Tezukayama RIEB Discussion Paper Series No. 18

The macroeconomic effects of a deregulation policy under international firm mobility

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April 2015

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ABSTRACT

This paper uses a new open economy macroeconomics model that incorporates international relocation of firms to analyze the consequences of deregulation shocks in the non-tradable goods sector. The paper shows that an unanticipated deregulation in the non-tradable goods sector of the home country results in an appreciation of the home currency, and then the appreciation decreases (increases) the real profits of firms in the tradable goods sector located in the home country (abroad), and consequently firms relocate to the foreign country. The paper also shows that the deregulation in the home country always increases (decreases) both the tradable and non-tradable consumptions in the home (foreign) country. In addition, the paper shows that a decrease in the relocation costs weakens the responses of the relative consumptions and the equilibrium exchange rate to the deregulation shock.

Keywords: Deregulation, non-tradable goods, international relocation of firms,

JEL classification numbers: E6, F2, F31, F41

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I. INTRODUCTION

In the new open economy macroeconomics (NOEM) literature, the relationship between demand stimulating policies and aggregate economic activity has been studied extensively; see, e.g., Obstfeld and Rogoff (1995, 1996, 2002), Lane (1997), Betts and Devereux (2000a, 2000b), Hau (2000), Bergin and Feenstra (2001), Caselli (2001), Corsetti and Pesenti (2001, 2005), Cavallo and Ghironi (2002), Devereux and Engel (2002), Kollmann (2001, 2002), Smets and Wouters (2002), Chu (2005), Ganelli (2005), Sutherland (2005a, 2005b), and Senay and Sutherland (2007).[1] This literature has focused on how the macroeconomic activity and consumption of each country are influenced by unanticipated monetary and fiscal shocks in one country under monopolistic distortions and nominal rigidities. The benchmark model of Obstfeld and Rogoff (1995) shows that a domestic monetary expansion raises foreign and domestic output and welfare through the first-order effect of increasing world consumption.[2]

However, we emphasize that none of the studies in the above literature consider the impact of policies for promoting competition as deregulation on the macroeconomic activity. The exception is Cavelaars (2006), who investigated the consumption, output and general price effects of a deregulation policy by introducing the non-tradable goods sector into a NOEM model. Cavelaars (2006) showed that an increase in the degree of

[1] Other related references include Benigno (2002), Engel (2002), Warnock (2003), Devereux (2004), Andersen and Beier (2005), Tille (2008), Johdo (2013), and Sousa (2013). For a survey of the NOEM models, see Lane (2001).

[2] This effect is attributed to the distortion of monopolistic competition in product markets. In closed-economy monopolistic competition models, Svensson (1986) and Blanchard and Kiyotaki (1987) also highlight this first-order effect of a marginal monetary expansion on output.

competition in the domestic non-tradable goods sector results in a short-run rise and long-run decline of the domestic consumption.

However, in this literature, the following question remains unresolved: how is the relationship between deregulation and short-run and long-run consumptions changed if international firm mobility is taken into account in the NOEM model? We do not believe that it is appropriate to ignore interactions between international firm relocation and the exchange rate when examining deregulation effects. Indeed, there is a large body of empirical research on the relationship between the exchange rate and firms' production location (and their foreign direct investment (FDI)) (see, e.g., Cushman, 1985 and 1988, Froot and Stein, 1991, Campa, 1993, Klein and Rosengren, 1994, Goldberg and Kolstad, 1995, Blonigen, 1997, Goldberg and Klein, 1998, Bénassy-quéré et al, 2001, Chakrabarti and Scholnick, 2002, and Farrell et al., 2004). For example, Campbell and Lapham (2004) find that exchange rate movements have a significant effect on the relocation of establishments in U.S. retail trade industries located near the U.S.-Canada border.

One exception, however, is Johdo (2015), who presents a new NOEM model with international relocation of firms. Johdo (2015) contrasts a two-country NOEM model without international relocation with a NOEM model with international relocation, and succeeds in showing explicitly the effects of one country's monetary expansion on the consumption of the two countries and the exchange rate, leading to firm relocation to the other country.

In order to analyze the consequences of deregulation shocks in a NOEM model with international relocation of firms, this paper takes the idea of deregulation in Cavelaars (2006) and combines it with the model of Johdo (2015). In particular, a novel feature of this model is that the international distribution of firms in the tradable goods sector responds to exchange rate movements caused by deregulation shocks.

We conclude that a deregulation shock in the non-tradable goods sector of the home country results in a proportionate increase in both the short-run and long-run relative home consumption levels and appreciation of the home currency. In addition, it is found that the appreciation decreases (increases) the real profits of firms in the tradable goods sector located in the home country (abroad), and consequently some firms in the tradable goods sector relocate to the foreign country. Further, we show that a decrease in the relocation costs weakens the responses of the relative consumptions and the equilibrium exchange rate to the deregulation shock.

The remainder of this paper is structured as follows. In Section 2, we outline the features of the dynamic optimizing model. In Section 3, we present the symmetric equilibrium with flexible nominal wages. In Section 4, we present a log-linearized version of this model, and explain how exchange rate changes affect the international relocation of firms. In Section 5, we examine how an unanticipated deregulation in non-tradable goods markets affects the international distribution of firms between countries, the exchange rate, and cross-country differences in consumption. The final section summarizes the findings and concludes the paper.

II. THE MODEL

We assume a two-country world economy, with a home and a foreign country. The models for the foreign and home countries are the same, and an asterisk is used to denote foreign variables. There is monopolistic competition in the markets for goods and labor, whereas the international bond market is perfectly competitive. There are two types of firms, tradable goods firms and non-tradable goods firms. The tradable goods firms exist continuously in the world in the [0, 1] range, and the non-tradable goods firms exist continuously in each country in the [0, 1] range. Each tradable and non-tradable goods firm uses only domestic labor as an input and produces a single differentiated product. In particular, tradable goods firms are mobile internationally, but non-tradable goods firms are not. Tradable goods producers in the interval [0, n_t] locate in the home country in period t, and the remaining (n_t, 1] producers locate in the foreign country, where n_t is endogenous. The size of the world population is normalized to unity. We assume that in the home country, households inhabit the interval [0, s] and those in the foreign country inhabit the interval (s, 1].

2. 1. Household decisions

Home and foreign households have perfect foresight and share the same utility function. Households in each country derive utility from consuming tradable and non-tradable differentiated goods (defined later), gain from money holdings through liquidity services, and incur the cost of expending labor effort. The intertemporal objective of household $i \in (0, s)$ in the home country at time 0 is to maximize the following lifetime utility:[3]

$$U^i_0 = \sum_{t=0}^{\infty} \beta^t \left(\gamma \log C^{iT}_t + (1-\gamma)\log C^{iN}_t + \chi \log(M^i_t/P_t) - (\kappa/2)(\ell^{si}_t)^2\right),\ \gamma \in (0,1),\ \chi, \kappa > 0, \quad (1)$$

[3] In what follows, we mainly focus on the description of the home country because the foreign country is described analogously.

where $0 < \beta < 1$ is a constant subjective discount factor, $\ell^{si}{}_t$ is the amount of labor supplied by household i in period t, and the consumption indices are defined as follows:

$$C^{iT}{}_t = \left(\int_0^1 C_t^{iT}(j)^{(\sigma - 1)/\sigma} dj\right)^{\sigma/(\sigma - 1)}, \ \sigma > 1, \tag{2}$$

$$C^{iN}{}_t = \left(\int_0^1 C_t^{iN}(j)^{(\theta - 1)/\theta} dj\right)^{\theta/(\theta - 1)}, \ \theta > 1, \tag{3}$$

$$C^{iN*}{}_t = \left(\int_0^1 C_t^{iN*}(j)^{(\psi - 1)/\psi} dj\right)^{\psi/(\psi - 1)}, \ \psi > 1, \tag{4}$$

where σ is the elasticity of substitution between any two differentiated tradable goods, θ and ψ are the elasticity of substitution between any two differentiated non-tradable goods produced in the home and foreign country, respectively, $C_t^{iT}(j)$ is the consumption of tradable good j in period t for household i, $C_t^{iN}(j)$ ($C^{iN*}{}_t$) is the home (foreign) consumption of non-tradable good j.[4] In particular, the non-tradable goods market approaches perfect competition as θ increases. Therefore, θ can be interpreted as a measure of the degree of competition in the non-tradable goods market. The second term in (1) is real money balances ($M^i{}_t/P_t$), where $M^i{}_t$ denotes nominal money balances held at the beginning of period $t + 1$, and P_t is the home country consumption price index (CPI), which is defined as $P_t = \varphi(P^T{}_t)^\gamma(P^N{}_t)^{1-\gamma}$, where $\varphi \equiv \gamma^{-\gamma}(1-\gamma)^{-(1-\gamma)}$, $P^T{}_t = \left(\int_0^1 P_t^T(j)^{1-\sigma} dj\right)^{1/(1-\sigma)}$, $P^N{}_t = \left(\int_0^1 P_t^N(j)^{1-\theta} dj\right)^{1/(1-\theta)}$, and $P^T{}_t(j)$ ($P^N{}_t(j)$) is the home-currency price of tradable (non-tradable) good j in period t. Analogously, the foreign country CPI is $P^*{}_t = \varphi(P^{T*}{}_t)^\gamma(P^{N*}{}_t)^{1-\gamma}$, where $P_t^{T*} = \left(\int_0^1 P_t^{T*}(j)^{1-\sigma} dj\right)^{1/(1-\sigma)}$ and $P^{N*}{}_t = \left(\int_0^1 P_t^{N*}(j)^{1-\psi} dj\right)^{1/(1-\psi)}$,

[4] Throughout the paper, we also use the index $j \in [0, 1]$ to refer to the product of firm j.

where $P_t^{T*}(j)$ ($P^{N*}_t(j)$) is the foreign-currency price of tradable (non-tradable) good j in period t. Under the law of one price, we can rewrite the price indexes as

$$P_t^T = (\int_0^{n_t} P_t^T(j)^{1-\sigma} dj + \int_{n_t}^1 (\varepsilon_t P_t^{T*}(j))^{1-\sigma} dj)^{1/(1-\sigma)}, \tag{5}$$

$$P_t^{T*} = (\int_0^{n_t} (P_t^T(j)/\varepsilon_t)^{1-\sigma} dj + \int_{n_t}^1 P_t^{T*}(j)^{1-\sigma} dj)^{1/(1-\sigma)}. \tag{6}$$

Because there are no trade costs between the two countries, the law of one price holds for any tradable variety j; i.e., $P_t^T(j) = \varepsilon_t P_t^{T*}(j)$, where ε_t is the nominal exchange rate, defined as the home currency price per unit of foreign currency. In this context, we assume that there is an international risk-free real bond market and that real bonds are denominated in units of the composite tradable consumption good. At each point in time, households receive returns on risk-free real bonds, earn wage income by supplying labor, and receive profits from all firms equally.[5] Thus, a typical domestic household faces the following budget constraint:

$$P^T{}_t B^i{}_{t+1} + M^i{}_t = P^T{}_t(1+r_t)B^i{}_t + M^i{}_{t-1} + W^i{}_t \ell^{si}{}_t$$

$$+ (\int_0^{n_t} \Pi_t^T(j)dj + \int_{n_t}^1 \varepsilon_t \Pi_t^{T*}(j)dj + \int_0^1 \Pi_t^N(j)dj + \int_0^1 \varepsilon_t \Pi_t^{N*}(j)dj) - P^T{}_t C^{iT}{}_t - P^N{}_t C^{iN}{}_t - P^T{}_t \tau^i{}_t, \tag{7}$$

where $B^i{}_{t+1}$ denotes real bonds held by home agent i in period $t + 1$, r_t denotes the real interest rate on bonds that applies between periods $t - 1$ and t, $W^i{}_t \ell^{si}{}_t$ is nominal labor income, where $W^i{}_t$ denotes the nominal wage rate of household i in period t,

[5] In a related two-country monopolistic trade model, Corsetti et al (2005) posit that each home and foreign household receives an equal share of profits of all firms. In contrast, Devereux and Engel (2001), Cavallari (2004), Ghironi and Melitz (2005), Lubik and Russ (2006), and Russ (2007) posit that each household only owns domestic firms in all these models.

$\int_0^{n_t} \Pi_t^T(j)dj$ ($\int_{n_t}^1 \varepsilon_t \Pi_t^{T*}(j)dj$) represents the total nominal profit flows of firms in the tradable goods sector located at home (abroad), and $\int_0^1 \Pi_t^N(j)dj$ ($\int_0^1 \varepsilon_t \Pi_t^{N*}(j)dj$) is the total nominal profit flows of firms in the non-tradable goods sector located at home (abroad). In addition, $P_t^T C^{iT}_t$ represents nominal consumption expenditure for the tradable goods, $P^N_t C^{iN}_t$ is nominal consumption expenditure for the non-tradable goods, and τ_t denotes real lump-sum transfers from the government in period t. Note that all variables in (7) are measured in per capita terms. In the government sector, we assume that government spending is zero and that all seignorage revenues derived from printing the national currency are rebated to the public in the form of lump-sum transfers. Hence, the government budget constraint in the home country, in units of tradables, is $0 = \tau_t + [(M_t - M_{t-1})/P^T_t]$, where M_t is aggregate money supply and $\tau_t = \int_0^s \tau_t^i di$. The nominal interest rate i_{t+1} is defined as usual by $1 + i_{t+1} = (P^T_{t+1}/P^T_t)(1 + r_t)$.

In the home country, firm j in the tradable (non-tradable) goods sector hires a continuum of differentiated labor inputs domestically and produces a unique product in a single location according to the CES production function, $y^T_t(j) = (s^{-1/\phi} \int_0^s \ell_t^{diT(\phi-1)/\phi} di)^{\phi/(\phi-1)}$ ($y^N_t(j) = (s^{-1/\phi} \int_0^s \ell_t^{diN(\phi-1)/\phi} di)^{\phi/(\phi-1)}$), where $y^T_t(j)$ ($y^N_t(j)$) denotes the production of home-located firm j in the tradable goods (non-tradable goods) sector, $\ell^{diT}_t(j)$ ($\ell^{diN}_t(j)$) is the firm j's input of labor from household i in period t, and $\phi > 1$ is the elasticity of input substitution. Given the home firm's cost minimization problem, firm j's optimal labor demand for household i's labor input is as follows:

$$\ell_t^{dix}(j) = s^{-1}(W^i_t/W_t)^{-\phi} y_t^x(j), \quad x = N, T \tag{8}$$

where $W_t \equiv (s^{-1}\int_0^s W_t^{i\ (1-\phi)}di)^{1/(1-\phi)}$ is a price index for labor input.

In the first stage, households in the home (foreign) country maximize the consumption index of tradable goods C^{iT}_t ($C_t^{i\,T*}$) subject to a given level of expenditure $P_t^T C^{iT}_t = \int_0^1 P_t^T(j)\, C^{iT}_t(j)dj$ ($P_t^{T*}C_t^{i\,T*} = \int_0^1 P_t^{T*}(j)\, C_t^{i\,T*}(j)dj$) by optimally allocating differentiated tradable goods. This static problem yields the following demand functions for tradable good j in the home and foreign countries, respectively:

$$C^{iT}_t(j) = (P^T_t(j)/P^T_t)^{-\sigma}C^{iT}_t, \quad C_t^{i\,T*}(j) = (P_t^{T*}(j)/P_t^{T*})^{-\sigma}C_t^{i\,T*}. \tag{9}$$

Aggregating the demands for tradable goods in (9) across all households worldwide and equating the resulting equation to the output of tradable good j produced in the home country, $y_t^T(j)$, yields the following market clearing condition for any tradable product j in period t:

$$y_t^T(j) = sC^{iT}_t(j) + (1-s)C_t^{i\,*T}(j) = (P^T_t(j)/P^T_t)^{-\sigma}C_t^{Tw}, \tag{10}$$

where $P^T_t(j)/P^T_t = P_t^{T*}(j)/P_t^{T*}$ from the law of one price, $sC^{iT}_t(j)$ ($(1-s)C_t^{i\,T*}(j)$) is aggregate home (foreign) consumption demand for tradable product j, and $C_t^{Tw} \equiv (sC^{iT}_t + (1-s)C_t^{i\,T*})$ is aggregate per capita world consumption, which is a weighted average of the home and foreign consumption levels.[6] Similarly, for product j of the foreign located firms, we obtain $y_j^{T*} = sC^{iT}_t(j) + (1-s)C_t^{i\,T*}(j) = (P_t^{T*}(j)/P_t^{T*})^{-\sigma}C_t^{Tw}$. Furthermore, the market clearing conditions for any non-tradable product j in period t in the home and foreign country are, respectively, as follows:

[6] Throughout the paper, we use the superscript w for aggregated per capita world variables.

$$y_t^N(j) = sC^{iN}{}_t(j) = (P^N{}_t(j)/P^N{}_t)^{-\theta} sC_t^N, \tag{11}$$

$$y_t^{N*}(j) = (1-s)C^{iN*}{}_t(j) = (P^{N*}{}_t(j)/P^{N*}{}_t)^{-\psi}(1-s)C_t^{N*}. \tag{12}$$

In the second stage, households maximize (1) subject to (7). The first-order conditions for this problem with respect to $B^i{}_{t+1}$, $M^i{}_t$ and $C^{iN}{}_t$ can be written as

$$C^{iT}{}_{t+1} = \beta(1 + r_{t+1})C^{iT}{}_t, \tag{13}$$

$$\gamma/C^T{}_t = \chi(P^T{}_t/P_t)(M^i{}_t/P_t)^{-1} + \beta(P^T{}_t/P^T{}_{t+1})(\gamma/C^T{}_{t+1}), \tag{14}$$

$$C^{iN}{}_t = ((1-\gamma)/\gamma)(P^T{}_t/P^N{}_t)C^{iT}{}_t. \tag{15}$$

Equation (13) is the Euler equation for consumption, (14) is the one for money demand, and (15) is the optimal condition for allocation between tradable and non-tradable goods.

Here, we introduce nominal rigidities into the model in the form of one-period wage contracts under which nominal wages in period t are predetermined at time $t-1$. In the monopolistic labor market, each household provides a single variety of labor input to a continuum of domestic firms. Hence, the equilibrium labor-market conditions in the tradable goods sector for the home and foreign countries imply that $\ell^{siT}{}_t = \int_0^{n_t} \ell_t^{diT}(j)dj$, $i \in [0,\ s]$ and $\ell^{siT*}{}_t = \int_{n_t}^1 \ell_t^{diT*}(j)dj$, $i \in (s,\ 1]$, respectively, where the left-hand sides represent the amounts of labor supplied by household i and the right-hand sides represent firms' total demand for household labor i. Similarly, the equilibrium labor-market conditions in the non-tradable goods sector for the home and foreign countries imply that $\ell^{siN}{}_t = \int_0^1 \ell_t^{diN}(j)dj$, $i \in [0, s]$ and $\ell^{siN*}{}_t = \int_0^1 \ell_t^{diN*}(j)dj$, $i \in (s, 1]$, respectively. Taking W_t, $P^T{}_t$, $y^x{}_t(j)$ (x = N, T), and n_t as given, by substituting $\ell^{si}{}_t = \int_0^{n_t} \ell_t^{diT}(j)dj + \int_0^1 \ell_t^{diN}(j)dj$ and equation (8) into the household budget constraint, given by (7), and maximizing the lifetime utility, given by (1), with respect to the nominal wage $W^i{}_t$, we obtain the following first-order condition for the optimal nominal wage, $W^i{}_t$:

$$\kappa \ell^{si}{}_t{}^2 \phi (W^i{}_t / P^T{}_t)^{-1} = (\phi - 1)(\ell^{si}{}_t / C^{Ti}{}_t). \quad (16)$$

The right-hand side of (16) represents the marginal consumption utility of additional labor income resulting from a decrease in the nominal wage rate. This term is positive because $\phi > 1$. The left-hand side represents the marginal disutility of an associated increase in labor effort. Hence, each monopolistically competitive household uses (16) to set its wage rate. Furthermore, (16) can be rewritten as $W^i{}_t/P^T{}_t = (\phi/(\phi-1))(\kappa \ell^{si}{}_t)C^{Ti}{}_t$. This equation shows that the real wage, $W^i{}_t/P_t$, which is the marginal benefit of additional effort, dominates the marginal disutility (in consumption terms), which is given by $(\kappa \ell^{si}{}_t)C^{Ti}{}_t$, and that the gap is equivalent to the mark-up, $\phi/(\phi-1)$ (>1), which reflects households' market power over their labor inputs. Therefore, domestic labor suppliers have an incentive to satisfy the demands for their labor from domestic firms at the contracted optimal wages. Foreign labor suppliers have an optimal wage condition that is analogous to equation (16).

2.2. Firm's decision

In the monopolistic tradable and non-tradable goods markets, each firm has some monopoly power over pricing. Because home-located firm j hires labor domestically, given W_t, $P^T{}_t$, $P^N{}_t$ and $C^w{}_t$, and subject to (8) to (12), home-located firm j in each sector faces the following profit-maximization problem:[7]

$$\max_{P_t(j)} \Pi^x{}_t(j) = P^x{}_t(j)y^x{}_t(j) - \int_0^s W_t^i \ell_t^{dix}(j)di = (P^x{}_t(j) - W_t)y^x{}_t(j), \quad x = N, T \tag{17}$$

where $\Pi^x{}_t(j)$ denotes the nominal profit of home-located firm j in sector x (= N, T) and $\int_0^s W_t^i \ell_t^{dix}(j)di$ represents total labor cost. By substituting $y^x{}_t(j)$ from equations (10) to (12) into the firm's profit $\Pi^x{}_t(j)$ ($x = N$, T) and then differentiating the resulting equation with respect to $P^x{}_t(j)$, we obtain the following price mark-ups:

$$P^T{}_t(j) = (\sigma/(\sigma - 1))W_t, \quad P^N{}_t(j) = (\theta/(\theta - 1))W_t, \quad P^{N*}{}_t(j) = (\psi/(\psi - 1))W^*{}_t. \tag{18}$$

Because W_t is given, from (18), all home-located firms in the tradable good sector charge the same price. In what follows, we define these identical prices as $P^T{}_t(j) = P^T{}_t(h)$, $j \in [0, n]$.[8] These relationships imply that each home-located firm supplies the same quantity of tradable goods, and hence each firm requires the same quantity of labor in the tradable good sector; i.e., $\ell^{idT}{}_t(j) = \ell^{idT}{}_t(h)$, $j \in [0, n]$, where the firm index j is omitted because of symmetry. Similarly, from (18), the price mark-ups for any non-tradable

7 Cavelaars (2006) assumes that each firm can produce both tradable and non-tradable goods at the same time. By contrast, in this model, we assume that tradable goods and non-tradable goods are produced by the firms of different sector, respectively.

8 We have used the index h to denote the symmetric values within the home country, and have used the index f for the foreign country.

product j in period t in the home country are identical $P^N{}_t(j) = P^N{}_t(h)$, $j \in [0, 1]$. In addition, the price mark-ups of foreign-located firms are identical because $P_t^{x*}(j) = P_t^{x*}(f)$, $x = N, T$. Substituting (10) and (18) into the real profit flows of the home- and foreign-located firms in the tradable goods sector, $\Pi^T{}_t(h)/P^T{}_t$ and $\Pi_t(f)^{T*}/P_t^{T*}$, respectively, yields

$$\Pi^T{}_t(h)/P^T{}_t = (1/\sigma)(P^T{}_t(h)/P^T{}_t)^{1-\sigma}C^{Tw}{}_t, \quad \Pi^T{}_t(f)^*/P_t^{T*} = (1/\sigma)(P_t^{T*}(f)/P_t^{T*})^{1-\sigma}C^{Tw}{}_t. \quad (19)$$

Similarly, the real profit flows of the home- and foreign-located firms in the non-tradable goods sector, $\Pi^N{}_t(h)/P^T{}_t$ and $\Pi_t(f)^{N*}/P_t^{T*}$, respectively, are as follows:

$$\Pi^N{}_t(h)/P^T{}_t = (1/\theta)(P^N{}_t(h)/P^N{}_t)^{1-\theta}(P^N{}_t/P^T{}_t)sC_t^N{}_t, \quad (20)$$

$$\Pi^N{}_t(f)^*/P_t^{T*} = (1/\psi)(P_t^{N*}(f)/P_t^{N*})^{1-\psi}(P^{N*}{}_t/P^{T*}{}_t)(1-s)C_t^{N*}. \quad (21)$$

2.3. Relocation behavior of tradable goods firms

In this model, the driving force for relocation to other countries is differences in current real profits between home- and foreign-located tradable goods firms. In addition, following the formulation in Johdo (2015), we assume that all tradable goods firms are not allowed to relocate instantaneously even if there is the profit gap. This adjustment mechanism for relocation at time t is formulated as follows:

$$n_t - n_{t-1} = \eta[\Pi^T{}_t(h)/P^T{}_t - \Pi^T{}_t(f)^*/P^T{}_t{}^*] = \eta[\Pi^T{}_t(h)/P^T{}_t - \varepsilon_t \Pi^T{}_t(f)^*/P^T{}_t], \quad (22)$$

where the third term can be rewritten by using PPP and η ($0 \le \eta < \infty$) is a constant positive parameter that determines the degree of firm mobility between the two countries: a larger value of η implies higher firm mobility between two countries. Intuitively, the parameter η reflects the costs incurred by mobile firms in their new locations. Examples include the cost of finding appropriate plants, the cost of establishing the distribution networks, the cost of training the local workforce, the cost of coping with the foreign language, and the cost of adapting to the local legal system. Because of these relocation costs, all firms cannot move instantaneously to a better location even if there is the profit gap between two countries.

2.4. Market conditions

The equilibrium condition for the integrated international bond market is given by $sB_{t+1}+(1-s)B^*_{t+1}=0$. In addition, the money markets are assumed always to clear in the two countries, so that the equilibrium conditions are given by $M_t = \int_0^s M_t^i di$ and $M^*_t = \int_s^1 M_t^{*i} di$, respectively.

III. A SYMMETRIC STEADY STATE

In this section, we derive the solution for a symmetric steady state in which all exogenous variables are constant, initial net foreign assets are zero ($B_0 = 0$), $\theta_0 = \psi_0$, and $s = s^* = 1/2$. The superscript *i* and the index *j* are omitted because households and firms make the same equilibrium choices within and between countries. Henceforth, we denote the steady-state values by using the subscript *ss*. Because symmetry, which implies $C^T_{ss} = C^{T*}_{ss} = C^{Tw}_{ss}$ and $C^N_{ss} = C^{N*}_{ss}$ hold, the steady-state allocation of firms in the tradable sector is

$$n_{ss} = 1/2. \tag{23}$$

The steady state labor, output and consumption levels are

$$\ell^{s}{}_{ss} = \ell^{s*}{}_{ss} = ((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{1/2}(\gamma/\kappa)^{1/2}[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{1/2}, \tag{24}$$

$$y_{ss}{}^{T} = y_{ss}{}^{T*} = C^{T}{}_{ss} = C^{T*}{}_{ss} = C^{Tw}{}_{ss} =$$
$$((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{1/2}(\gamma/\kappa)^{1/2}[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{-1/2}, \tag{25}$$

$$y_{ss}{}^{N} = y_{ss}{}^{N*} = sC^{N}{}_{ss} = (1-s)C^{N*}{}_{ss} =$$
$$(1/2)((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{1/2}(\gamma/\kappa)^{1/2}[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{-1/2}((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta). \tag{26}$$

The steady-state levels of real profit for home- and foreign-located firms in the tradable and non-tradable goods sectors are:

$$\Pi_{ss}{}^{T}(h)/P_{ss}{}^{T} = \Pi_{ss}(f)^{T*}/P_{ss}{}^{T*} =$$
$$(1/\sigma)((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{1/2}(\gamma/\kappa)^{1/2}[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{-1/2}, \tag{27}$$

$$\Pi^{N}{}_{ss}(h)/P_{ss}{}^{T} = \Pi^{N}{}_{ss}(f)^{*}/P_{ss}{}^{T*} =$$
$$(1/2\theta)((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{1/2}(\gamma/\kappa)^{1/2}((\gamma-1)/\gamma)[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{-1/2}. \tag{28}$$

IV. A LOG-LINEARIZED ANALYSIS

IV.1 The relationship between relocation and the exchange rate

In this model, as in Cavelaars (2006), we also interpret the elasticity of substitution between any two differentiated non-tradable goods (θ) as an instrument of deregulation.[9] To examine the macroeconomic effects of an unanticipated unilateral deregulation shock in the non-tradable goods markets ($d\theta > 0$, $d\psi = 0$), we solve a log-linear approximation of the system around the initial, zero-shock steady state with $B_{ss,0} = 0$ and $\theta_0 = \psi_0$, which is the same as that derived in the previous section. For any variable X, we use $\hat{X}$ to denote 'short-run' percentage deviations from the initial steady-state value; i.e., $\hat{X} = dX_1 / X_{ss,0}$, where $X_{ss,0}$ is the zero-shock initial steady-state value and subscript 1 denotes the period in which the shock takes place. These short-run percentage deviations are consistent with the length of nominal wage contracts. Thus, nominal wages can be determined as $\hat{W} = \hat{W}^* = 0$ in the short-run log-linearized equations. In addition, we use $\overline{X}$ to denote 'long-run' percentage deviations from the initial steady-state value; i.e., $\overline{X} = dX_2 / X_{ss,0} = dX_{ss} / X_{ss,0}$, which is consistent with flexible nominal wages. Note that $X_2 = X_{ss}$ because the new steady state is reached at period 2.

By log linearizing equation (22) around the symmetric steady state and setting $\hat{W} = \hat{W}^* = 0$, we obtain the following log-linearized expression for the international distribution of firms:

[9] Because of the symmetry of the model, a foreign deregulation shock is treated analogously. In particular, we focus on the effects of deregulation policy shocks of the home country.

$$\hat{n} = 2\eta(\gamma/\kappa)^{1/2}((\phi-1)/\phi)^{1/2}((\sigma-1)/\sigma)^{3/2}[1+((\gamma-1)/\gamma)(\sigma/(\sigma-1))((\theta-1)/\theta)]^{-1/2}\hat{\varepsilon}\,. \quad (29)$$

Equation (29) shows that an exchange rate depreciation induces global relocation of firms towards the home country.[10] Intuitively, with fixed nominal wages, which cause nominal product prices to be sticky because of mark-up pricing by monopolistic product suppliers (i.e., $\hat{W} = \hat{W}^* = \hat{P}^T(h) = \hat{P}^{*T}(f) = \hat{P}^N(h) = \hat{P}^{*N}(f) = 0$), the depreciation increases relative home tradable goods production through the 'expenditure-switching effect'; i.e., $\hat{y}^T(h) - \hat{y}^{*T}(f) = \sigma\hat{\varepsilon}$.[11] This increases the relative profits of home-located tradable goods firms, and consequently, other tradable goods firms relocate to the home country. Equation (29) also shows that nominal exchange rate changes have greater effects the greater is the flexibility of relocation (the larger is η). By contrast, when relocation costs are high (η = 0), nominal exchange rate changes have a negligible effect on the relocation of tradable goods firms.

V. Analysis of unilateral deregulation shocks

In order to show the macroeconomic effects of deregulation policy shocks of the home country, we consider the impacts of an unanticipated permanent increase in θ in period

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[10] This result is consistent with the evidence found in the empirical literature on the relationship between exchange rates and FDI (e.g., Cushman, 1988, Caves, 1989, Froot and Stein, 1991, Campa, 1993, Klein and Rosengren, 1994, Blonigen, 1997, Goldberg and Klein, 1998, Bénassy-quéré et al, 2001, Chakrabarti and Scholnick, 2002, Kiyota and Urata, 2004, and Bolling et al, 2007).

[11] The expenditure-switching effect arises intuitively because exchange rate depreciation causes a decrease in the relative real price of home tradable goods for households in both countries so that world consumption demand switches toward home tradable goods. Corsetti et al (2005) also define this as 'competitive effect'.

1. This means $\overline{\theta} = \hat{\theta} > 0$.[12] In particular, we analyze the influence of the deregulation shock on the following key variables: the exchange rate, the international relocation of firms, and the relative consumptions of tradable and non-tradable goods. The closed-form solutions for the key variables are as follows:

$$\hat{\varepsilon} = -\frac{1}{\eta_1}\left\{\delta^{-1}\left(\frac{2\theta_2}{\theta-1}\right)(2+4\eta\theta_1+\sigma)^{-1}\overline{\theta}+\left(\frac{1-\gamma}{\theta}\right)\hat{\theta}\right\}<0, \tag{30}$$

$$\hat{n} = -\frac{2\eta\theta_1}{\eta_1}\left\{\delta^{-1}\left(\frac{2\theta_2}{\theta-1}\right)(2+4\eta\theta_1+\sigma)^{-1}\overline{\theta}+\left(\frac{1-\gamma}{\theta}\right)\hat{\theta}\right\}<0, \tag{31}$$

$$\hat{C}^N - \hat{C}^{N*} = \left(\frac{1}{\theta-1}\right)\hat{\theta} > 0, \tag{32}$$

$$\overline{C}^N - \overline{C}^{N*}$$

$$= \frac{1}{\eta_1}\left[\frac{4\eta\theta_1+\sigma}{2+4\eta\theta_1+\sigma}\right]\left\{\delta^{-1}\left(\frac{2\theta_2}{\theta-1}\right)(2+4\eta\theta_1+\sigma)^{-1}\overline{\theta}+\left(\frac{1-\gamma}{\theta}\right)\hat{\theta}\right\}+\left[\frac{1+4\eta\theta_1+\sigma}{2+4\eta\theta_1+\sigma}\right](\theta-1)^{-1}\overline{\theta}>0, \tag{33}$$

$$\hat{C}^T - \hat{C}^{T*} = \overline{C}^T - \overline{C}^{T*} = \frac{1}{\eta_1}\left\{\delta^{-1}\left(\frac{2\theta_2}{\theta-1}\right)(2+4\eta\theta_1+\sigma)^{-1}\overline{\theta}+\left(\frac{1-\gamma}{\theta}\right)\hat{\theta}\right\}>0, \tag{34}$$

$$\eta_1 = \delta^{-1}\left[1+2\theta_2\left(\frac{4\eta\theta_1+\sigma}{2+4\eta\theta_1+\sigma}\right)-\theta_2\right]+4\gamma\tilde{\sigma}\eta\theta_1+\gamma(\sigma-1)-\theta_2+1>0,$$

$$\theta_1 = \gamma^{1/2}\tilde{\phi}^{1/2}\tilde{\sigma}^{3/2}\tilde{\kappa}^{1/2}\left(1+\tilde{\gamma}\tilde{\sigma}^{-1}\tilde{\theta}\right)^{-1/2}>0,\quad \theta_2 = \tilde{\sigma}\gamma\left(1+\tilde{\gamma}\tilde{\sigma}^{-1}\tilde{\theta}\right)<1,$$

[12] Because of the symmetry of the model, a foreign deregulation shock is treated analogously, i.e., $d\psi > 0$, $d\theta = 0$. In this paper, we focus on the effects of deregulation policy shocks of the home country.

where $\tilde{\gamma} = (1-\gamma)/\gamma$, $\tilde{\theta} = (\theta - 1)/\theta$, $\tilde{\phi} = (\phi - 1)/\phi$, $\tilde{\sigma} = (\sigma - 1)/\sigma$, $\tilde{\kappa} = 1/\kappa$. Equation (30) indicates that an increase in the degree of competition in the home non-tradable goods sector ($\overline{\theta} = \hat{\theta} > 0$) leads to appreciation of its currency ($\hat{\varepsilon} < 0$). Equation (31) indicates that an increase in the degree of competition in the non-tradable goods sector leads to the relocation of some firms from the home to the foreign countries. Equations (32) and (33) show that the relative non-tradable consumption levels of the home country increase in the short-run and long-run when there is an increase in the degree of competition in the non-tradable goods sector. Equation (34) shows that the relative tradable consumption levels of the home country increase in the short-run and long-run when there is an increase in the degree of competition in the non-tradable goods sector.

The above results can be explained intuitively as follows. First, the exchange rate effect is determined by two conflicting mechanisms. On the one hand, an unanticipated deregulation in the home country leads to an instantaneous decline of the goods prices of the non-tradables because of the fall in the price mark-ups of the non-tradable goods sector. With fixed nominal consumer price subindex of tradable goods, the decrease of the non-tradable price subindex reduces the consumption price index in the home country, which causes depreciation of its currency to restore money market equilibrium for a given level of initial tradable and non-tradable consumptions. On the other hand, the instantaneous fall in the price mark-ups of the non-tradable goods sector leads to the decrease of the non-tradable price subindex, which then raises the relative non-tradable consumptions in the home country (see equation (32)). This then leads to an increase in labor demand in the home country, which in turn raises labor income in the home country. As a result, the increase in labor income in the home country increases the relative tradable and non-tradable consumptions in the home country (see equations (33) and (34)). Because of the latter mechanism, the home currency must appreciate to restore equilibrium in the market for real balances. This is because the real money demand for liquidity services is increasing in aggregate consumption. Thus, the impact of a deregulation in the home country on the equilibrium exchange rate is ambiguous. However, from equation (30), such a deregulation unambiguously leads to appreciation of the home currency. In addition, the appreciation decreases relative home tradable goods production through the expenditure-switching effect; i.e., $\hat{y}(h)-\hat{y}^*(f)=\sigma\hat{\varepsilon}$. This then decreases the relative profits of home-located tradable goods firms, and consequently, home located tradable goods firms relocate to the foreign country ($\hat{n}<0$, see equation (31)).

Equation (33) and (34) also show that an increase in the flexibility of relocation (the larger is η) weakens the effect of deregulation on relative home consumptions of tradable and non-tradable goods. Intuitively, as the relocation of firms becomes more flexible (η increases), there is a greater relative decrease in labor income in the home country, because more tradable goods firms relocate to the foreign country, and therefore the increase in the relative consumptions of tradable and non-tradable goods are smaller. The opposite mechanism is valid when η is small (the degree of firm mobility is small). Furthermore, equation (30) shows that the larger is the value of η, the smaller is the response of exchange rate to the deregulation shock. This happens because, given that the demand for real money balance is increasing with consumption (as implied by the money demand function), the home currency must depreciate and reduce the supply of real money balances in the home country to restore money market equilibrium. The opposite mechanism is also valid when η is small (the degree of firm mobility is small).

VII. CONCLUSION

This paper has presented the impacts of deregulation on the consumption and exchange rate using a two-country model with international firm mobility. The main findings of our analysis are that i) the deregulation in the home country always increases the tradable consumption levels as well as the non-tradable consumption levels in the home country in the relative terms, ii) an increase in the degree of competition in the home country's non-tradable sector results in appreciation of the home currency, iii) the appreciation then decreases the relative real profits of firms located in the home country, and consequently firms relocate to the foreign country, iv) an increase in the flexibility of relocation (or a decrease in the relocation costs) weakens the responses of the relative consumptions and the equilibrium exchange rate to deregulation.

The model developed here is rather simple in a number of respects. This suggests many directions for future research. First, this paper may yield results that are more interesting if the current model is modified to include sunk costs, as in Russ (2007).[13] Also of interest is extending the model to account for trade impediments such as tariffs and transport costs as in Fender and Yip (2000), Reitz and Slopek (2005) and Hwang

[13] Campa (1993) finds the negative effect of sunk costs (e.g., investment in advertising and media promotion) on industry entry into the US during the 1980s. Brainard (1997) also finds that overseas production by multinationals decreases with the fixed costs of production.

and Turnovsky (2013).[14] Further, the consideration of the effects of deregulation under a fixed exchange rate system in our model is noteworthy. These issues remain for future research.

REFERENCES

Andersen, T.M. and Beir, N.C. (2005). 'International transmission of transitory and persistent monetary shocks under imperfect information', *Journal of International Economics*, 66, pp. 485−507.

Bénassy-quéré, A., Fontagné, L. and Lahréche-révil, A. (2001). 'Exchange-rate strategies in the competition for attracting foreign direct investment', *Journal of the Japanese and International Economies*, 15, pp. 178−198.

Benigno, P. (2002). 'A simple approach to international monetary policy coordination', *Journal of International Economics*, 57, pp. 177−196.

Bergin, P.R. and Feenstra, R.C. (2001). 'Pricing-to-market, staggered contracts, and real exchange rate persistence', *Journal of International Economics*, 54, pp. 333−359.

Betts, C. and Devereux, M. (2000a). 'Exchange rate dynamics in a model of pricing-to-market', *Journal of International Economics*, 50, pp. 215−244.

Betts, C. and Devereux, M. (2000b). 'International monetary policy coordination and competitive depreciation: A reevaluation', *Journal of Money, Credit, and Banking*, 32, pp. 722−745.

Blanchard, O. and Kiyotaki, N. (1987). 'Monopolistic competition and the effects of

[14] Empirical evidence shows that higher tariff has an important effect on foreign direct investment of firms based in developed countries (see Brainard, 1997, and Blonigen, 2002).

aggregate demand', *American Economic Review*, 77, pp. 647−666.

Blonigen, B.A. (1997). 'Tariff-jumping antidumping duties', *Journal of International Economics*, 57, pp. 31−50.

Blonigen, B.A. (2002). 'Tariff-jumping antidumping duties', *Journal of International Economics*, 57, pp. 31−50.

Bolling, C., Shane, M. and Roe, T. (2007). 'Exchange rates and U.S. foreign direct investment in the global processed food industry', *Agricultural and Resource Economics Review*, 36, pp. 230–238.

Brainard, L.S. (1997). 'An empirical assessment of the proximity-concentration trade-off between multinational sales and trade', *American Economic Review*, 87, pp. 520−544.

Campa, J.M. (1993). 'Entry by foreign firms in the united states under exchange rate uncertainty', *Review of Economics and statics*, 75, pp.614−622.

Campbell, J.R. and Lapham, B. (2004). 'Real exchange rate fluctuations and the dynamics of retail trade industries on the U.S.-Canada border', *American Economic Review*, 94, pp. 1194−1206.

Caselli, P. (2001). 'Fiscal consolidation under fixed exchange rates', *European Economic Review*, 45, pp. 425−450.

Cavallari, L. (2004). 'Optimal monetary rules and internationalized production', *International Journal of Finance and Economics*, 9, 175−186.

Cavallo, M. and Ghironi, F. (2002). 'Net foreign assets and the exchange rate: Redux revised', *Journal of Monetary Economics*, 49, pp. 1057−1097.

Cavelaars, P. (2006). ‘Output and price effects of enhancing services sector competition in a large open economy’, *European Economic Review*, 50, pp. 1131−1149.

Caves, R. (1989). ‘Exchange-rate movements and foreign direct investment in the United States’, in *The Internationalization of U.S. Markets*, pp.199−228, Audretsch, D.B. and Claudon, M.P., eds, New York University Press.

Chakrabarti, R. and Scholnick, B. (2002). ‘Exchange rate expectations and foreign direct investment flows’, *Weltwirtschaftliches Archiv*, 138, pp. 1−21.

Chu, H. (2005). ‘Welfare and public: The role of internationalized production’, *Economic Inquiry*, 43, pp. 542−557.

Corsetti, G. and Pesenti, P. (2001). ‘Welfare and macroeconomic interdependence’, *Quarterly Journal of Economics*, 116, pp. 421−444.

Corsetti, G. and Pesenti, P. (2005). ‘International dimensions of optimal monetary policy’, *Journal of Monetary Economics*, 52, pp. 281−305.

Corsetti, G., Martin, P. and Pesenti, P. (2005). ‘Productivity, terms of trade, and the ‘home market effect’’, *Journal of International Economics*, 73, pp. 99−127.

Cushman, D.O. (1985). ‘Real exchange rate risk, expectations, and the level of foreign direct investment’, *Review of Economics and Statistics*, 67, pp. 297−308.

Cushman, D.O. (1988). ‘Exchange rate uncertainty and foreign direct investment in the United Statess’, *Weltwirtschaftliches Archiv*, 124, pp. 322−336.

Devereux, M.B. (2004). ‘Should the exchange rate be a shock absorber?’, *Journal of International Economics*, 62, pp. 359−377.

Devereux, M. and Engel, C. (2001). ‘The optimal choice of exchange rate regime: price setting rules and internationalized production, in Topics in Empirical International Economics, Blomstrom M, Goldberg L (Eds.). University of Chicago Press: Chicago.

Devereux, M. and Engel, C. (2002). ‘Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect’, *Journal of Monetary Economics*, 49, pp. 913−940.

Engel C. (2002). ‘The responsiveness of consumer prices to exchange rates: A synthesis of some new open economy macro models’, *The Manchester School Supplement*, 1463−6786, pp. 1−15.

Farrell, R., Gaston, N. and Sturm, J.M. (2004). ‘Determinants of Japan’s foreign direct investment: An industry and country panel study, 1984−1998’, *Journal of the Japanese and International Economies*, 18, pp. 161−182.

Fender, J. and Yip, C.K. (2000). ‘Tariffs and exchange rate dynamics redux’, *Journal of International Money and Finance*, 19, pp. 633−655.

Froot, K.A. and Stein, J.C. (1991). ‘Exchange rates and foreign direct investment: an imperfect capital markets approach’, *Quarterly Journal of Economics*, 106, pp. 1191−1217.

Ganelli, G. (2005). ‘The new open economy macroeconomics of government debt’, *Journal of International Economics*, 65, pp. 167−184.

Ghironi, F. and Melitz, M.J. (2005). ‘International trade and macroeconomic dynamics with heterogeneous firms’, *Quarterly Journal of Economics*, 120, pp. 865−915.

Goldberg, L. and Klein, M. (1998). 'Foreign direct investment, trade, and real exchange rate linkages in developing countries', in Glick, R., eds., *Managing Capital Flows and Exchange rates: Perspectives from the Pacific Basin*, pp. 73−100. Cambridge, UK: Cambridge University Press.

Goldberg, L. and Kolstad, C. (1995). 'Foreign Direct Investment, Exchange rate variability and Demand Uncertainty', *International Economic Review*, 36, pp. 855−873.

Hau, H. (2000). 'Exchange rate determination: The role of factor price rigidities and nontradeables', *Journal of International Economics*, 50, pp. 421−447.

Hwnag, Y. and Turnovsky, S.J. (2013). 'Exchange rate pass-through and the effects of tariffs on economic performance and welfare', *Journal of International Money and Finance*, 33, pp. 81−102.

Johdo, W. (2013). 'Does monetary expansion improve welfare under habit formation?', *Economics Bulletin*, 33, pp. 1959−1968.

Johdo, W. (2015). 'Monetary policy, foreign welfare and international firm mobility', forthcoming in *International Journal of Economic Theory*.

Kiyota, K. and Urata, S. (2004). 'Excahnge rate, exchange rate volatility and foreign direct investment', *The World Economy*, 1501−1536.

Klein, M.W. and Rosengren, E.S. (1994). 'The real exchange rate and foreign direct investment in the United States: relative wealth vs. relative wage effects', *Journal of International Economics*, 36, pp. 373−389.

Kollmann, R. (2001). 'Explaining international comovements of output and asset returns: The role of money and nominal rigidities', *Journal of Economic Dynamics and Control*, 25, pp. 1547–1583.

Kollmann, R. (2002). 'Monetary policy rules in the open economy: effects on welfare and business cycles', *Journal of Monetary Economics*, 49, pp. 989–1015.

Lane, P.R. (1997). 'Inflation in open economies', *Journal of International Economics*, 42, pp. 327–347.

Lane, P.R. (2001). 'The new open economy macroeconomics: A survey', *Journal of International Economics*, 54, pp. 235–266.

Lubik, T.A. and Russ, K.N. (2006). 'Entry, multinational firms and exchange rate volatility', University of California, Davis, Woking Paper No. 06-22.

Obstfeld, M. and Rogoff, K. (1995). 'Exchange rate dynamics redux', *Journal of Political Economy*, 103, pp. 624–660.

Obstfeld, M. and Rogoff, K. (1996). *Foundations of International Macroeconomics*, MIT press, Cambridge, MA.

Obstfeld, M. and Rogoff, K. (2002). 'Global implications of self-oriented national monetary rules', *Quarterly Journal of Economics*, 117, pp. 503–535.

Reitz, S. and Slopek, U.D. (2005). 'Macroeconomic effects of tariffs: Insights from a new open economy macroeconomics model', *Schweizerische Zeitschrift fur Volkswirtschaft und Statistik*, 141, pp. 285–311.

Russ, K.N. (2007). 'The endogeneity of the exchange rate as a determinant of FDI: A model of entry and multinational firms', *Journal of International Economics*, 71, pp. 344–372.

Senay, O. and Sutherland, A. (2007). ‘Foreign money shocks and the welfare performance of alternative monetary policy regimes’, *Scandinavian Journal of Economics*, 109, pp. 245−266.

Smets, F. and Wouters, R. (2002). ‘Openness, Imperfect exchange rate pass-through and monetary policy’, *Journal of Monetary Economics*, 49, pp. 947−981.

Sousa, T.V. (2013). ‘Asymmetries in an open economy model’, *Journal of International Money and Finance*, 33, pp. 358−380.

Sutherland, A. (2005a). ‘Cost-push shocks and monetary policy in open economies’, *Oxford Economic Papers,* 57, pp. 1−33.

Sutherland, A. (2005b). ‘Incomplete pass-through and the welfare effects of exchange rate variability’, *Journal of International Economics*, 65, pp. 375−399.

Svensson, L.E.O. (1986). ‘Sticky goods prices, flexible asset prices, monopolistic competition, and monetary policy’, *Review of Economic Studies*, 53, pp. 385−405.

Tille, C. (2008). ‘Financial integration and the wealth effect of exchange rate fluctuations’, *Journal of International Economics*, 75, pp. 283−294.

Warnock, F.E. (2003). ‘Exchange rate dynamics and the welfare effects of monetary policy in a two-country model with home-product bias’, *Journal of International Money and Finance*, 22, pp. 343−363.