Pacific Economic Review

Pacific Economic Review, 21: 2 (2016) pp. 123–150
doi: 10.1111/1468-0106.12077

TAX POLICIES, REGIONAL TRADE AGREEMENTS AND FOREIGN DIRECT INVESTMENT: A WELFARE ANALYSIS

CHARLES BRAYMEN* *Creighton University*
YANG-MING CHANG *Kansas State University*
ZIJUN LUO *Colgate University*

Abstract. In this paper, we develop a partial equilibrium three-country model to examine the relationship between regional trade agreements (RTAs) and foreign direct investment (FDI) in an environment with double taxation. Our analysis shows that FDI is welfare-improving for at least one or both of the two regional countries if wage asymmetry is significantly large. FDI and an RTA are also welfare-improving for the high-wage country and the region if the wage differential is not small. We also examine the role of repatriation taxes in affecting the determination of firm location under an RTA. Our results suggest that the signing of an RTA may induce relocation from the high-wage country to the low-wage country unless an increase in the repatriation tax rate also occurs.

1. INTRODUCTION

The last half-century has brought unprecedented growth in the trade in goods and cross-border capital flows despite the numerous obstacles involved in moving both goods and capital across international borders. Great advances in communications and transportation have combined with an ever-expanding array of international agreements to reduce the friction associated with these international transactions. Although regional trade agreements (RTAs) have reduced the burden of tariffs on traded goods, agreements have also been established to promote cross-border foreign direct investment (FDI) flows. Recent international agreements, such as the North American Free Trade Agreement (NAFTA), have addressed both trade and investment.[1] Likewise, the growing number of bilateral investment treaties and double-taxation treaties also seek to promote FDI. While the influences of both FDI and trade agreements are extensively explored as separate concepts in the literature, the joint impact has received relatively less attention despite the fact that a growing number of RTAs address investment. The primary focus of the present paper is to examine the joint impact of FDI and trade agreements in an environment with potential double taxation.

Firms seeking to extend their markets overseas may choose to enter foreign markets through exporting or, alternatively, by way of horizontal FDI. Many

**Address for Correspondence*: Department of Economics and Finance, Creighton University, Omaha, NE 68178, USA. E-mail: charlesbraymen@creighton.edu.

[1] In particular, Chapter 11 of NAFTA concerns cross-border investment and the settlement of investor disputes. Adams *et al.* (2003) and Dee and Gali (2005) note that such agreements represent a 'third wave' of RTAs that include substantial non-trade components.

factors can affect this mode of entry into foreign markets. For example, Brainard's (1997) proximity-concentration trade-off suggests that firms will take into account transportation costs and market size when choosing between exporting and overseas production. Markusen (2002) notes that both trade costs and plant-level fixed costs influence overseas behaviour in international duopolies. Similarly, Helpman *et al.* (2004) show that firms with the highest productivity levels may enter foreign markets by way of horizontal FDI, whereas relatively less productive firms are more likely to serve foreign markets by exporting. Yeaple's (2003) empirical findings suggest that US FDI flows are driven by a complex interaction of labour endowments and the skill intensity of the industry. He notes that his results suggest that outgoing US FDI likely occurs due to both this endowment-based 'comparative advantage motive' as well as the 'market access motive' of horizontal FDI. Such endowment-based investment may provide final or intermediate goods to both the firm's home country and a third market, the latter of which might be classified by the literature as export-platform FDI (Ekholm *et al.*, 2007).

A body of literature also exists that examines the role of tax and tariff policies on FDI and export decisions of firms. Davies *et al.* (2010) develop a model of tax competition where countries are able to influence this FDI or export decision by way of profit taxation. They note that potential host countries can utilize profit taxes to provide a disincentive for a foreign firm's FDI in order to avoid a decrease in domestic welfare. In their model with heterogeneous firms, Cole and Davies (2011) note that equilibrium tariffs are lower when the potential for FDI is permitted in their model.[2] Likewise, Haufler and Wooton (2006) note that coordinated regional tax policies can be welfare enhancing due to their ability to attract FDI. As a whole, these prior works suggest that exports and FDI are inherently linked at the firm level, which indicates the existence of an influential relationship between FDI-related tax policies and trade agreements.

Foreign direct investment under an RTA may result in firm behaviour and welfare outcomes that differ from those that occur without such an agreement. For example, Raff (2004) theoretically models tax competition for FDI under RTAs and shows that free trade agreements may either induce or deter FDI, with the outcome largely dependent on the production costs within the region relative to the rest of the world. Ethier (1998a, 1998b) argues that RTAs may promote FDI flows to the smaller countries in a region by way of market access motives. Similarly, Collie's (2011) theoretical model suggests that RTAs lead to an increase in both FDI and trade, which occurs due to the export-platform nature of the FDI that is induced in such an environment.

Although these prior works provide a theoretical foundation for the link between FDI and RTAs, several recent empirical studies examine this relationship as well. MacDermott (2007) uses a gravity model to examine the impact of NAFTA on FDI flows into NAFTA members from OECD countries. He shows positive, country-specific relationship influences of NAFTA on FDI inflows, but

[2] We find a similar result when the wage differential between the two regional countries and the profit tax rate of the low wage country are sufficiently high.

also suggests that these FDI flows originate outside of the region. Medvedev (2012) provides evidence that RTAs encourage FDI flows and this effect is driven largely by the subsample of time that includes the 1990s and 2000s. Medvedev notes that the RTAs in this subsample are often integrated agreements that include investment components that may lead to significant increases in FDI flows, which corresponds with Bergstrand and Egger (2013), who note that bilateral investment treaties (BITs) and integrated agreements are often seen as a way to increase FDI flows to host countries by reducing the cost of FDI associated with expropriation risk.

The objective of the present study is to expand the previous theoretical literature concerning FDI and trade agreements in a framework that includes double taxation, which presents an additional obstacle to foreign investment. When profits are earned by foreign subsidiaries they are taxable by the foreign government and a repatriation tax imposed by the home government when the firm repatriates its profits. Double taxation may be welfare-deteriorating due to the distortion of the cross-border post-tax return to capital. These potential distortions have prompted many countries to implement double-taxation treaties (DTTs) that permit either credits or exemptions in the calculation of taxes on repatriated profits. However, the theoretical and empirical evidence regarding the influence of double taxation treaties on FDI is mixed,[3] which suggests that additional influences beyond changes in double-taxation policy may play a role in determining FDI flows. We posit that one such influence is the establishment of RTA, which are becoming increasingly common.

Our model examines the welfare effects of RTAs in an environment that includes both double taxation and FDI. DTT and BITs are key instruments for policy-makers to address the issues of double-taxation and FDI. Therefore, one way to implicitly examine the relative importance given to these issues of double taxation, FDI and RTAs by policy-makers is to examine the enactment of treaties governing these behaviours. Table 1 shows that the share of RTAs that are signed with prior BIT and DTT agreements in place is generally growing over time. Likewise, columns 4 and 5 show that the signing of an RTA also appears to result in additional negotiations concerning investment and double taxation, which may be signed before or after the RTA, but are largely part of the same negotiation effort. These descriptive statistics suggest that the issues of FDI, double taxation and RTAs are interrelated, which is precisely our focus in this paper. Although our model does not explicitly address bilateral investment and double-taxation treaties, it does address the influence of double taxation on the FDI decisions of firms when an RTA is established, which is a key issue underlying the implementation of such policies.

In this paper, we analyse the location decision and welfare implications of the interaction between FDI and an RTA while also addressing the impact of

[3] Davies (2003) uses a theoretical model to examine the OECD model treaty and finds that the use of credits results in welfare improvements under symmetric countries, but such treaties will not necessarily result in welfare improvements in the case of asymmetric countries. For mixed empirical studies, see Blonigen and Davies (2004), Egger *et al*. (2006), Coupé *et al*. (2009), Barthel *et al*. (2010) and Neumayer (2007).

Table 1. Agreements prior to the signing of a regional trade agreement

	Agreements prior to RTA signing as a share of RTA established (%)			Share of RTA signed within 5 years of other agreement (%)	
	DTT only	BIT only	Both BIT and DTT	DTT	BIT
Decade	(1)	(2)	(3)	(4)	(5)
1960s	0.28	1.70	0.00	8.59	23.68
1970s	3.83	0.45	0.11	17.07	7.14
1980s	1.90	0.38	0.08	7.45	16.67
1990s	10.99	8.40	11.15	39.37	78.68
2000s	7.57	9.56	9.79	33.56	49.85

Regional trade agreements (RTA) often include more than two countries, whereas bilateral investment treaties (BIT) and double-taxation treaties (DTT) do not. Therefore, we compare bilateral relationships across treaty types. For example, a three-country RTA would include three bilateral country pairs that could be contrasted with prior BIT and DTT, which are bilateral in nature. RTA are categorized by the year of entry into force, not the date of World Trade Organization notification. DTT and BIT are dated according to the date of signature.
Sources: UNCTAD DTT and BIT Databases, WTO RTA Database.

double taxation. We contribute to the literature by analysing how FDI alongside an RTA impacts behaviour of firms, government revenue and welfare. We develop an asymmetric three-country model where firms are headquartered and owned by households in the two countries that are considering an RTA. The firms produce their entire output in one country, serving the other two countries through exporting. Wage asymmetry across the two countries in the potential RTA further enhances the model by creating a potential for comparative advantage-based FDI and export-platform FDI. In the first stage of our model, the high-wage country chooses the rate at which it will tax repatriated profit. In the second stage, all countries simultaneously set their tariff rates. In the third stage, the firms will optimally choose to locate production in one of the three countries, which is a decision driven by the after-tax profit implications of the location decision, as well as tariff rates and the cost of production in each country. In the final stage, the firms compete via Cournot competition. We analyse and compare welfare under six cases, including: (i) trade without FDI and without an RTA; (ii) trade with FDI, but no RTA; (iii), trade with an RTA and without FDI; (iv) trade when an RTA is established and FDI also occurs; (v) trade when FDI occurs after an RTA is already established; and (vi) trade when FDI has occurred before an RTA is established.[4] We then extend our analysis to examine the critical values of a repatriation tax that induces a firm to engage in FDI when an RTA is and is not established.

The remainder of the paper is organized as follows. Section 2 lays out the analytical framework of the paper and presents the firms' and governments' decisions. Section 3 examines the social welfare consequences under each case

[4] We present the last two cases in the Appendix A1 and A2.

noted above. Section 4 then analyses how a firm's investment decision is affected by policy, focusing on the government's decision regarding a repatriation tax rate. The final section concludes.

2. THE MODEL

2.1. *The basic assumptions*

We consider a simple three-country model in which two countries, A and B, are located in the same region, while a third country, C, lies outside the region.[5] Countries A and B will potentially form an RTA, permit firms to engage in FDI, or both. Country C serves as a potential export market for firms located in countries A and B.

In both country A and country B, there is a firm owned by the households of each country. Although each firm is headquartered inside its own country, its production plant (denoted as A or B) can be located in any of the three countries. The separation of the headquarters and the production components of the firm allows us to analyse the impact of a repatriation tax on firm behaviour when the firm engages in overseas production.

We assume a simple demand structure that is functionally identical across countries A and B, but varies with the market size of country C:

$$Q_A = 1 - p_A; \quad Q_B = 1 - p_B; \quad Q_C = n(1 - p_C), \tag{1}$$

where Q_i and p_i are, respectively, the consumption and price of the final good in country i(= A, B, C), and n represents the relative size of the market in country C. As in Haufler and Wooton (2006), we set $n \in [1,2]$.

Labour is the only input in the production of the final good and technology is the same across countries. Specifically, one unit of labour is used to make one unit of the final good. Denote w_j as the competitive wage rate in country $j(= A, B, C)$, and τ_{ji} as a specific tariff (or subsidy) that country i imposes on imports from country j when $i \neq j$. To make the analysis simple, we assume that transportation costs are zero. To allow for input cost asymmetry, we assume that the wage rate is higher in country A than in country B. We also assume that the wage rate in country C is critically high. That is, $w_C \gg w_A > w_B$. Other things being equal, this assumption eliminates the following possibilities: (i) plant B will locate in country A and (ii) both plants A and B will locate in country C. Both firms are able to segment markets such that when firm $k(= A, B)$'s plant is located in country j, the pre-tax profit from servicing country i is:

$$\pi_{ji}^k = (p_i - c_{ji})x_{ji}^k, \tag{2a}$$

where p_i is the market price of final good in country i, x_{ji}^k is the quantity sold in country i by firm k when produced in country j, $c_{ji} = w_j + \tau_{ji}$, and $\tau_{jj} = 0$. We

[5] Country C can also represent the rest of the world.

assume that each of the three countries optimally sets tariff rate τ_{ji} to maximize its social welfare, which is the sum of consumer surplus, producer surplus (post-tax profit) and government revenue (tax and tariff).[6]

All plants pay a tax on their profits to the host country, which we denote as t_j for potential host countries $j(= A, B)$. If a plant is located in the same country as its headquarters (i.e. $j = k$), its total post-tax profit is:

$$\Pi^k = (1 - t_k) \sum_{i \in (A,B,C)} (p_i - c_{ki}) x_{ki}^k. \tag{2b}$$

Following Haufler and Wooton (2006), we assume the profit-tax rate, t_j, is previously established and is set by policy-makers to address concerns outside our model. However, if firm A decides to locate its plant in country B, then country A may also impose a repatriation tax, t^r, on the post-profit-tax profits of firm A that are assumed to be repatriated in this one-period game. While many tax policies may, in practice, utilize exemptions, credits or deductions to change the tax rate paid on repatriated profits as compared with the tax rate on domestic profits, the overall effects of these policies are different tax rates based upon the location where such profits are earned. Thus, we model the repatriation tax, t^r, as a continuous variable that is distinct from the domestic profit tax, t_j, which allows us to specifically examine the influence of the repatriation tax rate on the location decision and may more closely coincide with policy environments where potential partial exemptions, credits and deductions exist. Accordingly, if plant A is located in the lower-wage country B, its total post-tax profit is

$$\hat{\Pi}^A = (1 - t^r)(1 - t_B) \sum_{i \in (A,B,C)} (p_i - c_{Bi}) x_{Bi}^A. \tag{2c}$$

The timeline of the game is described as follows. There is a four-stage game. In the first stage, country A announces a repatriation tax rate t^r when its firm undertakes FDI by locating its production plant abroad. In the second stage, countries set their optimal tariff rates, τ_{ji}, for goods produced in country j and exported to country i. In the third stage, taking into account the aforementioned conditions, each firm decides where to locate its plant. In the last stage of the game, the firms adopt a Cournot strategy and compete in each market.

2.2. *Firm decisions*

2.2.1. *Production without foreign direct investment*

In the last stage of the game, firms A and B independently and simultaneously determine the quantities of their outputs in each market $i(= A, B, C)$. Given the demand and profit equations 1 and 2 and taking into account the fact that plant

[6] We refer to ‘taxes’ as profit and repatriation taxes, but not tariffs.

B always locates in its own country due to a relatively lower wage rate there, we obtain the profit of firm $k(=A, B)$ in market $i(=A, B)$ when plant A locates at home (no FDI) as[7]

$$\pi_i^A = (1 - x_i^A - x_i^B - w_A - \tau_{Ai})x_i^A \quad \text{and} \quad \pi_i^B = (1 - x_i^A - x_i^B - w_B - \tau_{Bi})x_i^B.$$

Taking the derivative of the profit functions with respect to quantity yields the first-order conditions (FOCs):

$$\frac{\partial \pi_i^A}{\partial x_i^A} = 1 - 2x_i^A - x_i^B - w_A - \tau_{Ai} = 0 \quad \text{and} \quad \frac{\partial \pi_i^B}{\partial x_i^B} = 1 - 2x_i^B - x_i^A - w_B - \tau_{Bi} = 0.$$

It follows from the FOCs that the equilibrium quantities x_i^A and x_i^B for markets $i(=A, B)$ are:

$$x_i^A = \frac{1}{3}(1 - 2w_A - 2\tau_{Ai} + w_B + \tau_{Bi}) \quad \text{and} \quad x_i^B = \frac{1}{3}(1 + w_A + \tau_{Ai} - 2w_B - 2\tau_{Bi}), \tag{3a}$$

For the market in country C, we have the profit functions of firms A and B as follows:

$$\pi_C^A = \left(1 - \frac{x_C^A}{n} - \frac{x_C^B}{n} - w_A - \tau_{AC}\right)x_C^A \quad \text{and} \quad \pi_C^B = \left(1 - \frac{x_C^A}{n} - \frac{x_C^B}{n} - w_B - \tau_{BC}\right)x_C^B.$$

The FOCs are given, respectively, as:

$$\frac{\partial \pi_C^A}{\partial x_C^A} = 1 - \frac{2x_C^A}{n} - \frac{x_C^B}{n} - w_A - \tau_{AC} = 0 \quad \text{and} \quad \frac{\partial \pi_C^B}{\partial x_C^B} = 1 - \frac{x_C^A}{n} - \frac{2x_C^B}{n} - w_B - \tau_{BC} = 0.$$

Solving for the equilibrium quantities x_C^A and x_C^B yields

$$x_C^A = \frac{n}{3}(1 - 2w_A - 2\tau_{AC} + w_B + \tau_{BC}) \quad \text{and} \quad x_C^B = \frac{n}{3}(1 + w_A + \tau_{AC} - 2w_B - 2\tau_{BC}). \tag{3b}$$

2.2.2. *Production with foreign direct investment*

When plant A locates in country B, firm A is engaged in FDI. Throughout the paper, a 'hat' is used to represent the case of FDI by firm A. Profits of firms A and B in the FDI case are given by

$$\hat{\pi}_i^A = (1 - \hat{x}_i^A - \hat{x}_i^B - w_B - \tau_{Bi})\hat{x}_i^A \quad \text{and} \quad \hat{\pi}_i^B = (1 - \hat{x}_i^A - \hat{x}_i^B - w_B - \tau_{Bi})\hat{x}_i^B,$$

and the FOCs are

[7] We drop the subscript on x indicating the location of the plant for remainder of the paper for notational simplicity.

$$\frac{\partial \hat{\pi}_i^A}{\partial \hat{x}_i^A} = 1 - 2\hat{x}_i^A - \hat{x}_i^B - w_B - \tau_{Bi} = 0 \quad \text{and} \quad \frac{\partial \hat{\pi}_i^B}{\partial \hat{x}_i^B} = 1 - 2\hat{x}_i^B - \hat{x}_i^A - w_B - \tau_{Bi} = 0.$$

Solving for the equilibrium quantities $\hat{x}_{Bi}^A$ and $\hat{x}_{Bi}^B$ in markets $i(= A,\ B)$ yields:

$$\hat{x}_A^A = \hat{x}_A^B = \frac{1}{3}(1 - w_B - \tau_{BA}); \quad \text{and} \quad \hat{x}_B^A = \hat{x}_B^B = \frac{1}{3}(1 - w_B). \tag{4a}$$

As for the market in country C, profits of firms A and B in country C are:

$$\hat{\pi}_C^A = \left(1 - \frac{\hat{x}_C^A}{n} - \frac{\hat{x}_C^B}{n} - w_B - \tau_{BC}\right)\hat{x}_C^A \quad \text{and} \quad \hat{\pi}_C^B = \left(1 - \frac{\hat{x}_C^A}{n} - \frac{\hat{x}_C^B}{n} - w_B - \tau_{BC}\right)\hat{x}_C^B,$$

and the FOCs are:

$$\frac{\partial \hat{\pi}_C^A}{\partial \hat{x}_C^A} = 1 - \frac{2\hat{x}_C^A}{n} - \frac{\hat{x}_C^B}{n} - w_B - \tau_{BC} = 0 \quad \text{and} \quad \frac{\partial \hat{\pi}_C^B}{\partial \hat{x}_C^B} = 1 - \frac{\hat{x}_C^A}{n} - \frac{2\hat{x}_C^B}{n} - w_B - \tau_{BC} = 0.$$

It is easy to verify that the equilibrium quantities $\hat{x}_C^A$ and $\hat{x}_C^B$ are:

$$\hat{x}_C^A = \hat{x}_C^B = \frac{n}{3}(1 - w_B - \tau_{BC}). \tag{4b}$$

2.2.3. *The firm location decision*

Similar to Davies *et al.* (2010), we find that the profit tax does not impact the level of output that the firm produces for each country conditional on the firm choosing to locate in a given country. However, the profit and repatriation taxes do influence the firm's location decision. In the third stage of the game, firm A must decide upon the location of its plant given its potential profit in each location as determined by taxes and tariffs implemented by the three countries. This decision can be defined as

$$\max\{\Pi^A, \hat{\Pi}^A\}.$$

In short, the firm remains a profit maximizer, regardless of the share of its profit transferred to the government, but the underlying tax and tariff structure impacts the country where firm A locates its plant. The profit tax represents a welfare-neutral transfer from the firm to the government if the plant is located in its home country. If the plant locates overseas, then the resulting profit tax is a transfer from the firm to the government of the host country. These impacts on welfare are described in Section 3.

2.3. *Government decisions*

2.3.1. *Tariffs*

In the second stage of the game, the governments of the three countries decide upon the tariff rates that would maximize their welfare conditional upon the location choice of plant A. As in the analysis in Subsection 2.2, we examine two alternative cases in terms of FDI:

(i) In the case without FDI, welfare for country $k(=A, B, C)$ is defined as:

$$W^k = CS^k + \Pi^k + GR^k, \tag{5a}$$

where CS^k is consumer surplus, and Π^k is firm k's profit with $\Pi^C = 0$ for the non-producing country C. Government revenue for country k, denoted as GR^k, is composed of profit tax and tariff revenue:

$$GR^k = t_k \sum_{i\in(A,B,C)} (p_i - c_{ki})x_i^k + \sum_{j\in(A,B)} \tau_{jk} x_k^j, \tag{6a}$$

where $x_i^C = 0$ for the non–producing country C and $\tau_{jj} = 0$.

(ii) In the case with FDI in that plant A locates in country B, country k's welfare becomes:

$$\hat{W}^k = \widehat{CS}^k + \hat{\Pi}^k + \widehat{GR}^k, \tag{5b}$$

where $\hat{\Pi}^A$ subtracts the repatriation tax from firm A's profit, as shown in equation 2c, and the aggregate profit for firm B is given as $\hat{\Pi}^B = \sum \hat{\pi}_i^B$. Government revenue for the three countries is now defined as:

$$\widehat{GR}^A = t^r(1-t_B) \sum_{i\in(A,B,C)} (p_i - c_{Bi})\hat{x}_i^A + \sum_{j\in(A,B)} \tau_{BA}\hat{x}_A^j, \tag{6b}$$

$$\widehat{GR}^B = t_B \sum_{k\in(A,B)} \sum_{i\in(A,B,C)} (p_i - c_{Bi})\hat{x}_i^k, \tag{6c}$$

and

$$\widehat{GR}^C = \sum_{k\in(A,B)} \tau_{BC}\hat{x}_C^k. \tag{6d}$$

In both the non-FDI and FDI cases, each government sets its tariffs to maximize welfare. In the case without FDI for country k, this is:

$$\max_{\{\tau_{ik},\tau_{jk}\}}(W^k) = \max_{\{\tau_{ik},\tau_{jk}\}}(CS^k + \Pi^k + GR^k), \tag{7a}$$

and with FDI, this is denoted as:

$$\max_{\{\tau_{ik},\tau_{jk}\}}(\hat{W}^k) = \max_{\{\tau_{ik},\tau_{jk}\}}(\widehat{CS}^k + \hat{\Pi}^k + \widehat{GR}^k), \tag{7b}$$

where (τ_{ik}, τ_{jk}) represent the tariff rates for goods potentially exported from the other two countries.[8]

2.3.2. *Repatriation tax*

For analysing issues related to repatriation tax policy, the first stage of the game involves the government in country A setting its repatriation tax rate. Similar to the previously mentioned profit tax, the repatriation tax, t^r, is a welfare-neutral transfer from firm A to the government in country A assuming that the firm locates its plant in country B. However, the repatriation tax can be used by the government to alter the location of firm A's plant. If the repatriation tax rate exceeds a threshold tax rate, $t_c{}^r$, firm A will choose to locate its plant in country A. Otherwise, the firm will locate its plant in country B. More formally, the government in country A is setting the repatriation tax to maximize social welfare as:

$$\max_{\{t^r > t_c{}^r, t^r < t_c{}^r\}} \{W_A^A, \hat{W}_B^A\}, \tag{8}$$

where the first element represents country A's welfare when the plant locates in country A and the second is the welfare when the plant locates in country B. The next section explicitly calculates these welfare levels. Section 4 examines the threshold level of the repatriation tax.

3. WELFARE ANALYSIS

We are now in a position to examine the resulting welfare outcomes without and with FDI (i.e. plant A locates in country B) under both the pre-RTA and RTA regimes. For each scenario, we calculate the resulting prices, tariff rates and social welfare. However, this firm-level location decision will be determined by the tariff and tax policies of the two countries. Section 4 specifically discusses the determination of the repatriation tax in the first stage of the model as defined in equation 8.

We use the pre-RTA regime as the benchmark to evaluate alternative regimes when: (i) firm A undertakes FDI and an RTA is not established, (ii) the two regional countries A and B form an RTA and FDI is not allowed; or (iii) both the establishment of an RTA and FDI occurs. We also analyse two additional scenarios in the Appendix: firm A undertakes FDI when an RTA is already in

[8] Countries A and B will not need to implement a tariff rate from the non-producing country C. In the case of FDI, country B will not need a tariff rate for goods coming from country A.

place, or the two countries consider forming an RTA when the location decisions of FDI have been made.

3.1. *Benchmark scenario welfare*

In this and the following cases, we only report optimal tariff rates, prices of final goods in the three markets and social welfare of each country. Without loss of generality, we assume $w_B = 0$ and interpret w_A as the intra-regional wage differential between countries A and B. For the three-country trade without the formation of an RTA between countries A and B (i.e. the pre-RTA regime), we have[9]

$$\tau_{BA} = \frac{1}{3}; \quad \tau_{AB} = \frac{1}{3}(1 - w_A); \quad \tau_{AC} = \frac{1}{35}(5 - 13w_A); \quad \tau_{BC} = \frac{1}{35}(5 + 8w_A); \quad (9a)$$

$$p_A = \frac{1}{9}(4 + 3w_A); \quad p_B = \frac{2}{9}(2 + w_A); \quad p_C = \frac{1}{7}(3 + 2w_A); \quad (9b)$$

$$W^A = \frac{4}{49}n - \frac{62}{81}w_A - \frac{48}{245}nw_A + \frac{113}{162}w_A^2 + \frac{144}{1225}nw_A^2 + \frac{65}{162}; \quad (9c)$$

$$W^B = \frac{4}{49}n + \frac{13}{81}w_A + \frac{8}{245}nw_A + \frac{11}{27}w_A^2 + \frac{4}{1225}nw_A^2 + \frac{65}{162}, \quad (9d)$$

where τ_{ji} is the optimal tariff on the final good produced in country j and exported to country i and W^k denotes country k's social welfare (see equations in (5a)). If $w_A < 5/13$ in equation 9a, then all tariff values are positive under the pre-RTA regime. This condition on the wage in country A is assumed in the remainder of the analysis unless otherwise specified.

3.2. *Welfare effect of foreign direct investment without a regional trade agreement*

In this subsection, we examine welfare implications when firm A locates its plant in country B (i.e. firm A decides to undertake its FDI in country B). In this case, there is no RTA between the two counties. It is important to note that the repatriation tax is welfare neutral for country A assuming that firm A locates its plant in country B; the tax simply transfers and reallocates firm A's post-tax profit to country A's government revenue. However, the repatriation tax rate may impact the firm's location decision, which is examined in Section 4.

We calculate tariff rates, final good prices, and social welfare for this case as follows:[10]

[9] See Appendix A3 for a detailed derivation of this case.

[10] See Appendix A4 for a detailed derivation of this case.

$$\tau_{BA} = \frac{t_B}{3+t_B};\ \tau_{BC} = \frac{2}{5}; \tag{10a}$$

$$p_A = \frac{1+t_B}{3+t_B};\ p_B = \frac{1}{3};\ p_C = \frac{3}{5}; \tag{10b}$$

$$\hat{W}^A = \frac{1}{225(3+t_B)}\left(300+27n-50t_B-18nt_B-25t_B^2-9nt_B^2\right); \tag{10c}$$

$$\hat{W}^B = \frac{1}{225(3+t_B)^2}\left(900+81n+900t_B+135nt_B+225t_B^2+63nt_B^2+25t_B^3+9nt_B^3\right). \tag{10d}$$

When there is FDI, all production of the final good for domestic consumption and exporting takes places in the low-wage country. In this case, there is no tariff revenue for country B. However, the low-wage country is able to collect revenue from taxing the profits of firm A, which sells final goods to all three markets. Consumers in the two regional countries are better off due to the lower price of goods produced by the two firms, and the price of the final good in country C increases, leading to a deterioration of consumer surplus. Profit for firm B decreases because of increased competition. However, the impact on firm A is ambiguous due to the fact that it also enjoys lower production costs in the low-wage country.

It is instructive to use graphs to illustrate the differences in welfare measures across the FDI and non-FDI scenarios. In Figure 1, we set $n = 1.6$ and plot country A's wage, w_A, against country B's profit tax, t_B. In Areas 1 and 2, the

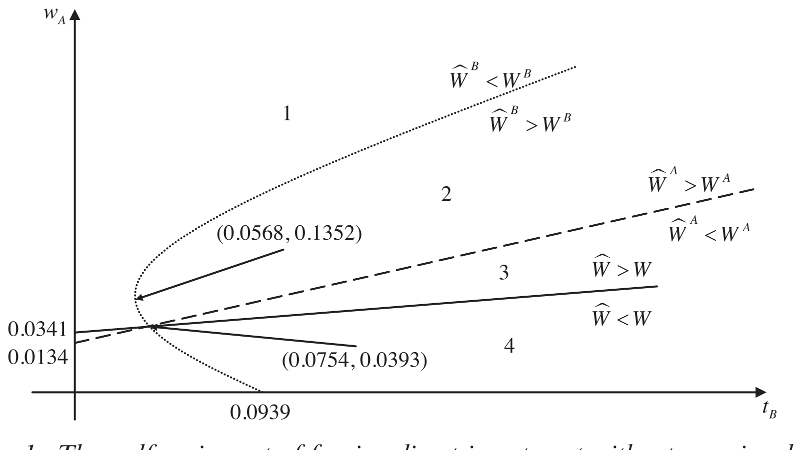

Figure 1. The welfare impact of foreign direct investment without a regional trade agreement

intra-regional wage differential is relatively large, which allows country A to benefit from lower production costs when its plant is located in country B. However, if the wage differential is small, the relocation of the plant to country B is welfare deteriorating for country A (Area 3) and potentially for the region as a whole (Area 4). These theoretical results coincide with the findings of Bergstrand and Egger (2013), which show that differences in relative factors lead to higher levels of welfare if additional FDI occurs due to the signing of a BIT. Overall, our results suggest that if the wage differential is relatively large, country A has an incentive to implement a repatriation tax rate that leads to the relocation of its firm overseas. These findings lead to the following proposition.

PROPOSITION 1. *FDI is welfare-improving for at least one of the two countries (Areas 1, 3 and 4) or both (Area 2), depending on the degree of the intra-regional wage cost asymmetry and the profit tax rate in the low-wage country. FDI is welfare-improving for the region if the intra-regional wage differential is sufficiently large (Areas 1, 2 and 3).*

3.3. *Welfare effect of a regional trade agreement without foreign direct investment*

For the case in which countries A and B sign an RTA to promote free trade and relocation does not occur, the model's solutions are as follows:[11]

$$\tau_{AC} = \frac{1}{35}(5-13w_A);\ \tau_{BC} = \frac{1}{35}(5+8w_A); \tag{11a}$$

$$p_A = p_B = \frac{1}{3}(1+w_A);\ p_C = \frac{1}{7}(3+2w_A); \tag{11b}$$

$$\bar{W}^A = \frac{4}{49}n - \frac{10}{9}w_A - \frac{48}{245}nw_A + \frac{17}{18}w_A^2 + \frac{144}{1225}nw_A^2 + \frac{4}{9}; \tag{11c}$$

$$\bar{W}^B = \frac{4}{49}n - \frac{2}{9}w_A + \frac{8}{245}nw_A + \frac{5}{18}w_A^2 + \frac{4}{1225}nw_A^2 + \frac{4}{9}, \tag{11d}$$

where $\bar{W}^k$ denotes country k's social welfare under the RTA, which eliminates tariffs between the two regional countries; that is, $\tau_{AB} = \tau_{BA} = 0$. It is easy to see that the final good prices in the regional countries are relatively lower under the RTA.

Next, we compare social welfare between the pre-RTA regime and the RTA regime without FDI. It follows from equations 9c, 9d, 11c and 11d that

[11] We use 'bars' for the remainder of the paper to denote the case of an RTA. See Appendix A5 for a detailed derivation of the model.

$$\bar{W}^A > W^A \text{ iff } w_A < \frac{7}{10} - \frac{3}{20}\sqrt{14} \approx 0.13875; \tag{12a}$$

$$\bar{W}^B > W^B; \bar{W}^A + \bar{W}^B > W^A + W^B. \tag{12b}$$

If the wage differential is small, both countries benefit from the RTA, which is a result consistent with Brander and Spencer's (1984) notion that a cooperative tariff reduction can increase welfare. When wage differentiation does not satisfy equation 12a, the loss in profits and tariff revenue is more than offset by the increase in consumer surplus. Consequently, forming an RTA makes the high-wage country worse off but the low-wage country better off when equation 12a is not satisfied. However, the region as a whole gains from the RTA. The findings in equations 12a and 12b permit us to establish the following proposition.

Proposition 2. *When two regional countries with wage cost asymmetry form an RTA without any relocation of their production plants, the RTA is welfare-improving for the low-wage country and the region, but is only welfare-improving for the high-wage country if the intra-regional wage differential is small.*

3.4. *Welfare effect of foreign direct investment with a regional trade agreement*

The next case of interest is when firm A locates its plant in country B and an RTA also exists. We calculate the equilibrium tariff, final good prices and social welfare while noting that $\tau_{AB} = \tau_{BA} = 0$ due to the RTA and τ_{AC} is irrelevant:[12]

$$\tau_{BC} = \frac{1}{4}; p_A = p_B = \frac{1}{3}; p_C = \frac{1}{2}; \tag{13a}$$

$$\hat{\bar{W}}^A = \frac{2}{9} + \left(\frac{2}{9} + \frac{n}{16}\right)(1 - t_B); \hat{\bar{W}}^B = \frac{4}{9} + \frac{n}{16}(1 + t_B). \tag{13b}$$

Equations 9c, 9d and 13b can be used to show that the welfare effect of the RTA alongside the relocation of the plant cannot be determined unambiguously. Setting $n = 1.6$, we use Figure 2 to illustrate these conditions.

Figure 2 shows that the RTA and relocation is welfare-improving for country B unless the intra-regional wage differential is extremely large and the profit tax rate is small, as in Area 1, which leads to the following proposition.

Proposition 3. *Forming an RTA between two regional countries with the relocation of the production plant from the high-wage country to the low-wage*

[12] See Appendix A6 for a detailed derivation of the model.

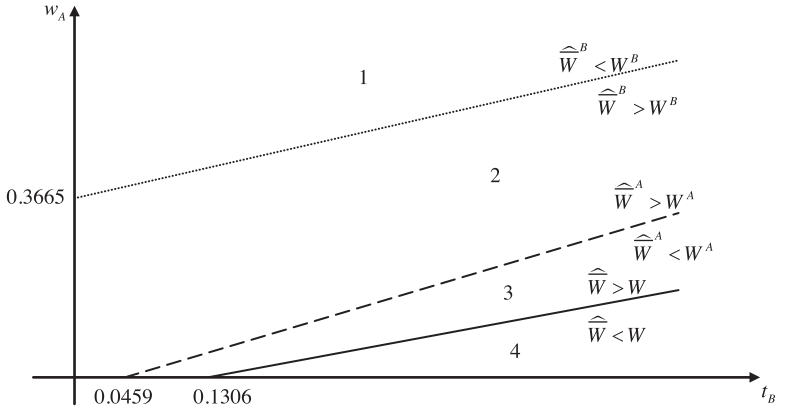

Figure 2. The welfare impact of foreign direct investment with a regional trade agreement

country is welfare-improving for the low-wage country unless the intra-regional wage differential is large and the profit tax of the low-wage country is high.

Likewise, country A benefits from the RTA and the relocation due to the lower wage used in the production of its output, unless the wage differential is small or the profit tax of country B is high, which would occur in Areas 3 and 4. Welfare is improved for the region as a whole unless the wage differential is small and the profit tax is high as shown in Area 4. This leads to Proposition 4.

Proposition 4. *Forming an RTA between two regional countries with the relocation of the production plant from the high-wage country to the low-wage country is welfare-improving for the high-wage country and the region unless the intra-regional wage differential is small and the profit tax of the low-wage country is high.*

4. CRITICAL VALUE OF REPATRIATION TAX RATE

In this section, we analyse the economic effects of repatriation taxes. Repatriation taxes constitute an important issue in the taxation of multinational firms by altering the incentive of a firm to locate its plant overseas. We wish to find out how the repatriation tax set by the high-wage country affects the post-tax profits of its firm when locating its plant in the low-wage country. Accordingly, the repatriation tax, t^r, is used by the high-wage country to influence the location decision of a firm's production plant in the first stage of the model.

We solve for the critical value of a repatriation tax for two cases. The first case is when an RTA does not exist. The second case is when both countries A and B trade under an RTA.

4.1. *Case I*

This critical value of t^r for the case without an RTA (but with FDI) satisfies the following condition:

$$\Pi^A = \left(1 - t^r\right)\hat{\Pi}^A, \tag{14}$$

where the term on the left-hand side is firm A's post-tax profit when its plant is located within its own country, and the term on the right-hand side is firm A's post-tax profit when its plant is located in country B. Solving for the critical value of t^r when there is no RTA between countries A and B yields

$$t_c^{\,r} = 1 - \frac{\left(\frac{4}{3} - 2w_A\right)^2 + \left(\frac{1}{3} - \frac{4}{3}w_A\right)^2 + n\left(\frac{6}{7} - \frac{36}{35}w_A\right)^2}{1 + \frac{9}{25}n + \left(\frac{3}{3 + t_B}\right)^2}\frac{(1 - t_A)}{(1 - t_B)}. \tag{15}$$

From equation 15, we have the following comparative statics:

$$\frac{\partial t_c^{\,r}}{\partial t_A} > 0; \frac{\partial t_c^{\,r}}{\partial t_B} < 0; \frac{\partial t_c^{\,r}}{\partial w_A} > 0; \frac{\partial t_c^{\,r}}{\partial n} < 0 \text{ for } w_A < \frac{5}{13}. \tag{16}$$

4.2. *Case II*

Next, we define $\overline{t_c}^r$ as the critical value of the repatriation tax rate for the case with both an RTA and FDI between the two regional countries. Making use of equation 9 and considering the presence of an RTA, we solve for $\overline{t_c}^r$ as follows:

$$\overline{t_c}^r = 1 - \frac{2(1 - 2w_A)^2 + n\left(\frac{6}{7} - \frac{36}{35}w_A\right)^2}{\frac{9}{16}n + 2}\frac{(1 - t_A)}{(1 - t_B)} \tag{17}$$

From equation 17, we have the following comparative statics:

$$\frac{\partial \overline{t_c}^r}{\partial t_A} > 0; \frac{\partial \overline{t_c}^r}{\partial t_B} < 0; \frac{\partial \overline{t_c}^r}{\partial w_A} > 0; \frac{\partial \overline{t_c}^r}{\partial n} < 0 \text{ for } w_A < \frac{5}{13} \tag{18}$$

These results naturally lead to the following proposition, which applies in both the RTA and non-RTA scenarios.

PROPOSITION 5. *If wage costs are asymmetric, the critical value of the repatriation tax is positively related to its profit tax rate in the high-wage country, and* *negatively related to the profit tax rate in the low-wage country. The critical value of the repatriation tax is positively related to the wage differential.*

For both t_c^r and $\overline{t}_c^r$, the effect of the wage differential or profit tax rates is intuitive. When the profit tax rate of the home country is relatively high (higher t_A or lower t_B), the firm has a higher incentive to locate its plant in the low-wage country B. This implies that a higher repatriation tax rate is required to keep the firm within its home country. The same logic applies when the wage differential is large. The economic effect associated with the market size of the outside country is somewhat surprising, however. If the intra-regional wage differential is not too large (i.e. $w_A < 5/13$), then the benefit to firm A of locating its plant in the low-wage country is more than offset by any double taxation. However, if the intra-regional wage differential is large, then the benefits of the lower wage that occur with the relocation offset the double-taxation at a rate that increases as the external market expands.

It is instructive to compare the critical repatriation tax rates as derived above for the two different cases. It follows from equations 15 and 17 that

$$t_c^r < \overline{t}_c^r.$$

PROPOSITION 6. *The critical value of the repatriation tax rate that induces the firm of the high-wage country to locate its plant in the high-wage country is lower when there is no RTA than when there is an RTA.*

The relationship between these critical repatriation tax rates and welfare can be related to the government's formal decision of setting the repatriation tax rate in equation 8. Proposition 6 implies that, if the repatriation tax is not very high (greater than t_c^r but lower than $\overline{t}_c^r$), then the signing of an RTA would induce the relocation of the plant to the low-wage country. Similar to Proposition 4, the high-wage country would benefit from this relocation and RTA if: (i) the wage differential is sufficiently large; or (ii) if the profit tax of the low-wage country is sufficiently small.

5. CONCLUDING REMARKS

In this paper, we derive economic conditions under which regional countries have incentives to create FDI-enabling policies, with or without forming an RTA, in an environment with double taxation. Using a stylized three-country model, we express these conditions in terms of profit tax rates, wage cost asymmetry and the market size outside of the region.

We show that the formation of an RTA between two regional countries with wage cost asymmetry makes the low-wage country and the region better off, but can be welfare-deteriorating for the high-wage country. Other things being equal, FDI through a relocation of a production plant from the high-wage country to the low-wage country can be welfare-improving or welfare-deteriorating, depending on the degree of wage cost asymmetry between the countries and the profit-tax rate in the low wage country. When the wage asymmetry is significantly large, FDI is welfare-improving for at least one or both of the two countries. FDI occurring alongside a newly formed RTA is welfare-improving for the high-wage country and the region if the wage differential is not small. The forming of an RTA with FDI is also a welfare-improving option for the low-wage country unless the wage differential is critically large.

The analysis in this paper is able to reconcile several observations and prior findings with theory. Similar to Cole and Davies (2011), our results suggest that enabling FDI may lead to lower tariff rates. Our results support the findings of Adams *et al.* (2003), who note the increasing establishment of RTA with investment provisions and their corresponding positive influence on FDI flows. If a high-wage country is to enter into an RTA with a low-wage country, then policies that positively influence FDI, such as investment provisions within the RTA or BIT that were signed prior to the RTA, will improve the welfare outcome of the high-wage country if the wage differential is large, which is consistent with Bergstrand and Egger (2013). The inclusion of such investment provisions or the signing of additional agreements would likely result in the positive FDI flows identified by Medvedev (2012). We further discuss the role of repatriation taxes under different trade regimes. Our results suggest that the signing of an RTA may induce FDI from the high-wage country to the low wage country in an environment with double taxation. However, the critical threshold of the repatriation tax that makes a firm indifferent in terms of its location decision varies across trade regimes, which suggests that the impact of double taxation treaties on FDI flows may be largely influenced by the trade regime. We expect that further attention to trade agreements in future empirical work will help to reconcile the different findings currently found in the literature concerning double taxation treaties and their impact on FDI.

REFERENCES

Adams, R., P. Dee, J. Gali and G. McGuire (2003) 'The Trade and Investment Effects of Preferential Trading Arrangements – Old and New Evidence', Productivity Commission *Staff Working Paper*. Productivity Commission, Australian Government.

Barthel, F., M. Busse and E. Neumayer (2010) 'The Impact of Double Taxation Treaties on Foreign Direct Investment: Evidence From Large Dyadic Panel Data', *Contemporary Economic Policy* 28, 366–77.

Bergstrand, J. and P. Egger (2013) 'What Determines Bits?', *Journal of International Economics* 90, 107–22.

Blonigen, B. A. and R. B. Davies (2004) 'The Effects of Bilateral Tax Treaties on U.S. FDI Activity', *International Tax and Public Finance* 11, 601–22.

Brainard, L. (1997) 'An Empirical Assessment of the Proximity-Concentration Tradeoff between Multinational Sales and Trade', *American Economic Review* 87, 520–44.

Brander, J. and B. Spencer (1984) 'Tariff Protection and Imperfect Competition', in H. Kierzkowski (ed.), *Monopolistic Competition and International Trade*, Oxford: Oxford University Press.

Cole, M. and R. B. Davies (2011) 'Strategic Tariffs, Tariff Jumping, and Heterogeneous Firms', *European Economic Review* 55, 480–96.

Collie, D. (2011) 'Multilateral Trade Liberalisation, Foreign Direct Investment and the Volume of World Trade', *Economics Letters* 113, 47–9.
Coupé, T., I. Orlova and A. Skiba (2009) 'The Effect of Tax and Investment Treaties on Bilateral FDI Flows to Transition Economies', in K. Sauvant and L. Sachs (eds), *The Effect of Treaties on Foreign Direct Investment*, Oxford: Oxford University Press.
Davies, R. (2003) 'The OECD Model Tax Treaty: Tax Competition and Two-Way Capital Flows', *International Economic Review* 44, 725–53.
Davies, R. B., H. Egger and P. Egger (2010) 'Profit Taxation and the Mode of Foreign Market Entry', *Canadian Journal of Economics* 43, 704–27.
Dee, P. and J. Gali (2005) 'The Trade and Investment Effects of Preferential Trading Arrangements', in T. Ito and A. Rose (eds), *International Trade in East Asia, NBER-East Asia Seminar on Economics, Volume 14*, Chicago: University of Chicago Press.
Egger, P., M. Larch, M. Pfaffermayr and H. Winner (2006) 'The Impact of Endogenous Tax Treaties on Foreign Direct Investment: Theory and Evidence', *Canadian Journal of Economics* 39, 901–31.
Ekholm, K., R. Forslid and J. Markusen (2007) 'Export-Platform Foreign Direct Investment', *Journal of the European Economic Association* 5, 776–95.
Ethier, W. (1998a) 'The New Regionalism', *The Economic Journal* 108, 1149–61.
Ethier, W. (1998b) 'Regionalism in a Multilateral World', *Journal of Political Economy* 106, 1212–45.
Haufler, A. and I. Wooton (2006) 'The Effects of Regional Tax and Subsidy Coordination on Foreign Direct Investment', *European Economic Review* 50, 285–305.
Helpman, E., M. J. Melitz and S. R. Yeaple (2004) 'Export Versus FDI with Heterogeneous Firms', *American Economic Review* 94, 300–16.
MacDermott, R. (2007) 'Regional Trade Agreement and Foreign Direct Investment', *North American Journal of Economics and Finance* 18, 107–16.
Markusen, J. (2002) *Multinational Firms and the Theory of International Trade*. Cambridge, MA, USA: MIT Press.
Medvedev, D. (2012) 'Beyond Trade: The Impact of Preferential Trade Agreements on FDI Inflows', *World Development* 40, 49–61.
Neumayer, E. (2007) 'Do Double Taxation Treaties Increase Foreign Direct Investment to Developing Countries?', *Journal of Development Studies* 43, 1501–19.
Raff, H. (2004) 'Preferential Trade Agreements and Tax Competition for Foreign Direct Investment', *Journal of Public Economics* 88, 2745–63.
Yeaple, S. (2003) 'The Role of Skill Endowments in the Structure of U.S. Outward Foreign Direct Investment', *The Review of Economics and Statistics* 85, 726–34.

APPENDIX

We recognize that decisions regarding the establishment of an RTA and FDI may not occur simultaneously, but rather a country may enter into an RTA after their firms have already established overseas operations or changes in the political or economic environment of a host country may induce FDI after an RTA has already been signed. For example, increased political stability or the signing of a bilateral investment treaty may lead a firm to evaluate an overseas investment that it had previously not considered. We address these two asynchronous decision processes in Appendices A1 and A2.

A1. *Foreign direct investment under the presence of a previously established regional trade agreement*

If the ability to locate overseas is made possible after the establishment of an RTA, firm A has a strong incentive to move overseas to take advantage of the wage differential, which is not offset by a tariff when the firm exports back to

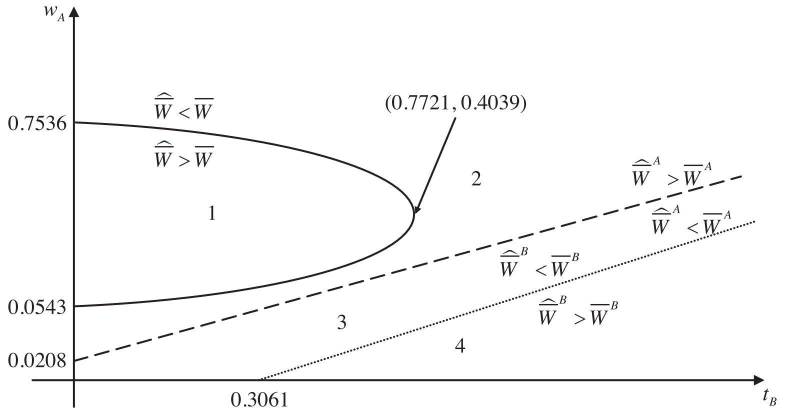

Figure A1. The welfare impact of foreign direct investment with a previously established regional trade agreement

country A. To access the welfare implication, we analyse social welfare by comparing the following pairs of social welfare:

$$\bar{W}^A \quad \text{and} \quad \hat{\bar{W}}^A;$$

$$\bar{W}^B \quad \text{and} \quad \hat{\bar{W}}^B;$$

$$\bar{W}^A + \bar{W}^B \quad \text{and} \quad \hat{\bar{W}}^A + \hat{\bar{W}}^B.$$

For comparing social welfare for countries A and B, as well as the two-country region with $n = 1.6$, we present the graphical results in Figure A1. For the four regimes, we have

Area 1: $\hat{\bar{W}}^A > \bar{W}^A$, $\hat{\bar{W}}^B < \bar{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B > \bar{W}^A + \bar{W}^B$;
Area 2: $\hat{\bar{W}}^A > \bar{W}^A$, $\hat{\bar{W}}^B < \bar{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B < \bar{W}^A + \bar{W}^B$;
Area 3: $\hat{\bar{W}}^A < \bar{W}^A$, $\hat{\bar{W}}^B < \bar{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B < \bar{W}^A + \bar{W}^B$;
Area 4: $\hat{\bar{W}}^A < \bar{W}^A$, $\hat{\bar{W}}^B > \bar{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B < \bar{W}^A + \bar{W}^B$.

These results lead to the following propositions:

Proposition A1. *In the presence of a previously established RTA, FDI is welfare-improving for the high-wage country if the wage differential is large or the profit tax in the low-wage country is small.*

Proposition A2. *In the presence of a previously established RTA, FDI is welfare-improving for the low-wage country if the wage differential is small or the profit tax in the low-wage country is large.*

As in any other case with new FDI (Subsections 3.2 and 3.4), the presence of FDI increases competition in all markets, causing the profit of firm B to decline. However, this negative impact on country B's welfare is offset by a collection of profit tax from plant A. On the other hand, the regional wage differential must be sufficiently high to make the relocation of plant A welfare improving for country A. The critical value of this wage differential is increasing with the level of profit tax in country B.

A2. *Welfare effect of a regional trade agreement when foreign direct investment has already occurred*

Similar to the analysis in Appendix A1, we assume that firm A has already located its plant in country B before the establishment of the RTA. Prior to the RTA firm A would be exposed to tariffs when exporting back to Country A. Once the RTA is established, this tariff is removed. In this case, we conduct a welfare comparison for the following pairs:

$$\hat{W}^A \quad \text{and} \quad \hat{\bar{W}}^A;$$

$$\hat{W}^B \quad \text{and} \quad \hat{\bar{W}}^B;$$

$$\hat{W}^A + \hat{W}^B \quad \text{and} \quad \hat{\bar{W}}^A + \hat{\bar{W}}^B.$$

This case is similar to the one that involves the trade regime change from pre-RTA to RTA. The difference between this case and the case discussed in Subsection 3.3 (welfare effect of an RTA without FDI) is that firm A's profits earned in country B are subject to the profit tax policy there.

Figure A2 presents the welfare impact of establishing an RTA when firm A has already relocated its plant to country B. The welfare comparisons are shown on the graph as:

Area 1: $\hat{\bar{W}}^A > \hat{W}^A$, $\hat{\bar{W}}^B > \hat{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B > \hat{W}^A + \hat{W}^B$;
Area 2: $\hat{\bar{W}}^A > \hat{W}^A$, $\hat{\bar{W}}^B < \hat{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B > \hat{W}^A + \hat{W}^B$;
Area 3: $\hat{\bar{W}}^A > \hat{W}^A$, $\hat{\bar{W}}^B < \hat{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B < \hat{W}^A + \hat{W}^B$;
Area 4: $\hat{\bar{W}}^A < \hat{W}^A$, $\hat{\bar{W}}^B < \hat{W}^B$, $\hat{\bar{W}}^A + \hat{\bar{W}}^B < \hat{W}^A + \hat{W}^B$.

Proposition A3. *When FDI through a relocation of the production plant from a high-wage country to a low-wage country is in existence despite import tariffs set by their respective governments, forming an RTA is a welfare-improving option for the low-wage country and the region. If profit tax set by the low-wage country is not critically high, the RTA formation is also welfare-improving for the high-wage country.*

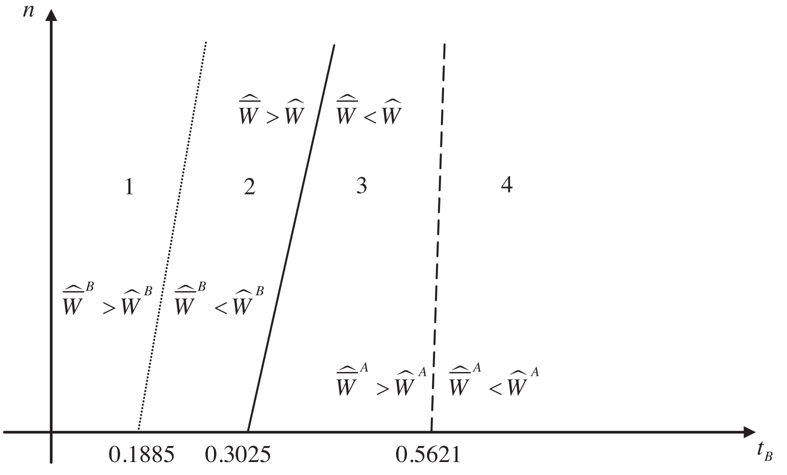

Figure A2. The welfare impact of a regional trade agreement with previous foreign direct investment

A3. *Optimal tariffs and social welfare without foreign direct investment or a regional trade agreement*

Given the equilibrium outputs x_A^A and x_A^B in equation 3a, we have total consumption in market A as $Q_A = x_A^A + x_A^B = \frac{1}{3}(2 - w_A - w_B - \tau_{BA})$ and the market price as $p_A = 1 - Q_A = \frac{1}{3}(1 + w_A + w_B + \tau_{BA})$. Profits of firms A and B in market A are $\pi_A^A = x_A^A(p_A - w_A) = \frac{1}{9}(1 - 2w_A + w_B + \tau_{BA})^2$; $\pi_A^B = x_A^B(p_A - w_B - \tau_{BA}) = \frac{1}{9}(1 + w_A - 2w_B - 2\tau_{BA})^2$, and consumer surplus there is $CS^A = \frac{1}{2}(1 - p_A)Q_A = \frac{1}{18}(2 - w_A - w_B - \tau_{BA})^2$. Next, the equilibrium outputs x_B^A and x_B^B in equation 3a imply that total consumption in market B is $Q_B = x_B^A + x_B^B = \frac{1}{3}(2 - w_A - w_B - \tau_{AB})$ and the market price is $p_B = 1 - Q_B = \frac{1}{3}(1 + w_A + w_B + \tau_{AB})$. Profits of firms A and B in market B are:

$$\pi_B^A = x_B^A(p_B - w_A - \tau_{AB}) = \frac{1}{9}(1 - 2w_A + w_B - 2\tau_{AB})^2;$$

$$\pi_B^B = x_B^B(p_B - w_B) = \frac{1}{9}(1 + w_A - 2w_B + \tau_{AB})^2$$

and consumer surplus there is: $CS^B = \frac{1}{2}(1 - p_B)Q_B = \frac{1}{18}(2 - w_A - w_B - \tau_{AB})^2$. Given the equilibrium outputs in market C are x_C^A and x_C^B in equation 3b, we have

$$Q_C = x_C^A + x_C^B = \frac{n}{3}(2 - w_A - w_B - \tau_{AC} - \tau_{BC}) \quad \text{and}$$

$$p_C = 1 - \frac{Q_C}{n} = \frac{1}{3}(1 + w_A + w_B + \tau_{AC} + \tau_{BC}).$$

Profits of firms A and B in market C are:

$$\pi_C^A = x_C^A(p_C - w_C - \tau_{AC}) = \frac{n}{9}(1 - 2w_A + w_B - 2\tau_{AC} + \tau_{BC})^2,$$

$$\pi_C^B = x_C^B(p_C - w_B - \tau_{BC}) = \frac{n}{9}(1 + w_A - 2w_B + \tau_{AC} - 2\tau_{BC})^2,$$

and consumer surplus there is:

$$CS^C = \frac{1}{2}(1 - p_C)Q_C = \frac{n}{18}(2 - w_A - w_B - \tau_{AC} - \tau_{BC})^2.$$

The aggregate profits for firms A and B are:

$$\Pi^A = \pi_A^A + \pi_B^A + \pi_C^A = \frac{1}{9}(1 - 2w_A + w_B + \tau_{BA})^2 + \frac{1}{9}(1 - 2w_A + w_B - 2\tau_{AB})^2 + \frac{n}{9}(1 - 2w_A + w_B - 2\tau_{AC} + \tau_{BC})^2;$$

$$\Pi^B = \pi_A^B + \pi_B^B + \pi_C^B = \frac{1}{9}(1 + w_A - 2w_B - 2\tau_{BA})^2 + \frac{1}{9}(1 + w_A - 2w_B + \tau_{AB})^2 + \frac{n}{9}(1 + w_A - 2w_B + \tau_{AC} - 2\tau_{BC})^2.$$

Social welfare functions of the three countries are given, respectively, as

$$W^A = CS^A + \Pi^A + x_A^B\tau_{BA}, \quad W^B = CS^B + \Pi^B + x_B^A\tau_{AB},$$
$$W^C = CS^C + x_C^A\tau_{AC} + x_C^B\tau_{BC}.$$

Country A chooses its optimal tariff τ_{BA} to maximize its social welfare W^A; Country B chooses its optimal tariff τ_{AB} to maximize its social welfare W^B; Country C chooses its optimal tariffs τ_{AC} and τ_{BC} to maximizes its social welfare W^C. The FOCs for the three countries are given, respectively, as

$$\frac{\partial W^A}{\partial \tau_{BA}} = -\frac{1}{9}(2 - w_A - w_B - \tau_{BA}) + \frac{2}{9}(1 - 2w_A + w_B + \tau_{BA}) + \frac{1}{3}(1 + w_A - 2w_B - 2\tau_{BA}) - \frac{2}{3}\tau_{BA} = 0;$$

$$\frac{\partial W^B}{\partial \tau_{AB}} = -\frac{1}{9}(2 - w_A - w_B - \tau_{AB}) + \frac{2}{9}(1 + w_A - 2w_B + \tau_{AB}) + \frac{1}{3}(1 - 2w_A + w_B - 2\tau_{AB}) - \frac{2}{3}\tau_{AB} = 0;$$

$$\frac{\partial W^C}{\partial \tau_{AC}} = -\frac{n}{9}(2 - w_A - w_B - \tau_{AC} - \tau_{BC}) + \frac{n}{3}(1 - 2w_A + w_B - 2\tau_{AC} + \tau_{BC}) - \frac{2n}{3}\tau_{AC} = 0;$$

$$\frac{\partial W^C}{\partial \tau_{BC}} = -\frac{n}{9}(2 - w_A - w_B - \tau_{AC} - \tau_{BC}) + \frac{n}{3}(1 + w_A - 2w_B + \tau_{AC} - 2\tau_{BC}) - \frac{2n}{3}\tau_{BC} = 0.$$

Solving for the optimal tariffs yields

$$\tau_{BA} = \frac{1}{3}(1 - w_B), \quad \tau_{BA} = \frac{1}{3}(1 - w_B), \quad \tau_{AC} = \frac{1}{35}(5 - 13w_A + 8w_B), \quad \tau_{BC} = \frac{1}{35}(5 + 8w_A - 13w_B).$$

Assuming $w_B = 0$ for the easiness of illustration, we have

$$\tau_{BA} = \frac{1}{3}, \tau_{AB} = \frac{1}{3}(1 - w_A), \tau_{AC} = \frac{1}{35}(5 - 13w_A) > 0 \text{ if } w_A < \frac{5}{13} \approx 0.3846 \text{ and } \tau_{BC} = \frac{1}{35}(5 + 8w_A),$$

as shown in equation 9a. Making use of these optimal tariffs, we can calculate the equilibrium market prices and social welfare as shown in equations 9b to 9d.

A4. *Optimal tariffs and social welfare with foreign direct investment without a regional trade agreement*

In this case, there is an FTA undertaken by firm A in country B. Given the equilibrium outputs $\hat{x}_A^A$ and $\hat{x}_A^B$ in equation 4a, we have total consumption in market A as $Q_A = \hat{x}_A^A + \hat{x}_A^B = \frac{2}{3}(1 - w_B - \tau_{BA})$ and the market price as $p_A = 1 - Q_A = \frac{1}{3}(1 + 2w_B + 2\tau_{BA})$. Profits of firms A and B in market A are: $\hat{\pi}_A^A = \hat{x}_A^A(p_A - w_B - \tau_{BA}) = \frac{1}{9}(1 - w_B - \tau_{BA})^2$ and $\hat{\pi}_A^B = \hat{x}_A^B(p_A - w_B - \tau_{BA}) = \frac{1}{9}(1 - w_B - \tau_{BA})^2$ and consumer surplus there is $CS^A = \frac{1}{2}(1 - p_A)Q_A = \frac{2}{9}(1 - w_B - \tau_{BA})^2$. Next, the equilibrium outputs $\hat{x}_B^A$ and $\hat{x}_B^B$ in equation 4a) imply that total consumption in market B is $Q_B = \hat{x}_B^A + \hat{x}_B^B = \frac{2}{3}(1 - w_B)$ and the market price is $p_B = 1 - Q_B = \frac{1}{3}(1 + 2w_B)$. Profits of firms A and B in market B are: $\hat{\pi}_B^A = \hat{x}_B^A(p_B - w_B) = \frac{1}{9}(1 - w_B)^2$ and $\hat{\pi}_B^B = \hat{x}_B^B(p_B - w_B) = \frac{1}{9}(1 - w_B)^2$ and consumer surplus there is $CS^B = \frac{1}{2}(1 - p_B)Q_B = \frac{2}{9}(1 - w_B)^2$. The equilibrium outputs $\hat{x}_C^A$ and $\hat{x}_C^B$ in equation 4b imply that total consumption in market C is $Q_C = \hat{x}_C^A + \hat{x}_C^B = \frac{2n}{3}(1 - w_B - \tau_{BC})$ and the market price there is

$p_C = 1 - \frac{Q_C}{n} = \frac{1}{3}(1 + 2w_B + 2\tau_{BC})$. Profits of firms A and B in market C are $\hat{\pi}_C^A = \hat{x}_C^A(p_C - w_B - \tau_{BC}) = \frac{n}{9}(1 - w_B - \tau_{BC})^2$ and $\hat{\pi}_C^B = \hat{x}_C^B(p_C - w_B - \tau_{BC}) = \frac{n}{9}(1 - w_B - \tau_{BC})^2$, and consumer surplus there is $CS^C = \frac{1}{2}(1 - p_C)Q_C = \frac{2n}{9}(1 - w_B - \tau_{BC})^2$.

The aggregate profits for firms A and B are:

$$\hat{\Pi}^A = \hat{\pi}_A^A + \hat{\pi}_B^A + \hat{\pi}_C^A = \frac{1}{9}(1 - w_B - \tau_{BA})^2 + \frac{1}{9}(1 - w_B)^2 + \frac{n}{9}(1 - w_B - \tau_{BC})^2;$$

$$\hat{\Pi}^B = \hat{\pi}_A^B + \hat{\pi}_B^B + \hat{\pi}_C^B = \frac{1}{9}(1 - w_B - \tau_{BA})^2 + \frac{1}{9}(1 - w_B)^2 + \frac{n}{9}(1 - w_B - \tau_{BC})^2.$$

Social welfare functions of the three countries are given, respectively, as

$$\hat{W}^A = \widehat{CS}^A + \hat{\Pi}^A(1 - t_B) + Q_A\tau_{BA}, \hat{W}^B = \widehat{CS}^B + \hat{\Pi}^B + \hat{\Pi}^A t_B \text{ and } \hat{W}^C = \widehat{CS}^C + Q_C\tau_{BC}.$$

Country A chooses an optimal tariff τ_{BA} to maximize its social welfare $\hat{W}^A$. Country C chooses optimal tariffs τ_{AC} and τ_{BC} to maximize its social welfare $\hat{W}^C$. The FOCs for the two countries are given, respectively, as

$$\frac{\partial \hat{W}^A}{\partial \tau_{BA}} = \frac{2t_B}{9}(1 - w_B - \tau_{BA}) - \frac{2}{3}\tau_{BA} = 0 \text{ and } \frac{\partial \hat{W}^C}{\partial \tau_{BC}} = \frac{4n}{9}(1 - w_B - \tau_{BC}) - \frac{2n}{3}\tau_{BC} = 0.$$

Solving for the optimal tariffs yields

$$\tau_{BA} = \frac{t_B}{3 + t_B}(1 - w_B) \text{ and } \tau_{BC} = \frac{2}{5}(1 - w_B).$$

Assuming $w_B = 0$, we have $\tau_{BA} = \frac{t_B}{3 + t_B}$ and $\tau_{BC} = \frac{2}{5}$, as shown in equation 10a. Making use of these optimal tariffs, we can calculate the equilibrium market prices and social welfare as shown in equations 10b to 10d.

A5. *Optimal tariffs and social welfare with a regional trade agreement* $(\tau_{AB} = \tau_{BA} = 0)$

When countries A and B form an RTA, imports from members are duty free so that $\tau_{AB} = \tau_{BA} = 0$. Substituting these conditions into equation 3a, we have $\bar{x}_A^A = \frac{1}{3}(1 - 2w_A + w_B)$ and $\bar{x}_A^B = \frac{1}{3}(1 + w_A - 2w_B)$. Total consumption in market A is $Q_A = \bar{x}_A^A + \bar{x}_A^B = \frac{1}{3}(2 - w_A - w_B)$ and the market price is $p_A = 1 - Q_A = \frac{1}{3}(1 + w_A + w_B)$. Profits of firms A and B in market A are:

$$\bar{\pi}_A^A = \bar{x}_A^A(p_A - w_A) = \frac{1}{9}(1 - 2w_A + w_B)^2 \text{ and } \bar{\pi}_A^B = \bar{x}_A^B(p_A - w_B) = \frac{1}{9}(1 + w_A - 2w_B)^2$$

and consumer surplus there is $\overline{CS}^A = \frac{1}{2}(1 - p_A)Q_A = \frac{1}{18}(2 - w_A - w_B)^2$.

Similarly, substituting $\tau_{AB}=\tau_{BA}=0$ into equation 3a yields $\bar{x}_B^A=\frac{1}{3}(1-2w_A+w_B)$ and $\bar{x}_B^B=\frac{1}{3}(1+w_A-2w_B)$. Total consumption in market B is $Q_B=\bar{x}_B^A+\bar{x}_B^B=\frac{1}{3}(1+w_A+w_B)$ and market price there is $p_B=1-Q_B=\frac{1}{3}(1+w_A+w_B)$. Profits of firms A and B in market B are:

$$\bar{\pi}_B^A=\bar{x}_B^A(p_B-w_A)=\frac{1}{9}(1-2w_A+w_B)^2 \text{ and } \bar{\pi}_B^B=\bar{x}_B^B(p_B-w_B)=\frac{1}{9}(1+w_A-2w_B)^2$$

and consumer surplus there is $\overline{CS}^B=\frac{1}{2}(1-p_B)Q_B=\frac{1}{18}(2-w_A-w_B)^2$.

Because only country C imposes tariffs on imports, we have $\bar{x}_C^A=\frac{n}{3}(1-2w_A+w_B-2\tau_{AC}+\tau_{BC})$ and $\bar{x}_C^B=\frac{n}{3}(1+w_A-2w_B+\tau_{AC}-2\tau_{BC})$ as in equation 4b. Total consumption in market C is $Q_C=\bar{x}_C^A+\bar{x}_C^B=\frac{n}{3}(2-w_A-w_B-\tau_{AC}-\tau_{BC})$ and the market price there is $p_c=1-\frac{Q_C}{n}=\frac{1}{3}(1+w_A+w_B+\tau_{AC}+\tau_{BC})$. Profits of firms A and B in market C are:

$$\bar{\pi}_C^A=\bar{x}_C^A(p_C-w_A-\tau_{AC})=\frac{n}{9}(1-2w_A+w_B-2\tau_{AC}+\tau_{BC})^2$$

$$\bar{\pi}_C^B=\bar{x}_C^B(p_C-w_B-\tau_{BC})=\frac{n}{9}(1+w_A-2w_B+\tau_{AC}-2\tau_{BC})^2$$

and consumer surplus there is

$$\overline{CS}^C=\frac{1}{2}(1-p_C)Q_C=\frac{n}{18}(2-w_A-w_B-\tau_{AC}-\tau_{BC})^2.$$

The aggregate profits for firms A and B are:

$$\bar{\Pi}^A=\bar{\pi}_A^A+\bar{\pi}_B^A+\bar{\pi}_C^A=\frac{2}{9}(1-2w_A+w_B)^2+\frac{n}{9}(1-2w_A+w_B-2\tau_{AC}+\tau_{BC})^2$$

and

$$\bar{\Pi}^B=\bar{\pi}_A^B+\bar{\pi}_B^B+\bar{\pi}_C^B=\frac{2}{9}(1+w_A-2w_B)^2+\frac{n}{9}(1+w_A-2w_B+\tau_{AC}-2\tau_{BC})^2.$$

Social welfare functions of the three countries are:

$$\bar{W}^A=\overline{CS}^A+\bar{\Pi}^A, \bar{W}^B=\overline{CS}^B+\bar{\Pi}^B, \text{and } \bar{W}^C=\overline{CS}^C+\bar{x}_C^A\tau_{AC}+\bar{x}_C^B\tau_{BC}.$$

The objective of country C is to choose optimal tariffs to maximize $\bar{W}^C$. The FOCs are:

$$\frac{\partial \bar{W}^C}{\partial \tau_{AC}} = -\frac{n}{9}(2 - w_A - w_B - \tau_{AC} - \tau_{BC}) + \frac{n}{3}(1 - 2w_A + w_B - 2\tau_{AC} + \tau_{BC}) - \frac{2n}{3}\tau_{AC} + \frac{n}{3}\tau_{BC} = 0$$

$$\frac{\partial \bar{W}^C}{\partial \tau_{BC}} = -\frac{n}{9}(2 - w_A - w_B - \tau_{AC} - \tau_{BC}) + \frac{n}{3}(1 + w_A - 2w_B + \tau_{AC} - 2\tau_{BC}) - \frac{2n}{3}\tau_{BC} + \frac{n}{3}\tau_{AC} = 0$$

Solving for the optimal tariffs yields

$$\tau_{AC} = \frac{1}{35}(5 - 13w_A + 8w_B) \text{ and } \tau_{BC} = \frac{1}{35}(5 + 8w_A - 13w_B).$$

Assuming $w_B = 0$, we have $\tau_{AC} = \frac{1}{35}(5 - 13w_A)$ and $\tau_{BC} = \frac{1}{35}(5 + 8w_A)$, as shown in equation 11a. Making use of these optimal tariffs, we can calculate the equilibrium market prices and social welfare as shown in equations 11b to 11d.

A6. *Equilibrium results for the case of foreign direct investment with a regional trade agreement*

For the case of RTA between countries A and B, we have $\tau_{AB} = \tau_{BA} = 0$. Substituting these conditions into equation 3a, we find that in market A the equilibrium outputs are $\hat{\hat{x}}_A^A = \frac{1}{3}(1 - w_B)$ and $\hat{\hat{x}}_A^B = \frac{1}{3}(1 - w_B)$. This implies that total consumption there is $Q_A = \frac{2}{3}(1 - w_B)$ and the market price is $p_A = 1 - Q_A = \frac{1}{3}(1 + 2w_B)$. Profits of firms A and B are $\hat{\hat{\pi}}_A^A = \hat{\hat{x}}_A^A(p_A - w_B) = \frac{1}{9}(1 - w_B)^2$ and $\hat{\hat{\pi}}_A^B = \hat{\hat{x}}_A^B(p_A - w_B) = \frac{1}{9}(1 - w_B)^2$, and consumer surplus is $\widehat{\widehat{CS}}^A = \frac{1}{2}(1 - p_A)Q_A = \frac{2}{9}(1 - w_B)^2$. In market B, the equilibrium outputs are $\hat{\hat{x}}_B^A = \frac{1}{3}(1 - w_B)$ and $\hat{\hat{x}}_B^B = \frac{1}{3}(1 - w_B)$, which imply that total consumption is $Q_B = \frac{2}{3}(1 - w_B)$ and market price is $p_B = \frac{1}{3}(1 + 2w_B)$. Profits of firms A and B are $\hat{\hat{\pi}}_B^A = \hat{\hat{x}}_B^A(p_A - w_B) = \frac{1}{9}(1 - w_B)^2$ and $\hat{\hat{\pi}}_B^B = \hat{\hat{x}}_B^B(p_A - w_B) = \frac{1}{9}(1 - w_B)^2$, and consumer surplus is $\widehat{\widehat{CS}}^B = \frac{1}{2}(1 - p_B)Q_B = \frac{2}{9}(1 - w_B)^2$. In market C, we have from equation 3b that the equilibrium outputs are $\hat{\hat{x}}_C^A = \frac{n}{3}(1 - w_B - \tau_{BC})$ and $\hat{\hat{x}}_C^B = \frac{n}{3}(1 - w_B - \tau_{BC})$, which imply that total consumption is $Q_C = \hat{\hat{x}}_C^A + \hat{\hat{x}}_C^B = \frac{2n}{3}(1 - w_B - \tau_{BC})$ and the market price is $p_C = 1 - \frac{Q_C}{n} = \frac{1}{3}(1 + 2w_B + 2\tau_{BC})$. Profits of firms A and B are $\hat{\hat{\pi}}_C^A = \frac{n}{9}(1 - w_B - \tau_{BC})^2$ and $\hat{\hat{\pi}}_C^B = \frac{n}{9}(1 - w_B - \tau_{BC})^2$ and consumer surplus is $\widehat{\widehat{CS}}^C = \frac{1}{2}(1 - p_C)Q = \frac{2n}{9}(1 - w_B - \tau_{BC})^2$. It follows that the aggregate profits for firms A and B are:

$$\hat{\hat{\Pi}}^A = \hat{\hat{\pi}}_A^A + \hat{\hat{\pi}}_B^A = \hat{\hat{\pi}}_C^A = \frac{2}{9}(1-w_B)^2 + \frac{n}{9}(1-w_B-\tau_{BC})^2;$$

$$\hat{\hat{\Pi}}^B = \hat{\hat{\pi}}_A^B + \hat{\hat{\pi}}_B^B = \hat{\hat{\pi}}_C^B = \frac{2}{9}(1-w_B)^2 + \frac{n}{9}(1-w_B-\tau_{BC})^2.$$

Social welfare functions of the three countries are:

$$\hat{\hat{W}}^A = \widehat{\widehat{CS}}^A + \hat{\hat{\Pi}}^A(1-t_B) = \frac{2}{9}(1-w_B)^2 + \left[\frac{2}{9}(1-w_B)^2 + \frac{n}{9}(1-w_B-\tau_{BC})^2\right](1-t_B);$$

$$\hat{\hat{W}}^B = \widehat{\widehat{CS}}^B + \hat{\hat{\Pi}}^B + \hat{\hat{\Pi}}^A t_B = \frac{2}{9}(1-w_B)^2 + \left[\frac{2}{9}(1-w_B)^2 + \frac{n}{9}(1-w_B-\tau_{BC})^2\right](1+t_B);$$

$$\hat{\hat{W}}^C = \widehat{\widehat{CS}}^C + Q_C\tau_{BC} = \frac{2n}{9}(1-w_B-\tau_{BC})^2 + \frac{2n}{3}(1-w_B-\tau_{BC})\tau_{BC}.$$

The objective of country C is to choose an optimal tariff to maximize $\hat{\hat{W}}^C$. The FOCs is:

$$\frac{\partial \hat{\hat{W}}^C}{\partial \tau_{BC}} = \frac{2n}{9}(1-w_B-\tau_{BC}) - \frac{2n}{3}\tau_{BC} = 0.$$

Solving for the optimal tariff yields $\tau_{BC} = \frac{1}{4}(1-w_B)$.

Making use of the optimal tariff, we can calculate the equilibrium market prices and social welfare as shown in equation 13a and 13b.