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Cyclical fiscal rules for oil-exporting countries☆

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ABSTRACT

Budget-balance tax-gap rules are preferred to other fiscal policy rules to stabilize the macroeconomic volatility and welfare in oil-exporting countries. The output-inflation trade-off is of particular concern for oil exporters relative to non-oil commodity exporters due to the pass through of oil prices into headline inflation which warrants fiscal reaction to crude oil revenue. This result is robust to several instruments satisfying the rule but with reduced efficiency for those instruments that impact potential output such as government investment and capital taxes. These rules are desirable for fixed exchange rate regimes but are unable to achieve the same degree of stability as when coordinated with inflation-targeting monetary policy. Even under optimal inflation-targeting regimes, the adoption of budget-balance tax-gap rules can produce reductions in macroeconomic volatility and welfare gains.

1. Introduction

Commodity exporters often adopt procyclical fiscal policies that exacerbate macroeconomic volatility (Gavin and Perotti, 1997; Kaminsky et al., 2004; Talvi and Vegh, 2005). Increasingly, empirical evidence suggests that the mismanagement of the commodity revenues may be a primary culprit behind the volatility in commodity-exporting countries (Adler and Sosa, 2014; Frankel et al., 2013). Husain et al. (2008) find that oil price changes affect the economic cycle of oil exporters primarily through their impact on fiscal policy.[1] However, stark differences exist across countries. For example, Chile, with its explicit fiscal framework, has successfully reduced macroeconomic volatility to commodity price fluctuations relative to other Latin American economies (Medina, 2010). This evidence has brought calls for the adoption of formal fiscal frameworks to manage the commodity revenue volatility (Kumhof and Laxton, 2013; IMF, 2012; Frankel et al., 2013).

Although fiscal rules for oil-exporting economies (i.e. Norway) include explicit provisions to respond to cyclical conditions, there are currently no studies examining the performance and design of alternative fiscal rules for oil-exporting countries. Nearly all of the current studies on the short-run management of revenues via fiscal policy rules focus on the case of managing copper revenues in models generally calibrated for Chile (Kumhof and Laxton, 2013; Bi and Kumhof, 2011; Garcia et al., 2011). It is not known whether the results for optimal fiscal policy for non-oil commodity exporters generalize to oil exporters.

For example, the aforementioned studies assume that the commodity is not consumed in the consumption basket. This unique feature of oil is known to have important consequences for consumption dynamics (Edelstein and Kilian, 2009; Hamilton, 2008) and the inflation-output trade-off for optimal monetary policy (Natal, 2012). In particular, household consumption of durables is observed to be responsive to real oil prices (Edelstein and Kilian, 2009). The failure to incorporate oil in consumption in formal models can help explain why output in these models are not found to be very responsive to real oil price changes, see for example the discussion of Aguiar-Conraria and Wen (2007).

Moreover, previous studies have assumed that demand driven price movements are commodity specific (Kumhof and Laxton, 2013; Bi and Kumhof, 2011) or commodity prices are exogenous (Garcia et al., 2011). Evidence suggests that oil price movements are partially driven by broad-based demand forces (Kilian, 2009; Kilian and Murphy, 2014; Juvenal and Petrella, 2015). A global model is necessary to distinguish between sources of oil price movements and capture these transmission channels via exchange rates, the non-oil balance, and capital accounts (Kilian et al., 2009; Bodenstein et al., 2012).

This paper evaluates alternative forms of fiscal policy rules for both macroeconomic and welfare stabilization for oil-exporting economies. The global market for crude oil is explicitly modeled in global dynamic stochastic general equilibrium (DSGE) model with two-regions: a small open oil exporter (SOE) and the rest of the world (ROW). The model includes endogenous demand, supply, and trade of oil and non-oil goods. Crude oil as an input into intermediate production and the

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[1] Macroeconomic stabilization in the face of commodity price volatility is one of policy priorities for commodity-exporting developing and emerging economies. Others include resource exhaustibility and intergenerational equity (see Baunsgaard et al. (2012) and Collier et al. (2010) among others for a discussion of these issues).

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final consumption basket. This allows for a realistic transmission to distinguish between oil supply and broad-based demand driven forces on the oil price for the trade balance and the output-inflation trade-off. Moreover, the model integrates both detailed formalizations of fiscal and monetary policy which is exploited to examine fiscal and monetary policy coordination.

Budget-balance rules with countercyclical responses to both the non-oil tax gaps and oil royalty gaps are found to be the preferable to alternative forms the fiscal policy rules to stabilize the macroeconomic volatility and welfare of oil-exporting countries. These rules clearly outperform fiscal rules that only target the debt-gap and are slightly more advantageous to fiscal rules that only respond to the output gap. Macroeconomic stabilization is found to require more aggressive fiscal reaction relative to welfare stabilization. The desirability of targeting of the oil-royalties gap is due to the high correlation of the oil-royalties gap with the pass-through of oil prices into headline inflation. This finding is unique to this study as previous studies have abstracted from the direct consumption of petroleum products (Kumhof and Laxton, 2013; Bi and Kumhof, 2011; Garcia et al., 2011; Montoro, 2012).

In addition, the optimal design of fiscal rules differs for externally driven demand and supply price movement due to each shocks unique impact on the non-oil balance and the corresponding inflation-output trade-off. The results are robust to alternative instruments satisfying the fiscal rule, but with reduced efficiency from instruments that impact potential output such as government investment and capital taxes. Moreover, budget-balance rules with countercyclical responses to both the non-oil tax gaps and oil royalty gaps are found to be robust across a diversified set of oil-exporters, including advanced countries such as Canada and Australia and OPEC oil specialists such as Saudi Arabia.

Jointly optimal fiscal and monetary policy regimes are examined. The use of fiscal policy rules is especially desirable for supply driven price movements as they show success in being able to tackle the inflation-output trade-off rife in oil-exporting countries. Optimal headline inflation targeting outperforms optimal core inflation targeting regimes under a structural surplus rule. However, when both fiscal and monetary rules are jointly optimized, both headline and core inflation targeting can roughly achieve the same degree of macroeconomic stabilization. Even under optimal monetary policy, adopting a fiscal rule can produce large reductions in macroeconomic volatility. For a fixed exchange rate regime, macroeconomic volatility is three times higher under the optimal fiscal rule compared to an optimized rule under an inflation targeting regime.

The paper is structured as follows: Section 2 outlines the structure and calibration of the model. Section 3 describes the results in three parts. The first part looks at the efficient design of fiscal policy rules for a benchmark oil exporter in the face of external oil-price shocks. The second part examines how the design of such rules differs given alternative structural characteristics of the oil exporter. Finally, joint coordination of fiscal and the monetary policy framework are considered. The final section concludes.

2. Model and calibration

This paper uses an open-economy New-Keynesian DSGE model similar to Christiano et al. (2005) and Smets and Wouters (2007). The model includes a detailed fiscal sector with non-Ricardian features to specifically examine the interaction of fiscal and monetary policy propagation mechanisms. In particular, the model is an extension of the Global Integrated Monetary and Fiscal model (GIMF) which has been widely used at the International Monetary Fund. The theoretical micro-foundations of the model are extensively described in Kumhof et al. (2010), which serves as a detailed technical appendix to this paper. A detailed examination of the properties of the GIMF model can be found in Anderson et al. (2013). Since the models structure apart from the oil sector specification, policy rules, country structure, and calibration, is identical to that described in Kumhof et al. (2010), this section provides an overview of the model structure with focus on the relevant aspects of the oil sector and fiscal policy.

The model is micro-founded with optimizing behavior of both households and firms. There is intertemporal stock-flow accounting in the level of government debt, net foreign assets, human wealth, and capital stocks. Keynesian properties are derived from frictions in the form of real and nominal adjustment costs, and the presence of both liquidity-constrained (LIQ) households. These Keynesian features provide non-neutrality in both spending- and revenue-based fiscal measures. They also capture the interaction of fiscal and monetary policies, which makes the model particularly suitable to jointly analyze fiscal and monetary policy.

Households pay distortionary taxes on labor income and consumption spending, and a non-distortionary lump-sum tax. LIQ households are perfectly borrowing constrained, consume all of their income in every period, and have no access to financial markets to smooth consumption. Overlapping-generation households (OLG), as in Blanchard (1985), are unconstrained and smooth their consumption. The presence of OLG households means that public debt is counted as net wealth since some of the associated tax liabilities will fall beyond their planning horizon. Thus, a decrease in government debt today represents a decrease in OLG household wealth. Real returns are equilibrated globally in the global savings and investment market by the global real interest rate, and current accounts are endogenous. The SOE can borrow and save at the global real interest rate. It is assumed that the sovereign risk premium is not responsive to the level of net foreign assets.

The multi-country structure of GIMF captures the effects of international trade spillovers. Bilateral trade flows of intermediate goods and final consumption and investment goods are modeled explicitly along with the relative prices between each region. Asset markets are incomplete, and the only assets traded internationally are nominal, non-contingent one-period bonds denominated in the rest of the world currency. Government debt is domestically owned and can crowd out the domestic holdings of net foreign assets. Firms are owned domestically and pay lump-sum dividends on a share of profits.

Production in GIMF is multi-layered. Capital, labor, and oil produce intermediate tradable and non-tradable goods. Capital is supplied by entrepreneurs with a procyclical financial accelerator à la Bernanke et al. (1999). This implies there are importance balance sheet effects from firm default as well as Fisher deflation effects on debt since bonds are defined in nominal terms. The financial accelerator helps to match the co-movement of consumption and investment both domestically and across economies (see for example, Beaton et al., 2014; Anderson et al., 2013). Firms have finite planning horizons in accordance with the preferences of their owners, the OLG households. Firms pay capital income taxes to governments and wages and dividends to households. Physical capital is sector-specific, but labor is mobile across sectors. Neither labor nor physical capital is mobile across regions, although trade in investment goods eases the restrictiveness of this assumption.

Domestic and imported intermediate goods are combined to produce consumption and investment goods. A share of oil is consumed directly in the household's consumption basket. Thus, an increase in the price of oil drives up the cost of production as well as the cost of the final consumption basket. The demand for oil, in production as well as in the consumption basket, is highly inelastic.

The oil sector is characterized by a low price elasticity of supply. For analytical tractability oil supply is modeled by flow endowments, X_t^{exog}, which grows at growth rate, $T_t n^t$, and can be stored and drawn from a stockpile, O_t, in each period for each country. The cost of storage is given by:

$$G_t^O = \frac{\phi_O}{2(T_t n^t)} O_t^2 - \kappa_O O_t, \tag{1}$$