Tariffs, offshoring and unemployment in a two-country model

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September 2011

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by

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Abstract

We develop a two-country model of international trade that incorporates offshoring opportunities, and we analyze the effects on employment and effective demand of offshoring in the home country under stagnation when there is a liquidity trap. A rise in the tariff on imported outsourced goods causes production to shift from the foreign to the home country. This increases employment in the home country but also causes an appreciation of the real exchange rate, which reduces employment. The latter effect dominates the former, so that home-country employment and consumption fall. However, the home and foreign countries respond in opposite ways to the production shift caused by the tariff and to real exchange rate adjustment. Consequently, employment and consumption in the foreign country rise. Furthermore, when there is unemployment, the effects of tariff on consumption are opposite to when there is full employment.

Keywords: employment, real exchange rate adjustment, offshoring, tariff

JEL Classification Number: E24, F31, F41
1. Introduction

Developed countries are increasingly outsourcing production. According to empirical work by Feenstra and Hanson (1996a) and Crinò (2009), the share of international outsourcing by U.S. firms was 11.61% in 1990 and 18.1% in 2002. According to surveys, as reported by Ito et al. (2007), 21% of manufacturing industries in Japan use offshoring. When firms shift the production of some components abroad and assemble the components into final goods at home, the components are imported. Since increased offshoring causes public concerns about loss of jobs, offshoring activity has become an important political issue. Furthermore, the effects of outsourcing on the structure of imports and exports also influences the current account balance, and thus, international relative prices (the terms of trade) may well change. In this case, government trade policy on offshoring may have macroeconomic effects on the real exchange rate, the employment rate and consumption. We examine the trade policy of imposing tariffs on imported outsourced goods designed to reduce offshoring in order to protect domestic employment. How does a rise (or fall) in tariffs affect macroeconomic variables in open economies? The purpose of this paper is to investigate whether increasing tariffs under synchronized stagnation improves domestic conditions and worsens conditions abroad. Given that Japan’s economy has experienced severe stagnation since the 1990s, the effects of offshoring on employment are an important contemporary policy issue. In particular, we show that international relative prices play an important role when analyzing the effects of offshoring on employment.

In the international outsourcing literature, Feenstra and Hanson (1996b) and Arndt (1997) highlight the importance of international outsourcing for determining labor demand in a static setting. Glass and Saggi (2001) construct a North–South production cycle model to examine the effects of increased outsourcing. Gao (2007) considers the relationship between non-tariff barriers (like an iceberg cost) and growth in an offshoring economy. Naghavi and Ottaviano (2009) obtain multiple equilibria in a North–South trade model with offshoring. Davis and Naghavi (2011) examine the relationship between trade liberalization, offshoring and labor allocation in a multi-sector model with heterogeneous workers. These models, however, are not conclusive with regard to the labor market effects of offshoring because they do not incorporate an adjustment mechanism between offshoring and the employment rate; that is, the authors assume that demand always matches supply in the labor market.
To the best of our knowledge, there are few studies of the effects of international outsourcing on the unemployment rate. Gaston (2002), Egger and Egger (2003) and Skaksen (2004) consider trade union activities as a source of labor market imperfection. Egger and Kreckemeier (2008) develop an efficiency wage model in an international fragmentation framework. Mitra and Ranjan (2010) introduce labor-market search frictions into an outsourcing economy. Because these are small open-economy models, however, the country under study is assumed to take world prices as exogenously given. Policy changes in countries with large shares of international markets, such as Japan and the U.S., may well affect international relative prices, which in turn affect not only domestic employment but also the employment rates of trading partners.

We develop an offshoring model that incorporates labor market imperfection that stems from a demand shortage in the goods market. Recently, Ono (2001) investigated the possible existence of stagnated equilibrium. He shows that stagnation may occur under two assumptions not found in the neoclassical literature: namely, insatiable liquidity preference and sluggish price adjustment. Under certain conditions, a demand shortage with a liquidity trap exists. In this model, Ono (2006) considers the spillover effects of fiscal and monetary policy on effective demand in a two-country economy. Johdo and Hashimoto (2009) introduce foreign direct investment into a two-country monopolistic competition model that incorporates a stagnation mechanism and analyze the effect of corporate taxation on employment in each country. However, these studies do not incorporate international outsourcing.

We contribute to the literature by first developing a two-country model that incorporates international outsourcing opportunities under stagnation, and then by using the model to shed light on the relationship between offshoring, international relative prices and the employment rate, and on the role of the tariffs on outsourced goods that lead to the substitution of production inputs. Using a two-country model may reveal new employment effects of offshoring that operate through international relative prices, which are important for interdependent countries in the world economy, which cannot be obtained from small-country models.

The main result is as follows. A rise in tariffs decreases imports of outsourced goods, which causes production to shift from foreign countries to the home country. This raises domestic employment but also causes an appreciation of the real exchange rate, which lowers employment. This is because an appreciation of the real exchange rate implies an increase in
the price of home goods relative to foreign goods, and thus, world demand for home goods decreases and domestic employment falls. The employment fall exceeds the employment rise, and thus, domestic employment and consumption fall. However, the home and foreign countries respond in opposite ways to the production shift caused by outsourcing and to real exchange rate adjustment. Consequently, employment and consumption in the foreign country rise. Thus, a decrease in the tariff, which promotes outsourcing activity, boosts the domestic labor market and consumption. In this context, Amiti and Wei (2005) use U.K. data from 1992–2001 to find evidence, in many empirical specifications, of a positive relationship between employment and outsourcing. Furthermore, when there is unemployment, the effects of outsourcing on consumption are opposite to when there is full employment.¹

The remainder of this paper proceeds as follows. Section 2 outlines the features of the model. Section 3 describes the steady-state equilibrium under stagnation with a liquidity trap. Section 4 presents the comparative steady-state results of tariffs and explains the underlying intuition. In section 5, we treat the case of full employment and compare the effect of outsourcing under full employment with that in the presence of unemployment. The final section summarizes our findings and concludes the paper.

2. The Model

2.1. Firms

Consider an economy with two countries, home and foreign, in which the firm sector of the home (foreign) country specializes in commodity 1 (commodity 2). First, consider the production of home country firms. Output $y_1$ is produced with two intermediate goods $z$ and $z^*$.² The intermediate good $z$ is produced in the home country, and $z^*$ is produced in the foreign country. The production function of $y_1$ is given by:

$$y_1 = \theta(z)^{\gamma} \left(z^*\right)^{\gamma},$$

(1)

where $\theta$ is constant productivity, $\gamma$ the input share of the intermediate input. An import tariff $\tau$ is levied on outsourced intermediate goods $z^*$. Given the production technology, we derive the cost function of final output $y_1$ by solving the cost-minimization problem:

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¹ There are several country-based empirical studies on the effect of international outsourcing on employment. See Geishecker (2008) regarding Germany, Feenstra and Hanson (1996a) for the USA, Yan (2006) for Canada, and Hsieh and Woo (2005) for Hong Kong. Cribb (2009) gives a detailed survey.

² Foreign country variables are shown with an asterisk.
\[ \min \{Qz + (1 + \tau)eQ^*z^*\}, \quad \text{subject to (1)}, \]

where \( Q( Q^* ) \) denotes the nominal price of intermediate goods in the home (foreign) country and \( e \) is the nominal exchange rate [e.g., yen/dollar]. The total cost \( (TC_1) \) of \( y_1 \) is then given by:

\[
TC_1 = \frac{1}{\theta} \Gamma Q^{1-\gamma}((1 + \tau)eQ^*)y_1. \tag{2}
\]

where \( \Gamma \equiv 1/\gamma^\gamma(1-\gamma)^{1-\gamma} \).

Given the nominal price of commodity 1 \( (P_1) \) and the nominal wage and exchange rate, the firm sector maximizes profit: \( P_1y_1 - TC_1 = \left(\theta P_1 - \Gamma Q^{1-\gamma}(1 + \tau)eQ^*/y_1\theta \right) \). The perfect adjustment of \( P_1 \) is assumed, and firm profit is zero because the commodity market is perfectly competitive;

\[
\theta P_1 = \Gamma Q^{1-\gamma}(1 + \tau)eQ^*/y_1. \tag{3}
\]

holds. In this case, production of commodity 1 can take any finite value.

Turning to the foreign firm, we assume that it does not have the opportunity of outsourcing. The production of commodity 2 \( (y_2) \) is then given by:

\[
y_2 = \theta^*l_y^*. \tag{4}
\]

where \( \theta^* \) is constant productivity and \( l_y^* \) represents the labor input for the production of \( y_2 \). Given the nominal price of commodity 2 \( (P_2) \) and the nominal wage, the firm sector maximizes profit as:

\[
P_2^*y_2 - W^*l_y^* = [\theta^*P_2^* - W^*]l_y^*, \]

where \( W^* \) denotes the nominal wage rate in the foreign country. Then, the first order condition is given by

\[
\theta^*P_2^* = W^*. \tag{5}
\]

Finally, consider the intermediate sector. The technology of intermediate goods \( z \) \((z^*)\) production is given by,

\[
z = \phi l_z, \quad z^* = \phi^* l_z^*, \tag{6}
\]

where \( l_z \) \((l_z^*)\) represents labor input for intermediate goods production in the home (foreign) country, and \( \phi (\phi^*) \) is constant productivity. Then, These sectors profits are: \( Qz - Wl_z = l_z(Q\phi - W) \) in home and \( Q^*z^* - W^*l_z^* = l_z^*(Q^*\phi^* - W^*) \) in foreign. Then we have obtain

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\[ ^3 \text{It is a non-trivial set-up because labor costs differ between the two countries. Even if we incorporate an opportunity for offshoring by foreign firms, the implications of the model remain mostly unchanged.} \]
\[ Q = W/\phi, \quad Q^* = W^*/\phi^*, \quad (7) \]

### 2.2. Households

We assume that the size of households in the home and foreign countries are \( L \) and \( L^* \), respectively. In addition, each household is endowed with one unit of (inelastically supplied) labor. The households in each country consume both commodity 1 and 2, and obtain utility \( v(m) \) by holding real money balances \( m \) (i.e., a money-in-the-utility-function model). The consumption index \( c \), defined below, is assumed to be symmetric both within and across countries. A home country’s household allocates total assets \( a \) between real money balances \( m \) and an international asset \( b \). Hence, the intertemporal maximization problem is:

\[
U(c, m) = \int_0^\infty [u(c) + v(m)] \exp(-\rho t) dt, \quad (8)
\]

\[
u'(\cdot) > 0, \quad u''(\cdot) < 0; \quad v'(\cdot) > 0, \quad v''(\cdot) \leq 0,
\]

\[
\dot{a} = ra + wx - c - Rm + \zeta, \quad (9)
\]

\[
a = m + b, \quad (10)
\]

\[
x = \min (1, \frac{L_x}{L}) \text{ for the home country, } x^* = \min (1, \frac{L_x^* + L_y^*}{L^*}) \text{ for the foreign country.} \quad (11)
\]

In (8), \( \rho \) is the subjective discount rate, assumed to be identical across both countries. Equation (9) is the flow budget equation, where \( w \) \((= W/P, \text{ where } P \text{ is the price index in the home country})\) denotes the real wage rate, \( x \) is the employment rate, and \( \zeta \) is lump-sum transfer from government. The nominal rate of return from holding home (foreign) assets is defined as \( R \) \((R^*)\). If the two assets are perfect substitutes, these assets must yield equal rates of return; i.e., \( R = \frac{\dot{e}}{e} + R^* \). The real rates of return to home and foreign are defined, respectively, as \( r \equiv R - \pi \) and \( r^* \equiv R^* - \pi^* \) where \( \pi \) \((= \dot{P}/P)\) and \( \pi^* \) \((= \dot{P}^*/P^*)\) represent inflation rates.

Equation (10) represents the stock constraint, we assume that the initial international asset holdings (that is initial debt) is zero, \( b_0 = 0 \). Equation (11) implies that realized labor supply is determined on the short side either as the potential labor supply or as actual labor demand by the firm.

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4 The real term represented by the small letter denotes the price of one unit of the consumption index since it is divided by the price index.

5 We assume that households have an access to international bonds. Enders and Mueller (2009) discuss implications of different international asset market structure on transmission of technology shocks.
Before turning to the dynamic problem, we consider the composition of a given level of nominal expenditure, $E$, in each instant to maximize the consumption index $c$. The consumption index, aggregating across the consumption of two goods ($c_1, c_2$), is given by
\[ c = \left( \kappa_1 c_1^\sigma + \kappa_2 c_2^\sigma \right)^{1/\sigma}, \quad 1 > \sigma > 0, \]
(12)
where $\kappa_i$ is the preference parameter for the good $i$ ($i = 1, 2$) and $\sigma$ is related to the elasticity of substitution, which is given by $1/(1 - \sigma)$. We take a particular point in time and define $E$ as $E = P_1 c_1 + \varepsilon P_2^* c_2$. Subject to this, the individual determines $c_1$ and $c_2$ to maximize (12). We obtain the following demand functions:
\[ P_1 c_1 = \delta(\omega)E \quad \text{and} \quad \varepsilon P_2^* c_2 = (1 - \delta(\omega))E, \]
(13)
where the relative price $\omega$ is represented by
\[ \omega = \varepsilon P_2^* / P_1, \]
(14)
and
\[ \delta(\omega) = \kappa_1^{1/(1-\sigma)} / \left[ \kappa_1^{1/(1-\sigma)} + \kappa_2^{1/(1-\sigma)} \omega^{\sigma/(1-\sigma)} \right], \]
(15)
\[ 1 > \delta(\omega) > 0, \quad \delta'(\omega) = \left[ \sigma/(1 - \sigma) \right] [\delta(1 - \delta) / \omega] > 0. \]

Similarly, we obtain the following demand functions for a foreign household:
\[ (P_1 / \varepsilon) c_1^* = \delta(\omega)E^* \quad \text{and} \quad \varepsilon P_2^* c_2^* = (1 - \delta(\omega))E^*, \]
(16)
where $E^* = (P_1 / \varepsilon) c_1^* + P_2^* c_2^*$. In this case, the general price levels $P$ and $P^*$ and real prices $p_1(\omega)$ and $p_2(\omega)$ are respectively
\[ P = \left[ \kappa_1^{1/(1-\sigma)} P_1^{-\sigma/(1-\sigma)} + \kappa_2^{1/(1-\sigma)} (\varepsilon P_2^*)^{-\sigma/(1-\sigma)} \right]^{-(1-\sigma)/\sigma}, \]
\[ P^* = \left[ \kappa_1^{1/(1-\sigma)} (P_1 / \varepsilon)^{-\sigma/(1-\sigma)} + \kappa_2^{1/(1-\sigma)} P_2^*^{-\sigma/(1-\sigma)} \right]^{-(1-\sigma)/\sigma}, \]
\[ p_1(\omega) (\equiv P_1 / P) = \left[ \kappa_1^{1/(1-\sigma)} + \kappa_2^{1/(1-\sigma)} \omega^{-\sigma/(1-\sigma)} \right]^{-(1-\sigma)/\sigma}, \]
\[ p_2(\omega) (\equiv P_2^* / P^*) = \omega \left[ \kappa_1^{1/(1-\sigma)} + \kappa_2^{1/(1-\sigma)} \omega^{-\sigma/(1-\sigma)} \right]^{-(1-\sigma)/\sigma}. \]
(17)
From the first two equations of (17), $P$ and $P^*$ satisfy
\[ P = \varepsilon P^*, \]
and thus inflation rates $\pi \ (= \dot{P} / P)$ and $\pi^* \ (= \dot{P}^* / P^*)$ satisfy
\[ \pi = \dot{e} / \varepsilon + \pi^*. \]  

(18)

Moreover, using \( R = \dot{e} / \varepsilon + R^* \) and the definition of the real rates of return, we obtain \( r = r^* \).

From (12), (13), and (17), we obtain

\[ c = e, \quad \text{where } e = E/P. \]  

(19)

In real terms, (13) and (16) can be rewritten as

\[ p_1 c_1 = \delta(\omega)e, \quad p_2 c_2 = (1 - \delta(\omega))e, \]

\[ p_1 c_1^* = \delta(\omega)e^*, \quad p_2 c_2^* = (1 - \delta(\omega))e^*. \]  

(20)

We now turn to the dynamic optimization problem. Because each household maximizes (8) subject to (9), (10), and (19), the current value Hamiltonian is given by

\[ H = u(e) + v(m) + \lambda[ra + wx - e - Rm], \]  

where \( \lambda \) is the costate variable for \( a \). The first-order optimality conditions for this problem reduce to

\[ \rho + \eta \frac{\dot{e}}{e} + \pi = R = v'(m)/u'(e), \]  

(21)

where \( \eta \equiv -u''(e)e/u'(e) \) is the elasticity of marginal utility with respect to consumption. Similarly, from the first-order conditions for a foreign household, we have

\[ \rho + \eta \frac{\dot{e}^*}{e^*} + \pi^* = R^* = v'(m^*)/u'(e^*). \]  

(22)

The transversality conditions are

\[ \lim_{t \to \infty} \lambda_s a_s \exp(-\rho t) = 0, \quad \lim_{t \to \infty} \lambda^*_t a^*_t \exp(-\rho t) = 0. \]

2.3. Governments

Suppose that the government of home country imposes a tariff on imported outsourced goods while that of country 2 imposes no tariff and that all tax revenue is shared home households in a lump sum. Then the government budget equation is given by

\[ \tau \varepsilon Q^* z^*/L = P \zeta. \]

Using \( P = \varepsilon P^* \), it can be rewritten in real terms:

\[ \tau q^* z^*/L = \zeta. \]  

(23)
2.4. Market adjustments

Given the household, firm and government behavior discussed above, the money and equity markets perfectly adjust, so that at any point in time:\(^6\)

\[
\begin{align*}
\text{the money markets: } & mL = M/P, \quad m^*L^* = M^*/P^*, \quad (24) \\
\text{the international asset market: } & bL + b^*L^* = 0. \quad (25)
\end{align*}
\]

The commodity market adjustment is also assumed to be perfect, and hence:

\[
\begin{align*}
\text{Commodity 1: } y_1 &= c_1L + c_1^*L^* = (eL + e^*L^*)\delta(\omega)/p_1(\omega), \quad (26) \\
\text{Commodity 2: } y_2 &= c_2L + c_2^*L^* = (eL + e^*L^*)(1 - \delta(\omega))/p_2(\omega). \quad (27)
\end{align*}
\]

In contrast, the labor market is segmented internationally and the nominal wage adjustment is sluggish, so we can consider the possibility of unemployment.\(^7\) This is simply represented by:

\[
\frac{\dot{W}}{W} = \alpha(x - 1), \quad \frac{\dot{W}^*}{W^*} = \alpha^*(x^* - 1), \quad (28)
\]

where \(\alpha (\alpha^*)\) represents the adjustment speed of the nominal wage \(W\) (respectively \(W^*\)), and the employment rate \(x (x^*)\) of each country in (11) can be defined as:

\[
x = \frac{l_z}{L}, \quad x^* = \frac{l_z^* + l_y^*}{L^*}. \quad (29)
\]

Expression (28) implies that the instant rate of nominal wage rates \(W\) (respectively \(W^*\)) are positively related to the excess labor demand \((l_z - L)\) (respectively \(l_z^* + l_y^* - L^*\)).

From (3), (5), (7) and (17), the relationships between the real price of good and wage rate can be rewritten as,

\[
\begin{align*}
\theta p_1 &= \Omega w^{1-\gamma}((1 + \tau)w^*)^\gamma, \quad (30) \\
\theta^* p_2 &= w^*. \quad (31)
\end{align*}
\]

and then the relative wage is given by

\[
w^*/w = f'(\omega; \tau) = [\Omega(0^*/\theta)]^{1/(1-\gamma)}(1 + \tau)^{\gamma/(1-\gamma)}\omega^{1/(1-\gamma)} \quad (32)
\]

\(^6\) Because of Walras’s law for stock variables, (25) is valid if (24) holds.

\(^7\) This assumption is imposed merely to allow disequilibrium to occur in the labor market; otherwise, the possibility of unemployment is intrinsically avoided. Note that under this assumption, the possibility of a full employment steady state is not eliminated. See Ploeg (1993) for the same type of sluggish price adjustment.
where $\Omega \equiv \Gamma / \phi^{\gamma} (\phi^*)^\gamma$. Using Shephard’s lemma, we obtain $l_z (= z/\phi)$ and $l_z^* (= z^*/\phi^*)$ from (2) and (26) as:

$$
l_z = (1 - \gamma) \frac{1}{\theta} \Omega ((1 + \tau) f(\omega))^\gamma y_1 = (1 - \gamma) \frac{1}{\theta} \Omega ((1 + \tau) f(\omega))^\gamma \frac{\delta(\omega)}{p_1(\omega)} (eL + e^*L^*)
$$

(33)

$$
l_z^* = \gamma \frac{1}{\theta} \Omega \frac{1}{((1 + \tau) f(\omega))^\gamma} y_1 = \gamma \frac{1}{\theta} \Omega \frac{1}{((1 + \tau) f(\omega))^\gamma} \frac{\delta(\omega)}{p_1(\omega)} (eL + e^*L^*)
$$

(34)

Furthermore, from (4) and (27), $l_y^*$ is given by:

$$
l_y^* = \frac{1}{\theta^*} y_2^* = \frac{1 - \delta(\omega)}{\theta^* p_2(\omega)} (eL + e^*L^*).
$$

(35)

Since the money supply in each country is constant, from (24), the dynamics of $m$ and $m^*$ are represented by $\dot{m} / m = -\pi$, and $\dot{m}^* / m^* = -\pi^*$. Then, the foreign asset dynamics are obtained by substituting the dynamics of money into budget equations (9)-(10):

$$
\dot{b} = rb + wx + \zeta - e, \quad \dot{b}^* = rb^* + w^*x^* - e^*.
$$

(36)

Expression (36) implies that total income (interest receipts, wage income and home government transfer) is devoted to expenditure and international assets holding.

3. Steady state with stagnation

We consider the case of persistent unemployment. Persistent stagnation that arises under a liquidity trap is analyzed by Ono (2001). This section applies the models therein to the present setting.

Money demand is given by the second equality of (21):

$$
R = \nu'(m)/u'(c).
$$

Along this curve, a liquidity trap arises if the desire for money holding is insatiable:

---

8 A firm decides to demand production factors ($z, z^*$) given the price of intermediate goods as an exogenous parameter because of the price taker assumption of a perfectly competitive market. Then Shephard’s lemma is applied while deriving factor demand; $z = \partial TC_1 / \partial Q$ and $z^* = \partial TC^1 / \partial((1 + \tau)eQ^1)$.

9 This model is widely used in various analyses under persistent stagnation in a dynamic-optimization framework of a monetary economy. For example, Matsuzaki (2003) finds the effect of a consumption tax on effective demand in the presence of poor and rich people. Hashimoto (2004) examines the intergenerational redistribution effects of the public pensions system in an overlapping-generations framework with the present type of stagnation. Johdo (2006) considers the relationship between R&D subsidies and unemployment in the present stagnation setting. Rodriguez-Arna (2007) examines the dynamic path with public deficit in the present stagnation case and compares it with that of the neoclassical case.
\[
\lim_{m \to \infty} v'(m) = \beta > 0,
\tag{37}
\]
where \(\beta\) is a positive constant.\(^{10}\) Figure 1 illustrates the money demand curve in this case.

Now we present the steady-state conditions required for both the home and foreign countries to be in stagnation. The steady state with stagnation is fivefold \((\omega, x, x^*, e, e^*)\).\(^{11}\) The above definition means not only that the real and nominal rates of interest and the real exchange rate are fixed but also that \(e\) and \(e^*\) remain constant. In addition, the steady state with stagnation requires involuntary unemployment to exist, consequently causing nominal wages, nominal prices and the price level to continue to decline, and hence real balances to continue to increase. This is because

\[
\pi = \frac{\dot{P}_1}{P_1} = \frac{\dot{W}}{W} = \alpha(x - 1), \quad \pi^* = \frac{\dot{P}_2^*}{P_2^*} = \frac{\dot{W}^*}{W^*} = \alpha^*(x^* - 1)
\tag{38}
\]

hold in the steady state from (17), (30), and (31).\(^{12}\) Hence the employment rate must satisfy \(0 < x < 1\) and \(0 < x^* < 1\) in the stagnation steady state, then \(v'(m) = \beta\) and \(v'(m^*) = \beta^*\) hold.

Moreover, because these remain constant, from (21) and (22), we obtain

\[
r = r^* = \rho.
\tag{39}
\]

Here, for simplicity, we specify the utility function for consumption as \(u(e) = \ln e\). Then (21) and (22) are reduced to

\[
\beta e = \rho + \alpha(x - 1), \quad \beta^* e^* = \rho + \alpha^*(x^* - 1).
\tag{40}
\]

From (29), (32) and (33), \(x\) is given by

\[
x = \frac{1}{L} \left(1 - \gamma\right) f (\omega; \tau) \frac{\delta(\omega)}{\theta^* p_2(\omega)} (eL + e^* L^*).
\tag{41}
\]

From (29), (32), (34) and (35), \(x^*\) is given by

\[
x^* = \frac{1}{L^*} \left[ \frac{\gamma}{1 + \tau} \frac{\delta(\omega)}{1 - \delta(\omega)} + (1 - \delta(\omega)) \right] \frac{1}{\theta^* p_2(\omega)} (eL + e^* L^*).
\tag{42}
\]

---

\(^{10}\) See Ono (1994: 4–8) for a discussion on the insatiable utility of money in the history of economic thought (e.g., Veblen, Marx, Simmel, Keynes) and its economic implications. The validity of this property is empirically supported by Ono (1994: 34–8) using the GMM (generalized method of moments) and more extensively by Ono, Ogawa and Yoshida (2004) using parametric and nonparametric methods.

\(^{11}\) If we assume \(v'(\infty) = \beta > 0\) in the initial period, the transition process does not exist in this model. In this case, the economy jumps immediately to the stagnation steady state.

\(^{12}\) See the Appendix A for the derivation of (38).
Then, from the four equations in (40)-(42), $e$ and $e^*$ are determined as functions of $\omega$ and $\tau$. The functions are implicitly derived in Appendix C.

Applying (23), (29) and (39) to the first equation of (36) yields the balance of payments condition as follows (see Appendix B):

$$
\dot{b}L = \rho bL + \delta e' L^* - (1 - \delta) eL - q^* z^*.
$$

(43)

On the right-hand side of this equation, the first term denotes the return of holding international assets (the income account), the second term denotes real exports and the third term denotes real imports.\(^{13}\) Finally, the last term represents real imports of intermediate goods for home goods production. Then, from (31), (34) and (40) – (42), $\dot{b}L$ in (43) is rewritten as

$$
\dot{b}L = \rho bL - \frac{1}{\Psi \beta^*} \left[ (\rho - \alpha) \left( \beta^* - \alpha^* \left( \frac{\gamma \delta}{1 + \tau} + 1 - \delta \right) \right) L + (\rho - \alpha^*) \alpha(1 - \gamma) f(\omega; \tau) \frac{\delta}{\theta' p_2} L^* \right] 
+ \left( 1 - \frac{\gamma}{1 + \tau} \right) \frac{1}{\Psi \beta^*} \left[ (\rho - \alpha)^* L + (\rho - \alpha^*) \beta L^* \right],
$$

(44)

where $\Psi \equiv 1 - \frac{\alpha}{\beta} (1 - \gamma) f(\omega; \tau) \frac{\delta}{\theta' p_2} - \frac{\alpha^*}{\beta^*} \left( \frac{\gamma \delta}{1 + \tau} + 1 - \delta \right) \frac{1}{\theta' p_2} > 0$, $\rho > \alpha$, $\rho > \alpha^*$.\(^{14}\)

This function is assumed to satisfy

Marshall–Lerner condition:\(^{15}\) $\frac{\partial (\dot{b}L)}{\partial \omega} (\equiv \Theta) > 0.$

(45)

where $\Theta (> 0)$ is defined as the coefficient of current account derivative by $\omega$. The relative price $\omega$ takes the value at which $\dot{b}L$ is zero, otherwise, the transversality condition is not satisfied.\(^{16}\) Then the steady state obtains

$$
\dot{b}L = 0.
$$

Once $\omega$ is thus determined, $e$, $e^*$, $x$ and $x^*$ are obtained from (40)–(42).

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\(^{13}\) In (43), we can confirm that the coefficient $\delta (1 - \delta)$ of $e' L^*$ ($eL$) represents the expenditure ratio of foreign (home) household spending on home (foreign) goods from (20).

\(^{14}\) See the Appendix C for the derivation of (44). $\Psi > 0$, $\rho > \alpha$ and $\rho > \alpha^*$ are required for a positive value for world expenditure: $eL + e^* L^* > 0$.

\(^{15}\) Naturally, the Marshall-Lerner condition relates to the trade balance. Equation (45) in the text (which ensures that the current account improves following a real devaluation) is be referred to as a modified Marshall-Lerner condition.

\(^{16}\) Clearly, this property holds as the two countries are assumed to have the same subjective discount rate. Ikeda and Ono (1992) consider the heterogeneity of the subjective discount rate across countries and examine the dynamics of the international asset.
4. Tariffs, consumption and employment

In this section, we examine how an increase in the tariff on imported intermediate goods affects consumption and employment in both countries. The purpose of this paper is not to determine the desirable tariff level but to show how tariffs affect macroeconomic variables.

In the neighborhood of the steady state, the partial derivatives of the current account (44) satisfy the following relationship:\(^{17}\)

\[ \frac{\partial (bL)}{\partial \tau} > 0. \]  

(46)

Thus, (45) and (46) imply

\[ \tau \uparrow \Rightarrow \omega \downarrow. \]  

(47)

Figure 2 illustrates this property. The intuition is as follows. From the second term on the right-hand side of (44), given the steady-state level real relative price \(\omega\), an increase in the tariff \(\tau\) decreases employment and consumption in the foreign country, whereas it increases employment and consumption in the home country. These effects cause the home country’s current account to deteriorate. Conversely, from the last term on the right-hand side of (44), an increase in the tariff \(\tau\) directly lowers imports of intermediate goods from the foreign country, and this improves the current account of the home country. Although these are opposing effects on the current account, in Appendix E, we show that the latter effect exceeds the former. Hence, given \(\omega\), an increase in \(\tau\) improves the home country’s current account.\(^{18}\) Then, from the Marshall–Lerner condition, real relative prices fall to cause a deterioration in the current account.

We now examine the impact of increased tariff on the consumption levels of both countries. From (40)–(42) (see Appendix C), we obtain consumption levels of \(e = e(\omega, \tau)\) and \(e^* = e^*(\omega, \tau)\). Thus, the impact on consumption is

\[ \frac{de(\omega, \tau)}{d\tau} = \frac{\partial e}{\partial \tau} + \left(\frac{\partial e}{\partial \omega}\right)\left(\frac{d\omega}{d\tau}\right), \]  

(48)

\[ \frac{de^*(\omega, \tau)}{d\tau} = \frac{\partial e^*}{\partial \tau} + \left(\frac{\partial e^*}{\partial \omega}\right)\left(\frac{d\omega}{d\tau}\right). \]  

(49)

In (48), because \((\partial e/\partial \tau) > 0\), the first effect, which is the ‘protective effect’, represents the increase in consumption following an increase in home employment that operates through

\(^{17}\) See Appendix D for explicit expressions for (46) and (47).

\(^{18}\) According to empirical work by Dornbusch (1987), the effect of tariffs on the current account is positive.
shifting production to the home country. In addition, because \((\partial e / \partial \omega)(d\omega/d\tau) < 0\), the second effect, the ‘relative price effect’, represents the decrease in consumption following the appreciation of the real exchange rate. The real exchange rate appreciates because of reduced outsourcing—which happens for the reason stated in the mechanism for (47)—and this causes the international relative price of the home commodity to rise. In turn, this decreases world demand for the production of home goods, and domestic employment and consumption decrease. Conversely, from (49), the direct effect decreases consumption, whereas the relative price effect increases it in the foreign country.

From (A8) and (A9) in Appendix C, the impact on \(e\) and \(e^*\) of an increase in the tariff evaluated at \(\tau = 0\) is explicitly given by

\[
de/d\tau = -\gamma \alpha (\rho - \alpha^*)(eL + e'L^*)(e/e^*)\delta \Delta_1/[w\Theta(\Psi^*\beta^*)^2L] < 0,
\]
\[
de^*/d\tau = \gamma \alpha^* (\rho - \alpha)(eL + e'L^*)\delta \Delta_2/[w^*\Theta(\Psi^*\beta^*)^2L^*] > 0,
\]where \(\Delta_1 \equiv (\gamma/(1 - \gamma))/\alpha + (-p_1'/p_1) > 0\) and \(\Delta_2 \equiv [(1 - \delta(1 - \gamma))/\delta]p_2'/p_2 > 0\).19, 20

Furthermore, (40) shows that \(de/dx > 0\) and \(de^*/dx^* > 0\) in the steady state with stagnation. Therefore, the impact of an increase in \(\tau\) on the steady-state employment rate is as follows:

\[
\text{sgn } dx/d\tau = \text{sgn } de/d\tau, \quad \text{sgn } dx^*/d\tau = \text{sgn } de^*/d\tau.
\]

This is formally stated in the following proposition.

**Proposition 1:** When unemployment arises in the steady state, an increased tariff on imported outsourced goods in the home country causes an appreciation of the real exchange rate and lowers both employment and consumption in the home country. Conversely, an increased tariff raises both employment and consumption in the foreign country.

Thus, if the relative price \(\omega\) is fixed, an increased tariff on imported outsourced goods raises employment and effective demand in the home country and lowers these variables in the foreign country, as expected. However, because reduced imports, through an increased tariff, improve the current account, the real relative price falls, and this lowers the competitiveness of home products. Proposition 1 implies that the relative price effect is so strong that an increased

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19 See Appendix E for derivations of \(de/d\tau\) and \(de^*/d\tau\). We can also consider the effect of a larger change in \(\tau\) on consumption. However, it is difficult to determine the signs of the effects, because the comparative statics calculations are complex. Thus, we focus on the effect of a small change in \(\tau\).

20 Note that the following properties are valid when \(b\) is fixed. This holds true when \(b\) is a real bond. If people hold nominal bonds, a change in the nominal interest rate caused by a shift in a parameter affects the bond price and thus generates an additional effect associated with international redistribution.
tariff in the home country decreases effective demand and employment at home, whereas an increased tariff raises effective demand and employment in the foreign country. Thus, a decrease in the tariff, which promotes outsourcing activity, boosts home employment and consumption.

5. Comparison with full employment

In this section, we analyze the case of full employment when there is no liquidity trap (because the demand for money holdings is satiable). We then compare the effect on consumption of an outsourcing shift caused by tariff imposition under full employment with the corresponding effect from the previous section under stagnation. We find that the effect under full employment is the opposite of that under stagnation.

Under full employment, \( x \) and \( x^* \) are unity, and hence, from (17), (23), (25), (29)–(33), (36) and (39), we obtain the following conditions in the steady state:

\[
e_f = [w(\omega; \tau) + (\tau/(1 + \tau))\gamma\delta(\omega)(L^*/L)(w^*(\omega) + \rho b^*) + \rho b]/[1 - \gamma\delta(\omega)\tau/(1 + \tau)]
\]

\[
e_f^* = w^*(\omega) + \rho b^*,
\]

\[
\omega = \omega(\tau) \Leftrightarrow (1 - \gamma)\delta(\omega)(L + f(\omega; \tau)L^*]/[1 - \gamma\delta(\omega)\tau/(1 + \tau)] = L,
\]

where \( e_f \) and \( e_f^* \) are the full-employment consumption levels of each country.\(^{21}\) From the last of these equations, the impact of an increase in \( \tau \) on \( \omega \) evaluated at \( \tau = 0 \) is given by

\[
\frac{d\omega}{d\tau} = -\gamma[(1 - \gamma)\delta'/\delta + (1 - \delta(1 - \gamma))/\omega]^{-1} < 0.
\]

From (17), the impact of an increased tariff on \( e_f \) and \( e_f^* \) evaluated at \( \tau = 0 \) is as follows:\(^{22}\)

\[
\frac{de_f}{d\tau} = -w[(\gamma/(1 - \gamma))/\omega + (-p_1')/p_1](d\omega/d\tau) > 0,
\]

\[
\frac{de_f^*}{d\tau} = w^*[p_2'/p_2](d\omega/d\tau) < 0,
\]

Thus, when there is full employment in the steady state, an increased tariff on imported outsourced goods in the home country causes an appreciation of the real exchange rate and raises consumption in the home country. By contrast, such a tariff increase lowers consumption in the foreign country. Hence, we can state the following proposition.

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\(^{21}\) The steady-state levels of real variables are independent of monetary variables. From (21), (38) and \( x = 1 \), the condition for \( m \) to satisfy this state is \( v'(m)/u'(e) = \rho \), with the demand for money holdings being satiable.

\(^{22}\) The partial derivative of foreign consumption with respect to the tariff, \( \partial e_f^*/\partial \tau \), is zero. Furthermore, the derivative for home consumption, \( \partial e_f/\partial \tau \), is also zero when evaluated at \( \tau = 0 \), using the third of the steady-state condition equations. Thus, the effect of a tariff on consumption comprises only the relative price effect.
**Proposition 2:** When there is full employment in the steady state, the effect on consumption per capita of an increased tariff on imported outsourced goods is the exact opposite of the corresponding effect when there is unemployment in the steady state.

Intuitively, an increased tariff does not influence the employment rate because there is full employment. The effect of the tariff (shifting production from abroad to home) is to increase labor demand in the home market and reduce labor demand in the foreign market. Then, in the home market, an increase in labor demand leads to a rise in the wage rate through an appreciation of the real exchange rate. As a result of these effects, home country consumption increases. By contrast, in the foreign market, because a decrease in labor demand leads to a reduction in the wage rate, consumption decreases. Therefore, the effect of an increased tariff under full employment is the exact opposite of the corresponding effect when there is unemployment.

We can also interpret these results through the terms of trade. An appreciation of the real exchange rate following an increased tariff represents an improvement in the terms of trade (1/ω). Thus, in the full-employment case, the effect of an increased tariff is to increase the consumption per capita of the home country. This is equivalent to the standard optimal tariff result. On the other hand, because effective demand determines production under stagnation, an appreciation of the real exchange rate has a negative effect on the demand for home goods, which lowers the consumption per capita of the home country.

6. Conclusion

In this paper, we developed a two-country model of international trade incorporating outsourcing opportunities in which persistent unemployment arises. We then analyzed the effects of tariffs on employment and effective demand in both the home and foreign countries. We found that a production shift from the foreign to the home country following the imposition of an increased tariff on imported outsourced goods lowers home-country employment and consumption. However, the two countries respond in opposite ways to the production shift caused by outsourcing and to real exchange rate adjustment. Consequently, a tariff increase raises employment and consumption in the foreign country.

The mechanism is as follows. A tariff increase raises employment in the home country but also causes an appreciation of the real exchange rate. The latter effect occurs because a tariff increase lowers imports of intermediate goods from the foreign country and thus improves the current account. So that current account balance is restored, the home currency
appreciates against the foreign currency, which raises the international relative price of the home commodity. This price increase lowers world demand for domestic production. Because the latter effect, which operates through the appreciation of the real exchange rate, outweighs the former effect, both employment and effective demand in the home country decrease. By contrast, because the foreign country’s international relative price falls, world demand for foreign production rises. Therefore, an increased tariff in the home country increases both employment and effective demand in the foreign country.
Appendix

Appendix A: The derivation of (38)

From (5), because $P_2^*$ and $W^*$ move in parallel, we obtain $\dot{P}_2^* / P_2^* = \dot{W}^* / W^*$. Furthermore, from the definition of $p_2 = P_2^*/P^*$ and (17), we have $\dot{P}_2^* / P_2^* - \pi^* = \delta(\omega) \hat{\omega} / \omega$. Thus, the following equation is satisfied in the steady state ($\omega$ is constant):

$$\pi^* = \frac{\dot{P}_2^*}{P_2^*} = \frac{\dot{W}^*}{W^*} = \alpha^*(x^* - 1).$$  \hspace{1cm} (A1)

From (3) and (7), the following equation is obtained:

$$\frac{\dot{P}_1}{P_1} = (1 - \gamma) \frac{\dot{W}}{W} + \gamma \left( \dot{e} + \frac{\dot{W}^*}{W^*} \right).$$  \hspace{1cm} (A2)

Using $\dot{W}^* / W^* = \pi^*$ from (A1) and $\pi = \dot{e} / e + \pi^*$ from (18), (A2) can be rewritten as

$$\frac{\dot{P}_1}{P_1} = (1 - \gamma) \frac{\dot{W}}{W} + \gamma \pi.$$  \hspace{1cm} (A3)

Moreover, because $\dot{P}_1 / P_1 - \pi = (1 - \delta(\omega)) \hat{\omega} / \omega$ holds from the definition of $p_1 = P_1/P$ and (17), we have $\dot{P}_1 / P_1 = \pi$ in the steady state. Therefore, we obtain

$$\pi = \frac{\dot{P}_1}{P_1} = \frac{\dot{W}}{W} = \alpha(x - 1).$$  \hspace{1cm} (A4)

(A1) and (A4) are equivalent to (38).

Appendix B: The derivation of (43)

From (36) and (29), we obtain

$$\dot{b} L = \rho b L + wL + \zeta L - eL.$$  \hspace{1cm} (A5)

Perfect competition in the market for production factors gives

$$P_1 y_1 = Qz + (1 + \tau) \varepsilon Q^* z^*.$$  \hspace{1cm} (A6)

Using the second equation of (6), (7), (23) and (A6), (A5) can be rewritten by

$$\dot{b} L = \rho b L + p_1 y_1 - q^* z^* - eL.$$  \hspace{1cm} (A7)

Substituting (26) into (A7) gives (43).
Appendix C: The derivation of (44)

From (40)–(42), we obtain $e$ and $e^*$ as a function of $\omega$:

$$
e = \frac{1}{\Psi} \frac{1}{\beta^*} \left[ (\rho - \alpha) \left( \beta^* - \alpha^* \left( \frac{\gamma \delta}{1 + \tau} + 1 - \delta \right) \right) \frac{1}{\theta^* p_2} L + (\rho - \alpha^*) \alpha (1 - \gamma) \frac{\delta}{\theta^* p_2} L^* \right] \frac{1}{L}, \quad (A8)$$

$$
e^* = \frac{1}{\Psi} \frac{1}{\beta^*} \left[ (\rho - \alpha^*) \left( \beta - \alpha (1 - \gamma) \frac{\delta}{\theta^* p_2} \right) L' + (\rho - \alpha^*) \alpha^* \left( \frac{\gamma \delta}{1 + \tau} + 1 - \delta \right) \frac{1}{\theta^* p_2} L \right] \frac{1}{L}, \quad (A9)$$

where the definition of $\Psi$ is in (44). Then, world expenditure is as follows:

$$eL + e^* L^* = \frac{1}{\Psi} \frac{1}{\beta^*} \left[ (\rho - \alpha) \beta^* L + (\rho - \alpha^*) \beta L^* \right]. \quad (A10)$$

Substituting (31), (32) and (A10) into (34), we obtain $l_z^*$ as a function of $\omega$:

$$l_z^* = \gamma \frac{1}{\theta} \frac{1}{(1 + \tau) \theta p_1} \frac{\delta}{\theta^* p_2} \left( eL + e^* L^* \right) = \gamma \frac{\delta}{1 + \tau} \frac{1}{\theta^* p_2} \frac{1}{\Psi} \frac{1}{\beta^*} \left[ (\rho - \alpha) \beta^* L + (\rho - \alpha^*) \beta L^* \right]. \quad (A11)$$

From (32), (43) and the first equality of (A11), we have

$$\dot{b} L = \rho b L - eL + \delta (eL + e^* L^*) - \frac{\gamma \delta}{1 + \tau} (eL + e^* L^*) \quad (A12)$$

Substituting (A8) and (A10) into (A12) gives (44).

Appendix D: The derivation of (46) and (47)

The partial derivative of $\dot{b} L$ with respect to $\tau$ is

$$\frac{\partial (\dot{b} L)}{\partial \tau} |_{\tau=0} = \frac{1}{\Psi \beta^*} \frac{\gamma}{1 - \gamma} \left[ - (1 - \gamma)(\rho - \alpha) \alpha^* \delta \theta^* p_2 - L - (\rho - \alpha^*) \alpha (1 - \gamma) \frac{\delta}{\theta^* p_2} L^* \right]$$

$$+ (1 - \gamma) \delta \left[ (\rho - \alpha) \beta^* L + (\rho - \alpha^*) \beta L^* \right]$$

$$= \frac{1}{\Psi \beta^*} \frac{\gamma}{1 - \gamma} (\rho - \alpha) \left[ \beta^* - \alpha^* \theta^* p_2 \right] > 0. \quad (A13)$$

The second equality is derived by using the steady-state condition for current account balance, $\dot{b} = 0$, and the initial debt condition $b_0 = 0$, which implies $- eL + \delta (1 - \gamma) (eL + e^* L^*) = 0$ from (A12), (A8) and (A10). From the second equation of (36) in the steady state, the second equation of (40), (28) and $b_0^* = 0$, the square bracket of the second equality in (A13) is given
by $[\beta^* - \alpha^*/\theta^* p_2] = (\rho - \alpha^*)/e^* > 0$. Thus, the partial derivative of $\dot{b}_L$ with respect to $\tau$ is positive: $\partial(\dot{b}_L)/\partial \tau > 0$.

From (45) and (A13), the impact of increased outsourcing on the real exchange rate is given by

$$d\omega = -\frac{1}{\Theta} \frac{1}{\Psi \beta^* \gamma} \frac{\delta}{\theta^* p_2} \frac{1}{L} \frac{\alpha^* (\rho - \alpha)}{e^*} (eL + e^* L^*) < 0$$

$$\Rightarrow [\partial(\dot{b}_L)/\partial \omega] d\omega + [\partial(\dot{b}_L)/\partial \tau] d\tau = 0. \quad (A14)$$

**Appendix E: The derivation of $de/d\tau$ and $de^*/d\tau$**

Differentiating (A8) and (A9) with respect to $\tau$ and $\omega$, and then evaluating the resulting equations at $\tau = 0$ yields

$$\partial e(\omega; \tau)/\partial \tau|_{\tau=0} = \frac{1}{\Psi \beta^* \gamma} \frac{\delta}{\theta^* p_2} \frac{1}{L} \alpha f^* \frac{\rho - \alpha}{e^*} (eL + e^* L^*)$$

(A15)

$$\partial e^*(\omega; \tau)/\partial \tau|_{\tau=0} = -\frac{1}{\Psi \beta^* \gamma} \frac{\delta}{\theta^* p_2} \frac{1}{L^*} \frac{\alpha^* (\rho - \alpha)}{e} (eL + e^* L^*),$$

(A16)

$$\partial e(\omega; \tau)/\partial \omega|_{\tau=0} = \frac{1}{\Psi \beta^* \gamma} \frac{\delta}{\theta^* p_2} \frac{1}{L} \left\{ (1 - \gamma) \frac{\delta}{\delta} \alpha f^* \frac{\rho - \alpha}{e^*} + (1 - \gamma) \alpha f^* \beta^* \right\} (eL + e^* L^*)$$

$$-\left\{ (1 - \gamma) \Delta \frac{\alpha^* e^* L^*}{w^*} + \Delta^* \frac{\alpha^* e L}{w} \right\}$$

(A17)

$$\partial e^*(\omega; \tau)/\partial \omega|_{\tau=0} = -\frac{1}{\Psi \beta^* \gamma} \frac{\delta}{\theta^* p_2} \frac{1}{L^*} \left\{ (1 - \gamma) \frac{\delta}{\delta} \frac{\alpha^* (\rho - \alpha)}{e} + \alpha^* \beta^* \Delta \right\} (eL + e^* L^*)$$

$$-\left\{ (1 - \gamma) \Delta \frac{\alpha^* e^* L^*}{w^*} + \Delta^* \frac{\alpha^* e L}{w} \right\},$$

(A18)

where the steady-state consumption levels $(e, e^*)$ at $\tau = 0$ are $e = (\rho - \alpha)/[\beta - \alpha/w]$ and $e^* = (\rho - \alpha^*)/[\beta^* - \alpha^*/w^*]$, which are obtained by using the steady-state condition for current account balance, $\dot{b} = \dot{b}^* = 0$ and the initial debt condition $b_0 = b_0^* = 0$.

From (44), the derivative of the current account with respect to $\omega$ is
\[ \Theta \equiv \partial (\hat{b}L / \hat{\omega}) = \frac{1}{\Psi \beta \beta'} \left[ \frac{(1 - \gamma)}{\delta} \frac{(\rho - \alpha)(\rho - \alpha^*)}{ee^*} (eL + e^* L^*) - (\rho - \alpha)\alpha^* \frac{\delta}{\theta^* p_2} L \Delta_2 \right] \]. \quad (A19)

From (A14)–(A19), we obtain the impact on \( e \) and \( e^* \) of an increase in \( \tau \).
References


Skaksen, J.R. (2004): “International outsourcing when labour markets are unionized”, 

Figure 1: Money Demand with a Liquidity Trap
Current Account in Home Country ($\hat{b}L$)

Figure 2. The effect of tariff on the current account