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Tariffs, the exchange rate, and location

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Abstract

This paper employs a new open economy macroeconomics model to examine the macroeconomic effects of a rise in one country's tariff rate leading to international relocation of firms. In such a model, both the real exchange rate and international relocation of firms offer the key to an understanding the impacts of the tariff policy. The main findings of our analysis are that (i) the imposition of a tariff by the home country always increases the relative home consumption, (ii) the imposition of the tariff 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 weakens the responses of both the relative consumption and the exchange rate to the imposition of the tariff.

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1. Introduction

In the new open economy macroeconomics (NOEM) literature, the international transmission of macroeconomic policies 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), and Johdo (2013). This literature has focused on mainly how the exchange rate and consumption of each country are influenced by unanticipated monetary and fiscal shocks in one country under monopolistic distortions and nominal price (or wage) rigidities. For example, as is well-known by now, 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 when there is a fixed international distribution of firms.

In the theoretical literature on the NOEM, there has so far been little study of the macroeconomic impacts of a tariff. The exceptions are Fender and Yip (2000) and Reitz and Slopek (2005), who investigated the macroeconomic effects of a tariff in a NOEM model with a fixed international distribution of firms.[1] They showed that the imposition of a tariff by a country always appreciates its currency, and consequently increases the country's relative consumption and welfare, respectively. However, in their models, the following question remains unresolved: how is the relationship between the imposition of a tariff and relative home consumptions changed if international firm mobility is taken into account; and how does the imposition of a tariff by one country affect international relocation of firms through the change in the exchange rate? Although it is feasible to explore the impacts of a tariff in this framework under the assumption of a fixed international distribution of firms, there is a large body of empirical research on the relationship between the exchange rate and firms' production location (and their foreign direct investment (see, Cushman, 1985, 1988; Froot & Stein, 1991; Campa, 1993; Klein & Rosengren, 1994; Goldberg & Kolstad, 1995; Blonigen, 1997; Goldberg & Klein, 1998; Bénassy-quéré et al, 2001; Chakrabarti & Scholnick, 2002; Farrell et al., 2004).

In order to address these issues, this paper takes the model of Reitz and Slopek (2005) and combines it with the model of Johdo (2015), who proposes a NOEM model that incorporates the international movement of firms, to account for the impact of a tariff on the consumption of the two countries in a situation where international firm mobility is taken into account. In particular, a novel feature of this model is that the international distribution of firms responds to exchange rate movements caused by the imposition of a tariff.[2] Thus, our model generates an additional international

[1] Reitz and Slopek (2005) extended the Fender and Yip framework to include the intertemporal linkages by taking short-run current account imbalances into consideration and showed different mechanisms for consumption and welfare effects of a tariff to those obtained from the benchmark Fender and Yip model. Other related references include Ryou (2002), Novy (2010), Hwang and Turnovsky (2013) and Wang and Zou (2013).

[2] 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).

transmission effect that operates through the international relocation of firms, which has been overlooked by the benchmark model of Reitz and Slopek (2005).

We conclude that the imposition of a tariff by the home country results in a proportionate increase in both the short-run and long-run relative home consumptions and appreciation of the home currency. In addition, it is found that the appreciation decreases (increases) the real profits of firms located in the home country (abroad), and consequently firms relocate to the foreign country. Further, we show that an increase in the firm mobility weakens the responses of both the relative consumptions and the equilibrium exchange rate to the imposition of the tariff.

2. The model

We assume a two-country world economy, with a home and a foreign country. The models for the home and foreign countries are the same, and an asterisk is used to denote foreign variables. Monopolistically competitive firms exist continuously in the world in the [0, 1] range. Producers in the interval [0, n_t] locate in the home country, and the remaining (n_t, 1] producers locate in the foreign country, where n_t is endogenous. We also assume that in the home country, households inhabit the interval [0, s] and those in the foreign country inhabit the interval (s, 1]. Finally, we assume that only the home country imposes a tariff, τ_t, on imported foreign goods.

Home and foreign households share the same utility function. The intertemporal objective of household $i \in (0, s)$ in the home country at time t is to maximize the following lifetime utility:

$$U^i_t = E_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} (\log C^i_\tau + \chi \log(M^i_\tau/P_\tau) - (\kappa/2)(L^{si}_\tau)^2), \tag{1}$$

where β is a constant subjective discount factor ($0 < \beta < 1$), L^{si}_t is the amount of labour supplied by household i in period t, and the consumption index C^i_t is defined as follows:

$$C^i_t = \left(\int_0^1 C^i_t(j)^{(\theta-1)/\theta} dj \right)^{\theta/(\theta-1)}, \ \theta > 1, \tag{2}$$

where θ is the elasticity of substitution between any two differentiated goods, $C^i_t(j)$ is the consumption of good j in period t for household i. In addition, 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 $P_t = \left(\int_0^1 P_t(j)^{1-\theta} dj \right)^{1/(1-\theta)}$, where $P_t(j)$ is the home-currency producer price of good j in period t. Analogously, the foreign country CPI is $P_t^* = \left(\int_0^1 P_t^*(j)^{1-\theta} dj \right)^{1/(1-\theta)}$, where $P_t^*(j)$ is the foreign-currency producer price of good j in period t. Under the law of one price with respect to producer prices, i.e., $P_t(j) = \varepsilon_t P_t^*(j)$, where ε_t is the nominal exchange rate, defined as the home currency price per unit of foreign currency, we can rewrite the price indices as

$$P_t = \left(\int_0^{n_t} P_t(j)^{1-\theta} dj + \int_{n_t}^1 \left((1+\tau_t) \varepsilon_t P_t^*(j) \right)^{1-\theta} dj \right)^{1/(1-\theta)}, \tag{3}$$

$$P_t^* = \left(\int_0^{n_t} \left(P_t(j)/\varepsilon_t \right)^{1-\theta} dj + \int_{n_t}^{1} P_t^*(j)^{1-\theta} dj \right)^{1/(1-\theta)}. \quad (4)$$

If the tariff is zero (i.e., $\tau_t = 0$), a comparison of the above price indices implies that purchasing power parity is represented by $P_t = \varepsilon_t P_t^*$. Following the literature, we assume that there is an international risk-free real bond market in which both home and foreign households can lend and borrow at the same risk-free interest rate denominated in units of the composite consumption good. In this model, households receive returns on risk-free real bonds, earn wage income by supplying labour, and receive profits from all firms equally. Therefore, the household budget constraint can be written as:

$$P_t B^i_{t+1} + M^i_t = P_t(1+r_t)B^i_t + M^i_{t-1} + W^i_t L^{si}_t + P_t \int_0^{n_t} \left(\Pi_t(j)/P_t \right) dj + P_t \int_{n_t}^{1} \left(\Pi_t^*(j)/P_t^* \right) dj - P_t C^i_t + P_t T^i_t, \quad (5)$$

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, $W^i_t L^{si}_t$ is nominal labour income, where W^i_t denotes the nominal wage rate of household i in period t, $\int_0^{n_t} \Pi_t(j)/P_t dj$ ($\int_{n_t}^{1} \Pi_t^*(j)/P^*_t dj$) represents the total real profit flows of firms located at home (abroad), where $\Pi_t(j)$ ($\Pi_t^*(j)$) is the nominal profit flow of firm j located at home (abroad). In addition, $P_t C^i_t$ represents nominal consumption expenditure and T^i_t denotes real lump-sum transfers from the government in period t. In the government sector, we assume that government spending is zero and that all seigniorage revenues derived from printing the national currency and all tariff revenue are rebated to the public in the form of lump-sum transfers. Hence, the government budget constraint in the home country is $T_t = \tau_t \varepsilon_t P_t^*(f)(1-n_t)C(f) + [(M_t - M_{t-1})/P_t]$, where M_t is aggregate money supply, and $T_t = \int_0^s T_t^i di$.

In the home country, firm $j \in [0, n_t]$ hires a continuum of differentiated labour inputs domestically and produces a unique product according to the CES production function, $y_t(j) = (s^{-1/\phi} \int_0^s L_t^{di\,(\phi-1)/\phi} di)^{\phi/(\phi-1)}$, where $y_t(j)$ denotes the production of home-located firm j in period t, $L^{di}_t(j)$ is the firm j's input of labour 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 labour demand for household i's labour input is as follows:

$$L^{di}_t(j) = s^{-1}(W^i_t/W_t)^{-\phi} y_t(j), \quad (6)$$

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

We now consider the optimization problem of households. In the first stage, households in the home (resp. foreign) country maximize the consumption index C^i_t (resp. $C^i_t{}^*$) subject to a given level of expenditure by optimally allocating differentiated goods $C^i_t(j), j \in [0, 1]$. This static problem yields:

$$C^i_t(h) = (P_t(h)/P_t)^{-\theta} C^i_t, \quad C^i_t(f) = (P_t(f)(1+\tau_t)/P_t)^{-\theta} C^i_t, \quad (7)$$

$$C^i_t{}^*(h) = (P_t{}^*(h)/P_t{}^*)^{-\theta} C^i_t{}^*, \quad C^i_t{}^*(f) = (P_t{}^*(f)/P_t{}^*)^{-\theta} C^i_t{}^*. \tag{8}$$

Aggregating the demands in (7) and (8) across all households worldwide and equating the resulting equation to $y_t(h)$ yields the following market clearing condition for any product h in period t:

$$y_t(h) = sC^i_t(h) + (1 - s)C^i_t{}^*(h). \tag{9}$$

Similarly, for any product f of the foreign located firms, we obtain $y_t(f)^* = sC^i_t(f) + (1 - s)C^i_t{}^*(f)$. In the second stage, households maximize (1) subject to (5). The first-order conditions for this problem with respect to B^i_{t+1} and M^i_t can be written as

$$1/C^i_t = \beta E_t[(1 + r_{t+1})/C^i_{t+1}], \tag{10}$$

$$M^i_t/P_t = \chi C^i_t((1 + i_{t+1})/i_{t+1}), \tag{11}$$

where i_{t+1} is the nominal interest rate for home-currency loans between periods t and $t+1$, defined as usual by $1 + i_{t+1} = (1 + r_{t+1})E_t[(P_{t+1}/P_t)]$. Equation (10) is the Euler equation for consumption and (11) is the one for money demand.

In the monopolistic goods markets, each firm has some monopoly power over pricing. Because home-located firm j hires labour domestically, given W_t, P_t, C^i_t, $C^i_t{}^*$ and n_t, and subject to (6) and (9), home-located firm j faces the following profit-maximization problem: $\max_{P_t(h)} \Pi_t(h) = P_t(h)y_t(h) - \int_0^s W^i_t L^{di}_t(h)di = (P_t(h) - W_t)y_t(h)$. By substituting $y_t(h)$ from equation (9) into the firm's nominal profit $\Pi_t(h)$ and then differentiating the resulting equation with respect to $P_t(h)$, we obtain the following price mark-up:

$$P_t(h) = (\theta/(\theta - 1))W_t. \tag{12}$$

Because W_t is given, from (12), all home-located firms charge the same price. Substituting (9) and (12) and those of foreign counterparts into the real profit flows of the home- and foreign- located firms, $\Pi_t(h)/P_t$ and $\Pi_t(f)^*/P_t^*$, respectively, yields,

$$\Pi_t(h)/P_t = (1/\theta)(P_t(h)/P_t)y_t(h), \quad \Pi_t(f)^*/P_t^* = (1/\theta)(P_t{}^*(f)/P_t{}^*)y_t(f)^*. \tag{13}$$

The model assumes that the driving force for relocation to other country is a difference in real profits between two bounded countries. In addition, we assume that all firms are not allowed to relocate instantaneously even if there is the profit gap. Following the formulation in Johdo (2015), the above adjustment process for relocation is formulated as follows:

$$n_t - n_{t-1} = \gamma[\Pi_t(h)/P_t - \Pi_t(f)^*/P_t^*]. \tag{14}$$

where γ ($0 \le \gamma < \infty$) is a constant positive parameter that determines the degree of firm mobility between the two countries: a larger value of γ implies higher firm mobility between two countries.

Following Corsetti and Pesenti (2001), 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 labour market, each household provides a single variety of labour input to a continuum of domestic firms. Hence, the equilibrium labour-market conditions for the home and foreign countries imply that $L^{si}{}_t = \int_0^{n_t} L_t^{di}(j)dj$, $i \in [0, s]$ and $L^{si*}{}_t = \int_{n_t}^{1} L_t^{di*}(j)dj$, $i \in (s, 1]$, respectively. By taking W_t, P_t, $y_t(j)$, and n_t as given, substituting $L^{si}{}_t = \int_0^{n_t} L_t^{di}(j)dj$ and (6) into the budget constraint given by (5), and maximizing the lifetime utility given by (1) with respect to $W^i{}_t$, we obtain the following first-order condition:

$$\phi(W^i{}_t/P_t)^{-1}E_{t-1}[\kappa L^{si}{}_t{}^2] = (\phi-1)E_{t-1}[(L^{si}{}_t/C^i{}_t)]. \tag{15}$$

The equilibrium condition for the integrated international real bond market is given by $sB_{t+1}+(1-s)B^*{}_{t+1} = 0$. The money markets are given by $M_t = \int_0^s M_t^i di$ and $M^*{}_t = \int_s^1 M_t^{*i} di$, respectively.

3. A symmetric steady state

In this section, we derive the solution for a symmetric steady state in which all exogenous variables are constant, initial real bond holdings of the home country are zero ($B_0 = 0$), the tariff is zero initially ($\tau_0 = 0$) 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. In the symmetric steady state, in which all variables are constant in both countries, given the Euler equation for consumption (equation (10)), the constant real interest rate is given by $r_{ss} = (1-\beta)/\beta \equiv \delta$, where δ is the rate of time preference. The steady-state allocation of firms is $n_{ss} = 1/2$. The steady state output levels are

$$L^s{}_{ss} = L^{s*}{}_{ss} = C_{ss} = C^*{}_{ss} = C^w{}_{ss} = y_{ss}(h) = y_{ss}{}^*(f)$$
$$= ((\phi-1)/\phi)^{1/2}((\theta-1)/\theta)^{1/2}(1/\kappa)^{1/2}. \tag{16}$$

Substituting $y_{ss}(h)$ and $y_{ss}{}^*(f)$ from equation (16) into equation (13) yields the following steady-state levels of real profit for home- and foreign-located firms, which are equal:

$$\Pi_{ss}(h)/P_{ss} = \Pi_{ss}(f)^*/P_{ss}{}^* = (1/\theta)((\phi-1)/\phi)^{1/2}((\theta-1)/\theta)^{1/2}(1/\kappa)^{1/2}. \tag{17}$$

4. The log-linearized model

To examine the macroeconomic effects of an unanticipated permanent tariff, we solve a log-linear approximation of the system around the initial, zero-shock steady state with $B_{ss,0} = 0$ and $\tau_{ss,0} = 0$, as 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. In addition, we use $\overline{X}$ to denote 'long run' percentage deviations from the initial steady-state value.

By log-linearizing equation (14) around the symmetric steady state and setting $\hat{P}(h)=\hat{P}^*(f)=0$, we obtain the following log-linearized expression for the short-run international relocation of firms:

$$\hat{n}=2\gamma\left((\phi-1)/\phi\right)^{1/2}\left((\theta-1)/\theta\right)^{3/2}(1/\kappa)^{1/2}\left(\hat{\varepsilon}+(1/2)d\tau\right). \tag{18}$$

Equation (18) shows that exchange rate appreciation ($\hat{\varepsilon}<0$) induces global relocation of firms towards the foreign country ($\hat{n}<0$) for a given level of a tariff. This result is consistent with the evidence found in the empirical literature on the relationship between exchange rates and FDI (Cushman, 1988; Caves, 1989; Froot & Stein, 1991; Campa, 1993; Klein & Rosengren, 1994; Blonigen, 1997; Goldberg & Klein, 1998; Baek & Okawa, 2001; Bénassy-quéré et al, 2001; Chakrabarti & Scholnick, 2002; Bolling et al, 2007; Udomkerdmongkol et al, 2008). Equation (18) also shows that nominal exchange rate changes have greater effects the greater is the flexibility of relocation (the larger is γ). In addition, from equation (18), for a given level of the exchange rate, the imposition of a tariff by the home country ($d\tau>0$) leads firms to relocate into the home country, i.e., $\hat{n}>0$. This equation offers the key to an understanding of the impacts of an unanticipated tariff on cross-country differences in consumption and the exchange rate.

5. The impacts of a tariff

We now consider the macroeconomic effects of the imposition of an unanticipated permanent tariff by the home country. The closed-form solutions for key variables are as follows:

$$\hat{C}-\hat{C}^*=\overline{C}-\overline{C}^*=\left(\frac{Z_3-(1/2)Z_1}{Z_1+Z_2}\right)d\tau>0, \tag{19}$$

$$\hat{\varepsilon}=-\left(\frac{Z_3+(1/2)Z_1}{Z_1+Z_2}\right)d\tau<0, \tag{20}$$

$$\hat{n}=-\gamma\tilde{\phi}^{1/2}\tilde{\theta}^{3/2}\tilde{\kappa}^{1/2}\left(\frac{1+\delta}{\delta}\right)\left(\frac{1}{Z_1+Z_2}\right)d\tau<0, \tag{21}$$

where

$$Z_1=\tilde{\theta}^2\left[\theta+4\gamma\tilde{\phi}^{1/2}\tilde{\theta}^{1/2}\tilde{\kappa}^{1/2}\right]>0,\quad Z_2=\left(\frac{1+\delta}{\delta}\right)+\left(\frac{\tilde{\theta}}{\delta}\right)\left[\frac{\theta-1+4\gamma\tilde{\phi}^{1/2}\tilde{\theta}^{3/2}\tilde{\kappa}^{1/2}}{\theta+1+4\gamma\tilde{\phi}^{1/2}\tilde{\theta}^{3/2}\tilde{\kappa}^{1/2}}\right]>0,$$

$$Z_3=(1/2)\left(\frac{1+\delta}{\delta}\right)+(1/2)\tilde{\theta}^2\left[\theta+4\gamma\tilde{\phi}^{1/2}\tilde{\theta}^{1/2}\tilde{\kappa}^{1/2}\right]>0,\quad \tilde{\phi}=\frac{\phi-1}{\phi},\tilde{\theta}=\frac{\theta-1}{\theta},\tilde{\kappa}=\frac{1}{\kappa}.$$

Equation (19) indicates that both the short-run and long-run relative home consumption levels increase when there is the imposition of a tariff by the home country ($d\tau>0$). Equation (20) shows that the imposition of the tariff leads to exchange rate appreciation

($\hat{\varepsilon} < 0$). Finally, the result in (21) shows that the imposition of the tariff leads to the relocation of some firms from the home to the foreign country.

In particular, the relocation impact of the imposition of the tariff has three effects with opposing implications. On one hand, the imposition of the tariff by the home country raises the home prices of foreign goods by $d\tau$ (relative price effect). From equation (7), this decreases the home demand for foreign goods and thereby decreasing foreign production. Therefore, this decreases the relative profits of foreign-located firms, and consequently some foreign located firms relocate to the home country ($\hat{n} > 0$). On the other hand, the imposition of the tariff transfers the tariff revenue to the home households, and thereby raising the relative consumption in the home country (income redistribution effect). This leads to exchange rate appreciation and causes consumption switching as world consumption demand shifts toward foreign country's goods because of the rise in the relative price of home goods. Accordingly, this causes some firms to relocate to foreign country because of the increase in relative profits of firms located in the foreign country ($\hat{n} < 0$). Furthermore, the imposition of the tariff raises domestic prices of foreign goods by $d\tau$, and thereby raising the domestic consumption price index, which leads to a fall in the real money supply (price index effect). Therefore, the home currency must appreciate to restore money market equilibrium, and consequently some firms relocate to the foreign country from (18) ($\hat{n} < 0$). The net relocation effect of the imposition of the tariff depends on the relative strength of these three conflicting pressures. However, from equation (21), the former effect is always dominated by the latter two effects, so we obtain $\hat{n} < 0$.

Finally, in the present model, the firm mobility plays an important role in determining the scale of relative consumption changes in response to the imposition of a tariff. This is because, from equation (19), an increase in γ weakens the effect of the imposition of a tariff on relative home consumption. In other words, the larger is the international mobility of firms, the smaller is the response of relative consumption levels to the imposition of a tariff. In addition, from the money market equilibrium, an increase in γ also weakens the effect of the imposition of a tariff on the equilibrium exchange rate.

6. Conclusion

This paper has presented the impacts of a tariff on consumption and exchange rate using a two-country intertemporal model with international firm mobility. The main findings of our analysis are that i) the imposition of a tariff by the home country always increases both the short-run and long-run levels of relative home consumption, ii) the imposition of the tariff 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 both the relative consumption levels and the equilibrium exchange rate to the imposition of a tariff.

References

Baek, I. M., & Okawa, T. (2001). Foreign Exchange Rates and Japanese Foreign Direct Investment in Asia. *Journal of Economics and Business*, **53**(1), 69–84.

Bénassy-quéré, A., Fontagné, L., & Lahréche-révil, A. (2001). Exchange-rate strategies in the competition for attracting foreign direct investment. *Journal of the Japanese and International Economies*, **15**(2), 178–198.

Bergin, P. R., & Feenstra, R. C. (2001). Pricing-to-market, staggered contracts, and real exchange rate persistence. *Journal of International Economics*, **54**(2), 333–359.

Betts, C., & Devereux, M. B. (2000a). Exchange rate dynamics in a model of pricing-to-market. *Journal of International Economics*, **50**(1), 215–244.

Betts, C., & Devereux, M. B. (2000b). International monetary policy coordination and competitive depreciation: A reevaluation. *Journal of Money, Credit, and Banking*, **32**(4), 722–745.

Blonigen, B. A. (1997). Tariff-jumping antidumping duties. *Journal of International Economics*, **57**(3), 31–50.

Blonigen, B. A. (2002). Tariff-jumping antidumping duties. *Journal of International Economics*, **57**(1), 31–50.

Bolling, C., Shane, M., & Roe, T. (2007). Exchange rates and U.S. foreign direct investment in the global processed food industry. *Agricultural and Resource Economics Review*, **36**(2), 230–238.

Brainard, L. S. (1997). An empirical assessment of the proximity-concentration trade-off between multinational sales and trade. *American Economic Review*, **87**(4), 520–544.

Campa, J. M. (1993). Entry by foreign firms in the united states under exchange rate uncertainty. *Review of Economics and statics*, **75**(4), 614–622.

Caselli, P. (2001). Fiscal consolidation under fixed exchange rates. *European Economic Review*, **45**(3), pp. 425–450.

Cavallo, M., & Ghironi, F. (2002). Net foreign assets and the exchange rate: Redux revised. *Journal of Monetary Economics*, **49**(5), 1057–1097.

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., & Scholnick, B. (2002). Exchange rate expectations and foreign direct investment flows. *Weltwirtschaftliches Archiv*, **138**(1), 1–21.

Chu, H. (2005). Welfare and public: The role of internationalized production. *Economic Inquiry*, **43**(3), 542–557.

Corsetti, G., & Pesenti, P. (2001). Welfare and macroeconomic interdependence. *Quarterly Journal of Economics*, **116**(2), 421–444.

Corsetti, G., & Pesenti, P. (2005). International dimensions of optimal monetary policy. *Journal of Monetary Economics*, **52**(2), 281–305.

Cushman, D. O. (1985). Real exchange rate risk, expectations, and the level of foreign direct investment. *Review of Economics and Statistics*, **67**(2), 297–308.

Cushman, D. O. (1988). Exchange rate uncertainty and foreign direct investment in the United Statess. *Weltwirtschaftliches Archiv*, **124**(2), 322–336.

Devereux, M. B., & Engel, C. (2002). Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *Journal of Monetary Economics*, **49**(5), 913–940.

Farrell, R., Gaston, N., & 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**(2), 161–182.

Fender, J., & Yip, C. K. (2000). Tariffs and exchange rate dynamics redux. *Journal of International Money and Finance*, **19**(5), 633–655.

Froot, K. A., & Stein, J. C. (1991). Exchange rates and foreign direct investment: an imperfect capital markets approach. *Quarterly Journal of Economics*, **106**(4), 1191–1217.

Ganelli, G. (2005). The new open economy macroeconomics of government debt. *Journal of International Economics*, **65**(1), 167–184.

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

Goldberg, L., & Kolstad, C. (1995). Foreign Direct Investment, Exchange rate variability and Demand Uncertainty. *International Economic Review*, **36**(4), 855–873.

Hau, H. (2000). Exchange rate determination: The role of factor price rigidities and nontradeables. *Journal of International Economics*, **50**(2), 421–447.

Hwnag, Y., & 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**, 81–102.

Johdo, W. (2013). Does monetary expansion improve welfare under habit formation?. *Economics Bulletin*, **33**(3), 1959–1968.

Johdo, W. (2015). Monetary policy, foreign welfare and international firm mobility. *International Journal of Economic Theory*, **11**(3), 311–328.

Klein, M. W., & 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**(3–4), 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**(10), 1547–1583.

Kollmann, R. (2002). Monetary policy rules in the open economy: effects on welfare and business cycles. *Journal of Monetary Economics*, **49**(5), 989–1015.

Lane, P. R. (1997). Inflation in open economies. *Journal of International Economics*, **42**(3–4), 327–347.

Lane, P. R. (2001). The new open economy macroeconomics: A survey. *Journal of International Economics*, **54**(2), 235–266.

Novy, N. (2010). Trade costs and the Open Macroeconomy. *Scandinavian Journal of Economics*, **112**(3), 514–545.

Obstfeld, M., & Rogoff, K. (1995). Exchange rate dynamics redux. *Journal of Political Economy*, **103**(3), 624–660.

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

Obstfeld, M., & Rogoff, K. (2002). Global implications of self-oriented national monetary rules. *Quarterly Journal of Economics*, **117**(2), 503–535.

Reitz, S., & Slopek, U. D. (2005). Macroeconomic effects of tariffs: Insights from a new open economy macroeconomics model. *Schweizerische Zeitschrift fur Volkswirtschaft und Statistik*, **141**(2), 285–311.

Ryou, J. (2002). Transaction costs and welfare effects of currency unions. *Seoul Journal of Economics*, **15**(4), 529–553.

Senay, O., & Sutherland, A. (2007). Foreign money shocks and the welfare performance of alternative monetary policy regimes. *Scandinavian Journal of Economics*, **109**(2), 245–266.

Smets, F., & Wouters, R. (2002). Openness, Imperfect exchange rate pass-through and monetary policy. *Journal of Monetary Economics*, **49**(5), 947–981.

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

Sutherland, A. (2005b). Incomplete pass-through and the welfare effects of exchange rate variability. *Journal of International Economics*, **65**(2), 375–399.

Udomkerdmongkol, M., Morrissey, O., & Görg, H. (2009). Exchange Rates and Outward Foreign Direct Investment: US FDI in Emerging Economies. *Review of Development Economics* **13**(4), 754–764.

Wang, C., & Zou, H. (2013). Optimal monetary and tariff policy in open economies. CEMA Working Papers **587**, Central University of Finance and Economics.