exchange rate regime for an oil-exporting small open economy using a welfare-based model. The paper extends the standard New Keynesian Small Open Economy model to include three countries: a small oil-exporting country and two large foreign countries. The model also features three sectors: traded, non-traded, and primary-commodity (crude-oil). The sources of uncertainty are random monetary (demand), productivity (real), and real oil price (supply) shocks. Despite the absence of a non-oil traded sector in this primary-commodity economy, the welfare analysis suggests that flexible exchange rate regimes can reduce external shocks and consumption volatility given certain caveats about pricing-schemes. The analysis also suggests that a basket peg is more welfare-improving than a unilateral peg, as higher volatility of the anchor currency reduces consumer welfare.

1. Introduction

Pegging to the US dollar or to a basket dominated by the US dollar has a long track record in many small oil-exporters, largely with the aim of stabilizing oil revenues and maintaining central bank creditability.[1] While a number of small oil-exporters have realized these expected benefits over the last three decades (Squalli, 2011), recent developments in the world economy have generated debates of whether oil-exporting countries should move to a more flexible exchange rate regime. One important development is the chronic deprecation of the US dollar vis-à-vis other major currencies coupled with increasing nominal exchange rate volatility. Such an outcome leaves the pegging country with prolonged misalignments in its real exchange rate and with inflationary pressures (Coudert et al., 2011; Yousefi and Wirjanto, 2003). Another important development is the shift in the direction of trade of oil-exporters away from the US and more towards the Euro area, East Asia, China, and Japan and the increasing countercyclicality of oil-exporters with the US business cycle (Habib and Stráský, 2008; Setser, 2007).[2]

In view of the above developments, this paper examines the optimal choice of exchange rate regimes for a small oil-exporter using an extended New Keynesian Small Open Economy model. By virtue of its micro-based structure, the New Keynesian Small Open Economy model allows for a wider set of assumptions pertaining to types and persistence of stochastic shocks, price-settings, alternative monetary policy rules and exchange rate regime choices.[3] With respect to shocks, the analysis in this paper is based on three types of stochastic shocks: monetary, productivity, and real oil price shocks. The evaluation of alternative exchange regimes is also carried for different assumptions on price-settings, allowing for both producer currency pricing and local currency pricing.

The paper makes a number of valuable contributions to the literature. First, by focusing on primary-commodity economies, the paper introduces the structure of the economy and primary-commodities into the monetary model of optimal exchange rate regime choice. The voluminous New Open Economy literature on optimal monetary policy seems to focus on certain assumptions about nominal rigidities, price-settings (export-invoicing), and some market imperfections (e.g. monopolistic competition), with less attention to analyze the different structures of economies (e.g. industrial versus primary-commodity production systems of economies).[4] The few papers

* Tel.: +968 92833012; fax: +968 24414043.
E-mail address: asalabri@squ.edu.om.

[1] As of 2010, of the 24 countries where oil exports represent at least 50% of total exports, 14 of them pegged their currency to the US dollar, 5 pegged to the Euro, and 6 pegged to a basket of currencies (IMF, 2010).

[2] Setser (2007) shows that importing the monetary policy of the US was often inconsistent with the trend in oil prices and the business cycle in oil exporting countries.

[3] The novel contribution of Obstfeld and Rogoff (1995) provided the basis for the micro-based "New Open Economy model". For a review of the important contributions in the New Open Economy literature see Lane (2001) and Tovar (2008).

[4] See for example, Adolfson et al. (2008), Corsetti and Pesenti (2005), Devereux and Engel (1998, 2003), Galí and Monacelli (2005), among others.

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that have incorporated crude-oil market into optimal monetary policy choice have mainly focused on oil importers.[5,6]

Second, while the literature on optimal monetary policy uses the standard two-country New Keynesian Small Open Economy model, this paper extends the model to three countries, a small home country and two large foreign countries. The home country is an oil-exporter and the two foreign countries are net oil-importers. The need to include a second foreign country is motivated as follows. If we think of the first foreign country as the United States, then the second foreign country (say rest of the world or rest of the OECD countries for approximation) is needed to incorporate the decline in the US trade share with many small oil-exporters. For example, the economies of many oil-exporters are becoming more integrated with the emerging Asian economies, (Habib and Stráský, 2008; Setser, 2007). In addition, a second foreign country is added to model the impact on the home country's welfare of swings of the US dollar vis-à-vis major world currencies. Also, by incorporating two foreign countries, we analyze the different factors that need to be considered in deriving the optimal composition of a basket peg.

Third, in contrast to previous studies which mainly focused on an objective function consisting of output and inflation as a means to evaluate alternative exchange rate regimes, this paper evaluates the optimal exchange rate regime for a small oil-exporter using consumer welfare as the criterion.[7] The welfare criterion, consisting of the mean and the variance of consumption, is derived within a dynamic general equilibrium with alternative price-settings.

The analysis reveals that the optimal exchange rate regime for an oil-exporting country depends on pricing-schemes of its imports as well as the response of its trading-partners to international oil price shocks. Under both pricing-schemes, producer currency pricing and local currency pricing, the welfare of home agents is higher with flexible exchange regimes when the central bank in the home country (the oil-exporting country) is able to predict both the shocks and the response of the foreign central banks to these shocks. Despite this theoretical support, the implementation of a flexible exchange rate regime will entail substantial and prolonged reforms to the current financial systems and institutional structures in these countries.[8] In view of this practical obstacle and assuming a passive monetary reaction by the home central bank, the analysis shows that a flexible exchange rate regime can still improve the welfare of home agents provided that foreign producers set their prices in local currency (i.e., incomplete pass-through from nominal exchange rates to local prices). In choosing among fixed exchange rate regimes, the analysis shows that a basket peg is more welfare-improving than a unilateral peg to a single currency. This is particularly the case if the oil-exporting country pegs its currency to the currency in which oil price is denominated and the anchor currency exhibits higher volatility.

The rest of the paper is organized as follows. Section 2 develops the foundations of the model. Section 3 presents the solution of the model under different pricing assumptions. Section 4 discusses the comparative welfare outcomes under fixed and flexible exchange rate regimes. Section 5 concludes.

2. The model

There are three countries: the home country (H) and two foreign countries (F1) and (F2), where the home country is assumed to be small and the two foreign countries are assumed to be large.[9] There are three sectors: traded, non-traded, and crude-oil. The home country produces two goods: a local non-traded good and a primary-commodity, crude-oil. It exports crude-oil only and consumes the local non-traded good and the traded good which is imported from the two foreign countries. The home country is small so that it is a price taker in both the crude-oil market and the traded good market. Each of the two foreign countries produces two goods, a traded good, which is consumed by the three countries, and a local non-traded good. The two foreign countries import part of their oil consumption from the home country. The assumption is that the three countries are populated by a continuum of monopolistic producers, indexed by $i \in [0,1]$ in the home country, and by $i^{F1} \in [0,1]$ and $i^{F2} \in [0,1]$ in foreign country one and foreign country two respectively. The representative home agent produces a non-traded good z' only, whereas a representative foreign agent produces a traded good z and a non-traded good z'. Thus, the varieties of traded goods and non-traded goods are also defined as a continuum of differentiated goods indexed by $z \in [0,1]$ and $z' \in [0,1]$ respectively.

2.1. Households

We assume that households in the three countries have identical preferences. They derive utility from consumption of the traded and non-traded goods, from holding real money balances (liquidity services), and from leisure (disutility of labor). Each country has an infinitely lived representative household with identical preferences. The lifetime utility of a typical home agent is defined as

$$U_0 = E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\rho}}{1-\rho} + \chi \ln\left(\frac{M_t}{P_t}\right) - L_t \right] \tag{1}$$

where E_0 is the expectation operator given the information available at period 0. β is the subjective discount factor ($0 < \beta < 1$). C_t is the composite consumption index, defined below, and ρ is the inverse of the inter-temporal elasticity of substitution of consumption ($\rho > 0$). χ is the weight of real money balances in the agent's utility. M_t denotes the nominal money stock that the individual acquires at the beginning of period t and then holds through the end of the period. P_t is the consumption price index which is defined below. L_t is the hours of labor. The real consumption index for the home agent is

$$C_t = \frac{C_{T,t}^{\gamma} C_{N,t}^{1-\gamma}}{\gamma^{\gamma}(1-\gamma)^{1-\gamma}} \tag{2}$$

where $C_{T,t}$ and $C_{N,t}$ denote the home agent's consumption index of traded goods and non-traded goods respectively. γ is the proportion of traded goods in the home agent's consumption ($0 < \gamma < 1$). The consumption index of traded goods is defined as

$$C_{T,t} = \frac{\left(C_{T,F1,t}\right)^{\eta}\left(C_{T,F2,t}\right)^{1-\eta}}{\eta^{\eta}(1-\eta)^{\eta}} \tag{3}$$

$C_{T,F1,t}$ and $C_{T,F2,t}$ are the consumption of the home agent of the traded goods produced in foreign country one and foreign country two respectively. η is the proportion of traded goods imported from foreign country one ($0 < \eta < 1$). We assume that the elasticity of substitution between the traded and the non-traded goods and the elasticity of substitution between the traded goods of foreign country one and foreign country two are both unity. The home agent's consumption indexes of traded goods, $C_{T,F1,t}$ and $C_{T,F2,t}$, and local non-traded goods, $C_{N,t}$, are

[5] See for example, Kormilitsina (2011).

[6] Two studies that have used other theoretical models to examine the optimal exchange rate regime for a small oil-exporter are Taş and Togay (2010) using a model of asymmetric information and dynamic learning in the spirit of Svensson and Woodford (2004), and Squalli (2011) using a general central bank loss function in the spirit of Berger et al. (2001).

[7] See footnote 6.

[8] To go around this practical obstacle and at the same time approximate a floating exchange rate regime, a recent strand has suggested pegging to a basket of currencies that include also the price of oil, Frankel (2005) and Setser (2007).

[9] The motivation for a second foreign country is discussed in the introduction.