Economic Modelling xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econmod

Government spending shocks and the real exchange rate in China: Evidence from a sign-restricted VAR model☆

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ARTICLE INFO

JEL classification:
E62
F31
F41

Keywords:
Government spending shocks
Real exchange rate
VAR
Sign restriction

ABSTRACT

This study analyzes the impact of government spending shocks on the real exchange rate in China over the period 1995Q1 - 2015Q2 using a structural VAR framework. To achieve identification, we derive robust restrictions on the sign of several impulse responses from an open economy general equilibrium model calibrated to China's economy. The results show that expansionary government consumption shocks and government investment shocks both lead to real exchange rate appreciation, which is different from the empirical evidence for some developed countries but is in line with the prediction of the conventional Mundell-Fleming model. We also find that both positive government consumption and investment shocks lead to a fall in the trade balance jointly with higher government deficits, which generate twin deficits.

1. Introduction

This paper analyzes the impact of government spending shocks on China's real exchange rate. Although, in the theoretical literature, not only the conventional Mundell-Fleming model but also a wide set of real business cycle and new-Keynesian models under standard calibrations predict that a government spending expansion will lead to a real exchange rate appreciation, recent empirical research has provided mixed results. For example, using quarterly data from countries such as the United States, the United Kingdom, Canada and Australia, Kim and Roubini (2008), Monacelli and Perotti (2010), Enders et al. (2011) and Ravn (2012) all document that positive shocks to government spending cause real exchange rate depreciation. By contrast, Beetsma et al. (2008) employ annual data for European countries and argue that an expansionary government spending shock yields a real exchange rate appreciation.

Thus far, almost all studies into the effects of fiscal policy shocks on the real exchange rate are related to developed countries with little attention paid to emerging economies, especially China. As monetary policy is constrained by a rapid increase in leverage and renminbi's exchange rate in recent years, China have taken a more proactive stance with fiscal policies to keep economic growth within a reasonable range. Growth in public infrastructure investment has strengthened, and a series of tax cuts is used to stimulate corporate and household demand. The budget deficit grows to more than 3% of gross domestic product, from around 2.3% in 2015, to support the fiscal expansion. Given the increasing importance of fiscal instruments at the policy level in China, it is crucial to understand the impact of fiscal shocks on the real exchange rate, as this heavily influences China's competitiveness in the international market.

In this paper, we study the impact of government spending shocks on the real exchange rate in China over the period 1995Q1 - 2015Q2 using a structural vector autoregressive (VAR) framework. The VAR system includes quarterly data of government spending, government budget balance, output, consumption, investment, net exports, inflation, the short-term interest rate and the real exchange rate measured by the real effective exchange rate of the Bank for International Settlements. Different from existing studies identifying exogenous structural innovations through either short-run or long-run restrictions, we follow Uhlig (2005) and Enders et al. (2011), restricting the sign of the responses to the shocks we seek to identify. Compared to other identification schemes, the sign-restriction method does not need any arbitrary timing assumptions, which may be difficult to justify on theoretical grounds, and it is well suited to address the anticipated effects of fiscal policies, which is important as shown in Ramey (2011). We derive robust restrictions on the sign of several impulse responses

☆ This research is supported by National Natural Science Foundation of China (71403227). We would like to thank the anonymous referee and participants at the 2016 Taipei International Conference on Growth, Trade and Dynamics and the International Conference on Applied Financial Economics held at Shanghai University for very useful comments and discussions.

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http://dx.doi.org/10.1016/j.econmod.2017.03.027
Received 30 July 2016; Received in revised form 2 March 2017; Accepted 28 March 2017

from an open economy general equilibrium model calibrated to China's economy as in Enders et al. (2011). Since the impact of a fiscal shock on the real exchange rate is likely to differ across government spending categories, we consider government consumption and government investment separately in our model, which is different from Enders et al. (2011). Under a sufficiently wide range of plausible parameterizations, our model shows robust predictions for the behavior of several macroeconomic variables, but does not deliver clear-cut predictions for the sign of the real exchange rate response to government consumption and investment shocks. So, to identify these fiscal shocks we restrict the responses of several variables with robust predictions, but leave the response of the exchange rate agnostic.

We find that both expansionary government consumption and investment shocks appreciate the real exchange rate in China; therefore, there is no puzzle concerning the response of the real exchange rate to government spending shocks as shown in earlier studies of some developed countries. These results are robust with respect to several variations of our baseline specification, such as using different sign-restriction sets, accounting for monetary policy shocks and anticipation of innovations in government spending. In addition, we find that both positive government consumption and investment shocks bring about a fall in trade balance jointly with higher government deficits, which shows that fiscal stimulus tends to generate twin deficits.

To investigate the mechanism for real exchange rate appreciation, our empirical results show that nominal interest rates tend to increase after positive government spending shocks, especially for government consumption shocks, which can cause a nominal (and real) appreciation and, in turn, a deterioration of the trade balance as illustrated in the conventional Mundell-Fleming model. We further investigate the effect of government spending shocks on long-run interest rates since theoretical models suggest that the real exchange rate can be expressed as long run interest rates plus some additional terms. Forni and Gambetti (2016) show that an expansionary government spending shock decreases long-run nominal interest rates and depreciates real exchange rates in the United States. However, we find that both positive government consumption and investment shocks decrease long-run nominal interest rates in China and cause an appreciation of real exchange rates. This implies that the transmission channels for real exchange rate appreciation in China are different from those suggested by existing studies on developed countries, such as Corsetti et al. (2012). Additionally, private consumption tends to increase when there is an increase in government spending although this crowd-in effect is not significant for government consumption shocks. These findings do not support mechanisms where expansionary government spending drives private consumption down through the wealth effect and the international risk-sharing condition implies that the real exchange rate appreciates.

The remainder of the paper is organized as follows. Section 2 describes a small open economy model. Section 3 derives sign restrictions based on this model applying a robust calibration strategy. Section 4 presents the structural VAR approach and discusses the data and our results. In this section, we also provide validity and robustness checks. Section 5 concludes.

2. A small open economy model

The model used to derive our sign restrictions is a standard open economy new-Keynesian dynamic stochastic general equilibrium (DSGE) model simplified from Adolfson et al. (2007). For the notations, domestic variables have no superscript while variables with an asterisk (*) indicate the corresponding world variables. Upper case letters denote nominal variables while lower case letters are real variables. A variable without a time subscript but with a bar (−) on it denotes its steady-state value.

2.1. Households

The representative household chooses consumption goods c_t, and working hours h_t to maximize its lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{[c_t^{\mu}(1-h_t)^{1-\mu}]^{1-\sigma}}{1-\sigma} \quad 0<\mu<1 \tag{1}$$

subject to the budget constraint

$$P_t(c_t + x_t) + B_t + S_t B_t^* = R_{t-1} B_{t-1} + S_t R_{t-1}^* B_{t-1}^* + (1-\tau_t)(W_t h_t + R_t^k k_{t-1} + D_t) \tag{2}$$

and the capital accumulation constraint

$$k_t = (1-\delta)k_{t-1} + \left[1 - \Gamma\left(\frac{x_t}{x_{t-1}}\right)\right] x_t \tag{3}$$

where β denotes the discount rate, and μ and σ jointly determine the Frisch elasticity of labor supply and the intertemporal elasticity of substitution. The household has a nominal income flow consisting of five components: wage income ($W_t h_t$), capital rental income ($R_t^k k_{t-1}$), aggregate profits paid by intermediate monopolistic firms (D_t), principal plus interest of domestic bonds ($R_{t-1} B_{t-1}$) and of foreign bonds ($S_t R_{t-1}^* B_{t-1}^*$). Foreign bonds are denominated in foreign currency units and therefore are converted into home currency units by multiplying by a nominal exchange rate, S_t, which is directly quoted. The real exchange rate, s_t, is defined by $(S_t P_t^*)/P_t$ where P_t is the domestic price level. The household's income is allocated into consumption ($P_t c_t$), investment ($P_t x_t$), the acquisition of domestic and foreign bonds (B_t and $S_t B_t^*$, respectively), and tax payment ($\tau_t(W_t h_t + R_t^k k_{t-1} + D_t)$). As for the capital accumulation equation, there exists a capital adjustment cost $\Gamma\left(\frac{x_t}{x_{t-1}}\right)x_t$ as in Christiano et al. (2005) with $\Gamma(1) = \Gamma'(1) = 0$, $\Gamma''(1) = \kappa > 0$.

2.2. Firms

2.2.1. Intermediate goods firms

Domestic intermediate goods firm $j \in [0, 1]$ hires labour ($n_t(j)$), rents private capital ($k_{t-1}(j)$), utilizes government capital (k_{t-1}^g) and converts those inputs into outputs through the Cobb-Douglas production function: $y_t(j) = [k_{t-1}^g]^{\alpha_g} k_{t-1}^{\alpha}(j) n_t(j)^{1-\alpha}$. Due to the cost minimization problem, the real marginal cost is given by $mc_t = (1-\alpha)^{\alpha-1}\alpha^{-\alpha}[k_{t-1}^g]^{-\alpha_g}(r_t^k)^{\alpha} w_t^{1-\alpha}$.

Prices of intermediate goods are set in a staggered fashion as in Calvo (1983). In each period, every firm has an opportunity to adjust its price with probability $1-\xi$. Unlucky firms simply continue with their price rates of the previous period. When a firm has the opportunity to adjust its price, it sets the new price $\widetilde{P}_{h,t}$ to maximize its expected discounted future profit, or

$$\max_{\widetilde{P}_{h,t}} \mathbb{E}_t \sum_{k=0}^{\infty} (\xi\beta)^k \lambda_{t+k} \left[\left(\frac{\widetilde{P}_{h,t}}{P_{t+k}} - mc_{t+k}\right) y_{t|t+k}(i)\right]. \tag{4}$$

2.2.2. Final goods firms

Final goods firms are assumed to face perfectly competitive markets. They produce final goods ($y_{n,t}$) by purchasing a bundle of domestic intermediate goods ($y_{h,t}$) at price ($P_{h,t}$) and import a bundle of foreign intermediate goods ($y_{f,t}$) at price ($P_{f,t}$) (both prices are denominated in domestic currency) according to the CES production function:

$$y_{n,t} = \left[\omega^{\frac{1}{\eta}}(y_{h,t})^{\frac{\eta-1}{\eta}} + (1-\omega)^{\frac{1}{\eta}}(y_{f,t})^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{5}$$

where η is the elasticity of substitution between domestic and imported intermediate goods, and $\omega \in [0, 1]$ denotes the degree of home bias in