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Optimal monetary policy regime for oil producing developing economies: Implications for post-war Iraq ☆

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ABSTRACT

This paper theoretically investigates optimal monetary policy regime for oil producing developing countries. We analyze credibility and reputation of the Central Bank and macroeconomic dynamics under alternative monetary policy regimes. We construct a detailed and realistic model that can be used to analyze macroecomic structure and expectation dynamics of an oil producing open economy. We take into account the asymmetric information between the public and the central bank and theoretically investigate how this asymmetric information impacts the real economy and the credibility of the central bank. The simulation results indicate that central bank achieves higher credibility and lower inflation under dollarization and higher output levels under currency board regime. The model constructed in this paper has many policy implications for oil producing open economies. Using the implications of the model, we make monetary policy regime recommendations for post-war Iraq.

1. Introduction

Determining optimal monetary policy for oil producing developing economies is non-trivial since many external factors like oil prices and exchange rate should be taken into account and there is significant amount of asymmetric information between the Central Bank (CB) and the public. This paper theoretically investigates the following question: what is the optimal monetary policy regime for an oil producing developing economy considering the interplay of external factors, asymmetric information and expectational dynamics? We analyze and compare the theoretical implications of three alternative monetary policy regimes on inflation, output growth, expectations, credibility and reputation of the CB. As in Hanke and Sekerke (2003), we investigate the following monetary policy regime alternatives: independent central bank (discretionary and inflation targeting), currency board and dollarization. While theoretically investigating these alternatives, we take into account the following conditions: 1) Impact of exchange rate on the economy (through oil revenues) 2) lack of credibility of the CB 3) importance of oil in the economy 4) asymmetric information and expectation dynamics.

We extend the control-theoretic model of Svensson and Woodford (2004) and Faust and Svensson (2001) with oil price and exchange rate dynamics. Also, we incorporate asymmetric information and hierarchical information structure as in Townsend (1983) into the model to investigate expectation dynamics of the CB and the private sector. Under asymmetric information, we consider the case that the CB has private information about future inflation, output and its inflation target.[1] We solve and implement this model to investigate optimal monetary policy regime for the oil producing economy. We analyze macroeconomic dynamics, credibility and reputation of the CB under alternative monetary policy regimes. We construct a detailed and realistic model that can be used to analyze the macroeconomic structure and expectation dynamics of an oil producing open economy.

There are five main results of this paper. First, theoretically we show that actions of the CB (interest rate and inflation target) significantly affect expectations of the public. The asymmetric information between the CB and the public partly causes that effect. Second, credibility of the CB under dollarization regime is significantly

☆ The matlab codes for the Kalman filtering algorithm and simulations are available from the corresponding author's website.

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[1] Under inflation targeting the inflation target of the CB becomes public information.

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higher than credibility under alternative regimes.[2] Third, under currency board regime the reputation of the CB is higher in the sense that the public expects the CB to accommodate higher output growth. Fourth, inflation is significantly lower when the CB adopts dollarization. Finally, output is higher under the currency board regime while the dollarization regime has the lowest level of output. This is caused by the fact that under dollarization the central bank does not have any power to impact the exchange rate. The only aim of the foreign central bank is to achieve lower inflation at its home country. Under the currency board regime the central bank targets the exchange rate and higher levels of oil revenues can be achieved. As a result, this paper has many important policy implications for oil producing developing economies. The theoretical results of the paper indicate that the CB should adopt dollarization if its main objective is to maintain higher credibility and lower inflation. But the currency board regime achieves higher levels of output through maintaining a certain level of exchange rate. The results of this paper make significant contributions to the ongoing debate about optimal monetary policy regime for post-war Iraq.

There are several studies about optimal monetary policy regimes for oil producing countries. Hanke and Sekerke (2003) and Roubini and Setser (2003) analyze and make proposals about optimal monetary policy regime for post-war Iraq. All of these studies are empirical and do not conduct any theoretical investigations. Thus, this study is making several important contributions to the literature. First of all, this study provides an extensive theoretical study about optimal monetary policy for oil producing developing economies like post-war Iraq. Second, this study contributes to the discussion of pegging the currency to export price. We construct a model of signaling and learning as in Townsend (1983) to investigate the changes in the expectations of the public under currency board (peg the currency). This forward-looking model allows us to analyze changes in expected inflation and output under currency board regime. Frankel and Saiki (2002), Frankel (2005) and Setser (2007) indicate that pegging to export price might be a better option and is robust to terms of trade shocks. Frankel (2003) analyzes the case of Iraq and propose that Iraq should include oil to the basket of currencies to which the dinar is to be pegged. All of these studies are empirical. We model the arguments in these studies and theoretically investigate the implications of previous empirical studies. Third, this study theoretically investigates the credibility of the CB and expectations of the public under alternative monetary policy regimes. Finally, theoretical analysis is provided to the ongoing debate about optimal monetary policy regime for post-war Iraq.

The rest of the paper is organized as follows: Section 2 explains the fundamental elements of the model of asymmetric information and learning. Section 3 solves the model to determine the expectation dynamics under alternative monetary policy regimes. Section 4 investigates reputation and credibility of the central bank under alternative monetary policy regimes. Sections 5 and 6 explain the calibration of the model and conduct simulations to present the findings of the model. Section 7 makes policy recommendations for post-war Iraq using the theoretical findings of the paper and Section 8 concludes.

2. The model of learning and expectation dynamics

This section constructs an extensive model to analyze the expectation dynamics of the CB and the public. The model incorporates the macroeconomic fundamentals of an oil producing open economy and asymmetric information between the CB and public. By introducing asymmetric information into our model, we provide an additional transmission mechanism for the CB through which it can impact the expectations of the public.

[2] This is caused by the fact the under dollarization, the CB adopts the credibility of the developed economy.

2.1. Macroeconomic dynamics of an oil producing open economy

The generic economic dynamics of this paper is an extended and modified version of the models used in Svensson and Woodford (2004)[3] and Aoki (2000).[4]

As in Svensson and Woodford (2004), inflation and output are determined by a VAR(1) process.[5] We consider an economy where output is dominated by production of oil as mentioned in Bayoumi and Eichengreen (1994).

In those countries, a change in relative prices is likely to show up as both an aggregate supply disturbance and an aggregate demand disturbance. A rise in oil prices is likely to affect Indonesia, for example, both by raising the underlying level of output through the increased incentive to produce oil and by boosting aggregate demand through the favorable impact of the terms of trade on real incomes.

Thus, to take into account the changes of oil prices on the economy and determine optimal monetary policy regime for an oil producing economy, we define an AR(1) equation for the oil prices and model the responses of inflation and output to the changes in oil prices.

Rautava (2004) indicates that "over the long run, a 10% permanent increase (decrease) in international oil prices is associated with a 2.2% growth (decline) in the level of Russian GDP. In addition, a 10% real appreciation (depreciation) of the ruble is associated with a 2.7% decrease (increase) in the level of GDP in the long run." Thus, oil is an incremental component of an oil producing country. We included oil into the generic economic dynamics of the model (inflation and output equations) to introduce the impact of oil into the economy.

Since we are investigating an open economy, exchange rate plays a significant role in our model. As explained in Gagnon and Ihrig (2004) exchange rate effects both inflation (exchange rate pass-through) and output. Exchange rate is added into the economy following the theoretical model of Gagnon and Ihrig (2004). They provide both theoretical and empirical evidence about the significant impact of the exchange rate on inflation and output.

The generic economic dynamics of the economy are as the following:[6]

$$\pi_{t+1} = \beta_{11}\pi_t + \beta_{12}x_t + \beta_{13}E\left(\pi_t|\Omega_t^{PRI}\right) + \beta_{14}E\left(x_t|\Omega_t^{PRI}\right) + \beta_{15}Oil\,P_t + \beta_{17}ex_t + \varepsilon_{t+1}^{\pi} \quad (1)$$

$$x_{t+1} = \beta_{21}\pi_t + \beta_{22}x_t + \beta_{23}E\left(\pi_t|\Omega_t^{PRI}\right) + \beta_{24}E\left(x_t|\Omega_t^{PRI}\right) + \beta_{25}\mathrm{Oil\ P}_t + \beta_{26}r_t + \beta_{27}\mathrm{ex}_t + \varepsilon_{t+1}^{x} \quad (2)$$

$$Oil\,P_{t+1} = \beta_{35}Oil\,P_t + \varepsilon_{t+1}^{OilP} \quad (3)$$

$$ex_{t+1} = \beta_{46}r_t + \beta_{47}ex_t + \varepsilon_{t+1}^{ex} \quad (4)$$

[3] There are four main differences of the model in this paper and the model in Svensson and Woodford (2004) (SW). First, the Central Bank possesses private information in this study not the private sector. Second, asymmetric information is investigated in the context of credibility, reputation and optimal monetary policy regime for an oil producing developing economy. Third, the source of information asymmetry is modeled in detail. (This is required to investigate the hierarchical information structure and the learning dynamics as shown in Townsend (1983).) Fourth, the effects of asymmetric information and learning on the expectations of the public are derived and described in detail. (SW assumes a functional form for the expectations.)

[4] Faust and Svensson (2001) and Taş (2009) also implement similar modelling specifications and solutions.

[5] This forward-looking structure has been used extensively in the literature and captures both contemporaneous and dynamic effects.

[6] The model can easily be updated to include private sector expectation of inflation at time $t+1$, $E(\pi_{t+1}|\Omega_t^{PRI})$instead of current inflation expectation, $E(\pi_t|\Omega_t^{PRI})$ in the current model. This will not change the results since private sector expectations affect current inflation in both cases. This timing is chosen to avoid the "curse of dimensionality". The usage of $t+1$ expectations requires addition of higher dimensions of some variables to the state vector which exponentially increases the size of the Kalman updating equation and other vectors. Thus, Townsend (1983) uses time t expectations also. As mentioned above, this specification does not change the results but makes the analysis tractable and simpler.