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Fiscal Policy, Consumption Home Bias and Macroeconomic Dynamics

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Abstract

In this paper we explore the dynamic adjustment process of fiscal expenditures shock on macroeconomic variables (such as: consumption, output, prices, exchange rates, terms of trade) and the role of consumption home bias. A New Open Economy Macroeconomics model with an imperfect competition setting and micro-foundation is used as the analytical framework. Through theoretical derivations and simulation analysis, we find that in the long run, increased government spending will cause domestic output, price and the exchange rate to rise, but crowd out domestic private consumption. The relationship between government spending and terms of trade are not clear and depends on the asymmetric consumption bias in two countries. In the short run, on the assumption that consumers of both countries have a bias in favor of consuming home-produced goods, the volatility in domestic consumption and output over the short run will be greater than that over the long run, thereby generating an phenomenon of overshooting. Without the above assumption, the volatility in domestic consumption and output over the short run will be smaller than that over the long run showing a undershooting phenomenon. In addition, fiscal expenditure will not affect price, exchange rates and terms of trade, and the relationship between interest rate and the government spending will be subject to asymmetric consumption bias.

Keywords: Fiscal policy, Consumption home bias, New Open Economy Macroeconomics

JEL Codes: E62, F41

1. Introduction

In the traditional Keynesian view, fiscal policy is an effective means to counter business cycle. In fact, when governmental role in economic regulation is highlighted, the operation of fiscal policy is also very positive. Various schools of thoughts have quite divided opinions about the

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effects of fiscal policy on output, consumption, interest rates and price.

In terms of public spending, Keynesian thought believes increased government spending will increase output and private investment, on the other hand, increased prices and interest rates will crowd out private sector investment which results in uncertain effects of private-sector investment. As for consumption of private sector, effects depend on size of the marginal propensity to consume and reaction to interest rate. The classical school believes fiscal policy only affects nominal variables and does not affect real variables. An Increase in government spending only cause price to rise. In addition, Neoclassical school emphasizes that temporary and permanent government spending have different effects on the macro economy. In addition, Supply-side economics prefer tax-cutting policy and believe it an incentive to increased amount of labor, increasing saving and investment, and can directly stimulate aggregate supply to increase reducing inflation and unemployment. The macroeconomic effects of fiscal policy on economic variables show great differences whether theoretical or empirical side. Besides, exchange rate is the relative price of domestic and foreign currencies which is charged with the important task of connecting domestic and international economics, regulating internal and external balance of the economy. Therefore, this paper explores effects of fiscal policy in a floating exchange rate system.

The initial development of analysis of open economy is Mundell-Fleming model (see Mundell, 1963; Fleming, 1962) and Dornbusch (1976) model which are derived from Keynesian theories. Although these early open economy models reveal and explain some of relationships among major economic variables, there is a common defect that is they lack micro-foundation. Lucas (1976) thinks that changes in macroeconomics variables can affect individual decisions in microeconomics, thereby causing changes in relationships among macroeconomic variables, resulting in bias in macro economy if the analysis lacks micro-foundation. Therefore, the birth of New Open Economy Macroeconomics (hereinafter referred to as NOEM) further opens a new stage of development of open macroeconomics. NOEM is a new-generation research method pertinent to open economy macroeconomics proposed by Obstfeld and Rogoff (1995). It has characteristics of micro-foundation and monopolistic competition market structure and is very suitable for analyzing impacts of exogenous shocks on macro economy. Therefore, this paper uses NOEM as basis for analysis.

There are four sections in this paper. Besides the introduction, the other sections are as follows: Section 2 convers a theoretical model, Section 3 includes the simulation analysis for exploring dynamic effects of fiscal expenditure shocks on macroeconomic variables as well as the role of consumption home bias plays, and section 4 are conclusions and recommendations.

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2. Literature Review

Theoretical and empirical literatures have inconsistent conclusions about effects of fiscal policy on economic activities, especially government expenditure shock on macroeconomic variables (such as private consumption, private investment, real wages, and employment). In theoretical literature, Real Business Cycle model proposed by Baxter and King (1993) assumed that consumer decision-making is subject to intertemporal budget constraints. When there is increased government spending financed with a fixed tax (lump-sum taxes), the present value of after-tax income will be reduced, resulting in a negative wealth effect that reduces consumption, and at a given wage level, labor supply will increase. In equilibrium, the real wages fall, employment and output increase. If the effect of employment continues, marginal productivity of capital will rise, resulting in increased investment (see Galí et al., 2007). In contrast, for traditional IS-LM model, its consumption is a function of disposable income rather than of lifetime earnings. Therefore, an increase in government spending will cause consumption to increase, and in the assumption that the money supply is fixed, nominal interest rates in the short-term will rise and private investment fall.

Moreover, studies about macroeconomic effects of fiscal policy concentrate on a closed economy (e.g. Barro, 1981; 1990, Futagami et al. 1993, Devereux and Love, 1995, Greiner, 1998, Greiner and Hanusch, 1998, Dasgupta, 1999, and Xie et al. 1999, etc.). Analysis of effects of fiscal policy in an open economy is relatively lacking. Until recently, with the rapid rise of NOEM such as Corsetti and Pesenti (2001); Ganelli (2003) and Pitterle and Steffen (2004a; 2004b), the studies on effects of fiscal policy now extend to open economic system. However, in the traditional NOEM model, exchange rate fluctuation is mainly caused by private consumption behavior. Therefore, in this paper we are interested to find out what will happen if we assume government behavior is included in consumer behavior and consumption home bias exist in both private and government purchasing behavior? So the purpose of this paper is to investigate the relationships among fiscal expenditure, consumption home bias and macroeconomic variables. Tervala (2008) analyzed the effects of fiscal policy under NOEM architecture, and it proved that the effect of government expenditure shock on welfare depend on the marginal rate of substitution of private and government consumption. However the paper ignores recent hot discussions about consumption home bias.

Although Obstfeld and Rogoff (2000) regards “home bias in consumption puzzle” as one of the six puzzles in international economics,[2] but under NOEM architecture, there is a lack of complete research on the role of asymmetry in consumption home bias and this paper seeks

[2] The six puzzles proposed by Obstfeld and Rogoff (2000) are consumption home bias puzzle, home bias in equity portfolios puzzle, purchasing power parity puzzle, exchange rate disconnect puzzle, the high investment-saving correlation puzzle, and the low international consumption correlation puzzle.

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a breakthrough. The so-called consumption home bias puzzle means consumers have a tendency to prefer domestic goods in the real world, but this phenomenon cannot be explained by researchers. Early studies of consumption home bias mostly concentrate on the causes of it such as trade costs (Obstfeld and Rogoff, 2000; Ried, 2009), country size and openness (Sutherland, 2005; De Paoli, 2009), non-traded goods (Stockman and Dellas, 1989; Pesenti and Van Wincoop, 2002) as well as trade in intermediate input factors (Hillberry and Hummels, 2002). More recent researches focus on effects of consumption home bias. For example, Pierdzioch (2004) analyzed the effects of monetary shock in different degree of consumption home bias and capital mobility. Hau (2002), Pitterle and Steffen (2004a; 2004b), Kollmann (2004), Sutherland (2005), Leith and Lewis (2006) and Cooke (2010) investigated the effect of consumption home bias on exchange rate fluctuations. De Paoli (2009) discusses consumption home bias and welfare effects of monetary policy. Noting further that the effects of consumption home bias on monetary policy is quite a hot topic recently. Studies include Faia and Monacelli (2006), Jondeau and Sahuc (2008), Galí and Monacelli (2008) and Wang (2010). Obviously, there is abundant research related to topics about consumption home bias, but still there is no literature that can clearly explain the role of consumption home bias on the effect of fiscal expenditure shock, thus inducing the motivation of this paper.

3. Theoretical model

3.1 Model Setting

This paper follows NOEM proposed by Obstfeld and Rogoff (1995) as a theoretical basis; the main assumptions are stated as follows:

(1). There are two countries in the world, “home country” and “foreign country”, all of the following foreign economic variables are marked as “*” for identification.

(2). World population is distributed in the interval [0,1], where individuals of home country are distributed between $[0, n)$ and foreign individuals are distributed between $[n, 1]$.

(3). Each individual is both consumer and producer, and he operates a monopoly competitor factory uses labor for production.

(4). Consumption home bias behavior exists in economic system and government spending is the only exogenous shock.

(5). The price featured with stickiness and is not adjustable in the short term, but can be freely adjusted in the long term steady state.

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3.1.1 Household

Assuming that all individuals have the same preferences, utility (U) and consumption (C) and real money balances (M / P) are in positive proportional, and is inversely proportional to the output (y), wherein, the lifetime utility function of representative individual is set as follows:

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} \left[\log C_s + \frac{\chi}{1-\varepsilon} \left(\frac{M_s}{P_s} \right)^{1-\varepsilon} - \frac{\kappa}{2} y_s(z)^2 \right], \quad \varepsilon > 0 \qquad (1)$$

Where β is the discount factor ($0 < \beta < 1$), ε is the elasticity of marginal utility of real money balance,[3] χ and κ represent the degree of significance of real money balances and output on the utility function, z refers to a particular product.

In Eq. (1), define the consumption index of representative consumer as the constant elasticity of substitution (CES) function:

$$C_t = \left[\int_0^n \alpha^{\frac{1}{\delta}} c_{h,t}(z)^{\frac{\delta-1}{\delta}} dz + \int_n^1 (1-\alpha)^{\frac{1}{\delta}} c_{f,t}(z)^{\frac{\delta-1}{\delta}} dz \right]^{\frac{\delta}{\delta-1}}, \quad \delta > 1 \qquad (2)$$

Where $c_h(z)$ is the consumption of domestic consumer for domestic specific products z, $c_f(z)$ is the consumption of domestic consumer for foreign specific product z, α is a consumption home bias parameter measuring domestic consumers' preference on domestic products, and δ is the elasticity of substitution of goods between two countries.

We can deduce domestic price index (P) from the definition of consumption index (Eq. (2)) by the problem of expenditure minimization as follows:

$$P_t = \left[\int_0^n \alpha p_{h,t}(z)^{1-\delta} dz + \int_n^1 (1-\alpha) p_{f,t}(z)^{1-\delta} dz \right]^{\frac{1}{1-\delta}} \qquad (3)$$

Likewise, the foreign price index (P^*) is as follows:

[3] The elasticity of marginal utility of real money balance (ε) is defined as the response of the change in the marginal utility of real money balances under a change of real money balances.

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$$P_t^* = \left[\int_0^n (1-\alpha^*) p_{h,t}^*(z)^{1-\delta} dz + \int_n^1 \alpha^* p_{f,t}^*(z)^{1-\delta} dz \right]^{\frac{1}{1-\delta}} \quad (4)$$

In above two equations, $p_h(z)$ represents the price of home commodity z expressed in domestic currency, $p_f(z)$ represents domestic currency price of foreign goods z, $p_h^*(z)$ represents the foreign currency price of domestic goods z, $p_f^*(z)$ represents foreign currency price of foreign goods z, α^* stands for foreign consumers' preference on foreign products.

For any kind of goods, the law of one price is held as follows:

$$p_{h,t}(z) = E_t p_{h,t}^*(z) \quad (5)$$

$$p_{f,t}(z) = E_t p_{f,t}^*(z) \quad (6)$$

where E represents the exchange rate.

From Eqs. (2) and (3), we can deduce the consumption of domestic representative consumer for specific home/foreign commodities as follows:

$$c_{h,t}(z) = \left(\frac{\alpha p_{h,t}(z)}{P} \right)^{-\delta} C \quad (7)$$

$$c_{f,t}(z) = \left(\frac{(1-\alpha) p_{f,t}(z)}{P} \right)^{-\delta} C \quad (8)$$

Likewise, the consumption that foreign representative consumer for domestic specific commodity and foreign specific commodities as follows:

$$c_{h,t}^*(z) = \left(\frac{(1-\alpha^*) p_{h,t}^*(z)}{P^*} \right)^{-\delta} C^* \quad (9)$$

$$c_{f,t}^*(z) = \left(\frac{\alpha^* p_{f,t}^*(z)}{P^*} \right)^{-\delta} C^* \quad (10)$$

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In both formulas as above, $c_h^*(z)$ is the consumption of foreign consumer for specific domestic products z, $c_f^*(z)$ is the consumption of foreign consumer for specific foreign products z.

3.1.2 Government

The government spending can be financed by seigniorage revenue and lump-sum tax, so the government budget constraint is:

$$G_t = T_t + \frac{M_t - M_{t-1}}{P_t} \tag{11}$$

Where the item at the left of the equation is real government spending; the first item at the right of the equation is real tax revenue and the second item at the right of the question is real seignorage revenue.

Assume that both the government sector and private sector have the same preferences, the government spending follows CES function as:

$$G_t = \left[\int_0^n \alpha^{\frac{1}{\delta}} g_{h,t}(z)^{\frac{\delta-1}{\delta}} dz + \int_n^1 (1-\alpha)^{\frac{1}{\delta}} g_{f,t}(z)^{\frac{\delta-1}{\delta}} dz \right]^{\frac{\delta}{\delta-1}}$$

where $g_h(z)$ is the consumption of the home-country specific product z by the domestic government sector; $g_f(z)$ is the consumption of the foreign country specific product z by the domestic government sector.

3.1.3 Asset Market

Suppose that there is an integrated international capital markets between two countries, each individual can trade real bonds (B) in this international capital market, the correlation between real interest rate (r) and nominal interest rate (i) of maturing bonds is as shown in Fisher equation, namely:

$$1 + i_t = \frac{P_{t+1}}{P_t}(1 + r_t) \tag{12}$$

The holding condition of bonds reflects the lending relationship between the residents of two countries, thus satisfying $nB_t + (1-n)B_t^* = 0$, or

 ISSN 1927-033X

$$B_t^* = -\frac{n}{1-n} B_t \tag{13}$$

where B is the amount of bond that domestic representative individual is holding, while B^* is the amount of bonds held by foreign representative individual.

3.1.4 Budget Constraint

The budget constraint of representative individual is expressed as:

$$M_t + P_t C_t + P_t B_t = M_{t-1} + P_t (1 + r_{t-1}) B_{t-1} + p_{h,t}(z) y_{h,t}(z) - P_t T_t \tag{14}$$

where the income sources of the consumer in period t includes: money balances in period $t-1$ (M_{t-1}), the principal and interest of the bond from period $t-1$ ($P_t(1+r_{t-1})B_{t-1}$) and output revenue ($p_{h,t}(z)y_{h,t}(z)$) in period t. The consumers can use the income for money holding (M_t), consumption ($P_t C_t$) and bond purchases ($P_t B_t$) as well as tax payments ($P_t T_t$).

3.1.5 Aggregate Demand

Based on the equation of consumption of home country specific products by domestic consumer (Eq. (7)) and the equation of consumption of home country specific products by foreign consumer (Eq. (9)), it can be inferred that the demand function faced by the home manufacturers is:

$$y_{h,t}(z) = n(c_{h,t}(z) + g_{h,t}(z)) + (1-n)(c_{h,t}^*(z) + g_{h,t}^*(z))$$

$$= n\left(\frac{\alpha p_{h,t}(z)}{P}\right)^{-\delta}(C_t + G_t) + (1-n)\left(\frac{(1-\alpha^*)p_{h,t}^*(z)}{P^*}\right)^{-\delta}(C_t^* + G_t^*) \tag{15}$$

Where G^* is the consumption of the foreign government sector.

Similarly, from on the equation of consumption of foreign specific products by domestic consumer (Eq. (8)) and the equation of consumption of foreign specific products by foreign consumers (Eq. (10)), it can be inferred that the demand function faced by the foreign manufacturers is:

 ISSN 1927-033X

$$y^*_{f,t}(z) = nc_{f,t}(z) + (1-n)c^*_{f,t}(z)$$

$$= n\left(\frac{(1-\alpha)p_{f,t}(z)}{P}\right)^{-\delta}(C_t + G_t) + (1-n)\left(\frac{\alpha^* p^*_{f,t}(z)}{P^*}\right)^{-\delta}(C^*_t + G^*_t) \quad (16)$$

3.1.6 First Order Conditions

When consumer is under the restriction of budget constraint (Eq. (14)), the first-order conditions for the maximization of the utility (Eq. (1)) are:

$$C_{t+1} = \beta(1+r_t)C_t \quad (17)$$

$$\frac{M_t}{P_t} = \left(\frac{(1+i_t)\chi}{i_t}C_t\right)^{\frac{1}{\varepsilon}} \quad (18)$$

$$[y_t(z)]^{\frac{\delta+1}{\delta}} = \left(\frac{\delta-1}{k\delta}\right)C_t^{-1}(C_t^W + G_t^W)^{\frac{1}{\delta}} \quad (19)$$

where Eq. (17) is the Euler Equation of consumption, which describes the intertemporal consumption behaviors, Eq. (18) is the equation of money demand for indicating the substitution relation between real money demand and consumption, Eq. (19) is the labor supply equation which stipulates the substitution relation between labor supply and consumption. In Eq. (19), C^W represents the world private consumption, $C_t^W \equiv nC_t + (1-n)C_t^*$; G^W represents the world government consumption, $G_t^W \equiv nG_t + (1-n)G_t^*$.

3.2 Derivation of Steady-State

Discussed in the following paragraphs are the effects of government spending shock on macroeconomic variables. To begin with, the initial state (0 steady state) is given, assuming that consumption home bias and government spending shock do not exist in the economic system. The initial state will then be used a baseline for comparison, so as to derive the economic system's long-term steady state. For analysis of long-term steady state, the symbols used are the subscript "$_t$"which indicates the macroeconomic variables under the long-term steady state, and subscript "$_0$" which indicates the macroeconomic variables under the initial state. For

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example, C_t and C_0 represent the consumption levels under the long-term steady state and initial state, respectively. For analysis of short-term steady state, however, the macroeconomic variables under the long-term steady state are denoted without the subscript symbols, while the subscript "$_t$" is used to distinguishingly denote the values of macroeconomic variables under the short-term steady state.

By substituting the government budget constraint (Eq. (11)) to the private budget constraint (Eq. (14)), and assuming that $B_{t-1} = 0$, the following equation is obtained:

$$C_t = -\hat{B}_t + \frac{p_{h,t}(z)y_{h,t}(z))}{P_t} - \hat{G}_t \tag{20}$$

Likewise, for foreign country, we have:

$$C_t^* = -\hat{B}_t^* + \frac{p_{f,t}^*(z)y_{f,t}^*(z)}{P_t^*} - \hat{G}_t^* \tag{21}$$

3.3 Log-linearization

In order to obtain closed-form solution, this paper uses Uhlig (1995)'s approach. Firstly, put the model in log-linearization, followed by granting values to the parameters in the model to perform simulation analysis. We put each variable in the vicinity of the initial state into log-linearization for acquiring the degree of each variable fluctuating in the steady state. In this paper, the superscript "$\wedge$" indicates the value of each variable being put into log-linearization.

For example: If $\hat{X}_t$ means the result of variable X_t being put into log-linearization in the vicinity of initial state (X_0), then:

$$\hat{X}_t \equiv \ln\frac{X_t}{X_0} \cong \frac{X_t - X_0}{X_0} \cong \frac{dX_t}{X_0}$$

3.3.1 Log-linearization of Price Index

Substitute Eqs. (5) and (6) into Eqs. (3) and (4) respectively, and process the log-

 ISSN 1927-033X

linearization to obtain:

$$\hat{P}_t = n\alpha\hat{p}_{h,t}(z) + (1-n)(1-\alpha)(\hat{E}_t + \hat{p}^*_{f,t}(z)) \tag{22}$$

$$\hat{P}^*_t = n(1-\alpha^*)(\hat{p}_{h,t}(z) - \hat{E}_t) + (1-n)\alpha^*\hat{p}^*_{f,t}(z) \tag{23}$$

Subtract Eq. (23) from Eq. (22) to obtain the difference between fluctuations of price indices of two countries:

$$\hat{P}_t - \hat{P}^*_t = n(\alpha - (1-\alpha^*))p_{h,t}(z) + ((1-n)(1-\alpha) + n(1-\alpha^*))\hat{E}_t$$

$$+ (1-n)((1-\alpha) - \alpha^*)p^*_{f,t}(z) \tag{24}$$

3.3.2 Log-linearization of the Law of One Price

Put Equation (5) and (6) into log-linearization to get:

$$\hat{p}_{h,t}(z) = \hat{E}_t + \hat{p}^*_{h,t}(z) \tag{25}$$

$$\hat{p}_{f,t}(z) = \hat{E}_t + \hat{p}^*_{f,t}(z) \tag{26}$$

3.3.3 Log-linearization of World Budget Constraint

We may get the world budget constraints equation from Eqs. (20) and (21) as follows:

$$C^W_t = nC_t + (1-n)C^*_t$$

$$= n\left(-B_t + \frac{p_{h,t}(z)y_{h,t}(z)}{P_t}\right) + (1-n)\left(-\hat{B}^*_t\frac{p^*_{f,t}(z)y^*_{f,t}(z)}{P^*_t}\right) - G^W_t \tag{27}$$

Put Eq. (27) into log-linearization and use Eqs. (25) and (26) to get:

$$\hat{C}^W_t = n(-\hat{B}_t + \hat{p}_{h,t}(z) + \hat{y}_{h,t}(z) - \hat{P}_t) + (1-n)(-\ddot{B}^*_t + \hat{p}^*_{f,t}(z) + \hat{y}^*_{f,t}(z) - \hat{P}^*_t) - \hat{G}^W_t \tag{28}$$

3.3.4 Log-linearization of Demand Function

Put domestic and foreign demand functions (Eqs. (15) and (16)) into log-linearization to get:

 ISSN 1927-033X

$$\hat{y}_{h,t}(z) = -\delta(n\alpha(\hat{p}_{h,t}(z) - \hat{P}_t) + (1-n)(1-\alpha^*)(\hat{p}^*_{h,t}(z) - \hat{P}^*_t)) + \hat{C}^W_t + \hat{G}^W_t \quad (29)$$

Similarly, for foreign country, we have:

$$\hat{y}^*_{f,t}(z) = -\delta(n(1-\alpha)(\hat{p}_{f,t}(z) - \hat{P}_t) + (1-n)\alpha^*(\hat{p}^*_{f,t}(z) - \hat{P}^*_t)) + \hat{C}^W_t + \hat{G}^W_t \quad (30)$$

3.3.5 Log-linearization of Labor Supply Function

Put the domestic labor supply function (Eq. (19)) into log-linearization to get:

$$(1+\delta)\hat{y}_{h,t}(z) = -\delta\hat{C}_t + \hat{C}^W_t + \hat{G}^W_t \quad (31)$$

Similarly, for foreign country, we have:

$$(1+\delta)\hat{y}^*_{f,t}(z) = -\delta\hat{C}^*_t + \hat{C}^W_t + \hat{G}^W_t \quad (32)$$

3.3.6 Log-linearization of Money Demand Function

Put the domestic money demand function (Eq. (18)) into log-linearization to get:

$$\hat{M}_t - \hat{P}_t = \frac{1}{\varepsilon}\hat{C}_t \quad (33)$$

Likewise, for foreign country, we have:

$$\hat{M}^*_t - \hat{P}^*_t = \frac{1}{\varepsilon}\hat{C}^*_t \quad (34)$$

Subtract Eq. (33) from Eq. (34), also use Eq. (24) to get the following relationship equation:

$$((1-n)(1-\alpha) + n(1-\alpha^*))\hat{E}_t = \hat{M}_t - \hat{M}^*_t - \frac{1}{\varepsilon}(\hat{C}_t - \hat{C}^*_t) - n(\alpha - (1-\alpha^*))p_{h,t}(z)$$

$$-(1-n)((1-\alpha) - \alpha^*)p^*_{f,t}(z) \quad (35)$$

 ISSN 1927-033X

3.3.7 Log-linearization of Terms of Trade

Define the terms of trade (*TOT*) as the ratio of export price to import price of the commodity, namely:

$$TOT = \frac{p_{h,t}(z)}{E_t p^*_{f,t}(z)}$$

Put the foregoing equation into log-linearization to get:

$$\hat{TOT} = \hat{p}_{h,t}(z) - \hat{E}_t - \hat{p}^*_{f,t}(z) \tag{36}$$

3.4 Steady-State Solution

Eqs. (20) and (21) are given the log-linearization process to obtain the following equations:

$$\hat{C}_t = -\hat{B}_t + \hat{p}_{h,t}(z) + \hat{y}_{h,t}(z) - \hat{P}_t - \hat{G}_t \tag{37}$$

$$\hat{C}^*_t = -\hat{B}^*_t + \hat{p}^*_{f,t}(z) + \hat{y}^*_{f,t}(z) - \hat{P}^*_t - \hat{G}^*_t \tag{38}$$

In the long-term, the price is flexible, and $\hat{B}_t = \hat{B}_{t+1} = 0$, we use a total of thirteen equations to achieve solutions. These thirteen equations include log-linearized version of price index (Eqs. (22) and (23)), log-linearized version of law of one price (Eqs. (25) and (26)), log-linearized version of the world consumption (Eq. (28)), log-linearized version of demand function (Eqs. (29) and (30)), log-linearized version of labor supply function (Eqs. (31) and (32), log-linearized version of money demand function subtraction equation (Eq. (35)), log-linearized version of terms of trade (Eq. (36)) and log-linearized version of private budget constraints (Eq. (37) and (38)). We then can obtain relationships of thirteen endogenous and exogenous variables including domestic consumption ($\hat{C}_t$), foreign consumption($\hat{C}^*_t$), world consumption ($\hat{C}^W_t$), domestic output ($\hat{y}_{h,t}(z)$), foreign output ($\hat{y}^*_{f,t}(z)$), domestic prices of a particular product produced in the home country ($\hat{p}_{h,t}(z)$), foreign prices of a particular product

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produced in the home country ($\hat{p}^*_{h,t}(z)$), foreign price of a particular product produced in a foreign country ($\hat{p}^*_{f,t}(z)$)), domestic price of a particular product produced in the foreign country ($\hat{p}_{f,t}(z)$)), exchange rate ($\hat{E}_t$), domestic price index ($\hat{P}_t$), foreign price index ($\hat{P}^*_t$) as well as the terms of trade ($\hat{TOT}_t$).

In the short-term, price is rigid ($\hat{p}_{h,t}(z) = 0$ ； $\hat{p}^*_{f,t}(z) = 0$). Separately, with log-linearized of consumption Euler equation (Eq. (17)) of the home country and Euler equation of foreign consumption, we can obtain the changes in world consumption of short-term as follows:

$$\hat{C}^W_t = \hat{C}^W - (1-\beta)\hat{r}_t \tag{39}$$

We now can use a total of fourteen equations to achieve solutions in the short-term. These include log-linearized version of price index (Eqs. (22) and (23)), log -linearized version of law of one price (Eqs. (25) and (26)), log-linearized version of the world consumption (Eq. (28)), log-linearized version of demand function (Eqs. (29) and (30)), log-linearized version of labor supply function (Eqs. (31) and (32)), log-linearized version of money demand function subtraction formula (Eq. (35)), log-linearized version of terms of trade (Eq. (36)) and log-linearized version of private budget constraints (Eqs. (37) and (38)), and the equation of relationship of world consumption in the long-term and short-term equation (Eq. (39)). We then can obtain relationships of fourteen endogenous and exogenous variables ($\hat{G}$) including domestic consumption ($\hat{C}_t$) , foreign consumption($\hat{C}^*_t$) , world consumption ($\hat{C}^W_t$) , domestic output ($\hat{y}_{h,t}(z)$), foreign output ($\hat{y}^*_{f,t}(z)$), foreign prices of a particular product produced in the home country ($\hat{p}^*_{h,t}(z)$), domestic price of a particular product produced in the foreign country ($\hat{p}_{f,t}(z)$)), the exchange rate ($\hat{E}_t$), domestic price index ($\hat{P}_t$), foreign price index ($\hat{P}^*_t$), the domestic current account ($\hat{B}_t$), the foreign current account t($\hat{B}^*_t$) as well as the terms of trade ($\hat{TOT}_t$).

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4. The Effects of Government Spending Shocks on Macroeconomic Variables

In order to capture the dynamic effects of consumption home bias parameter change on fiscal expenditure impact, this paper conducts a simulation analysis.

4.1 Parameterisation

This paper now covers a simulation analysis to capture the effects of changes in parameters of consumption home bias on fiscal expenditure shock. First, to simplify the analysis, two economies of equal size are chosen as analysis objects under NOEM framework. In selecting parameter values, we use empirical data of the United States and countries of similar scale (such as the OECD countries, the European Union) to analyze the impacts of fiscal expenditure shocks. First, the elasticity of substitution of product between countries is set to 5 similar to that of Bergin et al. (2007). The elasticity of marginal utility of the real money balances is set to 1, similar to the practice of Mankiw and Summers (1986) and Schmidt (2006). The setting of consumption home bias parameter value is similar to that of Wang (2010) ($\alpha = 0.85$), and corresponding scenario of absence of consumption home bias ($\alpha = 0.5$) and preference to foreign goods are presented ($\alpha = 0.15$). Parameter of foreign preference to foreign goods and domestic goods has the same value of consumption home bias. As for other policy variables, such as domestic money supply ($\hat{M}$), foreign money supply ($\hat{M}^*$), and the foreign fiscal expenditure shock ($\hat{G}^*$), since they are not focus of the paper, we assume the change rate to be 0, parameter values are set as showed in Table 1.

Table 1. Selection of parameters

Symbol	Meaning	Value
n	Country size	0.5
δ	Elasticity of substitution of product between countries	5
ε	Elasticity of marginal utility of the real money balances	1
α	Consumption bias of the home country	0.15; 0.5; 0.85
α^*	Consumption bias of the foreign country	0.15; 0.5; 0.85

4.2 Simulation and Comparative Static Analysis

In this section, we use parameters set in the previous section with numerical simulation to investigate effects of fiscal policy on exchange rate, prices, consumption, output and terms of trade and other macroeconomic variables. The simulation results show in Table 2.

From Table 2 (a) to (m) we can see that, in the long run, fiscal expenditure and domestic output, domestic price index and exchange rate have positive relationships and have negative

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relationship with domestic consumption. The relationship between fiscal expenditure and terms of trade depend on asymmetry of consumption preferences of agents in two countries. Fiscal spending has a positive correlation with terms of trade when "consumers in both countries have special preferences for goods of opponent country", "there is no special preference behavior in home country, but consumers in foreign country have special preference for domestic-produced goods" and "there is no special preference behavior in foreign country, but consumers in home country have special preference for foreign-produced goods." In all other cases, there is negative correlation between terms of trade and fiscal expenditure.

Table 2. The long-term effect of fiscal policy on the macroeconomic variables

(a) Long-Term Effect of Fiscal Policy on Domestic Consumption

$\partial \hat{C}_t / \partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	-0.373	-0.426	-0.116
	0.5	-0.423	-0.45	-0.398
	0.85	-1.370	-0.562	-0.475

(b) Long-Term Effect of Fiscal Policy on Foreign Consumption

$\partial \hat{C}_t^* / \partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	-0.127	-0.077	0.869
	0.5	-0.074	-0.05	0.062
	0.85	-0.384	-0.102	-0.025

(c) Long-Term Effect of Fiscal Policy on World Consumption

$\partial \hat{C}_t^W / \partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	-0.25	-0.252	0.377
	0.5	-0.248	-0.25	-0.168
	0.85	-0.877	-0.332	-0.25

 ISSN 1927-033X

Table 2. The long-term effect of fiscal policy on the macroeconomic variables (cont.)

(d) Long-Term Effect of Fiscal Policy on Domestic Output

	$\partial y_{h,t}(z)/\partial \hat{G}$		
	α		
α^*	0.15	0.5	0.85
0.15	0.353	0.396	0.243
0.5	0.394	0.417	0.387
0.85	1.078	0.496	0.437

(e) Long-Term Effect of Fiscal Policy on Foreign Output

	$\partial y^*_{f,t}(z)/\partial \hat{G}$		
	α		
α^*	0.15	0.5	0.85
0.15	0.147	0.106	-0.578
0.5	0.104	0.083	0.004
0.85	0.257	0.113	0.063

(f) Long-Term Effect of Fiscal Policy on Domestic Price Index

	$\partial \hat{P}_t/\partial \hat{G}$		
	α		
α^*	0.15	0.5	0.85
0.15	0.123	0.173	0.910
0.5	0.175	0.2	0.284
0.85	0.075	0.176	0.225

(g) Long-Term Effect of Fiscal Policy on Foreign Price Index

	$\partial \hat{P}^*_t/\partial \hat{G}$		
	α		
α^*	0.15	0.5	0.85
0.15	-0.123	-0.175	-0.075
0.5	-0.173	-0.2	-0.176
0.85	-0.910	-0.284	-0.225

 ISSN 1927-033X

Table 2. The long-term effect of fiscal policy on the macroeconomic variables (cont.)

(h) Long-Term Effect of Fiscal Policy on the Price of Domestic Product z Denoted in Domestic Currency

$\partial \hat{p}_{h,t}(z)/\partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	0.397	0.351	1.552
	0.5	0.358	0.333	0.499
	0.85	-1.373	0.118	0.313

(i) Long-Term Effect of Fiscal Policy on the Price of Domestic Product z Denoted in Foreign Currency

$\partial \hat{p}^*_{h,t}(z)/\partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	-0.220	-0.350	-0.418
	0.5	-0.342	-0.467	-0.585
	0.85	-3.343	-0.966	-1.223

(j) Long-Term Effect of Fiscal Policy on the Price of Foreign Product z Denoted in Domestic Currency

$\partial \hat{p}_{f,t}(z)/\partial \hat{G}$				
		α		
α^*		0.15	0.5	0.85
	0.15	0.220	0.342	3.343
	0.5	0.350	-0.467	0.966
	0.85	0.418	0.585	1.223

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Table 2. The long-term effect of fiscal policy on the macroeconomic variables (cont.)

(k) Long-Term Effect of Fiscal Policy on the Price of Foreign Product z Denoted in Foreign Currency

$\partial \hat{p}^{*}_{f,t}(z) / \partial \hat{G}$				
		α		
α^{*}		0.15	0.5	0.85
	0.15	-0.397	-0.358	1.373
	0.5	-0.351	-0.333	-0.118
	0.85	-1.552	-0.499	-0.313

(l) Long-Term Effect of Fiscal Policy on Exchange Rate

$\partial \hat{E}_t / \partial \hat{G}$				
		α		
α^{*}		0.15	0.5	0.85
	0.15	0.617	0.071	1.970
	0.5	0.701	0.8	1.084
	0.85	1.970	1.054	1.536

(m)Long-Term Effect of Fiscal Policy on Terms of Trade

$\partial T\hat{O}T_t / \partial \hat{G}$				
		α		
α^{*}		0.15	0.5	0.85
	0.15	0.177	0.009	-1.791
	0.5	0.009	-0.133	-0.467
	0.85	-1.791	-0.467	-0.910

From Table 2 (a) to (m) we can see that, in the long run, fiscal expenditure and domestic output, domestic price index and exchange rate have positive relationships and have negative relationship with domestic consumption. The relationship between fiscal expenditure and terms of trade depend on asymmetry of consumption preferences of agents in two countries. Fiscal spending has a positive correlation with terms of trade when “consumers in both countries have special preferences for goods of opponent country”, “there is no special preference behavior in

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home country, but consumers in foreign country have special preference for domestic-produced goods" and "there is no special preference behavior in foreign country, but consumers in home country have special preference for foreign-produced goods." In all other cases, there is negative correlation between terms of trade and fiscal expenditure.

Economic intuitions behind these conclusions can be explained as follows: an increase in government spending increase demand for domestic goods, leading to increase domestic output and price. But because of the "crowding out effect", there will be decline in private consumption and money demand, leading to depreciation of domestic currency (raise of exchange rate). As for the relationship between government spending and terms of trade, uncertainty arise because of mutual exclusive effects of increased prices and exchange rates, which is depend on asymmetry of consumption bias of agent in the two countries.

Results of simulation analysis and comparative static analysis in the short-term are shown in Table 3. In the short-term, we find that only the relationship between government expenditure and interest rates will be influenced by asymmetry of consumer preferences. Relationships among government expenditure and other macroeconomic variables will not be affected by behavior of consumer preferences. Results are as follows: $\partial \hat{C}_t / \partial \hat{G}_t = \partial \hat{C}_t^* / \partial \hat{G}_t = \partial \hat{C}_t^W / \partial \hat{G}_t$ =-0.25; $\partial y_{h,t}(z) / \partial \hat{G}_t = \partial y_{f,t}^*(z) / \partial \hat{G}_t$ =0.25; $\partial \hat{P}_t / \partial \hat{G}_t = \partial \hat{P}_t^* / \partial \hat{G}_t = \partial \hat{p}_{h,t}^*(z) / \partial \hat{G}_t = \partial \hat{p}_{f,t}(z) / \partial \hat{G}_t$ = $\partial \hat{E}_t / \partial \hat{G}_t = \partial T\hat{O}T_t / \partial \hat{G}_t$ =0; $\partial \hat{B}_t / \partial \hat{G}_t$ =-0.5; $\partial \hat{B}_t^* / \partial \hat{G}_t$ =0.5。

Table 3. The short-term effect of fiscal policy on interest rate

		$\partial \hat{r}_t / \partial \hat{G}_t$		
		α		
		0.15	0.5	0.85
α^*	0.15	0	-0.2	62.7
	0.5	0.2	0	8.2
	0.85	-62.7	-8.2	0

Comparing results of long-term and short-term simulation analysis (Table 2 and Table 3), we can find that for consumption and output, when "consumers of two countries have consumption bias for domestic-produced goods", domestic consumption and output will show overshooting. In other cases, domestic consumption and output will show undershooting.

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As for short-term effects of fiscal expenditure on price, exchange rates and terms of trade, since the price is rigid, price, exchange rates and terms of trade are not affected by fiscal expenditure shock, relations between fiscal expenditure and interest rates will be subject to the asymmetry of consumption bias. In the cases of “domestic consumers have preferences for foreign goods, and foreign consumers do not have consumption bias”, “consumers of two countries prefer domestic-produced goods” and “domestic consumers prefer domestic products, and foreign consumers do not have consumption bias”, an increase in fiscal spending will result in decrease in public sector savings, monetary supply, leading to higher interest rates. In other cases of “consumers of two countries prefer foreign-produced products”, “domestic consumers have no consumption bias and foreign consumers prefer domestic-produced goods”, and “domestic consumers do not have consumption bias, and foreign consumers have preferences for foreign-produced goods”, an increase in fiscal spending will cause interest rates to fall.

5. Conclusion

It has been more than 20 years since the development of NOEM model. Compared to the popularity study of impacts of monetary policy, studies of the effects of fiscal policy are relatively lacking. Due to the above reason, this paper uses theoretical framework of NOEM proposed by Obstfeld and Rogoff (1995), integrated with consumption home bias to explore dynamic effects of macroeconomic variables when a country is faced with fiscal expenditure shocks. We hope results of this paper can be used as reference for policy-making by relevant authorities.

Through theoretical derivation and simulation results, we find out in the face of fiscal expenditure shock, except the case of “consumers of two countries have special preferences for domestically-produced goods,” fluctuations in domestic consumption and output in the short term will be bigger than those in the long term, showing an overshooting phenomenon. In other cases, fiscal expenditure shock does not affect price, exchange rates and terms of trade. Relationship between interest rate and fiscal expenditure shock will be subject to asymmetry of consumption bias, which can cause short-term interest rates to rise or fall.

Finally, one should notice that although NOEM framework plays an important role in various economic issues, many assumptions are required if one wants to easily achieve solutions. If one of the assumptions or settings no longer exists, the results may differ, we deem this deficiency as one of restrictions of this paper.

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