

# Comparison of Deep Regional Integration in the Melitz, Krugman and Armington Models

## The Case of The Philippines in RCEP

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## Abstract

This paper estimates the impacts on The Philippines of deep integration in a modern mega-preferential trade agreement, the Regional Comprehensive Economic Partnership. The paper assesses how the results differ with three versions of market structure: (i) perfect competition, Armington style; (ii) monopolistic competition Krugman style; and heterogeneous firms, Melitz style. The paper develops a new numerical model of foreign direct investment with heterogeneous firms where firms produce in the host country and demand corresponds to the “proximity burden,” and is the first to apply a heterogeneous-firms model of foreign direct investment to preferential trade analysis. It also develops an extension of the Krugman model that allows small countries to impact the number of varieties. Both of these model extensions, as well as market structure, are

crucial to the results. The trade and foreign direct investment responses are held constant across the three market structures. Lowering trade costs is examined from: (i) the reducing non-tariff barriers in goods; (ii) lowering barriers against foreign services providers, from foreign direct investment and cross-border; and (ii) facilitating trade. The results show that in all three market structures, there are substantial gains from deep integration, but virtually no gains from preferential tariff reduction. Both Krugman and Melitz style models produce significantly larger welfare gains than the Armington structure, especially in the impacts of foreign direct investment or with wider spillover effects on non- Regional Comprehensive Economic Partnership regions. The relationship between the welfare gains in the Krugman versus Melitz models is complex.

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## **1. Introduction**

The impact of the new trade theories on the welfare effects of modern preferential trade agreements (PTAs) has not been examined. Notwithstanding the initial results of Arkolakis, Costinot and Rodriguez-Clare (2012) on the welfare equivalence of the Armington, Krugman and Melitz models, further research by Costinot and Rodriguez-Clare (2014), Melitz and Redding (2015) and Balistreri and Tarr (2018) has shown that substantial differences appear in the welfare results of these market structures when there are departures from the one-sector stylized model of Arkolakis *et al.* (2012). Our paper is the first to compare the welfare impacts of the Armington (1969), Krugman (1980) and Melitz (2003) trade theories within the context of PTAs. As argued by Arkolakis, Costinot and Rodriguez-Clare (2012) and Costinot and Rodriguez-Clare (2014), to obtain a fair comparison of the impact of market structure, we adjust elasticities in all three models, such that the trade response is equal in all three of our models. Our estimated welfare gains in the monopolistic competition models are substantially larger than the estimated gains in the Armington model.

Further, most modern PTAs involve deep integration. Tariffs alone cannot explain the impact of preferential trade agreements (PTAs) on trade. Limão (2016, pp. 307, 312) notes that “observed tariffs can only explain a fraction of the PTA effect and that to fully explain the PTA effect requires an elasticity considerably higher than standard estimates, hence the elasticity puzzle....This justifies the widespread use of dummies in the gravity approach to capture other

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channels through which PTAs can increase bilateral trade. But it also begs the question of what those channels are.” This partly motivates the conclusion of Schiff and Winters (2003) that the real gains from regional trade initiatives come from deep integration.

Despite the evidence that tariffs miss the majority of the impacts of PTAs, the modern general equilibrium simulation analyses of regional trade agreements have focused on tariffs, and have produced rather small estimated welfare gains from preferential trade agreements (PTAs).<sup>2</sup> In this paper, in addition to tariffs, we consider deep integration via three broader trade costs channels through which PTAs may reduce trade costs: time in trade costs; non-tariff barriers on goods; and barriers to services.<sup>3</sup> We find that, across all three market structures, deep integration contributes substantially to welfare; but preferential tariff reduction contributes virtually nothing.

To capture the important commitments that countries make in modern PTAs in business services, we develop the first multi-sector numerical model of foreign direct investment (FDI) with heterogeneous firms that captures the key stylized facts regarding FDI, including the defining characteristics of the knowledge capital model (Markusen, 2002).<sup>4</sup> We apply our FDI model to business services, as these are the sectors in which FDI is most actively negotiated in international trade agreements. Our FDI firms produce in our host country (The Philippines); and, reflecting the literature on the proximity burden in services, the demand structure in the host country distinguishes between services provided with a local presence and foreign produced services. That is, the “proximity burden” literature notes that foreign services provided through FDI are better substitutes for host country domestically provided services than services provided cross-border (Francois and Hoekman, 2010). In our Krugman and Melitz versions, our FDI firms interact under monopolistic competition with endogenous productivity effects in the use of their outputs through the Dixit-Stiglitz mechanism from additional varieties of business services. As such, our model incorporates the economic theory and the substantial and growing empirical literature based on firm level data showing that foreign direct investment and the wide

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<sup>2</sup> See Caliendo and Parro (2015) and Caliendo *et al.* (2017). Limão (2016, pp.316, 319) concludes that he believes that the small estimates of the gains from PTAs from these simulation studies are explained by the fact that they only consider the tariff impacts of the PTAs.

<sup>3</sup> The estimates of Hummels *et al.*, (2007) and Minor (2013) show the trade facilitation costs alone (what they call the “time in trade” costs) are greater than tariffs as an obstacle to trade for most countries. The World Economic Forum (2012) found that the cost of trading is a more important obstacle to trade development than trade policies.

<sup>4</sup> Arkolakis *et al.* (2018) have recently produced an important single sector, heterogeneous firms model on foreign direct investment, but do not compare the impacts to a Krugman or Armington style model. The model of Bernard, Jensen, Redding and Schott (2018) is a general theoretical model of heterogeneous multinational firms.

availability of business services results in total factor productivity gains to the manufacturing sector and the economy of the host country more broadly.<sup>5</sup>

We extend to FDI the logic of Arkolakis *et al.* (2012) regarding the importance of holding the trade response constant across model structures for a fair comparison of the welfare effects of market structures. That is, we hold the FDI response constant in the Melitz, Krugman and Armington (to the extent possible) market structures. Our estimated welfare gains from FDI liberalization in our Krugman and Melitz models are about double the estimated gains in the Armington model.

An additional innovation is that we break the all varieties are consumed everywhere property of the Krugman (1980) model. This responds to the stylized fact that small economies, especially small developing economies, typically have fewer varieties available than large developed economies. This significantly impacts the results, as our small open economy then reaps a non-trivial Dixit-Stiglitz externality gain on additional varieties of goods or services, including services provided by FDI.

We apply these models to the impact of the Regional Comprehensive Economic Partnership (RCEP) on The Philippines. With the withdrawal of the United States from the Trans-Pacific Partnership (TPP), 16 countries in Asia and the Pacific (the ASEAN 10, China, Japan, India, the Republic of South Korea, Australia and New Zealand) have turned more earnestly to negotiations of RCEP.<sup>6</sup> Collectively, these countries account for almost half of the world's population and almost thirty percent of the world's GDP.

The guiding principles of RCEP<sup>7</sup> call on the member governments to progressively eliminate tariff and non-tariff barriers on substantially all trade in goods; to substantially eliminate restrictions or discriminatory measures with respect to trade in services among RCEP members; and to facilitate investment in the region. There are also discussions in RCEP meetings regarding trade facilitation, especially with respect to the improvement of customs procedures.

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<sup>5</sup> See Francois and Hoekman (2010) for a survey of the theory and more than a dozen empirical studies that support this finding. In addition, in recent years, several studies that use firm level data support the finding that FDI and the wide availability of business services results in total factor productivity gains to the manufacturing sector and the economy broadly. These include Arnold *et al.* (2011) for the Czech Republic, Fernandes and Paunov (2012) for Chile, Arnold *et al.* (2016) for India, Shepotylo and Vakhitov (2015) for Ukraine and Duggan *et al.* (2013) for Indonesia. Two of the important theoretical papers are Markusen (1989; 1995).

<sup>6</sup> Between 2012 and March 2017, there were 17 negotiation rounds. For summaries of these rounds and Ministerial meetings, see: <http://dfat.gov.au/trade/agreements/rcep/Pages/regional-comprehensive-economic-partnership.aspx>

<sup>7</sup> <http://dfat.gov.au/trade/agreements/rcep/Documents/guiding-principles-rcep.pdf>

We build small open economy models of The Philippines with the following seven external regions: (i) Rest of ASEAN; (ii) Japan; (iii) China; (iv) India; (v) South Korea, Australia and New Zealand; (vi) United States; and (vii) Rest of the World. For each market structure, we provide an aggregate estimate of the welfare impact of RCEP, plus eight additional simulations that isolate the various components of RCEP. These latter simulations allow us to assess the relative importance of the deep integration components, as well as preferential tariff reductions.

Regarding market structure, our estimated gains in the Krugman model are about double the estimated gains in the Armington model. We find that the biggest difference in the results between the Armington model and the monopolistic competition models is the difference in the estimated gains from FDI reform in services; both monopolistic competition models produce estimated gains more than twice that of the Armington model for FDI reform in services. Although not a general result, our overall estimated welfare gains in our Melitz model fall between the Krugman and Armington models.

We take advantage of the calibrated share form of CES technologies and preferences suggested by Rutherford (2002). We reduce information requirements by choosing units such that initial prices are unity. Analogous to the “exact hat” approach of authors such as Dekle *et al.* (2008) and Costinot and Rodriguez-Clare (2014),<sup>8</sup> we recover the proportional changes in prices and quantities as the equilibrium solution to the numerical problem.

The paper is organized as follows. We provide a review of the related literature in section 2 and an overview of the model in section 3. In section 4 we explain the data that we have developed or used in constructing this model. Results are presented in section 5. We conduct sensitivity analysis in section 6 to (i) spillovers in the policy scenario; (ii) the trade and FDI responses; and (iii) parameters of the model. We conclude in section 7.

## 2. Literature Review

### 2.1 Estimates of Goods Market Preferential Liberalization: Beyond Tariffs or Armington

The formation of the Canada-US free trade agreement led to the pioneering work on imperfect competition in applied trade policy analysis by Harris (1984). He showed that if the agreement leads to a more competitive pricing strategy by imperfectly competitive Canadian firms,

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<sup>8</sup> The term "exact-hat" refers to the characterization of equilibrium impacts in proportional changes. That is, if  $\hat{v}$  is the change in a variable denoted in the benchmark and counterfactual as  $v$  and  $v'$ , respectively, then  $\hat{v}$  can be summarized as  $\hat{v} = v'/v$ .

there would be substantial welfare gains. The creation of the single market in the European Union led to innovative analysis that required the use of multi-region models with imperfect competition to capture the competition aspects of the single market (Harrison, Rutherford and Tarr, 1996; Smith and Venables, 1988).<sup>9</sup> These studies considered trade facilitation benefits and linked the competitive aspects of the single market to the standards and product regulation issues. Tariff changes were ignored since there already was free trade within the European Union prior to the single market reforms. That is, the single market reforms were exclusively about deep integration.

The North American Free Trade Agreement (NAFTA) led to many numerical studies summarized in the Francois and Shiells (1994) volume. One of the more interesting was by Levy and van Wijnbergen (1995). They use their dynamic model to argue that dynamic incentive problems in adjustment policies for Mexican agriculture imply that adjustment policies should focus on increasing the value of the assets of poor farmers, not their incomes. Preferential arrangements of the European Union with its Mediterranean and Eastern neighbors led to several assessments of deep aspects of these agreements in Armington models, including Harrison, Rutherford and Tarr (1997a) for Turkey and Rutherford, Rutstrom and Tarr (1997; 2000) for Morocco and Tunisia. Maliszewska *et al.* (2009) employed a multi-region model with imperfect competition to examine bilateral deep integration between the EU and five countries in the former Soviet Union: the Russian Federation, Armenia, Azerbaijan, Georgia and Ukraine. They estimated substantial welfare gains to the partner countries of the EU from deep integration, but acknowledge their estimates are upward biased since they are based on a comparative steady-state model. Harrison, Rutherford and Tarr (2002) estimated that Chile would lose from individual preferential arrangements with Southern neighbors unless it lowered its 11 percent uniform tariff in place at the time. However, due to substantial estimated terms-of-trade gains to Chile in partner markets, the collective impact of its “additive regionalism” or “competitive regionalism” strategy produced estimated welfare gains many multiples of unilateral tariff liberalization.<sup>10</sup> Rutherford and Tarr (2003) showed that simply making the Chilean model dynamic will not increase the estimated gains from these agreements if there are no endogenous productivity effects.

Balistreri, Tarr and Yonezawa (2015) examined deep integration in East and Southern Africa, while Balistreri *et al.* (2018) extended the analysis to a poverty and income distribution

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<sup>9</sup>Baldwin, Forslid and Haarland (2000) assessed the investment impacts of the single market.

<sup>10</sup> Harrison, Rutherford, Tarr and Gurgel (2004) found comparable results for Brazil and Uruguay.

application. These studies found significant gains to the member countries from deep integration, but tariffs had only a negligible impact.

In a numerical application of the Eaton and Kortum model, Caliendo and Parro (2015) focus on tariffs and find that NAFTA increased the welfare of Mexico by 1.31 percent, the U.S. by 0.08 percent and the welfare of Canada declined by 0.06 percent. In a model with heterogeneous firms, Caliendo, Feenstra, Romalis and Taylor (2017, p. 3) also focus on tariffs and conclude that “PTAs contributed virtually nothing to total world trade and welfare.”

Finally, regarding related work on The Philippines, Cororaton (2016) employed a GTAP, Armington style model to estimate the impact of RCEP on The Philippines. His analysis considered tariff reductions and a reduction in non-tariff measures. He estimates approximately a two percent gain in equivalent variation after ten years but does not decompose the impacts into tariff and non-tariff measure impacts. Also using an Armington style model, Cororaton and Orden (2015) evaluated the impact of the Trans-Pacific Partnership on The Philippines. They assess endogenous reductions in tariff and non-tariff measures, as well as an exogenously estimated increase in FDI (following Petri *et al.*, 2012). They estimate a gain to The Philippines of 1.5 percent of GDP by 2024. They do not decompose the tariff and non-tariff measure impacts but estimate that 0.3 percentage points of the gains are due to FDI inflows. Further, they estimate that The Philippines would lose 0.2 percent of GDP if it failed to join the TPP.

## **2.2 Estimates of Foreign Direct Investment Liberalization in Services**

The theory and empirical work on FDI (Markusen, 1989, 1995, 2002; Francois and Hoekman, 2010; Dunning, 1985) argues that firms that engage in FDI are intensive in the use of knowledge capital and have created firm specific assets (like blueprints, patents, special formulae or reputation and managerial expertise) that their subsidiaries may use at low cost to their foreign affiliates; but arms-length transactions in these assets are very difficult or impossible. The decision to locate a production facility abroad is based on multiple considerations: (i) in services, which is our focus, the “proximity burden” implies that only local production can effectively compete with host country services; (ii) high transport costs or tariffs may make sales from abroad too costly; and (iii) low production costs in the host country may make FDI advantageous. In addition, we have cited above numerous studies that show that in services, additional providers of services provide productivity gains to local firms.

Petri (1997), using a perfectly competitive Armington style model, was the first to capture many of these key features in a CGE framework. His model included separate production

structures of the parent and subsidiary and the implications for the demand structure.

Reforms in his model impact the global reallocation of capital. But there is no zero-profit constraint for firms and no endogenous productivity impacts from the actions of imperfectly competitive firms. Building on Petri, Dee *et al.* (2003) and Brown and Stern (2001) employ multi-country, three-sector models with homogeneous imperfectly competitive firms. Despite including firms in their model, liberalization remains based on a global reallocation of capital. The welfare results for the countries in the model of Dee *et al.*, depend heavily on rents gained or lost. In the Brown and Stern model, countries generally gain or lose from the liberalization depending on whether they are capital importing or exporting, respectively. However, there is no entry or exit of firms in national markets. So, profits or losses may occur on activities in individual markets without an entry or exit response from the firm or its competitors in that national market; and there is no Dixit-Stiglitz productivity externality from additional providers of services.

Markusen, Rutherford and Tarr (2005) developed the first numerical model of FDI in an imperfectly competitive framework that incorporated the above stylized facts with an entry and exit decision by the foreign and host country firms based on zero profit constraint for the firm types. They show that the endogenous productivity effects from the Dixit-Stiglitz externality in their model results in important differences from the implications of a Heckscher-Ohlin model. Their model was applied to datasets and policy issues of real economies in small open economy models by Jensen, Rutherford and Tarr (2006; 2007; 2010), Rutherford and Tarr (2008; 2010) and Balistreri, Rutherford and Tarr (2009) in Russia, Kenya and Tanzania. But these models could not assess regional preferences in services. Konan and Maskus (2006) assessed FDI liberalization in Tunisian services with a small open economy, perfectly competitive model in which regulatory barriers imposed a wedge between lowest possible costs and prices due to both high-cost producers and cartel pricing (the latter of which was not endogenously modeled).

Recently, Arkolakis, Ramondo, Rodriguez-Clare and Yeaple (2018) produced an important numerical model of foreign direct investment. Their model is a heterogeneous firms, single sector, single factor, multi-country model, where firms can locate production in any location. They do not, however, compare their heterogeneous firms model to a Krugman or Armington style model.

The model described in this paper is closest to the small open economy models developed by Balistreri, Jensen and Tarr (2015) and especially Jensen and Tarr (2012). Balistreri, Jensen and Tarr (2015) have shown that there is an analogy to trade diversion in goods whereby preferential

commitments to foreign investors in services could be immiserizing. Jensen and Tarr (2012) extended the analysis to include the impact of improved trade facilitation and the reduction of non-tariff barriers in Armenia. Neither Balistreri, Jensen and Tarr (2015) nor Jensen and Tarr (2012) held the trade and FDI responses constant between the Krugman and Armington structures; nor did they consider heterogeneous firms.

### **2.3 Modern Assessment of the Welfare Gains from Trade Liberalization**

The early CGE literature was based on constant returns to scale models, where the gains were based on comparative advantage and calculated from “Harberger triangles.” The estimated gains from trade liberalization were sometimes characterized by the “Harberger constant,” i.e., the gains were generally less than one percent of GDP from trade liberalization. Among others, de Melo and Tarr (1990) and Jensen and Tarr (2003) showed that, even in a perfect competition constant returns to scale model, if there were rents involved, the gains could be many multiples of the gains from the “Harberger triangles.” Harrison, Rutherford and Tarr (1997) found that rationalization gains in imperfectly competitive quantity adjusting models did not produce significant gains above perfectly competitive models.

Rutherford and Tarr (2002) showed that in a fully dynamic model based on Paul Romer style endogenous growth with gains from variety, the gains from trade liberalization would be many multiples of the gains in a constant returns to scale model. Markusen, Rutherford and Tarr (2005) and Rutherford and Tarr (2008) showed that introducing foreign direct investment in services in a monopolistic competition model would substantially increase the welfare gains. Francois, Manchin and Martin (2013) have summarized many approaches to modeling market structure in CGE models and suggested ways that the alternate model structures could be tested.

Regarding heterogeneous firms, the first effort at a CGE model was by Zhai (2008). His model was developed into an application to the Trans Pacific Partnership in Petri, Plummer and Zhai (2012) and employed in the *Global Economic Prospects* of the World Bank (2016). Unlike the Melitz model, however, neither Zhai’s model, nor the model of Petri, Plummer and Zhai, allows entry or exit of firms, nor does it allow uncertainty about the productivity (Zhai, 2008, pp. 7, 8). But their models do allow existing firms to enter new markets from the selection effect, and that type of entry creates a new variety and a welfare gain. Since domestic firms face increased competition from foreign entry, some would be expected to exit. The model of Zhai, however, does not allow firm exit; consequently, the model exaggerates the variety externality. This explains why Petri, Plummer and Zhai obtain such large increases in the variety externality

in their model. The first numerical model of real economies that has been developed that is consistent with the model of Melitz (2003) is Balistreri, Hillberry and Rutherford (2011). In their multi-region model they find that the welfare gains from tariff reductions are several times larger than with a standard CRTS trade model. Jafari and Britz (2017) follow the model of Balistreri, Hillberry and Rutherford to assess the Transatlantic Trade and Investment Partnership (TTIP); they also find that the Melitz model produces considerably larger welfare gains than the Armington model. Neither Balistreri, Hillberry and Rutherford (2011) nor Jafari and Britz (2017), however, hold the trade response constant across the market structures.<sup>11</sup>

### **3. Overview of the Model**

We build multi-sector small open economy models with three market structures: (i) perfect competition in the style of Armington (1969); (ii) monopolistic competition with homogeneous firms; we call this a Krugman style model; and (iii) monopolistic competition with heterogeneous firms, what we call a Melitz style model. We have important extensions in both the Krugman (1980) and Melitz (2003) models. A mathematical description of the model may be found in Balistreri and Tarr (2018, appendix B) and Balistreri, Olekseyuk and Tarr (2017, appendix G) for the FDI equations in the Krugman style model. Here we provide a general description of the structure.

First, the version of the Krugman model differs in a fundamental way from the Krugman (1980) model. In our model, small countries may significantly impact the number of varieties available to them. That is, in a multi-region, multi-sector model with sectors based on Krugman (1980), all countries consume all varieties that are produced anywhere. Thus, the multi-sector, multi-region version of Krugman (1980) has the unrealistic feature that small countries have the same number of varieties available to them as large economies. In our model of The Philippines, there is a fixed cost of operating in The Philippines by any foreign firm, and a zero-profit condition of sales in The Philippines. Then a reduction in trade costs for foreign firms selling in The Philippines will induce entry into The Philippines, providing a variety externality. With this extension, we call this our Krugman style (or sometimes simply Krugman) model. Importantly for policy results, without our extension of the multi-sector, multi-region version of the Krugman model, reduction of trade barriers by small countries will have only a negligible impact on their

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<sup>11</sup> Dixon, Jerie and Rimmer (2018) explain how to add Melitz equations to the GTAP general equilibrium modeling system. In their application, they develop a 10 region, 57 sector model with 56 Armington sectors and one Melitz sector to assess a unilateral tariff increase in the Melitz sector by the North American region.

variety externality, since a country can impact the available varieties only insofar as it impacts global demand and the number of varieties available globally.

Second, in both our Krugman and Melitz style models, there are three types of sectors: (i) perfectly competitive goods and services sectors in the Armington style; (ii) monopolistically competitive goods sectors (with homogeneous firms in the Krugman style model or heterogeneous firms in the Melitz style model); and (iii) monopolistically competitive services sectors with foreign direct investment (with homogeneous firms in the Krugman style model or heterogeneous firms in the Melitz style model).

There are 23 sectors in the model shown in table 1. In the Armington model, all sectors are perfectly competitive. In the Krugman and Melitz models, there are three categories of sectors: (1) nine perfectly competitive goods and services sectors; (2) seven monopolistically competitive goods sectors; and (3) seven services sectors in which there is monopolistic competition and foreign direct investment. The cost, production and pricing structures in the three categories differ, but regardless of sector, all firms minimize the cost of production.

Primary factors are skilled labor, unskilled labor and capital (including land).<sup>12</sup> Regarding capital, there is mobile capital and sector-specific capital in monopolistically competitive goods sectors and services sectors with FDI; and inputs imported by multinational service providers, reflecting specialized management expertise or technology of the firm. There is some sector specific capital for each imperfectly competitive firm for each region of the model. In the sectors where there is sector specific capital, there are decreasing returns to scale in the use of the mobile factors and supply curves in these sectors slope up. We calibrate the elasticity of substitution between sector specific capital and other inputs in each sector so that the elasticity of supply of the firms is consistent with econometric evidence that indicates that the supply response and productivity gain from trade for the importing country depends on the research and development stock of the exporting country.<sup>13</sup>

In each of our experiments we hold real government consumption fixed (in both its overall size and in its commodity composition) via an endogenous transfer between the representative household and the public sector. In the Public Finance literature this is referred to as a ‘differential’

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<sup>12</sup> Given the nature of the shocks we consider (which are economy-wide), we do not believe the aggregation of capital and land has a significant impact on the results.

<sup>13</sup> See section 4.1.4. To maintain comparability between the Armington model and the monopolistic competition models, when we execute the Armington model, all sectors are CRTS, but we include sector specific factors in the sectors we model as monopolistically competitive in our Krugman and Melitz models.

analysis (see, for example, Ballard, 1990). If we assume that the benefits from public expenditures accruing to household is separable from private consumption of goods and leisure, our approach allows us to evaluate welfare impacts without making inferences about the value households place on public expenditures. A reduction in tariff revenue is compensated through a direct transfer so the benefits associated with public expenditure are unchanged, and we can measure welfare using equivalent variation in private consumption.<sup>14</sup>

### **3.1 Perfectly competitive goods and services sectors**

In these sectors, we employ the “Armington” structure, with goods and services differentiated by the country of origin. Exports are also differentiated from products produced for the home market. For exports and domestic goods, we use a constant elasticity of transformation production function with elasticity of transformation equal to four for all perfectly competitive sectors. Prices in foreign markets to exporters from The Philippines are perfectly elastic in these sectors, but they may change in response to policy variables.

### **3.2 Imperfectly competitive goods sectors (Krugman style model)**

Goods in these seven sectors (and all IRTS services) are differentiated at the firm level. Each firm produces a unique variety that is differentiated in the demand functions of users of the goods. Users of the differentiated goods have an elasticity of substitution (Dixit-Stiglitz) for the different varieties. The number of varieties affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation, i.e., the effective cost function for users declines in the total number of goods-firms in the industry. Manufactured goods may be produced domestically or imported from firms in any region in the model. Firms in these industries set prices such that marginal cost equals marginal revenue; and there is free entry, which drives profits to zero. For domestic firms, costs are defined by observed domestic primary factors and intermediate inputs to that sector in the base year data. Foreigners produce the goods abroad at constant marginal cost with respect to output (if factor prices are held constant) but incur a fixed cost of operating in The Philippines. The transportation cost inclusive import price of foreign goods is simply defined by the import price, and, by the zero profits assumption, in equilibrium the import price must cover fixed and marginal costs of foreign firms.

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<sup>14</sup> As an alternative to a “differential” analysis, the Public Finance literature sometimes considers “balanced-budget” experiments (again see Ballard, 1990). In a balanced-budget experiment, changes in taxes change expenditures, and there are alternative methods (compensated or uncompensated) for evaluating the welfare costs and benefits on both the revenue and expenditure sides as explained by Anderson and Martin (2011).

In this model, consistent with firm level product differentiation, we assume that the elasticity of demand in each of the export markets is the Dixit-Stiglitz elasticity of demand. Filipino firms then set marginal revenue equal to marginal costs in each of the seven export markets. If the partner countries of The Philippines reduce their barriers preferentially against exporters from The Philippines, that will induce entry from firms in The Philippines. Introducing downward sloping demand curves into the model, however, means that there are terms-of-trade affects to consider in this model that were not present in the Rutherford and Tarr (2008) model.<sup>15</sup> We present a parameter in each of our scenarios to show the percentage change in the terms-of-trade.

Following Krugman (1980), we assume that imperfectly competitive firms have a fixed cost of production and that marginal costs are constant with respect to output. Then, suppressing subscripts for firms, sectors and regions, total costs are:

$$TC(q; p) = q * MC(p) + FC(p) \quad (1)$$

where TC is total costs, MC is marginal costs, FC is fixed costs, q is output of the firm and p is a vector of factor prices. Following the literature (e.g., Helpman and Krugman, 1985), we assume that the input proportions of fixed and marginal costs are identical, from which it follows that the ratio of fixed to marginal costs is constant. That is, for all firms producing under increasing returns to scale (in both goods and services), we have:

$$FC(p)/MC(p) = k \text{ where } k \text{ is a constant} \quad (2)$$

Equations (1) and (2), in the Chamberlinian framework, imply that output per firm remains constant, i.e., the model does not produce rationalization gains or losses. The number of varieties affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation. The effective cost function for users of goods produced subject to increasing returns to scale declines in the total number of firms in the industry.

### **3.3 Imperfectly competitive goods sectors (Melitz model)**

We follow Melitz (2003) or more closely since this is a comparative static small open economy model, Demidova and Rodriguez-Clare (2009). Our model adopts most of the assumptions of the Krugman model, with two key additions. First, the marginal costs of firms depend on the productivity draw of firms. Firms do not know their productivity prior to entering the market. They receive a productivity draw from an untruncated Pareto probability density

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<sup>15</sup> Balistreri and Markusen (2009) show that since Chamberlinian firms choose an optimal markup based on the elasticity of substitution between firm varieties, which equals the export demand elasticity, the role for optimal tariffs is reduced.

function after entering the market which determines their marginal costs. This gives rise to a heterogeneous structure of firms regarding their productivity, price and output. More productive firms charge a lower price and capture a larger market share. There is a cutoff productivity level, below which, firms do not produce, i.e., they are not active.

Firms face an additional fixed cost of selling in any export market. This gives rise to a second cutoff where only the more productive firms export as well as sell in their domestic market. Crucially, quasi-rents on exports of the firm must cover the fixed costs of exporting to that market. This breaks the all varieties are sold in all markets property of the Krugman model and, analogous to our version of the Krugman model, allows small open economies to significantly influence the number of varieties available in their home market.

One scenario that is important for the intuition is where partners of The Philippines lower their barriers on Filipino exports (without and reduction of barriers in The Philippines). Then exporting becomes more profitable and more Filipino firms export. Increased expected profits imply that more Filipino firms enter (the “entry” effect). The larger number of Filipino firms in the Filipino market lowers the equilibrium domestic price and raises the productivity cutoff for Filipino firms to remain active. There is a reallocation of industry resources toward more efficient firms (the Melitz model “selection” effect). Regarding the number of firms, the additional entry leads to an increase in firms and varieties; but the less efficient firms exit, leading to a loss of firms and varieties in the Filipino market. On the other hand, in the Krugman model, firms are homogeneous, so there is no selection effect reducing the number of varieties. We only have the entry effect which leads to a clear increase in varieties when foreigners lower their barriers to Filipino exports. This explains our results below where we find that the value of the Dixit-Stiglitz externality is larger in the Krugman model. We discuss these issues in more detail in section 5.3.

### **3.4 Imperfectly competitive service sectors in which foreign direct investment occurs (Krugman style)**

In these services sectors, we observe that some services are provided by foreign service providers on a cross border basis analogous to goods supply from abroad. But a large share of business services is provided by service providers with a domestic presence, both multinational and local.<sup>16</sup> Our model allows for both types of provision of foreign services in these sectors.

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<sup>16</sup> One estimate puts the world-wide cross-border share of trade in services at 41% and the share of trade in services provided by multinational affiliates at 38%. Travel expenditures (20%) and compensation to employees working abroad (1%) make up the difference. See Brown and Stern (2001, table 1). In the case of U.S. firms, in 2005, two-

The cost, production, demand and competition structure for firms in this group of industries follows the same structure as the imperfectly competitive goods firms with two differences. The first difference is that we allow multinational service firms to establish a local presence to produce in The Philippines and compete directly with Filipino service firms. Multinational service firms produce a Filipino region-specific variety in The Philippines, which is differentiated from Filipino varieties and the varieties of other multinational services firms in The Philippines. Crucially, all firms (foreign and domestic) incur a fixed cost of operating in The Philippines.

For domestic firms, costs are defined by the costs of local primary factors and intermediate inputs. When multinationals service providers decide to establish a local presence in The Philippines, they will predominantly use Filipino inputs; but they will also import some of the specialized technology or management expertise of the parent firm. That is, foreign direct investment generally entails importing specialized foreign inputs. Thus, the cost structure of multinationals differs from Filipino service providers. Multinationals incur costs related to both imported inputs and local primary factors, in addition to intermediate factor inputs. Provision of services through FDI differs from cross-border provision of services or exports of goods, since services provided through FDI use predominantly local primary inputs, i.e., Filipino inputs in our case.

Our source or parent company produces specialized technology or management techniques and obtains a payment for these goods from its subsidiaries or licensees; but it does not produce the business services that are the sectors of our model. The foreign firms who supply The Philippines through FDI, either sell through FDI or do not produce anything.

For multinational firms, the barriers to foreign direct investment raise their costs of production. The reduction of the barriers lowers these costs, raises the profitability of FDI and induces entry by multinationals until zero expected profit is restored. This leads to a welfare gain from the Dixit-Stiglitz variety externality. In addition, liberalization of FDI barriers frees capital and labor that was used to overcome the barriers for use elsewhere in the economy. In all model variants, including the Armington model, we assume that the reduction in the constraints on foreign direct investment allows the domestic economy to capture rent rectangles. In addition,

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thirds of services exports were from FDI and about one-third from cross-border sales. See Markusen and Strand (2009, table 1).

reducing barriers induces foreign entry until profits are driven to zero, so there are also “Harberger” triangles of efficiency gains.

### **3.5 Imperfectly competitive service sectors in which foreign direct investment occurs (Melitz style).**

We develop a new innovative model of FDI with heterogeneous firms. The key departure from the Krugman style model of FDI described above is that the marginal costs of firms depend on the productivity draw of firms. Foreign firms who wish to enter the market of The Philippines do not know their productivity prior to entering the Filipino market. They receive a productivity draw from an untruncated Pareto probability density function after entering the market which determines their marginal costs. This gives rise to a heterogeneous structure of foreign firms regarding their productivity, price and output. There is a cutoff productivity level, below which, foreign firms do not provide the service in The Philippines.

We assume foreign firms who provide services through FDI in The Philippines, produce in The Philippines and use predominantly Filipino primary inputs. We believe this is a crucial property of FDI. For example, the two major mobile telephone companies in The Philippines, which are primarily owned by nationals of Hong Kong SAR, China and Singapore, use almost all Filipino workers. Consistent with the knowledge capital model, our multinationals operating in The Philippines import specialized technology or management techniques from their parent firm; but they do not produce the final product in the source country.

Our model is also consistent with the proximity burden literature in services that argues that a local presence is required for foreign firms to compete effectively with host country services (see Francois and Hoekman, 2010). A local presence in services allows FDI provided services to be better substitutes for host country services than cross-border services. It follows that services provided through FDI and cross-border services are not perfect substitutes. For example, banks with a physical presence in The Philippines are a better substitute for Filipino banks in The Philippines than foreign banks that provide banking services cross-border on an electronic basis. More strikingly, in services such as mobile telephone services or trucking services, it is very difficult for foreign firms to compete with domestic firms without a physical presence in the host country. Our model incorporates the stylized fact that FDI services are better substitutes for host country services than cross-border services.

Our source or parent company produces specialized technology or management techniques and obtains a payment for these goods from its subsidiaries or licensees; but it does not produce the business services that are the sectors of our model. The foreign firms that supply The Philippines through FDI, either sell through FDI or do not produce anything. So the productivity cutoff for these firms to be active in the host country market is their sole productivity cutoff.

### 3.6 Labor-Leisure Choice

We assume that there is a labor-leisure choice, where utility may be represented by a CES function that is weakly separable between leisure and all goods and services consumption. We consider an aggregate non-leisure consumption good C, with a dual price P. Utility is:

$$U = \left[ \mu^{1-\rho} C_0^\rho + (1-\mu)^{1-\rho} C^\rho \right]^{\frac{1}{\rho}} \quad \rho < 1 \quad \sigma = \frac{1}{1-\rho}$$

Where  $C_0$  = leisure and C = consumption of the aggregate good/service.

Let E = the total time endowment of the consumer/worker; W = the wage rate; L = labor supply; and P = the price index of goods and services. The demand for leisure is:

$$C_0 = \frac{\mu(WE + Y)}{W^\sigma k} \text{ where } k = \mu W^{1-\sigma} + (1-\mu)P^{1-\sigma} \text{ and } Y = \text{non-labor income.}$$

The uncompensated elasticity of leisure demand with respect to the wage rate is:

$$\eta_{C_0} = \frac{\mu E * W}{W^\sigma C_0 k} - \frac{\mu(1-\sigma)W}{W^\sigma k} - \sigma$$

and the uncompensated elasticity of labor supply with respect to the wage rate is<sup>17</sup>:

$$\eta_L = \left[ \frac{C_0}{C_0 - E} \right] \eta_{C_0} = - \left[ \frac{E}{L} - 1 \right] \eta_{C_0}$$

We evaluate the labor supply elasticity in the neighborhood of the initial equilibrium, where we choose units such that W = P = k = 1. Then we have:

$$\eta_L = - \left[ \frac{E}{L} - 1 \right] \left[ \left( \frac{E}{E+Y} \right) - \mu(1-\sigma) - \sigma \right]$$

The values of L and Y are data in the initial equilibrium. In the special case of a single primary factor, zero trade balance and zero non-labor factor income, the elasticity of labor supply reduces to:

$$\eta_L = \left[ \frac{E}{L} - 1 \right] (\sigma - 1)(1 - \mu).$$

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<sup>17</sup> See Ballard (2000) for details of the derivations in this subsection and a summary of the empirical literature on the elasticities of labor supply.

Then the elasticity of labor supply is positive if and only if the elasticity of substitution exceeds unity.

We prefer to avoid assuming a value of the time endowment  $E$  and the share of the time endowment devoted to leisure  $\mu$ , since these may be arbitrary and Ballard (2000) has shown that the impact can be substantial. Instead, based on empirical estimates, we assume that the value of the uncompensated elasticity of labor supply is 0.2 and the compensated elasticity of labor supply of 0.7. Given the unshown expression for the compensated elasticity of labor supply, these values allow us to solve for (calibrate) the parameters on the right-hand side of the elasticity of labor supply.

### 3.7 The Multi-Sector Feenstra Ratio

Feenstra derived a measure we call the Feenstra ratio that precisely measures the welfare impact of the variety externality in a one-sector monopolistic competition model. We extend that measure to a multi-sector, multi-region Krugman or Melitz model. Details are in Balistreri and Tarr (2018, appendix A). Here we provide the key results.

Despite the fact that all varieties are consumed everywhere in the Krugman model, Feenstra (1994; 2010) has shown that in a one-sector model, the welfare impact of a variety depends on its expenditure share. From Feenstra (2010, Theorem 2), the Feenstra ratio is:

$$F = \left[ \frac{\lambda_{t-1}(I)}{\lambda_t(I)} \right]^{1/(\sigma-1)} = \frac{e(p_{t-1}, I_{t-1})}{e(p_t, I_t)} P^{SV}(p_t, p_{t-1}, q_t, q_{t-1}, I)$$

where  $e$  is the unit expenditure function,  $p_t$  and  $q_t$  are the vectors of prices and quantities in period  $t$ ,  $I_t$  is the set of goods available in period  $t$  at prices  $p_t$ ,  $I$  is the set of goods available in both period  $t$  and  $t-1$  and  $P^{SV}(\dots)$  is the Sato-Vartia index that shows the ratio of the unit expenditure function in the two periods if the sets of available goods in the two periods are identical. Feenstra's theorem tells us that the proportional change in the unit expenditure function is the product of two terms that are: (i) a measure of the change in the prices charged by firms on goods common to the two periods (the Sato-Vartia index); and (ii) a ratio that is a measure of the value of the variety gain, the Feenstra ratio. The methodology requires distinguishing changes in the price charged by firms on goods available in both periods from the variety externality. Feenstra shows that  $1 - \lambda_t(I)$  is the expenditure on new goods relative to total expenditure in period  $t$ , so a larger number of new goods in period  $t$  will tend to lower  $\lambda_t(I)$ . A value of

1.01 for our Feenstra ratio means that the cost of a unit of utility declined by one percent due to new varieties.

In a multi-sector, multi-region model, we define the Feenstra ratio for region s as:

$$\bar{F}_s = \sum_i \theta_{is} F_{is}$$

where  $\theta_{is}$  is the economy-wide expenditure share (absorption share) on goods or services of sector i in region s; and  $F_{is}$  is the Feenstra ratio for sector i in region s defined as:

$$F_{is} = \frac{PDS_{is}(0)}{PDS_{is}(1)} P_{is}^{SV}$$

where  $PDS_{is}(t)$  is the Dixit-Stiglitz price index in sector i in region s, and  $P_{is}^{SV}$  is the Sato-Vartia index for sector i in region s. Given that the Sato-Vartia index remains an “ideal” index of firm level prices at the sub-sector level, and the Dixit-Stiglitz index is the unit cost of goods in sector i taking variety into account, our index  $F_{is}$  is precise at the sector level. If we have a one-sector model, our measure reduces to the ratio of Feenstra (2010). Given the existence of intermediates in our model, the aggregation across sectors is an approximation.

### 3.8 Terms-of-Trade Parameter

We define the terms-of-trade for region r as the weighted average of export prices divided by the weighted average of import prices:

$$TOT_r = \frac{\sum_i \exp_{ir} p_{ir}}{\sum_i \sum_{s \neq r} imp_{isr} p_{is}}$$

In our definition for the terms-of-trade,  $p_{is}$  is the composite price of the i-th good in region s. This is the dual price variable that we define as the left-hand side variable in Balistreri and Tarr (2018, appendix B).  $p_{is}$  incorporates the technology and the optimization, and its depends on the Armington, Krugman or Melitz market structure. The other parameters are weights, which we define as follows.

Define  $X_{isr}$  is the total value of country r's expenditures on good i from country s (excluding tariffs). The export weights are:

$$\exp_{ir} = \frac{\sum_{s \neq r} X_{irs}}{\sum_j \sum_{s \neq r} X_{jrs}}$$

The import weights are:

$$imp_{isr} = \frac{(1+tar_{isr})X_{isr}}{\sum_j \sum_{t \neq r} (1+tar_{jtr})X_{jtr}} \quad \text{for } r \neq s$$

Where  $tar_{isr}$  is the tariff rate on imports from region s shipped to region r. Note that for exports, there is a unique weight associated with any good in a particular region; but the import weights  $imp_{isr}$  are bilateral.

## 4. Data of the Model, Key Elasticities and the Trade and FDI Responses

### 4.1 Holding the Trade and FDI Responses Constant: Key Elasticities

#### 4.1.1 The Trade Response.

Following Arkolakis, Costinot and Rodriguez-Clare (2012), we hold the trade response constant across in the Armington, Krugman and Melitz models. To be precise, let  $\lambda_p$  indicate the share of Filipino expenditures that are spent on goods that are produced in The Philippines:

$$\lambda_p \equiv \frac{X_{pp}}{\sum_s X_{sp}},$$

where  $X_{sp}$  is the total value of Filipino expenditures on goods from region s. If  $\lambda_p$  is the domestic trade share of The Philippines in the benchmark data and  $\lambda'_p$  is the domestic trade share in the counterfactual equilibrium, then  $1 - \hat{\lambda}_p$  is the percentage change in the trade share where  $\hat{\lambda}_p$  is defined by:

$$\hat{\lambda}_p \equiv \frac{\lambda'_p}{\lambda_p}.$$

Note that in the special case of a movement to autarky, in the counterfactual,  $\lambda'_p = 1$ .

The calculation of the trade response is nontrivial in a multi-sector model. Although the trade response is unique in a one sector model and may be calibrated consistent with a unique trade elasticity from a gravity model, in a multi-sector model, there are trade responses in each sector. Further, depending on model assumptions, the trade elasticity may not be constant.<sup>18</sup> In this paper, we hold the aggregate trade response constant across the Armington, Krugman and

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<sup>18</sup> Melitz and Redding (2015) showed that the "existence of a single constant trade elasticity and its sufficiency property for welfare are highly sensitive to small departures from those Arkolakis, Costinot and Rodriguez-Clare (2012) parameter restrictions."

Melitz models, which means that trade responses at the sector level are not necessarily constant across the models.

#### **4.1.2 Key Trade Response Elasticities.**

The key elasticities that determine the trade response are: (i) in the Melitz model, the Dixit-Stiglitz elasticities and the Pareto shape parameter; (ii) in the Krugman model, the Dixit-Stiglitz elasticities; and (iii) in the Armington model, the elasticities of substitution of domestic for foreign goods,  $\sigma(D,M)$  and the elasticities of substitution of imports from different regions,  $\sigma(M,M)$ .

For our central unadjusted values of these elasticities, we have the following. We based our values of these Dixit-Stiglitz elasticities on the estimates of Broda, Greenfield and Weinstein (2006). Since the Philippines is not in the Broda, Greenfield and Weinstein dataset, we chose their estimates for Indonesia as our proxy for The Philippines.<sup>19</sup> We aggregate the estimates of the Broda, Greenfield and Weinstein dataset for three-digit industries in Indonesia to the Dixit-Stiglitz sectors of our Krugman style model of The Philippines. For the Pareto distribution shape parameter in the Melitz model, we choose the value 4.58 from the structural estimation of the Melitz style model of Balistreri, Hillberry and Rutherford (2011). In the Armington model, we do not nest the demand structure and start with the values of the  $\sigma(M,M)$  elasticities in the GTAP database and scale all of them such that the export response of the Philippines is the same as in the Krugman model. These values as well as the supply elasticities are in table 4.<sup>20</sup>

We take the trade response in the Krugman model as our central trade response and adjust the elasticities of substitution in the Armington model and the Pareto shape parameter in the Melitz model to be consistent with the trade response of the Krugman model. Since the selection effect magnifies the trade response in the Melitz model, to hold the trade response constant between the Krugman and Melitz models requires adjusting our central value of the Pareto shape parameter in the Melitz model and the Armington elasticities of substitution in the Armington model. The alternate strategy of taking the trade response from the Melitz model as

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<sup>19</sup> Indonesia has many characteristics similar to The Philippines that makes it a good proxy: their annual per capita incomes are close. According to the IMF in 2016, in thousands of USD on a PPP basis, Indonesia's per capita income was 10.5 and The Philippines is 8.3; they are both island economies with populations of more than 100 million and both are ASEAN members.

<sup>20</sup> In the “other manufacturing” sector, of 44 estimates, we excluded two outliers of 33.5 and 35.3; other values were less than 9. In “textiles and apparel,” of 23 estimates, we excluded three outliers with values above 33.5. All other estimates were less than 11.4.

our central trade response and adjusting elasticities in the Krugman model, would require increasing the Dixit-Stiglitz elasticities in the Krugman model which would build in a greater valuation of varieties for the Melitz model. Since the RCEP scenario is a complicated mix of policies aimed at imports, exports and FDI, we choose the reduction in non-tariff measures as the most appropriate scenario (closest to a gravity estimate) to adjust elasticities to match the trade response in goods.

As shown in table 6, the required adjustment is only to .98 times the central value of the Pareto shape parameter in the Melitz model. Due to the entry of new firms in the Krugman model, to hold the trade response constant, we find that we must choose the Armington elasticities of substitution about 124 percent of their central unadjusted values. The required scaling of all trade elasticities is shown in tables 5-7.

#### **4.1.3 FDI Response.**

By similar reasoning to holding the trade response constant across the market structures, it seems appropriate for a fair comparison across the market structures to hold the FDI response constant across the market structures as well. For the FDI response, the obvious choice for calibration of the FDI response is the scenario where we reduce barriers against FDI in the Krugman model. We then adjust the elasticities in the Armington and Melitz models that determine the FDI response to match the FDI response of the Krugman model. Having determined the elasticities of the Armington, Krugman and Melitz models, based on the trade and FDI responses for these two scenarios, we hold those elasticities fixed in all scenarios. In section 5, we provide more details on the magnitude of the trade and FDI responses and the adjustments necessary to hold these constant.

#### **4.1.4 Elasticities of Supply.**

Beginning with the path-breaking work of Coe and Helpman (1995), a rich literature now exists that has empirically investigated the transmission of knowledge through the purchase of imported intermediate goods and through foreign direct investment. Coe and Helpman found that OECD countries benefit from foreign research and development (R&D), that they benefit more from trading with countries that have a larger stock of research and development, and that the benefits are greater the more open the country is to foreign trade. Moreover, while in large countries the elasticity of total factor productivity (TFP) with respect to domestic R&D capital stocks is larger than that with respect to foreign R&D capital stocks, the opposite holds in small

countries; that is, foreign R&D is more important for small countries. Coe, Helpman, and Hoffmaister (1997) extend these results based on a sample of 77 developing countries. They find developing countries that do little R&D on their own, have benefited substantially from industrialized country R&D through trade in intermediate products and capital equipment with industrialized countries. Regarding the impact of FDI in services, we have cited numerous papers above that establish that FDI in services increases TFP in the economy.

In summary, this literature shows that the purchase of intermediate inputs from industrialized countries and FDI in services is an important mechanism for the transmission of R&D and productivity growth in developing countries. For small developing countries, trading with large technologically advanced countries is crucial for TFP growth. In our model, the parameter that reflects the ability of a region to increase total factor productivity through the transmission of modern technologies is the elasticity of firm supply with respect to the price. The greater the elasticity of firm supply in a sector the more varieties will be received in response to a price increase with respect to that country. Based on these considerations, in the increasing returns to scale sectors of our model, we assume that the elasticity of firms' supply with respect to price is 3 for all IRTS sectors in The Philippines, India and the Rest of ASEAN; 4 for China and 5 for all other regions. These values are in a footnote to table 4. We conduct sensitivity analysis on these parameters, to determine the impact of these parameter values on the results.

#### **4.2 Ad Valorem Equivalents (AVEs) of the Barriers against Business Services.**

**4.2.1 Estimates of the AVEs of Barriers against FDI in Business Services.** Our estimates of the ad valorem equivalents of discriminatory barriers against foreign providers of services in the services sectors are taken from Jafari and Tarr (2015) and shown in table 3. The Jafari and Tarr estimates are based on the World Bank database of discriminatory regulatory barriers in 11 services sectors in 103 countries; that database is described in Borchert, Gootiiz and Mattoo (2014). Borchert *et al.* produced “Services Trade Restrictiveness Indices,” but did not transform their indices of the regulatory regimes into ad valorem equivalents. The Jafari and Tarr methodology uses the World Bank database for an assessment of the regulatory regimes, but builds on a series of studies, supported by the Australian Productivity Commission, to convert assessments of services regulatory regimes into ad valorem equivalents for all 11 sectors in 103 countries. Most of the Australian studies are published in Findlay and Warren (2000). Jafari and Tarr define mappings from the World Bank database to the scoring matrices of the Australian

authors. In this manner, they score the regulatory regimes of the 11 sectors in the 103 countries according to the Australian authors' criteria.

**4.2.2 Estimates of AVEs of Barriers to Cross-Border Trade in Services.** Several authors have used gravity models to estimate AVEs of barriers to cross-border trade in services. The most comprehensive of these efforts is by Francois, Hoekman and Woerz (2007). Using data from the International Monetary Fund, they estimated the AVEs of barriers in four categories of cross-border services for 178 countries, including the Philippines. We use their estimates for the Philippines in their table A2 and map their four services categories into our eight services sectors as follows: (i) transportation: our three transportation services sectors; (ii) producer services: communication, insurance and other financial services; (iii) other business services: professional services; and (iv) other non-traded services: trade and various mechanical repairs. The results for the AVEs are in table 3.

#### **4.3 Estimates of the AVEs of the Costs of Time in Exporting and Importing.**

In order to estimate the impact of improved trade facilitation, in this paper we apply the time cost of trade dataset of Hummels and Schaur (2013) and Hummels *et al.* (2007). Using the estimates of Hummels and his co-authors, Peter Minor (2013) provided estimates for the regions and products in the GTAP database on a bilateral basis. There are separate estimates for the time cost of exports and imports. We use estimates from Peter Minor, which we aggregate to the sectors and regions of our model, yielding the time cost of trade for exports and imports by product and country on a bilateral trade basis.<sup>21</sup> The results are displayed in table 3.

#### **4.4 Estimates of the AVEs for Non-Tariff Measures (NTMs) for the Regions of our Model**

Cadot and Gourdon (2014) have shown that the old command and control non-tariff measures, like quotas, bans, licenses and foreign exchange rationing have significantly declined in importance; but sanitary and phyto-sanitary (SPS) regulations and standards as technical barriers to trade (TBTs) have become the new non-tariff measures that restrict trade. In the case of the RCEP countries, there are a total of 3,813 SPS measures and 4,367 TBTs in effect. The RCEP countries with the most SPS measures reported are China (1,020), New Zealand (524), South Korea (518), Japan (430), Australia (386) and The Philippines (332). The RCEP countries with the most TBTs are China (1,162), Japan (758), Korea (742) and Thailand (584) and The Philippines

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<sup>21</sup> For the mathematics of the aggregation see the online appendix C to Balistreri, Tarr and Yonezawa (2015).

(250).<sup>22</sup> SPS regulations and standards on industrial goods, however, have legitimate regulatory functions. For example, in the case of SPS, countries have the right and obligation to protect human, animal and plant life. The World Trade Organization SPS and TBT agreements recognize these legitimate regulatory functions but call for these regulations to be applied in a manner that does not discriminate against imports.<sup>23</sup> Where the non-tariff measure has a regulatory function, we assume that our measure is the discriminatory component of the regulation.

Our estimates of the AVEs of NTMs are based on the estimates of Kee *et al.*, (2009). Building on Kee *et al.*, (2008), Kee *et al.*, (2009) estimate the AVEs of NTMs for 105 countries at the 6-digit level as well as aggregated estimates for manufacturing and agriculture.<sup>24</sup>

The measure we use from Kee *et al.* (2009) is the uniform tariff equivalent that generates the same level of import value for the country in a given year, based on applied tariffs, which take into account bilateral trade preferences.<sup>25</sup> At the six-digit level, the estimates of Kee *et al.* are sometimes subject to a substantial margin of error that may lead to misleading results in a policy analysis. Consequently, we have chosen to use the aggregated estimates of Kee *et al.*, i.e., for each country, we have two AVEs: one AVE of the NTMs in manufacturing and one AVE of the NTMs in agriculture. For regions in our model that are aggregates of countries, we take a simple average of the AVEs of the countries.<sup>26</sup> In the case of agriculture, we apply the AVE of the non-tariff barriers in our model to agriculture and forestry; and to wheat and cereals. In manufacturing we applied the AVE of the non-tariff barriers to beverages and tobacco; chemicals, minerals and metal products; electronic equipment; food products; other manufacturing; petroleum and coal products; textiles and apparel; meat and dairy products; processed rice and sugar. Table. The results are presented in a footnote to table 3.

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<sup>22</sup> “Standards and Testing in RCEP,” Asian Trade Centre Policy Brief No. 11-16, June 2015. Available at: [www.asiantradecentre.org](http://www.asiantradecentre.org)

<sup>23</sup> See: [https://www.wto.org/english/tratop\\_e/sps\\_e/spsagr\\_e.htm](https://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm)

<sup>24</sup> The dataset is available at:

<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22574446~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>.

<sup>25</sup> Specifically, we take the difference between the Overall Trade Restrictiveness Index (OTRI) and for the Tariff-only OTRI (OTRI\_T), which gives us the AVE of the NTMs.

<sup>26</sup> For our aggregate regions, we take simple averages of the AVEs of the individual countries. In the case of Rest of ASEAN, estimates are available for Brunei, Indonesia, Malaysia, Singapore and Thailand, but not for Cambodia, the Laos Peoples Democratic Republic, Myanmar and Vietnam. We take an average of the available estimates.

## **4.5 Tariff and Trade Data**

Trade data and tariff rates are taken from the GTAP 9.1 database. For tariff rates, GTAP uses the MACMap-HS6 database, described in Guimbard, Jean and Mimouni (2011). The ASEAN members have committed themselves to a maximum tariff of five percent within ASEAN. The five percent maximum tariff has reportedly been achieved among the original six members of ASEAN (The Philippines, Brunei, Indonesia, Malaysia, Singapore and Thailand). The remaining four members, Cambodia, Myanmar, Laos and Vietnam, have committed to implement the maximum five percent tariff, but have been allowed a longer adjustment period. Consequently, we adjust all tariffs above five percent among ASEAN members to five percent in our benchmark. The tariff rates and the ad valorem equivalents of the barriers on FDI are listed in table 3.

## **4.6 Social Accounting Matrices**

The core structural data of the model comes from the GTAP 9.1 dataset.<sup>27</sup> Exports and imports and by trading partner of The Philippines from this source are available in tables 2.

## **4.7 Share of Market Captured by Foreign Direct Investors in Services**

In the business services sectors of our model, it was necessary to calculate their market share in The Philippines of each region of our model. Except for telecommunications and insurance, for the shares of the sector captured by the aggregate of foreign firms, we used data from the final Census of Philippine Business and Industry for 2012.<sup>28</sup>

To allocate the shares among foreign firms, we used data from the Central Bank of the Philippines in their report “Net Foreign Direct Investment Flows by Country of Origin, 2014-2016, in millions of dollars.”<sup>29</sup> This report provides data on aggregate foreign direct investment (FDI) in The Philippines by source country for the years 2014-2016. We assumed that the foreign ownership shares sectors correspond to the shares of aggregate FDI by source country. We took the average of FDI flows for 2015 and 2016 to calculate the shares.

In the case of telecommunications, we obtained shares of the market by company from the Annual Report of the Philippine National Telecommunications Commission, 2014. Company shares were calculated based on the number of subscribers.<sup>30</sup> There are two large telephone

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<sup>27</sup> See <https://www.gtap.agecon.purdue.edu/databases/default.asp>.

<sup>28</sup> <https://psa.gov.ph/content/2012-census-philippine-business-and-industry-economy-wide-all-establishments-final-results>. We thank Daniel Reyes and his research assistant for these data and calculations.

<sup>29</sup> [http://www.bsp.gov.ph/statistics/spei\\_new/tab10\\_fdc.htm](http://www.bsp.gov.ph/statistics/spei_new/tab10_fdc.htm). Calculations based on equity flows as data on reinvested earnings and debt are not available by country.

<sup>30</sup> [http://ntc.gov.ph/wp-content/uploads/2015/10/reports/Annual\\_Report\\_2014.pdf](http://ntc.gov.ph/wp-content/uploads/2015/10/reports/Annual_Report_2014.pdf)

service providers (who also own some of the smaller brands): Globe, with a 30.7% market share and PLDT with 69.3% of the market. Globe owns the Innove and Bayantel brands, while PLDT owns the Digitel brand. Based on the PLDT disclosure letter to the Filipino Stock Exchange of January 12, 2017, we know the top 100 stockholders.<sup>31</sup> Globe reports its ownership structure on its website.<sup>32</sup> Ownership shares by nationality in each company were weighted by the company shares in the overall market.

In the case of insurance, for the shares of foreign versus domestic, we took the share of the sum of premiums for life insurance, other insurance and reinsurance for 2015 from the Insurance Commission of The Philippines.<sup>33</sup> The results of all these calculations are in table 1.

## 5. Results: RCEP and Its Key Components: Comparing Market Structures

We evaluate RCEP and its components in three model classes: Armington, Krugman and Melitz. In our Krugman model, aggregate exports increase by 1.1 percent as a result of the reduction in import non-tariff barriers. To achieve the same percentage change in aggregate exports in the Armington model, all of the GTAP values of the Armington elasticities of substitution were adjusted equi-proportionately, (multiplied by 1.24 as reported in tables 5-7). For the Melitz model, we retain the same Dixit-Stiglitz elasticities in both the Krugman and Melitz models (so as to not directly impact the variety externality); we achieve the equivalent increase in aggregate exports by adjusting the shape parameter in the Pareto distribution in all IRTS goods and services sectors. We scale down the shape parameter in our application by 0.98 (to a value of 4.49), which is a slightly more heterogeneous distribution than the distribution of Balistreri, Hillberry and Rutherford (2011) who had a preferred value of 4.58. The value of 4.49 mutes the trade response so that it is the same as in the Krugman model.

In our Krugman model, we observe an increase in FDI output in The Philippines of 26.8 percent as a result of the decrease in barriers against foreign direct investors in services. We take the FDI response from the Krugman model as our central response and adjust elasticities in the Melitz and Armington model for consistency of the FDI response. For the FDI response, we use

<sup>31</sup> [http://www.pldt.com/docs/default-source/shareholders-information/top-stockholders/2016/pse\\_pldt-list-of-top-100-stockholders\\_dec-31-2016.pdf?sfvrsn=0](http://www.pldt.com/docs/default-source/shareholders-information/top-stockholders/2016/pse_pldt-list-of-top-100-stockholders_dec-31-2016.pdf?sfvrsn=0)

<sup>32</sup> <http://corporate-governance.globe.com.ph/shareholding-structure.html>. Singtel is from Singapore and Ayala is Filipino. We assigned the balance to Filipino owners.

<sup>33</sup> *Annual Report of the Insurance Commission of The Philippines*, 2015, pages 18, 25 and 29. Available at: <https://www.insurance.gov.ph/statistics/ic-annual-report/>.

the Dixit-Stiglitz elasticities of demand for services between multinational and Filipino services with a domestic presence as our adjustment elasticities. In the Melitz model, no adjustment in these Dixit-Stiglitz elasticities is required to match the increase in FDI output of 26.8 percent.

In the Armington model, we use the analogous Armington elasticities: the elasticities of substitution in The Philippines between FDI provided services and Filipino services; but the adjustment required to match the FDI response without endogenous firm entry is dramatically larger. We impose an upper bound on these elasticities of substitution of 90 (a multiple of 30 times our central value of 3.0) for numerical stability of the model; then our FDI output response is 24.4 percent increase, which falls slightly short of the 26.8 percent increase in the central Krugman case. The extensive margin effect of new firm entry in the Krugman model is very difficult for the Armington model to match with only an intensive margin effect. This highlights the point made by Kehoe (2003), that to match the trade response (in this case the FDI response) in the Armington model, elasticities have to be increased to unrealistic levels.<sup>34</sup> Having calibrated these elasticities to match the FDI response, we hold them fixed in all scenarios.

## 5.1 Scenario Definitions

We evaluate the impact of the principle changes under negotiation by the RCEP member and the aggregate of those changes. These changes are: (i) 50 percent reduction of the ad valorem equivalent of the barriers against providers of services through both foreign direct investment and through cross-border delivery of services; (ii) a full reduction in the tariffs by The Philippines on RCEP members and reciprocal action by the RCEP members on Filipino exports (ASEAN tariffs are assumed to be maximum 0-5 percent in the benchmark equilibrium); (iii) a twenty percent reduction in the ad valorem equivalent of non-tariff barriers in goods by The Philippines and reciprocal action by the RCEP members on Filipino exports; and (iv) a 20 percent reduction in the time in trade costs on both imports and exports. In the case of time in trade (or trade facilitation) costs, reforms to facilitate trade with RCEP partners inevitably will, at least partially, reduce these costs for third countries; thus, we include a spillover effect on non-RCEP countries of five percent. In the sensitivity analysis, we consider spillover impacts in NTMs and in services.

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<sup>34</sup> Kehoe (2003) showed that only unrealistically high elasticities of substitution can get the models of NAFTA to match the observed trade responses.

In order to assess the relative importance of the reforms, and to identify the reforms in RCEP most important to The Philippines, we decompose the reforms into their components and simulate each separately. In tables 5-7, the heading of the table specifies what we are assuming in our central RCEP scenario and in the scenarios that assess each of the reforms separately.

## 5.2 Effects of RCEP in the Krugman Model

Our aggregate and decomposed results for our Krugman model are presented in table 5. There are nine scenarios, with the head of the columns labeled 1-9. Welfare gains are 3.1 percent of the value of goods and services consumption in the benchmark equilibrium or 2.5 percent of GDP.<sup>35</sup> Since our model is comparative static, these gains are to be interpreted as annual recurring gains above the real income that the economy would otherwise achieve. The three components of deep integration all contribute significantly to the improvement in the welfare of the Philippines. We estimate that trade facilitation would result in an increase in welfare on an annual basis of 0.8 percent of consumption, where 0.5 percent derives from reduction in time in trade costs on imports and 0.3 percent derives from reduction of time in trade costs on exports. The reduction in barriers against foreign direct investment in services would result in an increase in welfare of 0.9 percent of consumption. Of these gains, virtually all derive from the reduction of barriers against FDI in our business services sectors; rounded to a single decimal, the reduction of barriers against cross border suppliers of services do not contribute to the estimated gains. The reduction by RCEP partners of their non-tariff measures against the exports of the Philippines results in an improvement in the terms-of-trade for Filipino exporters and a gain in welfare of 0.5 percent of consumption. The reduction of non-tariff measures by the Philippines against the imports of partners in RCEP contributes an additional 0.3 percent to the welfare of the Philippines.

There are three sources of these gains. First, these deep integration measures result in gains since we assume that the maintenance the barriers imposes real resource costs. That is, liberalization of the barriers frees capital and labor that was used to overcome the barriers for use elsewhere in the economy allowing the domestic economy to capture rent rectangles. These rent recapture gains are also present in our perfectly competitive model. The second source of gains is that the reduction in barriers induces additional supply. In our Krugman model, additional supply derives from entry by new firms into the market (an extensive margin). In the perfectly

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<sup>35</sup> Note that we do not include the imputed value of leisure in our denominator.

competitive model, existing RCEP firms will sell more. So, there are “Harberger” triangles of efficiency gains (an intensive margin).<sup>36</sup>

There is a third source of gains that is present in our Krugman model, but does not exist in the perfectly competitive model. This is the gains from the Dixit-Stiglitz externality due to additional varieties in the Krugman model. Take the preferential liberalization of services, for example. The reduction of barriers against RCEP suppliers of services to the Philippines, increases profitability for provision of services in the Philippines by suppliers from RCEP. This induces new entry by service providers from RCEP until zero profits are restored for RCEP services suppliers in the Philippines. Although there is a loss of varieties from domestic service providers and non-RCEP varieties of services due to increased competition from RCEP services providers, we find that there is a net increase in varieties. Businesses in the Philippines will then have improved access to services in areas like telecommunication, banking, insurance, transportation and other business services. The additional service varieties in the business services sectors lowers the cost of doing business for users of these services through the Dixit-Stiglitz effect. Key to this story is that our model allows small countries to significantly impact varieties since our version of the Krugman model does not have the property of Krugman (1980) that all varieties are consumed in all regions. Our multi -sector Feenstra ratio shows that there is an increase in equivalent variation due to the increase in varieties in the aggregate RCEP scenario, where the value of the change in varieties depends on the Dixit-Stiglitz elasticity of substitution and the expenditure share on the sector with the increase in varieties.

It is striking that our results indicate that the change in import tariffs within RCEP does not contribute to the increase in welfare in the Philippines. Unlike the measures of deep integration we have just discussed, we apply the conventional assumption that tariffs do not induce the expenditure of capital and labor in the home country (and thus do not induce rents). Consequently, there are no recaptured rents to be gained from tariff liberalization. Further, preferential tariff reduction may induce trade diversion, i.e., it may induce purchases from suppliers who are less efficient than third country suppliers. It has been well documented in economic theory (beginning with Viner, 1950), that the possible induced switch to less efficient

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<sup>36</sup> For example, if trade facilitation is improved, reducing delay time, then the cost of delivering the product will fall on the entire *quantity of initial shipments*. The initial quantity times the cost saving is a “rectangle” of gains in rents. In addition, the lower costs of transport services will induce additional shipments. The additional gains, in partial equilibrium, are triangles equal to one-half the change in quantity times the change in costs.

suppliers in the partner regions away from more efficient suppliers on world markets may result in net losses from preferential tariff reduction. As noted above, small or no gains in the welfare impact of preferential tariff reduction is consistent with other modern assessments of the impact of preferential tariff liberalization, as in Caliendo and Parro (2015) and Caliendo *et al.* (2017). These are the reasons we have focused our work on deep integration.

### 5.3 Effects of RCEP--Armington Compared with Krugman

Decomposed results for the Armington model are in table 7. Aggregate welfare gains from RCEP as a percent of benchmark consumption are: 1.5 percent in the Armington model as opposed to 3.1 percent in the Krugman model. The largest differences in the gains is from the removal of barriers against foreign providers of services through FDI and from the reduction in non-tariff barriers against exports. The reduction of 50 percent of the ad valorem equivalent of the FDI barriers leads to estimated gains of 0.9 percent of consumption in the Krugman model, but only 0.3 percent in the Armington model. The reduction by RCEP partners of the ad valorem equivalent of their non-tariff measures against the exports of the Philippines leads to estimated gains of 0.5 percent of consumption in the Krugman model, but only 0.2 percent of consumption in the Armington model.

Since we do not have rationalization gains in Krugman model, and our terms-of-trade parameter shows that the terms-of-trade gains are slightly greater in the Armington model, the larger welfare gains between the Krugman and Armington models is entirely due to the additional varieties. When barriers against FDI are reduced in The Philippines, the new FDI firms enter The Philippines. This adds new varieties, which reduces the quality adjusted cost of the service and increases welfare.

In the Krugman model, when barriers against Filipino exports by RCEP partners are removed, there is an extensive margin response from the entry of new firms that magnifies the gains from trade. That is, the additional profits on exports induce more entry as the quasi-rents on exports help to cover the fixed production costs. Firm entry continues until there are zero profits. Since all domestic firms have the same cost structure in the Krugman model, any firm that supplies the export market also supplies the domestic market. So, there are more domestic varieties available as a result of increased profits on exports which increases welfare above the Armington model. Crucially for our interpretation below regarding the difference between the Melitz and Krugman model, since there is no reduction of barriers against foreign firms in The Philippines

in this scenario, there is no loss of domestic varieties. Our Feenstra ratio shows an estimated gain in the net value of varieties.

#### **5.4 Effects of RCEP: Melitz Compared with Krugman**

Our aggregate results with the Melitz model are presented in table 6. At 2.1 percent of consumption, welfare gains as a percent of consumption in the Melitz model are more than 25 percent larger than in the Armington model. But they are also significantly less than the gains of 3.1 percent of consumption in the Krugman model.

Decomposition of the aggregate RCEP scenario into its components shows that the most significant difference in the Krugman versus Melitz results is in the scenarios in columns 7 and 9, in which we reduce RCEP partners tariffs and non-tariff barriers on Filipino exports of goods to RCEP. Consider the case of NTMs first. The estimated welfare gains as a percent of consumption are 0.5 percent in the Krugman model versus 0.3 percent in the Melitz model. First, we note that the Dixit-Stiglitz variety externality of Filipino welfare is dependent on the number of varieties that are available *domestically* in The Philippines. Varieties available in foreign markets do not influence welfare in The Philippines. Second, in this decomposed scenario, foreign firms do not obtain a reduction in the non-tariff barriers they face in The Philippines, so there is no first order impact on foreign firm participation in The Philippines. i.e., the principal impact derives from what happens to domestic firms.

Third, given the nature of the scenario, the selection effect in the Melitz model results in a reduction in the number of varieties available in The Philippines. In the Melitz model, there is a Zero Cutoff Productivity level for firms to be active in the domestic market,  $\phi^*$ , and a Zero Cutoff Productivity for exporting,  $\phi_x^*$ . The reduction in barriers on exports increases the profitability of exporting and lowers the Zero Cutoff Productivity for exporting,  $\phi_x^*$ . Since the expected profits of entry must be zero, and the expected profits from exporting increases, the expected profits from serving only the domestic market must decrease. The equilibrium requires that the Zero Cutoff Productivity level for firms to be active in the domestic market,  $\phi^*$  increases. Thus, there is a decrease in the share of active or surviving Filipino firms that serve only the domestic market, i.e., the selection effect on Filipino firms by itself in the Melitz model results in a decrease in the Dixit-Stiglitz variety externality in this scenario. There is, however, a positive entry effect; that is, the mass of Filipino entrants increases until expected profits of entry are zero. Our Feenstra ratio

shows that there is a net increase in the value of varieties in the Melitz scenario that partly explains the larger gains in the Melitz model compared to the Armington model in this scenario. As discussed above, since the selection effect is absent in the Krugman model, there is no loss of domestic varieties and the variety gains are larger in the Krugman model. Thus, even though the selection effect results in an increase in the average productivity of surviving firms, the estimated gains are larger in the Krugman model in this scenario due to the larger gains in the value of varieties.

A similar argument applies in both the scenario where we reduce the time in trade costs *on exports* and the scenario where we reduce tariff barriers *on exports* within RCEP (columns 5 and 7). Compared with the Melitz model, our Feenstra ratios show larger welfare gains in the Krugman model from varieties in these scenarios.

Comparing the Krugman model to Melitz, there are also slightly larger estimated gains in the Krugman model in the scenarios where the ad valorem equivalents of import NTMs are reduced in The Philippines and where the time in trade costs on imports are reduced. A reduction in import barriers increases the price of exports and imports relative to goods sold on the domestic market. This real exchange rate depreciation provides an incentive to sell more exports compared to selling on the domestic market. Then the argument above applies again, but to a lesser degree. That is, the variety effects in the Krugman model will again be slightly larger due to the absence of the selection effect on Filipino firms that reduces domestic varieties. Our calculated Feenstra ratios show larger gains from the value of varieties in the Krugman model in these cases.

We do not believe the ranking of Krugman versus Melitz in this application is a general result. First, it depends on our extension of the Krugman model. Further, using a multi-region model of world trade, Balistreri and Tarr (2018) find that the *average* estimated gains for the world are generally larger in the Melitz model than in the Krugman model; and the Armington model produces the smallest gains. Due to different terms-of-trade effects and other considerations, however, for individual regions, Balistreri and Tarr (2018) find numerous cases of a reversed welfare rankings between Armington, Krugman and Melitz. Consequently, they conclude that relative welfare results for individual regions depend on model, scenario, data and parameter assumptions.

As a general vehicle for assessing the relative gains in Melitz versus Krugman, we believe our small open economy (SOE) model produces smaller welfare gains for the Melitz model relative

to a multi-region trade model (MRT) as in Balistreri and Tarr (2018). Ignoring import variety gains for the moment, the key gains in the Melitz model derive from efficient firms selecting into export markets in the goods sectors. Unlike an MRT model, however, in a SOE model there are no reciprocal increases in foreign productivity and income that would stimulate export demand for these goods sectors. Regarding import variety, foreign firms select into The Philippines after trade liberalization due to better prices in The Philippines. But, consistent with the small open economy assumption and following Demidova and Rodriguez-Clare (2009), we assume that the mass of foreign firms is not impacted by policies in The Philippines. Selection into The Philippines by foreign firms, induces exit by small high-cost domestic firms. But with no increase in the mass of foreign firms, there is no entry effect on foreign firms that would lead to an increase of additional foreign firms that serve The Philippines market.<sup>37</sup>

## 6. Sensitivity Analysis

We conduct three types of sensitivity analysis. First, we conduct policy sensitivity with respect to an assumption of wider spillovers with respect to the rest of the world. In these policy scenarios, we assume non-RCEP regions obtain a reduction of ten percent of ad valorem equivalents of barriers against FDI in services and five percent in non-tariff measures. We examine the impacts in all three market structures in the aggregate RCEP and decomposed scenarios. Second, given the demonstrated importance on the welfare effects of matching the trade responses across market structures, we examine the welfare impacts across the three market structures when we change the central trade and FDI responses in the Krugman model and match these in the Melitz and Armington models. Finally, we conduct piecemeal sensitivity on the parameters of our model in our central Krugman model.

### 6.1 Sensitivity of Deep Integration to Spillovers or Liberalization to Non-RCEP Regions.

Baldwin (2014) has argued that compared to regional preferences regarding tariffs, the deep integration aspects of 21<sup>st</sup> century regional agreements are relatively difficult to limit to partners to the agreement; further, global value chain considerations lead to a “multilateralization” of some of the deep integration aspects of 21<sup>st</sup> century regional agreements.

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<sup>37</sup> Feenstra (1994; 2010) has shown that if new varieties are consumed in lower quantities, then their impact on the quality adjusted price index or the expenditure function will be less compared to where the same number of varieties are consumed in equal amounts. Arkolakis *et al.* (2008) argue that the firms with the highest productivity are already present in the market prior to the trade liberalization. Thus, the Melitz model would imply that the firms that enter after trade liberalization have lower productivity and lower value of sales on average compared with incumbent firms. Calling this the “curvature” effect, Arkolakis *et al.* (2008) apply the Feenstra methodology to conclude the variety gains from trade in the Melitz model are muted.

We argued above that measures that reduce the time in trade costs for RCEP members would inevitably convey at least a partial benefit to non-members. For that reason, in our central scenario, we allowed non-RCEP regions to realize a five percent reduction in their time in trade costs on exports to and imports from The Philippines, while RCEP members obtained a 20 percent reduction. Regarding preferential liberalization of barriers against foreign investors in services, it is an unsettled question of how feasible it is to exclude third countries from preferential liberalization in services.<sup>38</sup> In our central scenario, we assumed a 50 percent reduction in the ad valorem equivalents of the barriers against RCEP partner region providers of services. Here we allow a ten percent reduction in the ad valorem equivalents of the barriers against service providers outside of RCEP regions. Similarly, regarding non-tariff measures, we allow a five percent reduction in the ad valorem equivalents to non-RCEP regions, while RCEP regions experience a 20 percent reduction. Note that, as opposed to spillovers, this scenario could also be interpreted as explicit policy choices with implementation by RCEP members to reduce trade costs on their trade with non-RCEP regions. The results, together with the percentage reductions in the ad valorem equivalents are in table 8.

The estimated welfare gains increase substantially in all three market structures with the spillovers. Widening of the benefits of deep integration in RCEP to regions that are not members of RCEP leads to more gains to The Philippines. Compared to the lower spillover case of our central RCEP scenario, the estimated welfare gains increase in the Armington model by 0.8 percent to 2.3 percent of consumption. In the Armington model, this is due to both rent capture and “Harberger triangle” type efficiency gains. There is a substantially larger increase in the wider spillover case, however, in the estimated welfare gains in both monopolistic competition models. Compared with our central scenario, they increase by 1.8 percent of consumption in both the Krugman and Melitz models, to 4.9 percent and 3.9 percent, respectively. Our Feenstra

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<sup>38</sup> If the preferential agreement grants equivalent rights to third country firms located in the partner region, the preferential arrangement becomes somewhat multilateral. The rules of origin would impact how multilateral the preferential liberalization becomes. What rules of origin apply in practice is an unsettled question both in the literature and in practice. Fink and Jansen (2009) note that, typically, FTAs require that enterprises eligible for the agreement’s preferences are incorporated under the laws of one of the partner countries. Further, to qualify for preferences, the enterprise must have "substantial business activities" within the region. This indicates that preferences do not extend to enterprises located in third countries if they are not incorporated with substantial business interests in the region. As an example of these principles, Fink and Molinuevo (2007) note that in East Asia non-parties can benefit from the preferences provided in the FTA, as long as they establish a juridical person in one of the FTA member countries and are commercially active in that country. But again, the preferences for non-parties are enterprise specific and do not extend to enterprises without a commercial preference with substantial business interest.

ratio parameter shows a larger increase in the Dixit-Stiglitz variety externality in the case of spillovers which primarily explains the widening of the difference in the estimated welfare gains between the monopolistic competition models and the Armington model. These results suggest that substantial gains can be achieved for the members of a regional agreement if the trade costs reduction of deep integration can be extended to third countries.

## 6.2 Sensitivity to the Trade Response and FDI responses

In these scenarios, we test the sensitivity of the welfare results to the trade response and the FDI response. As in our central scenarios, for the trade response sensitivity, we focus on the scenario where we reduce the ad valorem equivalents of the non-tariff measures. We choose this scenario since it is the scenario closest to a gravity model estimate of the trade response impact of a reduction of trade costs. For the FDI response, we choose the scenario where we reduce the barriers against FDI. Our results are in table 9.

### 6.2.1 Sensitivity to the Trade Response

To generate high and low trade responses in the Krugman and Armington structures, we vary the Dixit-Stiglitz and Armington elasticities from their central values. In the Melitz structure, we vary the Pareto shape parameter and hold the Dixit-Stiglitz and Armington elasticities constant.

A key result from the table is that the welfare results are rather robust to changes in the trade response. The differences in the estimated welfare gains as a percent of consumption between the low and high trade response cases in the Melitz, Krugman and Armington cases are 0.03 percent, 0.02 percent and 0.01 percent, respectively.

The welfare results in the Krugman model vary inversely with the Dixit-Stiglitz elasticities of substitution, since additional varieties are valued less highly with high Dixit-Stiglitz elasticities. In the Melitz structure, as the shape parameter increases, the distribution of firms becomes more homogeneous and the welfare impacts in the Melitz model decline since there is less of a productivity gain from the selection effect. In the Armington case, there is only a 0.01 percent difference between the low and high trade response case, but the estimated gains are lower with the larger trade response. The slight decline in estimated gains with an increase in the trade response is due to a larger adverse terms-of-trade effect in the trade elasticity case.<sup>39</sup>

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<sup>39</sup> To maintain comparability to the monopolistic competition models, we retain the sector specific factor in the Armington case. Then the import supply curves of foreign firms are less than perfectly elastic. The reduction of NTMs on RCEP goods producing firms leads to increased quantity demanded for the imports of foreign firms and

**6.2.2 Sensitivity to the FDI Response.** Our central model is the Krugman model and we calibrate elasticities in the Armington and Melitz models to match the FDI responses. In response to a reduction in the ad valorem equivalents of barriers against services provided by FDI, the key parameters that determine the FDI response in The Philippines are the Filipino elasticities of substitution between services provided by FDI and services provided by Filipino firms, i.e., services provided with a domestic presence. Our central value of these elasticities in the Krugman case is 3.0. In the high parameter case, we increase them to 4.5 (=1.5 times 3.0) and in the low parameter case, we reduce them to 2.7.

These changes induce a 27.1 percent increase in the FDI response in the low parameter case and a 26.3 percent increase in the high parameter case. One might expect a larger FDI response in the high Dixit-Stiglitz elasticity case, since a larger elasticity allows a greater response to the new incentives of the change in the market price of the service. However, a larger elasticity implies that each variety is valued less highly so the quality adjusted price (or the Dixit-Stiglitz price) falls by less and there is less of a price incentive to purchase more of the services that decline in price. In this model and data, the smaller decline in the Dixit-Stiglitz price is more important than the ease of substitution in inducing more FDI. In the Melitz model, for the high FDI response case, to achieve a 27.1 percent increase in FDI, we use the same Dixit-Stiglitz elasticities as in the Krugman model (i.e., 2.7), without changing the Pareto shape parameter from its central value of 4.49 (= 0.98\*4.58). In the low FDI response case, to achieve a FDI response of 26.3 percent in the Melitz model, we again use the Dixit-Stiglitz elasticities of the Krugman model, but adjust the Pareto shape parameter to 4.47 (=0.975\*4.58).

We impose an upper bound on the elasticities of substitution in the Armington model of 90 for numerical stability of the model. Despite these extremely high elasticities, our FDI output response in the Armington model is 24.4 percent increase in our central scenario; this falls slightly short of the 26.8 percent increase in the central Krugman case. We also fail to perfectly match the FDI response in the low and high FDI response cases. This emphasizes the point that it may be unrealistic to expect the Armington model to match the responses in the monopolistic competition models.

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an increase in their price, i.e. an adverse terms-of-trade effect. With the larger elasticity of demand for imports, the adverse terms-of-trade effect is larger, which explains the result in the table. We reran the Armington scenario with close to perfectly elastic supply of imports (so there is no adverse terms-of-trade effect) and obtained the result that the welfare gains are higher than in the high trade elasticity case.

The Krugman and Melitz models produce very close estimates of the changes in welfare as a percent of consumption. In both the Krugman and Melitz models, the welfare impacts vary inversely with the Dixit-Stiglitz elasticities. The FDI response is not changing substantially between these low and high parameter values, so the differences in the welfare estimates are primarily determined by the valuation of varieties.

There is no difference in the welfare estimates in the Armington cases in the table. This reflects the lack of a change in the FDI response due to the upper bound on the elasticities of substitution of 90.

### **6.3 Piecemeal Parameter Sensitivity of the Krugman Model Welfare Estimates in the RCEP Scenario**

In these simulations, we examine how robust are the welfare estimates in our central scenario, which is RCEP in the Krugman model. We examine the sensitivity of the results to ten sets of parameters listed in table 10. The central parameter values are the values we employed in our results of table 5. The central welfare value in table 10 of a welfare gains of 3.08 percent of consumption is that of table 5 for the RCEP scenario in the Krugman model. We perturb an elasticity (or set of elasticities) that is indicated in a single row of the table, while holding all other elasticities constant.

We see in table 10 that of the ten sets of elasticities, five have only a minor impact. Most important are the elasticities of firm supply by RCEP partners with respect to the price of output in The Philippines. When there is a reduction of trade costs in The Philippines for RCEP partners in either goods or services, the welfare gains in The Philippine increase to 3.92 percent of consumption when RCEP partner firms are more responsive to those reduced costs. If the same elasticities are higher for non-RCEP firms, other things equal, the welfare gains for The Philippines are reduced slightly, showing a loss of varieties due to stronger trade diversion effects for non-RCEP firms.

The welfare gains fall or rise significantly with an increase or decrease in the Dixit-Stiglitz elasticities of substitution. The welfare gains fall with an increase in these elasticities due to the lower gains from an additional variety. The set of elasticities of substitution between business services and value-added results in an increase or decrease in about 0.2 of EV as a percent of consumption. These are the elasticities through which we incorporate into the model the substantial body of econometric research that shows that firm level productivity is increased by greater access to business services. The final set of elasticities that has a significant impact is

the set of elasticities of intermediate demand. If intermediate demand is Cobb-Douglas, EV as a percent of consumption increases to 3.27 or falls to 2.88 if it is Leontief.

## 7. Conclusions

We found that The Philippines can experience a welfare gain of 3.1 percent of consumption from deep integration in RCEP; but tariffs contribute virtually nothing to the estimated gains. These results emphasize the importance of including deep integration in the evaluation of PTAs. If the benefits of deep integration can be partially extended to non-RCEP countries, either through spillovers or intentional broader liberalization, our estimated gains increase substantially, up to equivalent variation at 4.9 percent of consumption in our central Krugman model. We developed the first numerical heterogeneous firms model of foreign direct investment where production of the FDI firms is located in the host country and demand responds to the “proximity burden” literature. We also developed an extension to the Krugman model that breaks the all commodities are consumed in all countries property. We find that these new models are important in explaining the results.

We compared the results under three market structures: multi-sector versions of Armington, Krugman and Melitz. Consistent with the results of Costinot and Rodriguez-Clare (2014), we held the trade response constant across the three market structure variants, and extended that logic to our FDI models by holding the FDI response constant across the market structures. We found that the Krugman model produced welfare gains about twice that of the Armington model. We found that the Melitz model also produces estimated welfare gains larger than the Armington model, but less than the Krugman model. There are several model variants of the Melitz model as well as the Krugman model under which one can evaluate the welfare impacts, including a multi-region, multi-sector trade model as in Balistreri and Tarr (2018). They show that the ranking of the relative gains will depend on these model variants as well as scenarios, parameters and data. That is, a Melitz or Krugman style model will not dominate the other regarding welfare impacts in all model variants.

## References

Anderson, James and Will Martin (2011), “Costs of Taxation and Benefits of Public Goods with Multiple Taxes and Goods,” *Journal of Public Economic Theory*, Vol. 13(2), 289-309.

APEC Policy Support Unit (2015), “Do FTAs Matter for Trade?” Available at:

[http://publications.apec.org/publication-detail.php?pub\\_id=1631](http://publications.apec.org/publication-detail.php?pub_id=1631)

Arkolakis, Costas., Arnaud Costinot, Dave Donaldson and Andres Rodriguez-Clare (2015), “The Elusive Pro-Competitive Effects of Trade,” NBER Working Paper No. w21370. Available at: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2633326](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2633326).

Arkolakis, Costas, Arnaud Costinot and Andres Rodriguez-Clare (2012), “New Trade Models, Same Old Gains?” *American Economic Review*, 102(1), 94–130.

Arkolakis, Costas, Arnaud Costinot and Andres Rodriguez-Clare (2010): “New Trade Models, Same Old Gains?” mimeo. Available at: <http://economics.mit.edu/files/6445>.

Arkolakis, Costas, S. Demidova, P. Klenow and Andres Rodriguez-Clare (2008), “Endogenous Variety and the Gains from Trade,” *American Economic Review, Papers and Proceedings*, 98(4), 444–450.

Arkolakis, Costas, Natalia Ramondo, Andres Rodriguez-Clare and Stephen Yeaple (2018), “Innovation and Production in the Global Economy” *American Economic Review*, 108(8), 2128–2173.

Arnold, Jens M., Beata S. Javorcik and Aaditya Mattoo (2011), “Does Services Liberalization Benefit Manufacturing Firms: Evidence from the Czech Republic,” *Journal of International Economics*, 85 (1), 136-146.

Arnold, Jens M., Beata S. Javorcik, Mary Lipscomb and Aaditya Mattoo (2016), “Services Reform and Manufacturing Performance: Evidence from India,” *Economic Journal*, Vol. 126, Issue 590, 1-39.

Arvis, Jean-Francois, Yann Duval, Ben Shephard, Chorthip Utoktham and Anasuya Raj (2016), “Trade Costs in the Developing World: 1996-2010,” *World Trade Review*, Vol. 15 (3), 451-474.

Australian Department of Foreign Affairs and Trade of (2017), Seventh Round of Negotiations—21 February to 3 March 2017, Kobe Japan. Available at:  
<http://dfat.gov.au/trade/agreements/rcep/news/Pages/seventeenth-round-of-negotiations.aspx>

Australian Department of Foreign Affairs and Trade (2016), “Barriers to Australian Trade and Investment in Regional Comprehensive Economic Partnership (RCEP) Countries,” Available at: <http://dfat.gov.au/trade/agreements/rcep/Pages/barriers-to-australian-trade-and-investment-in-regional-comprehensive-economic-partnership-rcep-participating-countries.aspx>

Baldwin, Richard (2014), “Multilateralizing 21<sup>st</sup> Century Regionalism,” OECD Global Forum on Trade Paper.

Baldwin, Richard E., Forslid, Rikard and Haaland, Jan (1999), "Investment Creation and Investment Diversion: Simulation Analysis of the Single Market Programme," in R. Baldwin and J. Francois (eds.), *Dynamic Issues in Applied Commercial Policy Analysis*, Cambridge: Cambridge University Press.

Balistreri, Edward J., Russell H. Hillberry and Thomas F. Rutherford (2011), “Structural Estimation and Solution of International Trade Models with Heterogeneous Firms,” *Journal of International Economics*, Vol. 83(2), 95-108.

Balistreri, Edward J., Russell H. Hillberry and Thomas F. Rutherford (2010), “Trade and Welfare: Does Industrial Organization Matter,” *Economics Letters*, 109(2), 85–87.

Balistreri, Edward J., Jesper Jensen and David G. Tarr (2015), “What Determines Whether Preferential Liberalization of Barriers against Foreign Investors in Services are Beneficial or Immiserizing: Application to the case of Kenya,” *Economics: The Open-Access, Open-Assessment E-Journal*, Vol. 9 (2015-42): 1—134. <http://dx.doi.org/10.5018/economics-ejournal.ja.2015-42>

Balistreri, Edward J., Maryla Maliszewska, Israel Osorio-Rodarte, David G. Tarr and Hidemichi Yonezawa (2018), “Poverty, Welfare and Income Distribution Implications from Reducing Trade Costs Through Deep Integration in Eastern and Southern Africa” *Journal of African Economies*, Vol. 27 (2), 172-200, <https://doi.org/10.1093/jae/ejx024>.

Balistreri, Edward and James Markusen (2009), “Sub-national differentiation and the role of the firm in optimal international pricing,” *Economic Modeling*, Vol. 26 (1), 47-62.

Balistreri, Edward J., Zoryana Olekseyuk and David G. Tarr (2017), “Privatization and the Unusual Case of Belarusian Accession to the WTO,” *The World Economy*, Vol. 40, 2564-2591. Appendices available at <http://dx.doi.org/10.2139/ssrn.2834330>

Balistreri, Edward J. and Thomas F. Rutherford (2013), “Computing general equilibrium theories of monopolistic competition and heterogeneous firms,” in *Handbook of Computable General Equilibrium Modeling*, Vol. 1, Peter B. Dixon and Dale W. Jorgenson eds., Amsterdam, North Holland, Elsevier, Chapter 23, 1513–1570.

Balistreri, Edward J., Thomas F. Rutherford and David G. Tarr (2009), “Modeling Services Liberalization: The Case of Kenya,” *Economic Modeling*, Vol. 26 (3), May, 668-679.

Balistreri, Edward J. and David G. Tarr (2018), “Welfare Estimates from the Reduction of Trade Costs in the Armington, Krugman and Melitz Models: Insights from a Structural Gravity Approach,” mimeo.

Balistreri, Edward J., David G. Tarr and Hidemichi Yonezawa (2015), “Deep Integration in Eastern and Southern Africa: What are the Stakes?” *Journal of African Economies*, Vol. 24(5), 677-706. For on-line appendices see [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2503724](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2503724).

Ballard, Charles (2000), “How Many Hours are in a Simulated Day? The Effects of Time Endowment on the Results of Tax-Policy Simulation Models.” Available at: <https://pdfs.semanticscholar.org/59b3/4cbb9cc1c02f2c0735dec3e3bcb9ad632507.pdf>

Ballard, Charles (1990), “Marginal Welfare Cost Calculations: Differential Analysis vs. Balanced Budget Analysis,” *Journal of Public Economics*, Vol. 41 (March), 263-276.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott (2018), “Global Firms,” *Journal of Economic Literature*, Vol. 56(2), 565-619.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott (2007), “Comparative Advantage and Heterogeneous Firms,” *Review of Economic Studies*, 74(1), 31–66.

Borchert, Ingo, Batshur Gootiiz and Aaditya Mattoo (2014), “Policy Barriers to International Trade in Services: Evidence from a New Database,” *World Bank Economic Review*, Vol. 28(1), 162-188.

- Broda, Christian and David E. Weinstein (2006), "Globalization and the Gains from Variety," *Quarterly Journal of Economics*, Vol. 121 (2), 541-585.
- Broda, Christian, Joshua Greenfield and David E. Weinstein (2006), "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth," National Bureau of Economic Research Working Paper 12512. Available at: <http://www.nber.org/papers/w12512>
- Brown, Drusilla and Robert Stern (2001), "Measurement and Modeling of the Economic Effects of Trade and Investment Barriers in Services," *Review of International Economics*, 9(2): 262-286.
- Cadot, Olivier and Julien Gourdon (2014), "Assessing the Price-Raising Effect of Non-Tariff Measures in Africa," *Journal of African Economies*, Vol. 23 (4), 425-463.
- Caliendo, Lorenzo and Fernando Parro (2015), "Estimates of the Trade and Welfare Effects of NAFTA," *Review of Economic Studies*, Vol. 82(1), January 1-44.
- Caliendo, L., R.C. Feenstra, J. Romalis and A. M. Taylor (2017), "Tariff Reductions, Entry and Welfare: Theory and Evidence for the Last Two Decades," NBER Working Paper, No. 2178. <http://faculty.som.yale.edu/lorenzocaliendo/TREW.pdf>
- Coe, David T., and Elhanan Helpman (1995), "International R&D Spillovers," *European Economic Review*, Vol. 39 (5): 859-887.
- Coe, David T., Elhanan Helpman and Alexander W. Hoffmaister (1997), "North-South R&D Spillovers", *Economic Journal*, Vol 107, 134-149.
- Cororaton, Caesar B. (2016), "Potential Effects of the Regional Comprehensive Economic Partnership on the Philippine Economy," Discussion Paper Series No. 2016-30, Philippine Institute for Development Studies.
- Cororaton, Caesar B. and David Orden (2015), "Potential Economic Effects on The Philippines of the Trans-Pacific Partnership (TPPP," GII Working Paper No. 2014-1, Virginia Polytechnic Institute and State University.
- Costinot, Arnaud and Andres Rodriguez-Clare (2014), "Trade Theory with Numbers: Quantifying the Consequences of Globalization," in *Handbook of International Economics*, Elhanan Helpman, Kenneth Rogoff and Gita Gopinath (eds.), Vol. 4, 197-262, Amsterdam: Elsevier.
- Costinot, Arnaud and Andres Rodriguez-Clare (2013), "Online Appendix to Trade Theory with Numbers: Quantifying the Consequences of Globalization," March. Available at: <https://economics.mit.edu/files/9215>
- Dee, Philippa, Kevin Hanslow and Tien Phamduc (2003), "Measuring the Costs of Barriers to Trade in Services," in *Trade in Services in the Asia-Pacific Region*, Takatoshi Ito and Anne Krueger (eds.), Chicago: University of Chicago Press.
- Dekle, Robert, Jonathan Eaton and Samuel Kortum (2008), "Global Rebalancing with Gravity: Measuring the Burden of Adjustment," *IMF Staff Papers*, Vol. 55(3), 511-540.
- Demidova, Svetlana and Andres Rodriguez-Clare (2009), "Trade Policy Under Firm-Level Heterogeneity in a Small Economy," *Journal of International Economics*, Vol. 78, 100-112.
- Dixon, Peter, Michael Jerie and Maureen Rimmer (2018), *Trade Theory in Computable General Equilibrium Models: Armington, Krugman and Melitz*, Singapore: Springer.

Duggan, Victor, Sjamsu Rahardja, and Gonzalo Varela (2013), "Service Sector Reform and Manufacturing Productivity: Evidence from Indonesia," Policy Research Working Paper 6349, World Bank, Washington, DC.

Dunning, J.H. (1985), *Multinational Enterprises, Economic Structure and International Competitiveness*, New York: John Wiley and Sons.

Ethier, Wilfred (1982), "National and International Returns to Scale in the Modem Theory of International Trade," *American Economic Review*, Vol. 72(2):389-405.

Ethier, Wilfred and James R. Markusen, (1996), "Multinationals, Technical Diffusion, and Trade," *Journal of International Economics*, Vol. 41, 1-28.

Feenstra, Robert C. (2010), "Measuring the Gains from Trade Under Monopolistic Competition," *Canadian Journal of Economics*, Vol. 43(1), 1-28.

Feenstra, Robert C. (1994), "New Product Varieties and the Measurement of International Prices," *American Economic Review*, Vol. 84, 157-177.

Fernandes, Ana M. and Caroline Paunov (2012), "Foreign Direct Investment in Services and Manufacturing Productivity: Evidence for Chile," *Journal of Development Economics*, 97 (2), 305-321.

Findlay, Christopher and Tony Warren, eds. (2000), *Impediments to Trade in Services: Measurement and Policy Implications*, London; Routledge.

Fink, Carsten and Martin Molinuevo (2007), "Liberalization of Trade in Services: East Asian Free Trade Agreements in Services, Roaring Tigers or Timid Pandas," The World Bank. Available at: [http://siteresources.worldbank.org/INTEAPSUMEASPR/Resources/2576847-1163691185244/East\\_Asian\\_FTAs\\_in\\_Services.pdf](http://siteresources.worldbank.org/INTEAPSUMEASPR/Resources/2576847-1163691185244/East_Asian_FTAs_in_Services.pdf)

Fink, Carsten and Marion Jansen (2009), "Services Provisions in Regional Trading Agreements: stumbling or building blocks for multilateral liberalization?" Paper presented at the WTO-CEPR conference. Available at: [https://www.wto.org/english/tratop\\_e/region\\_e/con\\_sep07\\_e/fink\\_jansen\\_e.pdf](https://www.wto.org/english/tratop_e/region_e/con_sep07_e/fink_jansen_e.pdf)

Francois, Joseph and Bernard Hoekman (2010), "Services Trade and Policy," *Journal of Economic Literature*, 48 (September), 642-692.

Francois, Joseph, Bernard Hoekman and Julia Woerz (2007), "Does Gravity Apply to Intangibles? Measuring Openness in Services." Paper presented at the European Trade Study Group annual meeting, Athens. Available at: <http://www.etsg.org/ETSG2007/papers/woerz.pdf>

Francois, Joseph, M. Manchin and Will Martin (2013), "Market Structure in CGE Models of International Trade," in Peter Dixon and Dale Jorgenson (eds.), *Handbook of Computable General Equilibrium Models*, Amsterdam: North Holland, Elsevier, 1571-1600.

Francois, Joseph and Clint Shiells (eds., 1994), *Modeling Trade Policy: Applied General Equilibrium Assessments of North American Free Trade*, Cambridge: Cambridge University Press.

- Guimbard, Houssein, Sébastien Jean and Mondher Mimouni (2011), "GTAP 8.1 Data Base Documentation - Chapter 10.D: MACMap-HS6 2007, an exhaustive and consistent measure of applied protection in 2007."
- Harris, Richard (1984), "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition," *American Economic Review*, Vol. 74(5), pages 1016-32.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (2002), "Trade Policy Options for Chile: The Importance of Market Access," *World Bank Economic Review*, Vol. 16, Number 1.
- Harrison, Glenn W., Thomas F. Rutherford and David G. Tarr (1997), "Quantifying the Uruguay Round," *Economic Journal*, Vol. 107, No. 444, September, 1405-1430.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (1997a), "Economic Implications for Turkey of a Customs Union with the European Union," *European Economic Review*, Vol. 41(3-5), 861-870.
- Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr. (1996), "Increased Competition and Completion of the Market in the European Community: Static and Steady-State Effects," *Journal of Economic Integration*, 11(3), September 1996, 332-365.
- Harrison, Glenn W., Thomas F. Rutherford and David G. Tarr (1995), "Quantifying the Outcome of the Uruguay Round," *Finance and Development*, December.
- Harrison, Glenn H., Thomas F. Rutherford, David G. Tarr and Angelo Gurgel (2004) "Trade Policy and Poverty Reduction in Brazil," *The World Bank Economic Review*, Vol. 18, 289-317, 2004.
- Helpman, Elhanen and Paul Krugman (1985), *Market Structure and Foreign Trade*, Cambridge MA: MIT Press.
- Helpman, Elhanen, Mark Melitz and Stephen Yeaple (2004), Exports Versus FDI with Heterogeneous Firms," *American Economic Review*, Vol. 94(1), March, 300-316.
- Hummels, David L. (2007), "Transportation Costs and International Trade in the Second Era of Globalization," *Journal of Economic Perspectives*, Vol. 21(3), 131-154.
- Hummels, David L., Peter Minor, Matthew Reisman and Erin Endean (2007), "Calculating Tariff Equivalents for Time in Trade," Arlington, VA: Nathan Associates Inc. for the United States Agency for International Development (USAID). Available at: [http://www.krannert.purdue.edu/faculty/hummelsd/research/tariff\\_equivalents.pdf](http://www.krannert.purdue.edu/faculty/hummelsd/research/tariff_equivalents.pdf)
- Hummels, David L. and G. Schaur (2013), "Time as a Trade Barrier," *American Economic Review*, Vol. 103, 1-27.
- Jafari, Yaghoob and Wolfgang Britz (2017), "Modelling Heterogeneous Firms and Non-Tariff Measures in Free Trade Agreements Using Computable General Equilibrium," *Economic Modelling*, <https://doi.org/10.1016/j.econmod.2018.04.004>, in press.
- Jafari, Yaghoob and David G. Tarr (2015), "Estimates of Ad Valorem Equivalents of Barriers Against Foreign Suppliers of Services in Eleven Services Sectors and 103 Countries," *The World Economy*. DOI: 10.1111/twec.12329

Jensen, Jesper, Thomas F. Rutherford and David G. Tarr (2010), "Modeling Services Liberalization: The Case of Tanzania," *Journal of Economic Integration*, Vol. 25 (4), December, 644-675. <http://dx.doi.org/10.11130/jei.2010.25.4.644>

Jensen, Jesper, Thomas F. Rutherford and David G. Tarr (2007), "The Impact of Liberalizing Barriers to Foreign Direct Investment in Services: The Case of Russian Accession to the World Trade Organization," *Review of Development Economics*, Vol. 11 (3), August, 482-506.

Jensen, Jesper, Thomas F. Rutherford and David G. Tarr (2006), "Telecommunications Reform within Russia's Accession to the WTO," *Eastern European Economics*, Vol. 44 (1), January-February, 25-58.

Jensen, Jesper and David G. Tarr (2012), "Deep Trade Policy Options for Armenia: The Importance of Trade Facilitation, Services and Standards Liberalization," *Economics: The Open Access-Open Assessment E-Journal*, Vol. 6, 2012-1. <http://dx.doi.org/10.5018/economics-ejournal.ja.2012-1>.

Jensen, Jesper and David G. Tarr (2008), "Impact of Local Content Restrictions and Barriers Against Foreign Direct Investment in Services: The Case of Kazakhstan's Accession to the World Trade Organization," *Eastern European Economics*, Vol. 46(5), 5-26.

Jensen, Jesper and David G. Tarr (2003), "Trade, Exchange Rate and Energy Pricing Reform in Iran: Potentially Large Efficiency Effects and Gains to the Poor," *Review of Development Economics*, Vol. 7, Number 4, November, 543-562.

Kee, Hiau Looi, Alessandro Nicita and Marcelo Olarreaga (2009). "Estimating trade restrictiveness indices," *Economic Journal*, Vol. 119, 172--199.

Kee, Hiau Looi, Alessandro Nicita and Marcelo Olarreaga. (2008), "Import Demand Elasticities and Trade Distortions", *Review of Economics and Statistics*, 90 (4), 666—682.

Kehoe, Timothy J. (2003), "An evaluation of the performance of applied general equilibrium models of the impact of NAFTA," Staff Report 320, Federal Reserve Bank of Minneapolis.

Konan, Denise Eby and Keith E. Maskus ( 2006), "Quantifying the impact of services liberalization in a developing country," *Journal of Development Economics*, Vol. 81(1), pages 142-162.

Krueger, Anne O. (1974), "The Political Economy of the Rent-Seeking Society," *American Economic Review*, Vol. 3, 291-303.

Krugman, Paul (1979), "Increasing Returns Monopolistic Competition and International Trade," *Journal of International Economics*, 9(4), 469–479.

Krugman, Paul. (1980), "Scale Economies, Product Differentiation, and the Pattern of Trade," *The American Economic Review*, 70(5), 950–959.

Levy, Santiago and Sweder van Wijnbergen (1995), "Transition Problems in Economic Reform: Agriculture in the North American Free Trade Agreement," *American Economic Review*, Vol. 85(4), September, 738-54.

Limão, Nuno (2016), "Preferential Trade Agreements," in *Handbook of Commercial Policy*, Vol. 1B, Kyle Bagwell and Robert Staiger (eds.), Chapter 6, 279-360, Amsterdam: North Holland.

Maliszewska, Maryla, Iryna Orlova and Svitlana Taran (2009), "Deep Integration with the EU and its Likely Impact on Selected ENP Countries and Russia," Case Network Report No. 88/2009. Available at: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1518342](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1518342)

Markusen, James R. (2002), *Multinational Firms and the Theory of International Trade*, Cambridge: MIT Press.

Markusen, James R. (1995), "Incorporating the Multinational Enterprise into the Theory of International Trade," *Journal of Economic Perspectives* Vol. 9, 169-189.

Markusen, James R. (1989), "Trade in Producer Services and in Other Specialized Intermediate Inputs," *American Economic Review*, Vol. 79, 85-95.

Markusen, James R. (2009), "Adapting the Knowledge Capital Model of Multinational Enterprise to Trade and Investment in Business Services," *The World Economy*, <https://doi.org/10.1111/j.1467-9701.2009.01155.x>

Markusen, James R., Thomas F. Rutherford and David G. Tarr (2005), "Trade and Direct Investment in Producer Services and the Domestic Market for Expertise," *Canadian Journal of Economics*, Vol 38 (3), 758-777.

Markusen, James R. and Anthony Venables (1998), "Multinational Firms and the New Trade Theory," *Journal of International Economics* Vol. 46, 183-204.

Martin, Will and L. Alan Winters (eds.) (1997), *The Uruguay Round and the Developing Countries*, Oxford: Oxford University Press.

Melitz, Marc J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, Vol. 71(6), 1695–1725

Melitz, Marc J. and Stephen J. Redding (2015), "New Trade Models, New Welfare Implications," *American Economic Review*, Vol. 105(3), 1105-1146.

Melo, Jaime de, and David G. Tarr (1990), "Welfare Costs of US Quotas in Textiles, Steel and Autos," *Review of Economics and Statistics*, August, 489-497.

Minor, Peter (2013), "Time as a Barrier to Trade: A GTAP Database of ad valorem Trade Time Costs," ImpactEcon, Second Edition, October. Available at: <http://mygtap.org/resources/>.

Petri, Peter (1997), "Foreign Direct Investment in a Computable General Equilibrium Framework," [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1549616](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1549616).

Petri, Peter A., Michael G. Plummer, and Fan Zhai (2012), "Trans-Pacific Partnership and Asia-Pacific Integration: A Quantitative Assessment," Washington, DC: Peterson Institute of International Economics.

Rutherford, Thomas F. (2002), "Lecture Notes on Constant Elasticity Functions." Available at: <http://www.gamsworld.org/mpsge/debreu/ces.pdf>

Rutherford, Thomas F., Elisabet E. Rutstrom and David G. Tarr (2000) "A Free Trade Agreement Between the European Union and a Representative Arab Mediterranean Country: A Quantitative Assessment," in Bernard Hoekman and Jamel Zarrouk (eds.), *Catching Up with the Competition: Trade Opportunities and Challenges for Arab Countries*, Ann Arbor: University of Michigan Press.

Rutherford, Thomas F., Elisabet E. Rutstrom and David G. Tarr (1997), "Morocco's Free Trade Agreement with the EU: A Quantitative Assessment," *Economic Modelling*, Vol. 14, No. 9, 237-269, April.

Rutherford, Thomas F. and David G. Tarr (2010), "Regional Impacts of Liberalization of Barriers against Foreign Direct Investment in Services," the case of Russia's accession to the WTO," *Review of International Economics*, Vol. 18(1), February, 30-46.

Rutherford, Thomas F. and David G. Tarr (2008), "Poverty Effects of Russia's WTO Accession: modeling 'real households' with endogenous productivity effects," *Journal of International Economics*, Vol 75 (1), pp 131-150.

Rutherford, Thomas F. and David G. Tarr (2003), "Regional Trading Arrangements for Chile: Do the Results Differ with a Dynamic Model?" *Economie Internationale*, No. 94-95, 2003, 261-282. Available at: <http://www.cairn.info/revue-economie-internationale-2003-2-page-261.html>.

Rutherford, Thomas F. and David G. Tarr (2002), "Trade Liberalization, product variety and growth in a small open economy: a quantitative assessment," *Journal of International Economics*, Vol. 56 (2), March, 247-272.

Schiff, Maurice and L. Alan Winters (2003), *Regional Integration and Development*, Oxford: Oxford University Press and the World Bank.

Sheptylo, O. and V. Vakhitov (2015), "Impact of Services Liberalization on Productivity of Manufacturing Firms" *Economics of Transition*, Vol. 23 (1), January, 1-44.

Smith, Alasdair, and Venables, Anthony J. (1988), "Completing the Internal Market in the European Community: Some Industry Simulations," *European Economic Review*, 32, 1501-1525.

Tarr, David G. (2014), *Applied Trade Policy Modeling in 16 Countries: Insights and Impacts from World Bank CGE Based Projects*, Singapore: World Scientific Publishers.

Tarr, David G. (2013), "Putting Services and Foreign Direct Investment with Endogenous Productivity Effects in Computable General Equilibrium Models," in *Handbook of Computable General Equilibrium Modeling*, Peter B. Dixon and Dale W. Jorgenson (eds.), Amsterdam: North Holland, Elsevier B.V., pp. 303-377.

Viner, Jacob (1950), "The Economics of Customs Unions," in *The Customs Union Issue*, P. Oslington (ed.), Oxford: Oxford University Press, 41-81.

Wonnacott, Paul and Ronald Wonnacott (1981), "Is Unilateral Tariff Reduction Preferable to a Customs Union? The Curious Case of the Missing Foreign Tariffs," *American Economic Review*, Vol. 71 (4), 704-714.

World Bank (2016), "Potential Macroeconomic Implications of the Trans-Pacific Partnership," *Global Economic Prospects*, Chapter 4, 218-255.

World Economic Forum (2012), *The Global Enabling Trade Report, 2012: Reducing Supply Chain Barriers*, edited by Robert Lawrence, Margareta Drzeniek Hanouz and Sean Doherty. Available at [www.weforum.org](http://www.weforum.org).

Zhai, Fan (2008), “Armington Meets Melitz: Introducing Firm Heterogeneity in a Global CGE Model of Trade,” *Journal of Economic Integration*, Vol. 23(3). September, 575-604.

**Table 1: Sectors, Factors of Production, Regions and Their Ownership Shares in Business Services of The Philippines**

<b>Sectors</b>	<b>Regions and their Ownership Percentages in Business Services of The Philippines</b>							
	Philippines	China and Hong Kong	Japan	India	USA	Korea, Australia and New Zealand	Rest of ASEAN	Rest of World
<b>Business Services</b>								
Business services nec	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communication	50.65	21.37	12.49	0.00	1.00	0.00	14.49	0.00
Financial services nec	82.45	1.00	1.00	1.00	1.15	1.68	2.48	9.23
Insurance	38.87	1.00	1.00	1.00	1.00	5.24	14.67	37.21
Air Transport	77.10	1.60	1.90	0.00	8.12	2.40	1.62	7.26
Water Transport	94.43	1.00	1.00	0.00	0.00	1.00	1.00	1.57
Other Transport	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>IRTS Goods</b>								
Beverages and Tobacco								
Chemicals Mineral and Metal products								
Electronic equipment								
Food Products								
Other manufacturing								
Petroleum and Coal Products								
Textiles and Apparel								
<b>Constant Returns to Scale Sectors</b>								
Agriculture and Forestry								
Meat and Dairy								
Other Services								
Primary Energy and Minerals								
Processed Rice								
Sugar								
Trade								
Utilities								
Wheat and cereal grains								
<b>Primary Factors of Production</b>								
		Compensation of unskilled employees						
		Compensation of skilled employees						
		Capital -- Gross operation surplus, mixed income						

**Table 2: Imports and Exports of The Philippines by Region and Sector of our Model**

Sector	China and Hong Kong				Korea Australia and New Zealand				China and Hong Kong				Korea Australia and New Zealand			
	Japan	India	USA	ASEAN	Rest of World	Japan	India	USA	New Zealand	ASEAN	World					
Wheat and cereal grains	0.001		0.006	0.672	0.367	0.018	0.126		0.000	0.000	0.000	0.000	0.000	0.000	0.001	
Agriculture and Forestry	0.329	0.011	0.038	0.118	0.046	0.192	0.330		0.536	0.962	0.003	0.233	0.349	0.088	0.620	
Primary Energy and Minerals	0.043	0.002	0.004	0.013	0.651	1.802	8.103		1.905	0.401	0.007	0.001	0.282	0.036	0.051	
Food Products	0.587	0.034	0.058	0.551	0.164	1.635	0.972		0.174	0.311	0.008	1.273	0.129	0.326	0.791	
Processed Rice	0.000	0.000	0.007	0.000	0.000	0.613	0.019		0.002	0.001	0.000	0.003	0.001	0.001	0.019	
Meat and Dairy	0.036	0.000	0.111	0.333	0.685	0.047	0.427		0.005	0.032	0.001	0.009	0.004	0.052	0.074	
Sugar	0.000	0.000	0.000	0.001	0.006	0.133	0.001		0.016	0.052	0.000	0.276	0.021	0.055	0.009	
Beverages and Tobacco	0.185	0.001	0.003	0.111	0.086	0.170	0.127		0.010	0.004	0.000	0.012	0.077	0.132	0.036	
Petroleum and Coal Products	1.897	0.132	0.007	0.019	0.680	1.385	0.845		0.078	0.004	0.002	0.014	0.027	0.462	0.364	
Textiles and Apparel	1.967	0.131	0.049	0.041	0.271	0.294	0.467		0.196	0.133	0.004	1.331	0.072	0.050	0.678	
Chemicals Mineral and Metal products	3.883	2.952	0.350	0.573	2.551	3.805	3.818		1.634	1.526	0.116	0.590	0.606	1.757	1.356	
Electronic equipment	1.813	2.258	0.015	1.717	2.108	3.257	4.384		8.684	1.164	0.139	3.230	1.397	3.124	6.376	
Other manufacturing	4.929	5.360	0.261	1.111	1.494	4.332	3.546		1.605	3.111	0.168	2.594	0.494	1.989	3.071	
Utilities	0.001	0.000	0.000	0.002	0.001	0.001	0.010		0.001	0.000	0.000	0.001	0.000	0.000	0.007	
Other Services	0.037	0.015	0.004	0.253	0.039	0.027	0.524		0.063	0.049	0.012	0.126	0.055	0.047	0.840	
Trade	0.415	0.005	0.003	0.046	0.017	0.020	0.240		0.048	0.028	0.009	0.095	0.040	0.031	0.568	
Transport nec	0.038	0.009	0.016	0.036	0.014	0.027	0.453		0.141	0.082	0.026	0.298	0.123	0.094	1.713	
Water Transport	0.006	0.002	0.001	0.005	0.003	0.008	0.069		0.013	0.021	0.006	0.022	0.019	0.015	0.233	
Air Transport	0.044	0.029	0.003	0.105	0.032	0.052	0.592		0.091	0.116	0.032	0.358	0.117	0.082	1.402	
Communication	0.006	0.002	0.004	0.023	0.004	0.008	0.145		0.024	0.012	0.008	0.083	0.021	0.031	0.545	
Financial services nec	0.020	0.008	0.005	0.108	0.009	0.016	0.330		0.016	0.010	0.004	0.042	0.013	0.011	0.243	
Insurance	0.006	0.005	0.004	0.055	0.005	0.009	0.191		0.006	0.003	0.001	0.020	0.003	0.004	0.066	
Business services nec	0.065	0.027	0.052	0.160	0.034	0.060	0.903		0.097	0.145	0.089	0.364	0.103	0.137	2.393	

**Source: GTAP 9 Database**

**Table 3: Ad Valorem Equivalents of Model Barriers: Filipino Tariffs, Time in Trade Costs, Cross-Border and FDI Services and Non-Tariff Measures\***

Sector	Tariffs on Imported Goods into the Philippines							Tariffs Against Exported Goods from the Philippines						
	China and Hong Kong	Japan	India	USA	Korea	Australia	Rest of	China	Japan	India	USA	Korea	Australi	Rest of
					New Zealand	ASEAN	World	Hong Kong	Japan	India	USA	New Zealand	World	
Wheat and cereal grains	2.3%		2.7%	3.4%	0.0%	1.9%	3.3%	0.7%						1.7% 0.2%
Agriculture and Forestry	1.1%	1.8%	11.3%	6.1%	1.0%	5.0%	5.8%	0.0%	8.0%	17.2%	0.6%	22.9%	5.0%	5.7%
Primary Energy and Minerals	0.7%	1.5%	2.3%	2.9%	0.0%	0.5%				3.7%		0.5%	0.1%	0.6%
Food Products	1.7%	3.1%	4.0%	4.8%	2.1%	0.4%	5.2%	0.5%	3.7%	37.0%	1.4%	12.2%	5.0%	9.2%
Processed Rice	50.0%	50.0%	50.0%	44.9%	5.0%	47.8%					0.5%			0.5%
Meat and Dairy	4.8%	9.6%	8.0%	8.4%	0.7%	1.1%	13.3%		6.3%	5.7%	7.0%	5.3%	2.0%	10.7%
Sugar	26.6%	4.0%	39.4%	9.2%	40.3%	5.0%	13.6%	49.8%	19.0%		11.1%	0.1%	5.0%	22.7%
Beverages and Tobacco	7.7%	4.4%	10.1%	4.3%	0.4%	0.9%	6.5%	1.6%	3.2%	101.0%	6.4%	12.4%	5.0%	20.6%
Petroleum and Coal Products	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.2%	4.3%	0.1%	0.4%	0.2%	1.5%
Textiles and Apparel	0.8%	0.1%	5.8%	6.3%	1.9%	0.2%	9.0%		0.3%	12.0%	13.0%	7.0%	5.0%	10.7%
Chemicals Mineral and Metal products	0.7%	2.1%	3.4%	4.7%	0.7%	0.9%	3.6%	0.3%	0.0%	6.9%	0.2%	1.5%	1.5%	3.0%
Electronic equipment	0.1%	0.4%	0.2%	1.3%	0.0%	0.6%	0.9%	0.1%		1.3%	0.0%	0.1%	0.2%	0.3%
Other manufacturing	1.9%	2.7%	10.3%	4.4%	5.6%	0.4%	4.7%	0.4%	0.2%	9.1%	0.6%	1.5%	5.0%	2.0%
<b>Time in Trade Costs on Imports into The Philippines</b>														
Wheat and cereal grains														
Agriculture and Forestry	16.3%	5.5%	9.3%	13.3%	7.9%	9.7%	10.2%	19.6%	21.0%	12.6%	16.0%	21.0%	12.3%	18.7%
Primary Energy and Minerals	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.4%
Food Products	10.1%	10.0%	9.2%	10.7%	11.2%	9.5%	10.6%	9.4%	8.1%	8.8%	9.2%	8.5%	11.4%	7.7%
Processed Rice														
Meat and Dairy	10.2%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	11.5%	11.5%	11.5%	11.5%	11.5%	11.6%	11.5%
Sugar														
Beverages and Tobacco	3.5%	3.4%	3.3%	3.4%	3.5%	3.4%	3.5%	4.1%	4.1%	3.8%	3.9%	4.0%	3.9%	4.0%
Petroleum and Coal Products	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%
Textiles and Apparel	4.1%	4.4%	4.5%	4.7%	4.1%	6.4%	4.6%	5.4%	5.1%	4.2%	4.8%	4.7%	4.3%	4.7%
Chemicals Mineral and Metal products	9.0%	9.4%	8.3%	9.0%	10.3%	10.0%	8.5%	12.8%	11.7%	12.7%	10.9%	12.3%	11.3%	11.4%
Electronic equipment	2.5%	2.2%	3.4%	1.6%	1.9%	2.3%	5.6%	2.4%	3.2%	2.6%	2.7%	2.8%	2.2%	5.0%
Other manufacturing	4.7%	5.2%	10.7%	5.9%	6.9%	7.6%	6.1%	4.0%	4.4%	7.4%	4.4%	4.1%	5.8%	5.1%
<b>Services Barriers</b>														
	Discriminatory Against FDI		Cross Border											
<b>Transport nec</b>	30.0%		21.9%											
<b>Water Transport</b>	33.0%		21.9%											
<b>Air Transport</b>	30.0%		21.9%											
<b>Communication</b>	32.0%		6.6%											
<b>Financial services nec</b>	29.0%		6.6%											
<b>Insurance</b>	19.0%		6.6%											
<b>Business services nec</b>	49.0%		0.0%											

\* AVEs of NTMs in each region for agriculture and manufacturing, respectively are: Philippines: 34.3, 15.4; Australia, Korea, New Zealand: 23.5, 7.4; China: 6.1, 5.1; Japan: 23.6, 3.8; India: 26.2, 4.8; Rest of ASEAN: 26.7, 7.2; United States: 14.8, 3.3; Rest of World: 11.7, 3.7.

\*\*Tariffs on all services are zero.

Source: GTAP 9 database for tariffs; Jafari and Tarr (2015) for FDI barriers; cross-border services non-tariff barriers are mapped into our sectors from estimates by Francois, Hoekman and Woerz (2007); time in trade calculations are trade-weighted from data in Minor (2013); and AVEs in goods from Kee *et al.* (2009).

**Table 4: Key Model Elasticities\***

	Unadjusted Armington Elasticities		Dixit-Stiglitz	Pareto shape
	Import-Domestic	Import-Import		
<b>Constant Returns to Scale Sectors</b>	sigma_dm	sigma_mm		
Agriculture and Forestry	4.6	4.6		
Meat and Dairy	8.0	8.0		
Other Services	3.8	3.8		
Primary Energy and Minerals	11.3	11.3		
Processed Rice	5.2	5.2		
Sugar	5.4	5.4		
Trade	3.8	3.8		
Utilities	5.6	5.6		
Wheat and cereal grains	5.7	5.7		
<b>Business Services</b>				
Business services nec	3.0	3.0	3.0	4.6
Communication	3.0	3.0	3.0	4.6
Financial services nec	3.0	3.0	3.0	4.6
Insurance	3.0	3.0	3.0	4.6
Air Transport	3.0	3.0	3.0	4.6
Water Transport	3.0	3.0	3.0	4.6
Other Transport	3.0	3.0	3.0	4.6
<b>IRTS Goods</b>				
Beverages and Tobacco	2.9	2.9	2.9	4.6
Chemicals Mineral and Metal products	2.9	2.9	2.9	4.6
Electronic equipment	4.2	4.2	4.2	4.6
Food Products	4.7	4.7	4.7	4.6
Other manufacturing	4.0	4.0	4.0	4.6
Petroleum and Coal Products	4.8	4.8	4.8	4.6
Textiles and Apparel	5.1	5.1	5.1	4.6

\*Additional elasticities:

**Supply elasticities** corresponding to the specific factor in all IRTS goods and Business Services sectors are 3.0 for The Philippines, India and Rest of ASEAN; 4.0 for China; and 5.0 for all other regions;

**Labor Supply elasticity** with respect to the real wage is 0.2;

**Elasticity of Transformation** between Domestic Output and Exports in all Armington sectors is 4;

**Elasticity of substitution between value-added and services** is 1.25;

**Elasticity of substitution between intermediates** is 0.5;

**Elasticity of substitution between labor and capital** is 1.0.

**Table 5: Impacts of RCEP with the Krugman and Armington Structures**

(results are percentage change from initial equilibrium, unless otherwise indicated)

Benchmark	RCEP	Krugman Structure (FDI and IRTS Goods)									Armington RCEP
		Cross-border Services		Import Trade Facilitation	Export Trade Facilitation		RCEP Partner Tariffs Only		Import NTMs Only	RCEP Partner NTMs Only	
		FDI Services Barriers Only	Services Barriers Only	Only	Only	Only	Tariffs Only	NTMs Only	NTMs Only	NTMs Only	
<b>Scenario definition</b>		1	2	3	4	5	6	7	8	9	10
RCEP FDI barriers (% reduction)		50	50								50
Cross-border services barriers (% reduction)		50		50							50
Import Trade Facilitation (% reduction for RCEP countries)		20			20						20
Import Trade Facilitation (% reduction for non-RCEP countries)		5			5						5
Export Trade Facilitation (% reduction)		20				20					20
Export Trade Facilitation (% reduction for non-RCEP countries)		5				5					5
Tariffs on Filipino Imports from RCEP (% reduction)		100					100				100
Tariffs on Filipino Exports to RCEP (% reduction)		100						100			100
NTMs on Filipino Imports from RCEP (% reduction)		20							20		20
NTMs on Filipino Exports by RCEP partners (% reduction)		20								20	20
Elasticity of Substitution Multiplier		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.24
FDI Elasticity Multiplier		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	30.00
<b>Aggregate welfare</b>											
Welfare (EV as % of consumption)		3.1	0.9	0.0	0.5	0.3	0.0	0.4	0.3	0.5	1.5
Welfare (EV as % of GDP)		2.5	0.7	0.0	0.4	0.2	0.0	0.3	0.3	0.4	1.2
<b>Government budget</b>											
Tariff revenue (% of GDP)		0.3	0.7	0.7	0.7	0.7	0.3	0.7	0.7	0.7	0.4
Tariff revenue		-48.9	1.0	0.0	0.7	1.2	-50.3	1.2	0.2	1.6	-47.5
<b>Aggregate trade</b>											
Real exchange rate		0.4	0.8	0.0	0.3	-0.5	0.6	-0.5	0.2	-0.5	-0.2
Aggregate exports		11.6	1.6	0.0	1.5	1.0	2.4	1.3	1.1	1.9	10.8
<b>FDI Output</b>		30.0	<b>26.8</b>	0.0	0.7	0.3	0.4	0.3	0.4	0.3	25.9
<b>Factor Earnings</b>											
Skilled labor		2.2	0.9	0.0	0.5	0.1	0.2	0.0	0.3	0.2	1.0
Unskilled labor		3.9	0.7	0.0	0.2	0.5	-0.1	1.3	0.0	0.7	2.6
Capital		3.3	1.1	0.0	0.4	0.3	0.4	0.3	0.2	0.5	2.0
<b>Diagnostics*</b>											
Feenstra Ratio Summary		100.84%	100.26%	100.00%	100.09%	100.08%	100.10%	100.09%	100.05%	100.14%	100.00%
Terms of trade		100.01%	99.96%	100.00%	99.61%	100.31%	99.52%	100.38%	99.69%	100.47%	100.36%

\*The percentage change is the value indicated minus 100.

Source: Authors' estimates

**Table 6: Impacts of RCEP with the Melitz and Armington Structures**

(results are percentage change from initial equilibrium, unless otherwise indicated)

Benchmark	Melitz Structure (FDI and IRTS Goods)									Armington RCEP	
	RCEP	Cross-border Services		Import Trade		Export Trade		RCEP			
		FDI Services Barriers Only	Services Barriers Only	Facilitation Only	Facilitation Only	Import Tariffs Only	Partner Tariffs Only	Import NTMs Only	RCEP Partner NTMs Only		
<b>Scenario definition</b>	1	2	3	4	5	6	7	8	9	10	
RCEP FDI barriers (% reduction)	50	50								50	
Cross-border services barriers (% reduction)	50		50							50	
Import Trade Facilitation (% reduction for RCEP countries)	20			20						20	
Import Trade Facilitation (% reduction for non-RCEP countries)	5			5						5	
Export Trade Facilitation (% reduction)	20				20					20	
Export Trade Facilitation (% reduction for non-RCEP countries)	5				5					5	
Tariffs on Filipino Imports from RCEP (% reduction)	100					100				100	
Tariffs on Filipino Exports to RCEP (% reduction)	100						100			100	
NTMs on Filipino Imports from RCEP (% reduction)	20							20		20	
NTMs on Filipino Exports by RCEP partners (% reduction)	20								20	20	
Pareto Shape Multiplier	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.00	
Elasticity of Substitution Multiplier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.24	
FDI Elasticity Multiplier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	30.00	
<b>Aggregate welfare</b>											
Welfare (EV as % of consumption)	2.1	0.9	0.0	0.4	0.2	-0.1	0.2	0.2	0.3	1.5	
Welfare (EV as % of GDP)	1.7	0.7	0.0	0.3	0.1	-0.1	0.1	0.2	0.2	1.2	
<b>Government budget</b>											
Tariff revenue (% of GDP)	0.4	0.7	0.7	0.7	0.7	0.3	0.7	0.7	0.7	0.4	
Tariff revenue	-47.5	1.0	0.0	0.8	1.0	-49.4	1.1	0.4	1.3	-47.5	
<b>Aggregate trade</b>											
Real exchange rate	0.3	0.8	0.0	0.3	-0.5	0.5	-0.5	0.2	-0.5	-0.2	
Aggregate exports	11.4	1.6	0.0	1.4	1.0	2.3	1.2	1.1	2.0	10.8	
<b>FDI Output</b>	28.6	<b>26.8</b>	0.0	0.5	0.1	0.2	0.1	0.3	0.1	25.9	
<b>Factor Earnings</b>											
Skilled labor	1.5	0.9	0.0	0.4	0.0	0.1	-0.2	0.2	0.0	1.0	
Unskilled labor	3.3	0.7	0.0	0.1	0.4	-0.2	1.2	0.0	0.5	2.6	
Capital	2.6	1.1	0.0	0.3	0.2	0.3	0.2	0.2	0.3	2.0	
<b>Diagnostics*</b>											
Feenstra Ratio Summary	100.42%	100.27%	100.00%	100.03%	100.01%	100.04%	100.01%	100.01%	100.04%	100.00%	
Terms of trade	100.15%	99.98%	100.00%	99.63%	100.33%	99.56%	100.40%	99.71%	100.49%	100.36%	

\*The percentage change is the value indicated minus 100.

Source: Authors' estimates

\*

**Table 7: Impacts of RCEP with the Armington Model: Decomposed Results**

(results are percentage change from initial equilibrium, unless otherwise indicated)

Benchmark	RCEP	Armington Structure								
		FDI Services Barriers Only		Cross-border Services Barriers Only	Import Trade Facilitation Only	Export Trade Facilitation Only	Import Tariffs Only	RCEP Partner Tariffs Only	Import NTMs only	RCEP Partner NTMs Only
		1	2	3	4	5	6	7	8	9
<b>Scenario definition</b>										
RCEP FDI barriers (% reduction)		50	50							
Cross-border services barriers (% reduction)		50		50						
Import Trade Facilitation (% reduction for RCEP countries)		20			20					
Import Trade Facilitation (% reduction for non-RCEP countries)		5			5					
Export Trade Facilitation (% reduction)		20				20				
Export Trade Facilitation (% reduction for non-RCEP countries)		5				5				
Tariffs on Filipino Imports from RCEP (% reduction)		100					100			
Tariffs on Filipino Exports to RCEP (% reduction)		100						100		
NTMs on Filipino Imports from RCEP (% reduction)		20							20	
NTMs on Filipino Exports by RCEP partners (% reduction)		20								20
Elasticity of Substitution Multiplier		1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
FDI Elasticity Multiplier		30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
<b>Aggregate welfare</b>										
Welfare (EV as % of consumption)		1.5	0.3	0.0	0.4	0.2	-0.1	0.2	0.2	0.2
Welfare (EV as % of GDP)		1.2	0.2	0.0	0.3	0.1	-0.1	0.2	0.2	0.2
<b>Government budget</b>										
Tariff revenue (% of GDP)		0.4	0.7	0.7	0.7	0.7	0.3	0.7	0.7	0.7
Tariff revenue		-47.5	0.5	0.0	0.9	1.1	-49.4	1.2	0.5	1.6
<b>Aggregate trade</b>										
Real exchange rate		-0.2	0.5	0.0	0.3	-0.6	0.5	-0.5	0.2	-0.5
Aggregate exports		10.8	1.0	0.0	1.4	1.0	2.2	1.3	1.1	2.0
<b>FDI Output*</b>		25.9	<b>24.4</b>	0.0	0.5	0.1	0.1	0.1	0.3	0.0
<b>Factor Earnings</b>										
Skilled labor		1.0	0.4	0.0	0.3	0.0	0.1	-0.1	0.3	0.0
Unskilled labor		2.6	0.3	0.0	0.1	0.4	-0.3	1.2	-0.1	0.5
Capital		2.0	0.5	0.0	0.2	0.2	0.3	0.2	0.2	0.3
<b>Diagnostics**</b>										
Feenstra Ratio Summary		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Terms of trade		100.36%	99.98%	100.00%	99.66%	100.37%	99.60%	100.42%	99.73%	100.56%

\*We impose an upper bound of 90 on the elasticity of substitution between FDI and domestic business services (30 times the Krugman value of  $\sigma=3$ ); in this case, we fall short of fully matching the FDI response in the Krugman model.

\*\*The percentage change is the value indicated minus 100.

Source: Authors' estimates

**Table 8: Sensitivity to the Spillover Assumption: Comparison Across Market Structures**  
**Results are percentage change unless otherwise indicated**

	RCEP	FDI Services Barriers Only	Cross-border Services Barriers Only	Import Trade Facilitation Only	Export Trade Facilitation Only	Import Tariffs Only	RCEP Partner Tariffs Only	Import NTMs	RCEP Partner NTMs only
<b>Scenario definition</b>	1	2	3	4	5	6	7	8	9
RCEP FDI barriers (% reduction for RCEP countries)	50	50							
RCEP FDI barriers (% reduction for non-RCEP countries)	10	10							
Cross-border services barriers (% reduction for RCEP countries)	50		50						
Cross-border services barriers (% reduction for non-RCEP countries)	10		10						
Import Trade Facilitation (% reduction for RCEP countries)	20			20					
Import Trade Facilitation (% reduction for non-RCEP countries)	5			5					
Export Trade Facilitation (% reduction)	20				20				
Export Trade Facilitation (% reduction for non-RCEP countries)	5				5				
Tariffs on Filipino Imports from RCEP (% reduction)	100					100			
Tariffs on Filipino Exports to RCEP (% reduction)	100						100		
NTMs on Filipino Imports from RCEP (% reduction for RCEP countries)	20							20	
NTMs on Filipino Imports from RCEP (% reduction for non-RCEP count)	5							5	
NTMs on Filipino Exports to RCEP (% reduction)	20								20
Pareto Shape Multiplier--Melitz	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Elasticity of Substitution Multiplier--Melitz	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FDI Elasticity Multiplier--Melitz	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Elasticity of Substitution Multiplier--Armington	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
FDI Elasticity Multiplier--Armington	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
<b>Aggregate welfare</b>									
EV as % of consumption--Krugman	4.9	2.7	0.0	0.5	0.3	0.0	0.4	0.4	0.5
EV as % of consumption--Melitz	3.9	2.6	0.0	0.4	0.2	-0.1	0.2	0.3	0.3
EV as % of consumption--Armington	2.3	1.2	0.0	0.4	0.2	-0.1	0.2	0.3	0.2
<b>Aggregate Exports</b>									
Krugman	13.7	3.4	0.1	1.5	1.0	2.4	1.3	<b>1.2</b>	1.9
Melitz	13.1	3.1	0.1	1.4	1.0	2.3	1.2	<b>1.2</b>	2.0
Armington	11.7	1.7	0.1	1.4	1.0	2.2	1.3	<b>1.2</b>	2.0
<b>FDI Output</b>									
Krugman	29.2	<b>26.0</b>	0.0	0.7	0.3	0.4	0.3	0.5	0.3
Melitz	27.8	<b>26.0</b>	0.0	0.5	0.1	0.2	0.1	0.4	0.1
Armington*	23.3	<b>21.8</b>	0.0	0.5	0.1	0.1	0.1	0.3	0.0
<b>Diagnostics**</b>									
Feenstra Ratio Summary--Krugman	101.53%	100.93%	100.00%	100.09%	100.08%	100.10%	100.09%	100.05%	100.14%
Feenstra Ratio Summary--Melitz	101.12%	100.96%	100.00%	100.03%	100.01%	100.04%	100.01%	100.01%	100.04%
Terms of trade--Krugman	99.93%	99.90%	100.00%	99.61%	100.31%	99.52%	100.38%	99.67%	100.47%
Terms of trade--Melitz	100.14%	100.00%	100.00%	99.63%	100.33%	99.56%	100.40%	99.69%	100.49%
Terms of trade--Armington	100.34%	99.98%	100.00%	99.66%	100.37%	99.60%	100.42%	99.71%	100.56%

\*We impose an upper bound of 90 on the elasticity of substitution between FDI and domestic business services (30 times the Krugman value of  $\sigma=3$ ); in this case, we fall short of fully matching the FDI response in the Krugman model.

\*\*The percentage change is the value indicated minus 100.

Source: Authors' estimates

**Table 9: Sensitivity to the Trade and FDI Responses Across Market Structures  
Welfare is Hicksian Equivalent Variation (EV) as a Percent on Benchmark Consumption**

	Low Trade or FDI Response			Central Trade or FDI Response			High Trade or FDI Response		
	Armington	Krugman	Melitz	Armington	Krugman	Melitz	Armington	Krugman	Melitz
<b>Scenario: Import NTMs.</b>									
Percent change in aggregate exports (calibration target)	1.06	1.06	1.06	1.08	1.08	1.08	1.19	1.19	1.19
Multiplier on Pareto shape value in table times 4.58 (a=4.58)*	NA	NA	0.9	NA	NA	0.975	NA	NA	1.5
Multiplier on domestic presence business-services substitution elasticities, value in table times $\sigma = 3$	1	1	1	1	1	1	1	1	1
Multiplier on non-business-services substitution elasticities**	1.21	0.965	1	1.235	1	1	1.37	1.125	1
EV (% of measured consumption in the benchmark)	0.25	0.33	0.25	0.24	0.32	0.24	0.24	0.31	0.22
<b>Scenario: FDI Services Barriers Only</b>									
Percent change in aggregate FDI (calibration target)	24.4	26.3	26.3	24.4	26.8	26.8	24.4	27.1	27.1
Multiplier on Pareto shape value in table times 4.58 (a=4.58)	NA	NA	0.975	NA	NA	0.98	NA	NA	0.98
Multiplier on domestic presence business-services substitution elasticities, value in table times $\sigma = 3$ ***	30	1.5	1.5	30	1	0.995	30	0.9	0.9
Multiplier on non-business-services substitution elasticities**	1.235	1	1	1.23	1	1	1.23	1	1
EV (% of measured consumption in the benchmark)	0.31	0.63	0.63	0.31	0.89	0.90	0.31	1.02	1.02

\*For a solution to the Melitz model, the Pareto shape parameter is restricted to be greater than the elasticity of substitution minus one:  $a(i) > [\sigma(i)-1]$ ; since  $\sigma(i) = 5.1$  in textiles and apparel, we must restrict  $a > 4.1$ . Then our multiplier on “a” may not be below .9

\*\*See table 4 for central values of the parameters.

\*\*\*We set an upper bound on the elasticity of substitution between FDI and domestically provided business services of 90 (=30 times the central value in Krugman of  $\sigma=3$ ). The Armington model still falls short of fully replicating the FDI response in the Krugman model.

Source: Authors’ estimates

**Table 10: Piecemeal Parameter Sensitivity of the Krugman Model Welfare Estimates**  
**RCEP Scenario: Welfare Results are Equivalent Variation (EV) as a percentage of consumption**

Parameter	Parameter Value			%EV RCEP			
	Lower	Central	Upper	Lower	Central	Upper	
$\sigma(v_a, b_s)**$	0.75	1.25	1.75		2.89	3.08	3.30
$\sigma(q_i, q_j)$ – services sectors	2.75	3.00	3.75		3.22	3.08	2.85
$\sigma(q_i, q_j)$ – goods sectors*	x0.75	x1	x1.5		3.47	3.08	2.72
$\sigma(D, M)$	x0.75	x1	x1.5		3.04	3.08	3.15
$\epsilon(LS)$	0.10	0.20	0.30		3.02	3.08	3.14
$\sigma(L, K)$	0.50	1.00	1.50		3.08	3.08	3.08
$\sigma(A_1, \dots, A_n)$	0.00	0.50	1.00		2.88	3.08	3.27
$\sigma(D, E)$	3.00	4.00	5.00		3.06	3.08	3.10
$\epsilon(\text{Philippines})$	3.00	4.00	6.00		3.08	3.08	3.07
$\epsilon(\text{RCEP})^*$	x0.75	x1	x1.5		2.66	3.08	3.92
$\epsilon(\text{non-RCEP})^*$	3.75	5.00	7.50		3.11	3.08	3.03

\*We scale all the relevant elasticities in table 4 by the number indicated in this table.

Source: Authors' estimates.

Key:

$\sigma(v_a, b_s)$ : Elasticity of substitution between value-added and business services

$\sigma(q_i, q_j)$ : Elasticity of substitution between firm varieties in imperfectly competitive sectors

$\sigma(D, M)$ : Elasticity of substitution between domestic and imported varieties

$\epsilon(LS)$ : Elasticity of labor supply

$\sigma(L, K)$ : Elasticity of substitution between primary factors of production in value added

$\sigma(A_1, \dots, A_n)$ : Elasticity of substitution in intermediate production between composite Armington aggregate goods

$\sigma(D, E)$ : Elasticity of transformation (domestic output versus exports)

$\epsilon(\text{Philippines})$ : Elasticity of national service firm supply with respect to price of output

$\epsilon(\text{RCEP})$ : Elasticity of RCEP IRTS firms with respect to price of output in the Philippines

$\epsilon(\text{non-RCEP})$ : Elasticity of non-RCEP IRTS firm supply with respect to price of output in Belarus