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Economic determinants of free trade agreements

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Abstract

The purpose of this study is to provide the first systematic empirical analysis of the economic determinants of the formation of free trade agreements (FTAs) and of the likelihood of FTAs between pairs of countries using a qualitative choice model. We develop this econometric model based upon a general equilibrium model of world trade with two factors of production, two monopolistically-competitive product markets, and explicit intercontinental and intracontinental transportation costs among multiple countries on multiple continents. The empirical model correctly predicts, based solely upon economic characteristics, 85% of the 286 FTAs existing in 1996 among 1431 pairs of countries and 97% of the remaining 1145 pairs with no FTAs.

Keywords: Free trade agreements; International trade; Qualitative choice models

JEL classification: F11; F12; F15

1. Introduction

> Free trade areas may well be an endogenous variable—that is, a response to, rather than a source of, large trade flows. . .. Presumably, (governments) are more likely to form free trade areas, (if) the benefits outweigh the costs. (Lawrence, 1998, p. 59)

Ever since Viner (1950), international economists have debated whether or not free trade agreements (FTAs)—on net—enhance or reduce economic agents' welfare. While

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most of the literature has focused on theoretical welfare gains or losses from FTAs for member (and nonmember) countries, there is no study in the literature that has tried to explain—or predict—FTAs between pairs of countries. As the quote above notes, FTAs may well be an endogenous variable. Lawrence's remark should come as no surprise to trade economists as there is a large literature in international economics on endogenous trade policy. While a large literature exists explaining empirically tariff and nontariff barriers cross-sectionally, no study has analyzed econometrically cross-sectional determinants of FTAs—much less one based upon a formal economic model.

The goal of this paper is to determine key economic factors influencing the likelihood of pairs of countries forming an FTA in a given year, based upon a qualitative choice methodology. We hope to provide an empirical benchmark for the determinants of FTAs, upon which strategic and political factors can be embedded subsequently. Qualitative choice models were designed to provide economists with the ability to evaluate decision behavior when choices are discrete (e.g. voting 'yes' or 'no') and characteristics of the population are unobservable (e.g. utility gain or loss from a policy decision). The decision to form an FTA is essentially a binary choice by a pair of countries' governments since, according to the GATT's Article XXIV, only complete (no partial) FTAs can be formed between a pair of countries. Qualitative choice models provide a framework to estimate the probability that a pair of governments are making a decision as if maximizing their respective agents' utilities.

What economic factors should influence the likelihood of an FTA? In his seminal survey of the theory of customs unions, Lipsey (1960) stated: "If one wishes to predict the welfare effects of a customs union it is necessary to predict the relative strengths of the forces causing trade creation and trade diversion (p. 498)". For the impatient reader, we find that trade-creating and trade-diverting economic characteristics matter considerably in explaining the probability of an FTA. Pairs of countries with FTAs tend to have the particular economic characteristics that the theory suggests should enhance the two countries' net trade creation and welfare (though possibly reducing nonmembers' net welfare). We find strong evidence that pairs of countries' governments tend to form FTAs: (i) the closer are two countries in distance; (ii) the more remote a pair of continental trading partners is from the rest of the world (ROW); (iii) the larger and more similar in economic size are two trading partners; (iv) the greater the difference of capital–labor ratios between two partners; and (v) the smaller the difference of the members' capital–labor ratios with respect to the ROW's capital–labor ratio. In the case of our framework, these 'pure economic' characteristics can predict accurately 85% of the 286 FTAs existing among 1431 country pairs in 1996 for which data were available and 97% of the remaining 1145 country pairs with no FTAs.

The remainder of the paper is as follows. Section 2 motivates the analysis. Section 3 presents the theoretical model. Section 4 discusses the econometric methodology and data requirements. Section 5 discusses simulations demonstrating theoretical relationships between the utility changes from an FTA and intercontinental and intracontinental transport costs, countries' real GDPs, and relative factor endowments, and presents empirical results on 'testable' hypotheses. Section 6 presents an evaluation of the robustness of the empirical results. Section 7 presents estimates of quantitative effects of typical changes in various economic characteristics on probabilities of FTAs. Section 8 interprets the results. Section 9 concludes.

2. Motivation and related literature

> The pure economic theory of trading blocs is essentially part of the broader theory of preferential trading arrangements. This theory... is a subject of inherent complexity and ambiguity; theory per se identifies the main forces at work, but offers few presumptions about what is likely to happen in practice. To make any headway, one must either get into detailed empirical work, or make strategic simplifications and stylizations that one hopes do not lead one too far astray. Obviously *detailed empirical work is the right direction*... (Krugman, 1993, p. 60; italics added)

Krugman (1991b) delineated sharply for the 1990s the debate on the relative merits of regional FTAs. In that paper, he appropriately separated discussions of the (pure) 'economics of trading blocs' and the 'political economy of FTAs'. In the 1990s, the debate about regional FTAs has subsequently followed these tracks. The 'economics' of trading blocs literature addresses FTAs in a competitive framework, either perfect or monopolistic competition. Baldwin and Venables (1995) discuss the economics of FTAs in terms of competitive frameworks[1]. Rodrik's (1995) survey addresses political economy frameworks. We discuss each approach in turn, with our focus on the former.

In addressing the economics of FTAs, Krugman (1991a,b) addressed the relative merits of FTAs in a static monopolistically-competitive framework, but emphasized economic geography. With zero intercontinental transport costs, continental FTAs decrease welfare unambiguously. With prohibitive intercontinental transport costs, such agreements increase welfare unambiguously. Krugman (1991b) concluded that, because most FTAs are among 'natural' trading partners, the likelihood of much trade diversion was small and "prospective moves toward regional free trade would almost surely do more good than harm to the members of the free trade areas" (p. 21). However, in a subsequent commentary, Bergsten (1991) noted: "This is an empirical question on which Krugman offers little supportive evidence" (p. 48). Our paper is concerned with providing supportive evidence.

The Krugman work led Frankel (1997), Frankel et al. (1995, 1996, 1998) to investigate the continuum between zero and prohibitive intercontinental transport costs. First, for high intercontinental transport costs, FTAs between countries geographically close—that is, continental or natural FTAs—are welfare enhancing on net and should lead social planners in these countries to adopt FTAs, because large intracontinental trade creation would

[1] The static effects are the net gains to a country's representative household from an FTA due to changes in trade volumes, trade distortion costs, or terms of trade that would arise in a perfectly competitive framework (with constant returns). These potential gains would be supplemented in the monopolistically competitive framework with scale and variety effects. The potential dynamic gains arise once factor accumulation is allowed, leading to potential investment creation and diversion.

dominate small intercontinental trade diversion. However, as intercontinental transport costs fall, continental FTAs may become welfare decreasing. Second, for any level of intercontinental transport costs, FTAs between countries geographically distant or on separate continents—that is, unnatural FTAs—are welfare decreasing and should lead countries' social planners to avoid FTAs, as the welfare loss from intracontinental trade diversion exceeds the welfare gain from intercontinental trade creation.

In the context of a qualitative choice framework with social planners, the FSW analysis suggests two hypotheses. First, all else constant, the more remote from the ROW are continental trading partners, the more likely an FTA will be formed due to less potential trade diversion. Second, the more natural (i.e. closer in distance) are two trading partners, the more likely an FTA will be formed by the countries' governments due to more potential trade creation. Consequently, the FSW model suggests two economic factors that could predict FTAs.

However, the Krugman and FSW theoretical results were generated in a model with identical economies, one industry and zero intracontinental transport costs. In reality, the world is not so generous as to make countries identical in terms of economic size or relative factor endowments, nor are intracontinental transport costs zero. As even noted in comments on Frankel et al. (1998) by Krugman (1998), the restriction of identical economic sizes may not be innocuous:

> My second, more analytical, concern is with the way Frankel, Stein, and Wei map the theoretical model onto the real world... there is a crucial assumption in the model that is not nearly true of the real world: that countries themselves are of equal economic size. In reality, of course, the size distribution of GDPs is highly unequal, and this surely makes a major difference when we try to model the effects of integration. (p. 115)

See Srinivasan (1998) and Panagariya (2000) for more on the problems raised by the symmetry assumption.

Second, the models in Krugman and FSW assume a world with one factor and one industry. As noted in Deardorff and Stern (1994) and Haveman (1996), such a model precludes trade in traditional comparative advantages, such as Heckscher–Ohlin trade. By eliminating traditional comparative advantages, the model may be relying too heavily on imperfect substitution among products that 'stacks the cards' against bilateralism.

Third, the Krugman and FSW models assume intra-continental transport costs are zero. Just as FSW noted Krugman's conclusions are sensitive to intercontinental transport costs, Nitsch (1996) challenged the FSW work by noting that the results are sensitive to intracontinental transport costs. Nitsch argued that introducing an intra-continental transport cost may cause the FSW phenomenon of 'supernatural' FTAs to disappear[2]. In FSW, the assumption of zero intracontinental transport costs is not innocuous; the trade diversion effect on welfare of a continental FTA is enhanced with zero intracontinental transport costs.

[2] In Frankel et al. (1995), the term 'supernatural FTA' refers to a continental FTA that is welfare-reducing on net due to low intercontinental transport costs.

Our paper generalizes the Krugman–FSW model to allow for economies with different absolute and relative factor endowments, and intra- as well as inter-continental transport costs. In our framework, governments are assumed to maximize their citizens' economic welfare. The net welfare gain or loss of two countries from forming an FTA depends on the trade creation versus trade diversion of the members. Economic determinants of trade creation and diversion can be categorized into three groups. The first is economic geography factors. Trade creation is greater the closer are two countries, and trade diversion is less the more remote two (continental) trading partners are from the ROW. The second category is intra-industry trade determinants. Trade creation is greater the larger and more similar are two countries' economic sizes, and trade diversion is less the smaller is the economic size of the ROW. The third category is inter-industry trade determinants. Trade creation is greater the wider are relative factor endowments between two countries, and trade diversion is less the smaller the difference between the relative factor endowments of the pair and that of the ROW. We find empirical support for all three groups of characteristics in predicting FTAs.

We now discuss briefly issues that we do not address to make our analysis tractable and to limit the paper's scope and length. First, as noted, the alternative track to the 'pure economics' of FTAs is the literature on the 'political economy' of FTAs. The latter literature is concerned largely with explaining theoretically the level of trade liberalization in general, or an FTA in particular, based on the relevant economic actors in an imperfect market structure with little competition. In the absence of special interest lobbies or distributional preferences, a government would act as a social planner, maximizing welfare of the country's agent.

As this paper is the first attempt to explain empirically the determinants of FTAs, we choose here to assume a social planner for each country that maximizes consumer welfare. While political lobbies and government distributional preferences may well influence FTA decisions, we intentionally ignore these factors initially to limit the scope and enhance the tractability of our analysis[3]. We find empirical support for our approach in Goldberg and Maggi (1999) which found "the weight of (consumer economic) welfare in the government's objective function is many times larger than the weight of (political) contributions" (p. 1135; italics added). Specifically, they estimated the weight of consumer welfare (political contributions) in government trade policy decisions to be 98% (2%)[4]. Our empirical investigation of select economic determinants of FTAs, based upon a model with monopolistically competitive firms and a social planner maximizing consumer welfare, consequently complements the political economy literature on empirical determinants of trade protection. Our paper intends to develop an empirical 'benchmark' for economic factors, hoping future research will address empirically political economy factors.

Second, we assume that the decision for a pair of countries' governments to form an FTA is based upon the welfare of only representative agents of the country pair, and ignore the possible net welfare loss to nonmember countries. We assume a social planner for each

[3] Moreover, we do not create any explicit coalition-formation structure in the model, as in Bond and Syropoulos (1996).

[4] Using a similar framework, Gawande and Bandyopadhyay (2000) estimated an even higher relative weight for consumer welfare versus contributions; their estimate ($a = 3175$) implies a welfare weight of 99%.

country, not for the world. In the (more restrictive) symmetric models of Krugman and FSW, inferences could be made about world welfare, and whether FTAs were good or bad for the world. We cannot attempt to address world welfare empirically; we restrict our analysis to the net welfare gain or loss of trade creation versus trade diversion for member countries. As in Baldwin and Venables (1995), tension between trade creation versus trade diversion makes the net welfare gain ambiguous for nonmember and member countries[5].

Third, we treat the decision to enter an FTA as a bilateral, rather than multilateral, one. While the decision of a country to form an FTA with the European Union (EU), for instance, may appear to be a multilateral one, every country in the EU has the ability to veto an FTA with a nonmember. In effect, every country in the EU decides bilaterally whether the net national welfare gain from an FTA with another country warrants formation[6].

Fourth, as we are interested in explaining empirically the cross-sectional variation in FTAs for a given year (1996), we assume that each country pair makes a decision in 1996 to form or not form an FTA, or to enforce or not enforce an FTA formed prior to 1996. This ‘static’ approach is in conformity with most cross-sectional ‘gravity’ analyses of bilateral trade flows where the presence or absence of an FTA is determined exogenously annually based upon government documentation. In theory, the presence or absence of an FTA in a given year depends only upon the economic characteristics in that year, similar to empirical cross-sectional endogenous trade-policy studies. Dynamic issues are important, but are outside the scope of the present paper and are left for future research.

3. The Model

In this section, we generalize the model in Frankel et al., (1995, 1996, 1998), Frankel (1997) to allow for asymmetries between countries and sectors, and intra- versus inter-continental transport costs. We use this theoretical model in Section 5 as the basis for a computable general equilibrium (CGE) model to illustrate the relationships between net utility gains (losses) from an FTA and relative transport costs, national outputs, and factor-endowment ratios. These relationships are employed to motivate the likely key empirical economic determinants of the probabilities of FTAs between pairs of countries.

International trade within each of two monopolistically-competitive sectors is generated by the interaction of consumers having tastes for diversity and production being characterized by economies of scale. Assume two factors of production, capital and labor, each perfectly mobile between sectors and each immobile internationally. We label the two sectors goods and services. Initially, these labels are arbitrary. Only much later will we differentiate the two sectors along conventional Balassa–Samuelson lines: goods (services) will be capital (labor) intensive in production and more (less) tradable. Within each

[5] As Baldwin and Venables (1995) note, “Perhaps the most important conclusion to be drawn is that—despite theoretical ambiguities—RIAs (regional integration agreements) seem to have generated welfare gains for the participants, with small, but possibly negative spillovers onto the rest of the world” (p. 1638).

[6] However, a bilateral decision does not imply a pair of countries ignores economic factors external to the pair. We address these considerations later.

sector, taste for diversity is captured formally by Dixit–Stiglitz preferences. Increasing returns to scale internal to the firm are captured with fixed costs and linear cost functions.

To capture the effects of asymmetries on regionalism, we assume three continents (indexed by 1, 2, 3) with two countries on each continent (countries indexed by A and B). Each country is allowed potentially to have different absolute and relative factor endowments of capital and labor. The two sectors are allowed potentially to differ in terms of relative factor intensities, tastes for variety, and trade barriers (transportation costs and/or tariffs). While earlier CGE models address the relative welfare benefits of regionalism, they do not explore these effects with explicit intercontinental and intracontinental transport costs, emphasizing—in the spirit of the Krugman and FSW frameworks—world geography.

3.1. Consumers

Each country i has a representative consumer who derives utility from consuming goods and services (g and s, respectively), based upon Cobb–Douglas preferences. Within each sector, the consumer has a taste for diversity captured formally by Dixit–Stiglitz (CES) preferences. The representative consumer for each of the six countries (i = 1A, 1B, 2A, 2B, 3A, 3B) has a nested utility function:

$$U_i = [(\Sigma_{k=1}^{n_i^g} g_{iik}^{\theta^g} + \Sigma_{k=1}^{n_{i'}^g} g_{ii'k}^{\theta^g} + \Sigma_{j\neq i,i'} \Sigma_{k=1}^{n_{j\neq i,i'}^g} g_{ijk}^{\theta^g})^{1/\theta^g}]^{\gamma}[(\Sigma_{k=1}^{n_i^s} s_{iik}^{\theta^s} + \Sigma_{k=1}^{n_{i'}^s} s_{ii'k}^{\theta^s} + \Sigma_{j\neq i,i'} \Sigma_{k=1}^{n_{j\neq i,i'}^s} s_{ijk}^{\theta^s})^{1/\theta^s}]^{1-\gamma} \quad (1)$$

where U_i denotes the utility of the representative household in i. Let g_{iik} (s_{iik}) be consumption in country i of differentiated good (service) k produced in the home country (i), $g_{ii'k}(s_{ii'k})$ is consumption in country i of good (service) k produced in the foreign country on the same continent (i'), and g_{ijk} (s_{ijk}) is consumption in country i of good (service) k produced in each of the four foreign countries on other continents (j). Let θ^g (θ^s) denote the parameter determining the elasticity of substitution in consumption in goods (services) with $0<\theta^g$, $\theta^s<1$. Let γ $(1-\gamma)$ be the Cobb–Douglas preference parameter for goods (services). Finally, let n_i^g (n_i^s) be the number of varieties of goods (services) produced in the home country, $n_{i'}^g$ ($n_{i'}^s$) the number of varieties of goods (services) produced in the foreign country on the same continent, and n_j^g (n_j^s) the number of varieties of goods (services) produced by a foreign country on another continent.

Within any country, households and firms are assumed symmetric; with symmetry, subscript k can be eliminated. Consequently, the budget constraint for the representative consumer in country i is:

$$w_i + r_i\left(\frac{K_i}{L_i}\right) + T_i = n_i^g p_i^g g_{ii} + n_i^g p_{ii'}^g g_{ii'} + \sum_{j\neq i,i'} n_j^g p_{ij}^g g_{ij} + n_i^s p_i^s s_{ii} + n_{i'}^s p_{ii'}^s s_{ii} + \sum_{j\neq i,i'} n_j^s p_{ij}^s s_{ij} \quad (2)$$

where w_i is the wage rate of the representative consumer–worker (or household) in country i, r_i is the rental rate on capital per household, K_i/L_i is the amount of capital exogenously supplied (or endowed) per household, T_i is tariff revenue redistributed back to households in a lump sum, p_i^{g} (p_i^{s}) is the price of the good (service) produced in the home country, $p_{ii'}^{\mathrm{g}}$ ($p_{ii'}^{\mathrm{s}}$) is country i's c.i.f. price of the good (service) produced in the foreign country on the same continent, and p_{ij}^{g} (p_{ij}^{s}) is country i's c.i.f. price of the good (service) produced in a foreign country on another continent.

Following FSW, c.i.f. prices differ from home prices due to Samuelson-type 'iceberg' transportation costs and ad valorem tariffs. Let a (b) represent the fraction of output exported by a country that is 'consumed' (or lost) due to intra- (inter-) continental transport[7]. Let $t_{ii'}$ and t_{ij} denote the ad valorem tariff rates in country i (that can potentially differ by trading partner). In the presence of positive tariffs and transport costs, country i's price of the good (service) produced by the foreign country on the same continent, $p_{ii'}^{\mathrm{g}}$ ($p_{ii'}^{\mathrm{s}}$), is

$$p_{ii'}^{\mathrm{g}} = p_{i'}^{\mathrm{g}} \left[\frac{1}{(1-a^{\mathrm{g}})}\right] + p_{i'}^{\mathrm{g}} t_{ii'}^{\mathrm{g}} \tag{3}$$

$$p_{ii'}^{\mathrm{s}} = p_{i'}^{\mathrm{s}} \left[\frac{1}{(1-a^{\mathrm{s}})}\right] + p_{i'}^{\mathrm{s}} t_{ii'}^{\mathrm{s}} \tag{4}$$

Country i's price of the good (service) produced by a foreign country on a different continent, p_{ij}^{g} (p_{ij}^{s}), is:

$$p_{ij}^{\mathrm{g}} = p_j^{\mathrm{g}} \left\{\frac{1}{[(1-a^{\mathrm{g}})(1-b^{\mathrm{g}})]}\right\} + p_j^{\mathrm{g}} t_{ij}^{\mathrm{g}} \tag{5}$$

$$p_{ij}^{\mathrm{s}} = p_j^{s} \left\{\frac{1}{[(1-a^{\mathrm{s}})(1-b^{\mathrm{s}})]}\right\} + p_j^{\mathrm{s}} t_{ij}^{\mathrm{s}} \tag{6}$$

Tariff rates and transport costs can differ across sectors[8]. For each country's consumer, maximizing Eq. (1) subject to Eqs. (2)–(6) yields a set of demand equations which, for brevity, are omitted here.

3.2. Firms

Each firm in the goods industry is assumed to produce output subject to the technology

$$g_i = z_i^{\mathrm{g}} (k_i^{\mathrm{g}})^{\alpha\mathrm{g}} (l_i^{\mathrm{g}})^{1-\alpha\mathrm{g}} - \varphi^{\mathrm{g}} \tag{7}$$

where g_i denotes output of the representative firm in this industry in country i, z_i^{g} is an exogenous productivity term for goods producers, k_i^{g} is the amount of capital used by this

[7] Note these transport costs are of the hub-and-spoke variety discussed in Frankel et al. (1995) where each continent represents a hub. For intercontinental shipments, costs are broken down into two components. The cost of transporting a good (service) from one hub to another is given by b^{g} (b^{s}) and the cost to distribute the good (service) to each spoke is a^{g} (a^{s}).

[8] Asymmetries in transport costs across pairs of countries is beyond the scope of the present model; thus, a change in a or b changes transport costs for all country pairs. Note that a and b both contribute to total "inter-continental" transport costs.

firm, l_i^g is the amount of labor used by this firm, and φ^g represents a fixed cost facing each firm (e.g. marketing costs absorbing both capital and labor), the latter assumed identical across countries for simplicity. Each firm in the services industry is assumed to have a similar technology:

$$s_i = z_i^s (k_i^s)^{\alpha s} (l_i^s)^{1-\alpha s} - \varphi^s \tag{8}$$

where s_i denotes output of the representative firm, z_i^s, k_i^s, l_i^s, and φ^s are defined analogously for services, and factor intensities α^g and α^s can differ.

Firms in each industry in each country maximize profits subject to the technology defined in Eqs. (7) and (8), given the demand schedules implied by Section 3.1 above. Equilibrium in these types of models is characterized by two conditions. First, profit maximization ensures that prices are a markup over marginal production costs:

$$p_i^g = (\theta^g)^{-1} \left[\left(\frac{C}{z_i^g} \right) r_i^{\alpha g} w_i^{1-\alpha g} \right] \tag{9}$$

$$p_i^s = (\theta^s)^{-1} \left[\left(\frac{D}{z_i^s} \right) r_i^{\alpha s} w_i^{1-\alpha s} \right] \tag{10}$$

where $C=(\alpha^g)^{-\alpha g}(1-\alpha^g)^{-(1-\alpha g)}$ and $D=(\alpha^s)^{-\alpha s}(1-\alpha_s)^{-(1-\alpha s)}$. Second, firms earn zero economic profits which implies:

$$g_i = \frac{\theta^g \varphi^g}{(1-\theta^g)} \tag{11}$$

$$s_i = \frac{\theta^s \varphi^s}{(1-\theta^s)} \tag{12}$$

Common to such models, output of the representative firm in each industry is determined parametrically.

3.3. Factor endowment constraints

As standard, we assume that endowments of capital (K_i) and labor (L_i) are exogenous, with both factors internationally immobile. Assuming full employment

$$K_i = K_i^g + K_i^s = n_i^g k_i^g + n_i^s k_i^s \tag{13}$$

$$L_i = L_i^g + L_i^s = n_i^g l_i^g + n_i^s l_i^s \tag{14}$$

3.4. Equilibrium

The number of firms and product varieties in each industry and country, factor employments and prices in each industry and country, consumptions of each good, and product prices can be determined uniquely given parameters of the model (γ, θ^g, θ^s, α^g, α^s,

φ^g, φ^s) and initial transport costs, tariffs, and factor endowments. All together, the model includes 204 equations in 204 endogenous variables; the remaining equations are described in a technical appendix available from the corresponding author on request.

3.5. The social planner

To enable comparison with FSW, we assume that the social planner in each country sets tariffs initially at 30%. The formation of an FTA eliminates tariffs between members, leaving the members' tariffs on nonmember countries' products at 30%[9]. If the changes in utility for two countries' agents from an FTA are positive, we assume each social planner would choose to enter an FTA with the other country's planner. Thus, for a bilateral FTA to be formed, it must be the case that the change in utility is positive for both countries' agents. If the change in utility is negative for either country, we assume an FTA is not formed.

4. Econometric issues and data

4.1. Econometric issues

The econometric framework we employ is the qualitative choice model of McFadden (1975, 1976). A qualitative choice model can be derived from an underlying latent variable model. For instance, let y* denote an unobserved (or latent) variable, where for simplicity we ignore the observation subscript. As in Wooldridge (2000), let y* in the present context represent the difference in utility levels from an action (the formation of an FTA), where

$$y* = \beta_0 + x\beta + e \tag{15}$$

where x is a vector of explanatory variables (i.e. economic characteristics), β is a vector of parameters, and error term e is assumed to be independent of x and to have a

[9] The calibration exercise later requires initial (or pre-integration) and post-integration tariffs. We use 0.30 as our initial tariffs and as our post-integration tariff rates on nonmember imports, similar to FSW. Frankel (1997, pp. 167–168) discusses the empirical rationale for using 0.30. The ideal approach would be to consider the Nash equilibrium tariffs; the Nash equilibrium tariffs in a post-integration situation are likely to differ from those in the pre-integration situation. Addressing this limitation, however, is beyond the scope of the present paper, especially due to the emphasis here on asymmetric economies with intra- and inter-continental transport costs; many papers solving for Nash equilibrium tariffs benefit from a symmetry assumption, such as Krugman (1991a). Bond and Syropoulos (1996) address how the Nash equilibrium tariffs change between pre- and post-integration situations; the authors show conditions under which the Nash equilibrium tariffs of FTA members with nonmembers may even fall. Bond and Syropoulos also show when the Krugman (1991a) approach is a limiting case; in the symmetric trading-blocs model in Krugman, the optimal tariff is $1/(\varepsilon - 1)$ where ε is the elasticity of demand for the country's exports, and this (in his model) is a function of the representative bloc's absolute economic size or number of blocs and the elasticity of substitution, $1/(1-\theta)$. Yi (2000) shows in a model with "taste-for-variety" preferences that an FTA could alter the Nash equilibrium tariffs of members with nonmembers downward to "balance" the varieties of imported goods. Ornelas (2001) shows that the Nash equilibrium tariffs of members with nonmembers may fall due to rent dissipation. See Bagwell and Staiger (1999) also for a detailed discussion of Nash equilibrium tariff structures in the presence of preferential and multilateral trade policies.

standard normal distribution. In the context of our model formally, $y^* = \min(\Delta U_i, \Delta U_j)$. Hence, both countries' consumers need to benefit from an FTA for their governments to form one.

Since y^* is unobservable, we define an indicator variable, FTA, which takes the value 1 if two countries have a FTA (indicating $y^*>0$), and 0 otherwise (indicating $y^* \leq 0$). The response probability, P, for FTA is

$$P(\mathrm{FTA} = 1) = P(y* > 0) = G(\beta_0 + x\beta) \tag{16}$$

where $G(\cdot)$ is the standard normal cumulative distribution function, which ensures that $P(\mathrm{FTA}=1)$ lies between 0 and 1. The standard errors of the estimates of β are asymptotically normally distributed and z-statistics reported in Section 5 will indicate whether estimates of β are statistically significant (see Wooldridge, 2000). While the statistical significance of the probit estimates can be determined, the coefficient estimates can only reveal the signs of the partial effects of changes in x on the probability of an FTA, due to the nonlinear nature of $G(\cdot)$. Letting $E(\cdot)$ denote the expectation of a variable, the direction of the effect of variable x_j on $E(y^*|x) = \beta_0 + x\beta$ is only qualitatively (not quantitatively) identical to the effect of x_j on $E(\mathrm{FTA}|x) = G(\beta_0 + x\beta)$. We estimate directly the partial effects on the response probabilities in Section 7. In Section 8, we compare predicted FTAs to actual FTAs.

4.2. Data issues

Since Linnemann (1966), a plethora of trade studies have measured the presence or absence of an FTA between a pair of countries using a binary variable; see Frankel (1997, Ch. 4) for a survey. Following those studies, variable FTA_{ij} will have the value 1 for a pair of countries (i, j) with an FTA in 1996, and 0 otherwise. This variable was constructed for the pairings of 54 countries (hence, $(54 \times 53)/2$ or 1431 pairings) using appendices in Lawrence (1996) and Frankel (1997) and FTAs notified to the GATT/WTO under GATT Article XXIV or the Enabling Clause for developing economies as of May 2002 (WTO, 2002). We included only full (no partial) FTAs or customs unions.

In the Krugman and FSW models, the dichotomy between inter- and intra-continental transport costs was simply an abstraction to emphasize that two countries that are closer geographically will tend to have lower transport costs. The lower are transport costs between two countries (ignoring their distance from the ROW), the more each country can consume the other's varieties, enhancing trade creation regionally. As the primary factor influencing such costs is bilateral distance, this task amounted to calculating 1431 bilateral distances among 54 countries' economic centers. Similar to Bergstrand (1985, 1989), distances were calculated in nautical miles using US Department of the Navy Oceanographic Office (1965) for sea distances and Road Atlas of Europe (1988) for land distances (the latter multiplied by a standard factor of 2 for the transport-cost differential between land and sea transport). We used Linnemann (1966) for identifying countries' economic centers. $\mathrm{NATURAL}_{ij}$ (denoting natural trading partners) is the natural logarithm of the inverse of the distance between the economic centers of i and j.

While measuring closeness is straightforward, measuring the 'remoteness' of a pair of continental trading partners from the ROW is not. We constructed REMOTE as

$$\text{REMOTE}_{ij} = \text{DCONT}_{ij} \times \left\{ \frac{\left[\log\left(\sum_{k=1,k\neq j}^{N} \text{Distance}_{ik}/N-1\right) + \log\left(\sum_{k=1,k\neq i}^{N} \text{Distance}_{jk}/N-1\right)\right]}{2} \right\}$$

The interpretation of REMOTE is as follows. First, DCONT is a binary variable assuming the value 1 if both countries are on the same continent, and 0 otherwise. If two countries (i,j) are on the same continent, REMOTE measures the simple average of (the natural logarithms of) the mean distance of country i from all of its trading partners except j and the mean distance of country j from all of its trading partners except i. If two countries (i, j) are on different continents, REMOTE has the value 0. This measure captures the spirit of b for natural FTAs because it measures how far two countries on the same continent are from other countries, but it has no value for unnatural trading partners. As will be discussed in Section 5 below, for any given value of intracontinental transport costs, only the welfare gains from a continental FTA increase monotonically with increases in intercontinental transport costs (b) in our model.

Other economic variables were readily measurable. Data on real GDPs and per worker physical capital stocks (all in international dollars) are from Baier et al. (2000), assembled from primary data in Mitchell (1992, 1993, 1995); availability of capital stock data determined the sample of countries[10]. Data on tariff rates for countries are from World Bank (2000). Despite the cross-sectional nature of the decision, an issue of potential endogeneity arises. In the context of our theoretical model, the decision between two countries to have an FTA or not in 1996 depends upon economic characteristics in 1996. However, income and factor endowments vary over time and have likely been influenced by trade liberalization. For many pairs, an FTA between two countries in 1996 was formed well before 1996, the earliest (the original six-member EEC) phased in over 10 years beginning in 1958. Since an FTA formed several years prior to 1996 likely influenced subsequent trade—which then influenced economic growth—incomes and capital stocks in 1996 may well be endogenous. To account for this, we used the earliest data on incomes and capital and labor stocks in Baier et al. (2000) for a wide sample, namely, 1960 data.

5. Numerical analysis and empirical results

This section offers seven theoretical hypotheses about the relationships between the net gains from an FTA and various economic characteristics of country pairs, using a calibrated CGE model based upon the theoretical model in Section 3. Following each hypothesis (except

[10] The 54 countries include Algeria, Egypt, Nigeria, South Africa, Hong Kong, Iran, Iraq, Japan, Singapore, Austria, Belgium, Denmark, France, Germany (W. Germany in 1960), Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, United States, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Bulgaria, Czech Republic (Czechoslovakia in 1960), Hungary, Poland, Romania, South Korea, Philippines, Thailand, Indonesia, and Australia.

one), we evaluate empirically the relationship between the likelihood of an FTA and the various economic characteristics using the qualitative choice framework outlined in Section 4.

Hypothesis 1. The net gain from an FTA between two countries increases as the distance between them decreases.

One of the key implications from Krugman (1991b), Frankel et al. (1995, 1996, 1998) is that natural FTAs are unambiguously welfare superior to unnatural FTAs; hence, the two countries' social planners will form an FTA the smaller the distance between them. For a given distance between country pair and the ROW (other things equal), the closer are two countries, the lower their transport costs of international trade and consequently the higher is their trade volume. Elimination of the ad valorem tariff between close members alleviates the price distortion on a large amount of trade, improving utility of consumers more in continental FTAs[11].

As a benchmark, consider initially a special case of our model where countries and continents are identical in factor endowments ($K_i = L_i = 100$ for $i = 1A, \ldots, 3B$) and industries are identical, analogous to FSW's single-industry case[12]. Fig. 1 illustrates the relationship between intercontinental transport costs, intracontinental transport costs, and net benefits from either a natural FTA or an unnatural FTA. The top (bottom) surface is the net welfare gain from a natural (unnatural) FTA. Consistent with FSW, the welfare effects of a natural FTA exceed (or equal) those of an unnatural FTA for any levels of inter- and intra-continental transport costs. Frankel et al. (1995) Fig. 2 is a special case of our Fig. 1 evaluated at $a = 0$; this special case is shown in Fig. 1 by the plane relating 'Percent Change in Welfare' to 'Intercontinental T.C. Factor'. Thus, the FSW relationship is robust to varying intracontinental transport costs (a).

In the context of our qualitative choice framework and theoretical model, two countries will have a higher probability of an FTA if the welfare benefits outweigh the welfare costs. The first testable hypothesis is that the probability of an FTA is higher as the distance between the countries' economic centers falls. Specification (column) 1 in Table 1 shows that the first hypothesis is supported; the likelihood of an FTA is larger the more natural are two countries as trading partners.

Hypothesis 2. The net welfare gain from an FTA for two continental trading partners increases as their remoteness from the ROW increases.

A second important implication from the FSW model is that the net welfare gains from a continental FTA increase the greater are intercontinental transport costs (b) relative to intracontinental transport costs (a). As relative intercontinental transport costs increase, the volume of trade with remote countries (on other continents) decreases and that with near countries (on the same continent) increases. With less trade with remote countries, the

[11] We use "continental" and "natural" interchangeably, "intercontinental" and "unnatural" interchangeably.

[12] With perfect symmetry, tariff rates between sectors and countries (t_{ij}^{g}, t_{ij}^{g}, t_{ij}^{s}, t_{ij}^{s}) are identical, transport costs between continents (b^{g}, b^{s}) and countries on the same continent (a^{g}, a^{s}) are identical between sectors, factor intensities (α^{g}, α^{s}) are identical, CES preference parameters θ^{g} and θ^{s} are identical and equal to 0.75 as in FSW (implying elasticities of substitution in consumption in both sectors of four), and preferences for goods versus services are identical ($\gamma = 1 - \gamma = 1/2$). For simplicity, fixed costs in each sector (φ^{g}, φ^{s}) are unity, tariff rates are 0.30 initially in both sectors as in FSW (see [9]), and total factor productivity is normalized to unity ($z_i^{g} = z_i^{s} = 1$).

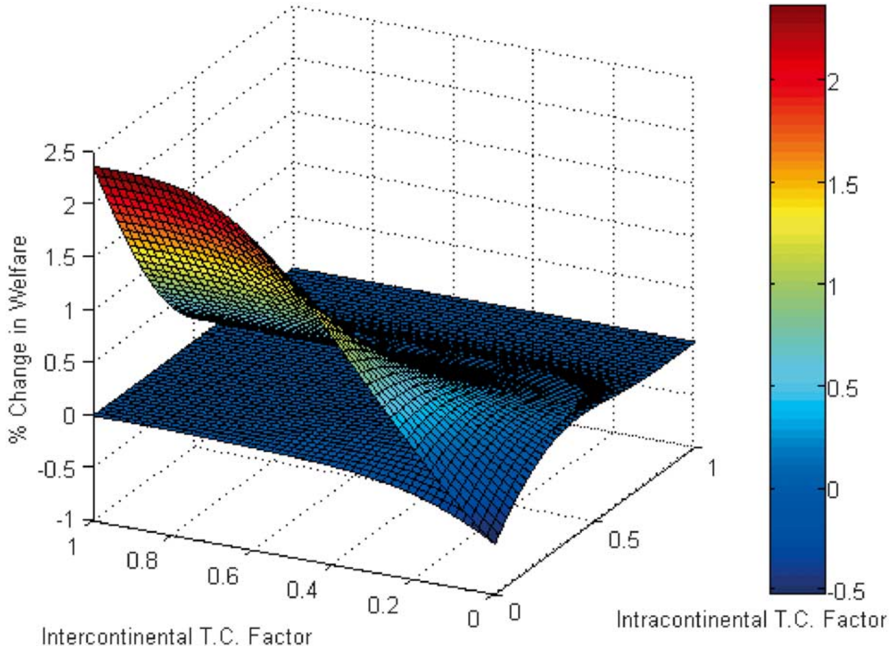

Fig. 1. Net welfare gains from natural and unnatural FTAs.

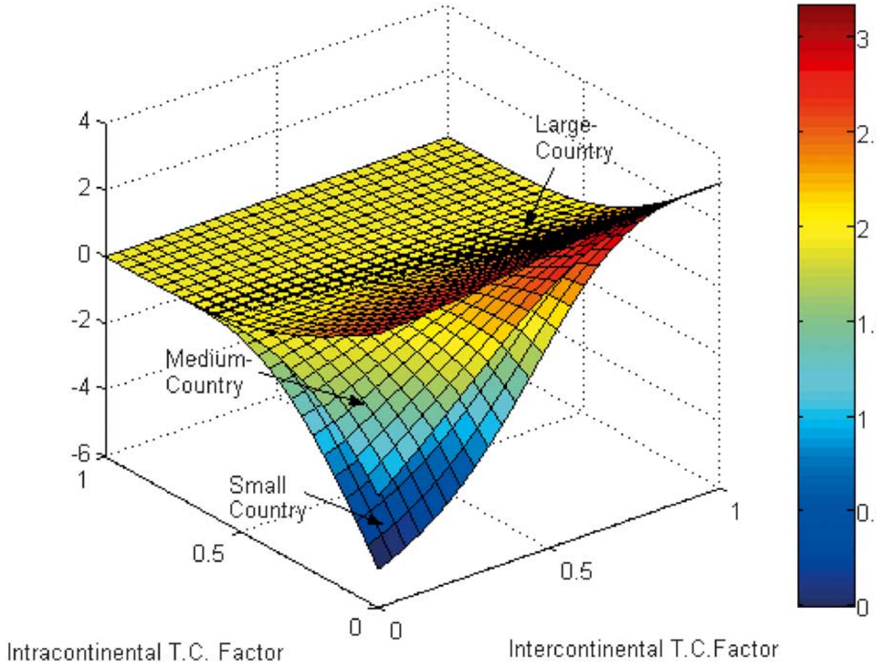

Fig. 2. Net welfare gains from natural FTAs and economic size.

Table 1
Probit results for the probability of an FTA

Variable:	Specification						
	1	2	3	4	5	6	7
Constant	13.42[a] (20.29)	9.76[a] (12.46)	4.31[a] (3.48)	3.49[a] (2.72)	4.22[a] (3.05)	4.22[a] (3.05)	7.90[a] (4.92)
NATURAL	1.74[a] (21.21)	1.36[a] (14.29)	1.49[a] (13.97)	1.52[a] (13.74)	1.64[a] (13.59)	1.65[a] (13.59)	1.76[a] (13.43)
REMOTE		0.15[a] (10.37)	0.15[a] (9.86)	0.16[a] (9.98)	0.17[a] (10.28)	0.17[a] (10.24)	0.18[a] (10.03)
RGDP			0.19[a] (5.33)	0.23[a] (5.94)	0.22[a] (5.28)	0.22[a] (5.27)	0.17[a] (3.67)
DRGDP				– 0.25[a] (-4.29)	– 0.27[a] (– 4.68)	– 0.28[a] (– 4.69)	– 0.34[a] (– 5.45)
DKL					0.43[a] (5.42)	0.49[b] (2.10)	0.85[a] (7.37)
SQDKL						– 0.02 (– 0.27)	
DROWKL							– 1.29[a] (– 5.53)
Pseudo R^2	0.571	0.647	0.668	0.683	0.704	0.704	0.728
Log likelihood	– 306.9	– 252.5	– 237.4	– 227.1	– 211.7	– 211.7	– 194.4
Number of observations	1431	1431	1431	1431	1431	1431	1431

[a] Denotes statistically significant *z*-statistic at 1% level in two-tailed test.
[b] Denotes statistically significant *z*-statistic at 5% level in two-tailed test.

relative tariff distortion with remote countries has less impact on utility; in Vinerian terms, there is less 'trade diversion'. With more trade with near countries, the elimination of the tariff distortion has greater utility gains.

The top surface in Fig. 1 reveals clearly for any level of a the monotonic relationship between greater intercontinental transport costs (b) and the larger net welfare benefits from a natural FTA. At $a=0$, the welfare effect of a regional FTA increases monotonically with b, and replicates (in the left-hand-side plane at $a=0$) FSW's Fig. 2 natural FTA line[13].

At higher values of a, the shape of this relationship remains monotonic, but 'flattens' considerably. The intuition is the following. First, suppose b is low. If a is zero, the utility loss of consumption of varieties intercontinentally (trade diversion) from a continental FTA exceeds the utility gain from more intracontinental trade (trade creation); with a equal to zero, there is no cost to transporting goods intracontinentally. However, at high levels of a, there is relatively little international trade, so there is relatively little welfare loss from increased relative discrimination against remote trading partners as well as little welfare gain from the continental FTA.

Next, suppose b is high. Even if a is zero, there is little intercontinental and much intracontinental trade, and hence little potential loss of trade volume intercontinentally (trade diversion) from a continental FTA. If a increases, intracontinental trade is dampened, decreasing the welfare gains from a continental FTA. Thus, the relationship between b and welfare from a continental FTA flattens as a increases[14].

The second testable hypothesis from the theory is that—for a given distance of two countries from one another—two continental trading partners will have a higher probability of forming an FTA the more remote the countries are from the ROW, measured by REMOTE_{ij}. Column 2 in Table 1 demonstrates that REMOTE is positively related to the probability of an FTA as expected and the coefficient estimate is statistically significant at the 1% level.

Hypothesis 3. The net welfare gain from an FTA between a pair of countries increases the larger are their economic sizes (i.e. average real GDPs).

We now introduce asymmetric sizes in terms of absolute factor endowments to determine scale-economies effects and address concerns raised earlier in Krugman (1998). We examine this in two exercises, first for natural trading partners and second for unnatural partners. In the first exercise, we allow countries on continent 1 (1A, 1B) to have larger absolute endowments of capital and labor than countries on continent 2 (2A, 2B), and 2A and 2B to have larger absolute endowments than countries on continent 3 (3A,

[13] FSW also showed that the net welfare loss from an unnatural FTA decreases unambiguously as intercontinental transport costs increase, possibly suggesting another testable hypothesis. However, in a world with asymmetric economies, this theoretical conclusion is not robust. We show, in the discussion below of Hypothesis 3, the ambiguous relationship between the net gains (losses) from an unnatural FTA and b.

[14] This result is in contrast to Nitsch (1996). Like Nitsch, we find that—for a given b—the welfare cost of a continental FTA decreases as a rises; however, FSW's "supernatural" region of welfare loss does not disappear. Only for higher values of a (such as 0.2–0.4) does the supernatural effect disappear. Moreover, Nitsch found that the entire two-dimensional line shifted up. We found this result counterintuitive. At high intercontinental transport costs, there is little intercontinental trade, and so a continental FTA generates large trade creation intracontinentally relative to little trade diversion intercontinentally. Thus, higher intracontinental transport costs should, on net, reduce the trade and welfare gains from a continental FTA as our figure confirms, counter to Nitsch's findings.

3B). Countries on the same continent have identical factor endowments. Moreover, for now relative factor endowments (capital–labor ratios) in every country are identical. Intuitively, the welfare gains from natural FTAs should be higher for countries with larger absolute factor endowments (and thus larger real GDPs). An FTA between two large partners (1A, 1B) increases the volume of trade in more varieties than an FTA between two small partners (3A, 3B), and reduces trade in fewer varieties from nonmembers than two small natural partners would, improving utility more in large countries relative to small countries. Second, the consequent larger increase in trade among two large economies causes a larger net expansion of demand and hence a larger rise in real income. Small countries 3A and 3B face considerable trade diversion when 1A and 1B form an FTA; the excess relative supply of factors in the small countries causes an erosion of terms of trade[15]. Fig. 2 illustrates that—for any values of a or b—the welfare gains from natural FTAs on all three continents are monotonically higher the larger the endowments of the countries.

Analogous reasoning applies to an unnatural FTA, the second exercise. Fig. 3 confirms the monotonic relationship—for any given values of a and b—between economic size and the welfare benefits of an unnatural FTA; net welfare gains (losses) increase (decrease) monotonically with economic size.

The third testable hypothesis is that the probability of an FTA is higher the larger economically are the trading partners, after accounting for distance and remoteness. $RGDP_{ij}$ measures the sum of the logs of real GDPs of countries i and j in 1960. Column 3 in Table 1 reveals that pairs of countries with larger average real GDPs have a higher probability of an FTA, in accordance with Hypothesis 3.

Figs. 2 and 3 also lend insight into the previous hypothesis about remoteness and FTA welfare gains. Fig. 2 illustrates also that—for a natural FTA—for a given economic size, net welfare gains (losses) increase (decrease) as remoteness (b) increases. However, Fig. 3 illustrates that such a monotonic relationship does not exist for unnatural FTAs. For $a = b = 0$, larger economies on net gain from an unnatural FTA due to trade in a larger number of varieties and favorable terms-of-trade effects. However, as b increases (relative to a) these relative benefits for the largest economies erode. By contrast, for smaller economies, the loss of consumption of varieties from discriminating against natural and other unnatural trading partners by introducing an FTA offsets the gain in trade with an unnatural partner, but the welfare losses of this distortion decrease as b rises[16]. In some

[15] This is a theoretical argument for the potential endogeneity of incomes in the subsequent empirical work. Simulations of real income confirm this.

[16] Note that the formation of an FTA is symmetric; each pair of countries on each continent is assumed to form an FTA, as in Krugman and FSW. However, in the empirical work that will follow, we are more interested in the likely effect of an increase in the economic size of a pair of countries on the formation of an FTA between that pair of countries (i.e. probit analysis). We find that the effect on net welfare of a single natural or unnatural FTA still increases monotonically with the countries' absolute factor endowment sizes; figures are not shown but are available on request. Welfare effects are qualitatively similar but quantitatively larger; with one pair of countries forming an FTA, there is less trade diversion. As this discussion suggests, the net welfare gains (losses) from an FTA are sensitive to what other bilateral decisions are being made. That is, the net welfare gain from an FTA between country 1A and 1B is sensitive to whether country 1A is considering one with (in a broader context) another country on the continent. While this issue important, it is beyond the scope of the present theoretical analysis which focuses on "bilateral" decisions, not multilateral ones; we leave this issue for future theoretical research. However, we do address this issue of bilateral decisions empirically in a limited fashion in the econometric analysis.

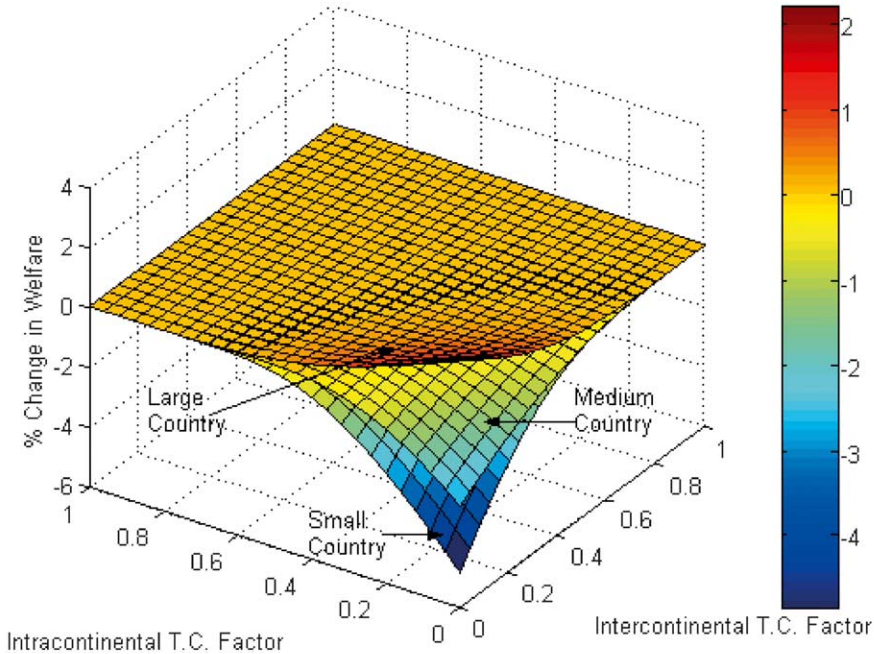

Fig. 3. Net welfare gains from unnatural FTAs and economic size.

cases, we can show the relationship between net welfare gains (losses) from an unnatural FTA and b is even quadratic.

Hypothesis 4. The net welfare gain from an FTA between a pair of countries increases the more similar are their economic sizes (i.e. real GDPs).

In this class of models, the more similar are the two countries' market sizes the larger the gains from an FTA. In the context of the first exercise, suppose 1A and 1B have identical shares of the two countries' factor endowments. The formation of a natural FTA provides gains from an increase in the volume of trade as the tariff distortion is eliminated on much continental trade. By contrast, if 1A has virtually all of the capital and labor on continent 1, formation of an FTA provides little welfare increase since there is virtually no trade between 1A and 1B. Similar reasoning applies to unnatural FTAs.

Fig. 4 illustrates the relationship between disparity in country sizes and the welfare benefits from a natural FTA for any given values of a and b (here, assuming $a = 0$). As disparity increases, the loss of trade vis-a-vis the ROW for the larger country rises relative to its diminishing trade being created with a smaller and smaller FTA partner. Since one of the countries' net welfare declines with size disparity, the likelihood of an FTA decreases with disparity.

The fourth testable hypothesis is that the probability of an FTA is higher the more similar economically are the trading partners. $DRGDP_{ij}$ measures the absolute value of the difference between the logs of real GDPs of countries i and j in 1960. Column 4 in Table 1

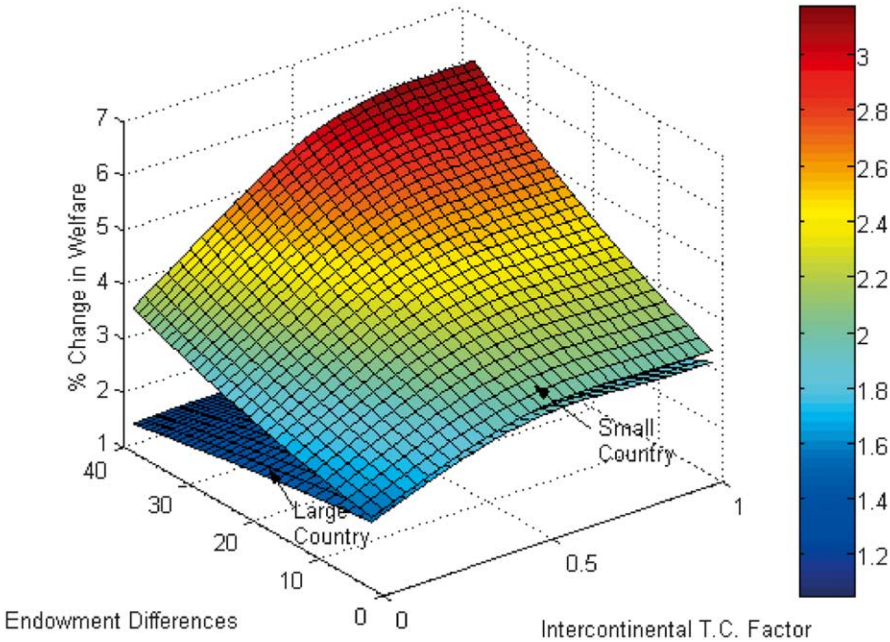

Fig. 4. Net welfare gains from a natural FTA for disparate economic sizes.

reveals that pairs of countries with smaller differences in real GDPs have a higher probability of an FTA.

Hypothesis 5. The net welfare gain from an FTA between a pair of countries decreases the larger is the economic size of countries outside the FTA (i.e. ROW real GDP).

The previous two hypotheses address the economic sizes of only those two countries. Surely the economic size of the ROW matters also. We can demonstrate (figure not shown) that the trade diversion from an FTA between a country pair is less the smaller the absolute factor endowment size of the ROW. As the ROW shrinks, the loss of consumption of varieties from the ROW due to an FTA is diminished. Moreover, the terms of trade effect is enhanced.

Unfortunately, the fifth hypothesis is difficult to evaluate empirically. In a cross-section of country pairs, the ROW's GDP does not vary much across the 1431 observations. Not surprisingly, the variance of this variable is trivial (coefficient of variation of 0.002) and consequently it was excluded.

Hypothesis 6. The net welfare gain from an FTA between a pair of countries increases with wider relative factor endowments, but might eventually decline due to increased specialization (if intercontinental transport costs are low).

At this point, asymmetries have been introduced between economies, but not between industries; a limitation of the Krugman–FSW model raised by Deardorff and Stern (1994) is the assumption of only one factor and one industry. As suggested in

Haveman (1998), the only paper in the literature that attempts to synthesize the complementary approaches of traditional Hecksher–Ohlin comparative advantage under perfect competition with the Krugman–FSW approach featuring imperfect competition to analyze the welfare benefits of regional FTAs in the presence of transport costs is Spilimbergo and Stein (1998). The limitation of Spilimbergo and Stein's two-factor two-industry extension is that each industry uses only one factor of production (capital in manufactures, labor in agriculture); in their framework, countries' factor endowments "differ only in their capital endowment" (p. 128). Consequently, differing capital–labor ratios only create differences in per capita income through scale-economies effects, not traditional comparative advantages. Changes in relative factor endowments cannot influence production shares and relative employment of capital and labor in sectors, since factors are immobile between sectors (an uncommon assumption to capture traditional Heckscher–Ohlin effects). Haveman (1998) notes that the Spilimbergo–Stein model "is really a world full of endowment economies" (p. 147). By contrast, our model allows endogenous adjustment of capital and labor between sectors (perfect factor mobility between sectors but not between countries) and endogenous determination of numbers of varieties of products in each industry. Our model can potentially separate differences between countries in per capita incomes due to scale-economies effects as well as specialization due to traditional comparative advantages; we allow also for differences in per capita incomes due to productivity differences.

Following most work, we assume 'goods' are capital-intensive and 'services' are labor-intensive in production in the spirit of the Balassa–Samuelson model, cf. Bergstrand (1991). As in Roland-Holst et al. (1994), we set $\alpha_g = 0.36$ and $\alpha_s = 0.27$ (capital shares in production). All other parameters for the two sectors are assumed identical. Starting with countries initially having identical capital and labor endowments, we increase the capital stock of country 1A to initiate a difference between the capital–labor ratios of 1A and 1B, but reduce 1A's productivity proportionately in both sectors (z^g, z^s) to hold 1A's real GDP fixed (to suppress scale-economies effects).

In traditional trade models (ignoring transport costs), the benefits of an FTA between a pair of countries should be enhanced the wider their relative factor endowments because traditional comparative advantages would be exploited more fully. Fig. 5 illustrates the relationship between differences in capital–labor endowment ratios and the net welfare benefits from a natural FTA for the capital-abundant country (1A). At high intercontinental transport costs, the relationship is positive and monotonic. At high values of b, there is little intercontinental trade. Consequently, most variety is exchanged intra-continentally. As relative factor endowments widen, both countries specialize more in the industries where they have comparative advantages and enjoy more net welfare gains from an FTA. There is little loss of variety (trade diversion) for 1A due to high intercontinental transport costs.

However, at low intercontinental transport costs, the net gains from an FTA increase at first with wider relative factor endowments, but eventually decline. At low values of b, there is considerable intercontinental trade in goods and services. As relative factor endowments widen, country 1A gains initially from specialization in goods. Yet, at high levels of specialization, 1A relies more on intra- and inter-continental trade to

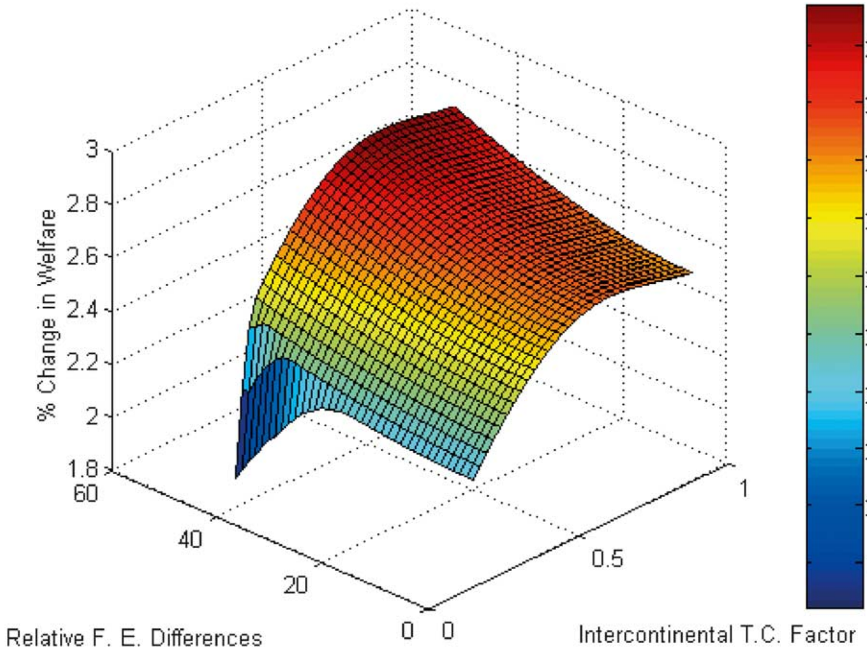

Fig. 5. A natural FTA and relative factor-endowment differences.

meet its demand for varieties of services. A natural FTA causes considerable trade diversion of services intercontinentally. With increasing specialization, the net welfare gains from inter-industry trade are eventually offset by the net trade diversion due to intra-industry trade. A qualitatively similar relationship holds for an unnatural FTA (figure not shown).

The sixth hypothesis is that the probability of an FTA is higher the larger the difference between two countries relative factor endowments, but possibly only up to a point. If intercontinental transport costs are not very low or relative factor endowment differences not high, the quadratic term may be unimportant. DKL_{ij} measures the absolute value of the difference between the logs of the capital–labor ratios of countries i and j in 1960; SQDKL_{ij} measures the square of DKL. DKL should be positively related to $P(\text{FTA}=1)$ while SQDKL should be negatively related to it. Column 5 in Table 1 reveals that DKL has the expected positive effect. Larger relative factor endowment differences between country pairs have a positive and statistically significant relationship with the probability of an FTA.

Column 6 reveals that the variables have the expected quadratic relationship with $P(\text{FTA}=1)$, but the statistical significance of the coefficient estimate of DKL erodes and the coefficient estimate for the quadratic term—while having the expected negative sign—is statistically insignificant. The overall explanatory power from adding the quadratic term is negligible; the pseudo-R^2 of specification 6 is virtually identical to that of specification 5. Hence, for parsimony, we omitted the quadratic term in subsequent regressions.

Hypothesis 7. The net welfare gain from an FTA between a pair of countries decreases the larger is the difference between the relative factor endowment of the pair and that of the ROW.

The previous hypothesis concerns only trade between the country pair and the pair's capital–labor ratios. The loss in welfare from an FTA for the country pair will be higher the more Heckscher–Ohlin trade is foregone with the ROW (up to a point). We can demonstrate readily (figure not shown) that the loss of gains from specialization from an FTA between a country pair is less the smaller the difference between the pair's relative factor endowment size and that of the ROW.

The last testable hypothesis is that the probability of an FTA declines the wider is the (absolute) difference between the capital–labor ratios of the member countries and the ROW's capital–labor ratio, due to potential trade diversion. This variable—DROWKL_{ij}—is measured as

$$\mathrm{DROWKL}_{ij} = \frac{\left\{\left|\log\left[\left(\sum_{k=1,k\neq j}^{N} K_k\right)/\left(\sum_{k=1,k\neq i}^{N} L_k\right)\right] - \log[K_i/L_i]\right| + \left|\log\left[\left(\sum_{k=1,k\neq j}^{N} K_k\right)/\left(\sum_{k=1,k\neq i}^{N} L_k\right)\right] - \log[K_j/L_j]\right|\right\}}{2}$$

Column 7 in Table 1 reveals that DROWKL has a negative relationship with the probability of an FTA and its coefficient estimate is statistically significant, likely due to the potential inter-industry trade diversion.

On net, the probit model works well. All six RHS variables in specification 7 have the expected sign and their coefficient estimates are statistically significant. Using the pseudo-R^2 term as a summary measure of explanatory power, specification 7 'explains' 73% of the variation of FTAs among 1431 country pairings in 1996. The pseudo-R^2 measure is the one discussed in Wooldridge (2000), one minus the ratio of the log-likelihood value for the estimated model to that for the model with only an intercept.

An alternative measure of goodness-of-fit for probit models is the 'percent correctly predicted,' also discussed in Wooldridge (2000). If the estimated probability of the pair exceeds 0.5, we define a variable *PredFTA* to be one; if the probability is less than 0.5, *PredFTA* takes on the value zero. The percentage of times that *PredFTA* matches FTA (which equals 1 if an FTA exists, and 0 otherwise) is an alternative measure of goodness-of-fit. However, Wooldridge notes that it is even more useful to report the percentage correctly predicted for each of the two possible outcomes, for the following reason. With 1431 country pairs and 286 FTAs, a probit specification of FTA on a constant only would result in predicted values of FTA of 0.2 for every observation (i.e. 286/1431). In this naive specification, however, *PredFTA* would still match FTA for 1145 of the 1431 cases, or 80% of the time. Even if the model failed to predict even one FTA correctly, this goodness-of-fit measure would suggest a predictive power of 80%.

Consequently, we report the percentage correctly predicted for each of the two possible outcomes. In our sample of 1431 pairs, 286 pairs have an FTA and 1145 pairs do not have an FTA. Using the rule described, 243 of the 286 FTAs are predicted correctly, or 84.97%. Also, 1114 of the 1145 pairs without an FTA are predicted correctly, or 97.29%. Thus, using alternative criteria the model appears to have a reasonably good fit.

6. Robustness of the empirical results

In this section, we evaluate the sensitivity of the results to several potential econometric issues.

6.1. Clustering and heteroskedasticity

First and foremost, the specifications assume that FTA_{ij} is independent across observations. In reality, a FTA between the United States and Mexico is not independent of such an agreement between the United States and Canada. Certain pairings of countries belong to a group or 'cluster'. The lack of independence of observations can influence the econometric results in several ways. First, it might influence the variance-covariance matrix of the econometric model. Akin to adjusting for heteroskedasticity, we re-estimated the specification in column 7 to adjust for possible interdependence of bilateral observations. This correction has an effect only on the standard errors, not the coefficient estimates. We assumed that pairs of countries within certain clusters (e.g. EU members) were interdependent, but clusters were independent. Clusters had three major categories: both countries belong to an FTA, one of the countries in a pair belongs to an FTA, or neither country belongs to one. We defined 99 clusters. Interdependence of observations within clusters had no significant effect on standard errors and thus was not a major concern. Hence, in the following empirical work, this adjustment was ignored[17].

6.2. Bloc size and bias

The fact that certain countries form a cluster might also introduce bias in coefficient estimates. For instance, Turkey may enter an FTA with the EU not to gain with respect to every member but to gain with respect to members on average. This possibility suggests that the results in specification 7 may be biased by the omission of a variable representing economic characteristics of the 'bloc,' such as the share of world GDP of the bloc's other members. We re-estimated the model adding two variables: the average share of world GDP of the other members of the trading bloc or blocs (if either or both of a country pair were in an FTA) and the absolute difference in these shares. The larger the relative economic size of the other members, the more likely an FTA existed between a country pair. The smaller the difference in these shares, the more likely an FTA existed. The variable representing the relative economic size of other trading bloc members had a positive and statistically significant coefficient estimate, as expected. Also, the variable representing the relative economic size difference had a negative and statistically significant coefficient estimate, as expected. The additional presence of these variables affected the other coefficients' quantitatively, but not qualitatively; the only RHS variable's coefficient estimate that became statistically insignificant—not surprisingly—

[17] We also re-estimated the model correcting for general heteroskedasticity; this had little effect on standard errors.

was the sum of the two countries' GDPs. In fact, the pseudo-R^2 rose from 0.73 to 0.80. The percent of FTAs (No FTAs) correctly predicted rose from 85 to 88% (97–98%).

Thus, the argument that multilateral, not bilateral, characteristics matter has merit; moreover, these empirical results are consistent with our theoretical model. However, we reserve caution about coefficient estimates from this specification due to potential endogeneity. If the econometric model is to 'explain' the likelihood of an FTA between a country pair using economic characteristics, it seems that a RHS variable constructed using a priori knowledge of bloc members (to determine the economic characteristics of the other bloc members) introduces an endogenous RHS variable. To err on the side of caution, we retained specification 7 in Table 1 as the primary specification for later analysis to preclude this potential endogeneity (with the other results available on request).

6.3. Sample bias

One might argue that the importance of bilateral distance and remoteness in explaining the likelihood of an FTA may well be driven by the presence of the EU and the size of the EU (in real GDP and number of countries). Moreover, as just discussed, countries that have obtained an FTA with the EU (say, Turkey) may be driven by the attractive market size of the entire EU, rather than by the economic size of individual EU member countries (say, Denmark). To address these issues, we re-estimated specification 7 for three sub-samples of our entire 1431 observations. The results are qualitatively identical to those in Table 1 (not shown for brevity), and most of the coefficient estimates remain statistically significant at the 1% significance level. Similar results are obtained when the sample excludes any country pair that includes a Western European country or a European country. Thus, results for specification 7 are robust to the exclusion of Europe, the most geographically-clustered country group.

6.4. Tariffs of nonmembers

The net welfare gains (losses) from an FTA should be sensitive to the levels of tariffs among nonmembers. The higher are tariffs in the ROW, the larger will be the volume of trade created within the FTA. We can demonstrate readily (figure not shown) that the net welfare gains (losses) increase (decrease) with higher ROW tariffs. We evaluated the hypothesis that the probability of an FTA increases the higher are tariff levels in the ROW. However, variation in this variable was virtually negligible (coefficient of variation of 0.04) as with ROW's GDP for country pairs; inclusion of ROW's tariffs had an effect only on the intercept's value and statistical significance. The percentage correctly predicted of FTAs (and No FTAs) changed trivially. Hence, we also excluded ROW's tariffs in the remaining analysis.

6.5. Endogeneity of GDPs and capital stocks

As noted earlier, time-varying RHS economic variables were measured using 1960 data to ensure predetermined values; 1996 values of incomes and capital stocks would be potentially endogenous. We implemented the test for endogeneity of the 1996 values of income and capital stocks proposed by Rivers and Vuong (1988). The test for endogeneity is a Wald test. The test statistic is a chi-squared (χ^2) statistic with four restrictions; the critical value is 13.28 at the 1% level. The χ^2 statistic was 51.67. The null hypothesis of exogeneity of 1996 values of incomes and capital stocks was rejected. This is consistent with our theory that trade policy, by influencing terms of trade and other factors, influences income and capital investment. This is consistent with empirical evidence in Frankel and Romer (1999).

6.6. Omitted institutional and political-economy variables

Consistent with our assumption that FTAs are formed by governments maximizing consumer welfare, we have not yet introduced any ‘political’ variables. In the context of our theory, such variables’ inclusion would be ad hoc. However, readers may be concerned that—despite the theory—some political, institutional, social, and cultural factors may be correlated with other RHS variables and with FTA, resulting in biased coefficient estimates of the economic determinants. An exhaustive examination of all such potential non-economic variables is clearly outside our scope.

Nevertheless, we considered several variables. We introduced three measures of ‘institutional’ characteristics that might affect the likelihood of an FTA: an index of the countries’ average degrees of ‘market orientation,’ a dummy variable to reflect shared legal origins (i.e. British law, etc.), and a dummy for having a common language. Governments also pay attention to national security issues, the environment, and labor standards in deciding on the formation of an FTA. We included, respectively, the share of GDP of the countries in defense expenditures and the (absolute value of the) difference in their shares, the per capita level of CO2 emissions in the countries and the difference in these values, and the (average) fraction of children in a country aged 10–14 in the country’s labor force and the difference in these fractions. Of all these nine variables, only one variable was significant; per capita CO2 emissions in a country pair had a negative and statistically significant relationship with the probability of an FTA.

As Trefler (1993) notes, common across many cross-industry endogenous tariff protection studies is the empirical result that protection tends to be higher in industries with greater import penetration. When the bilateral trade between the country pairs was the sole RHS variable in a probit regression, the coefficient estimate was positive and significant; however, the pseudo-R^2 (0.082) was considerably smaller than in any of Table 1’s specifications. The addition of the level of trade between a country pair to specification 7—already holding constant the pair’s economic size (and other economic determinants)—can be a crude proxy for import ‘penetration’; the expected coefficient is negative. In this enhanced specification, the countries’ bilateral trade in 1958–1960 had a negative relationship with the FTA probability, consistent with the endogenous protection literature. The coefficient estimate was -0.20 and was significant at 1% ($z = -2.96$). Yet, other coefficient estimates did not change materially.

Finally, Grossman and Helpman (1995) addressed the ‘politics’ of FTAs. In their theoretical political economy analysis, the formation of an FTA by two governments is more likely when there are substantial economic welfare gains for each country’s average voter, similar to our model. Moreover, in their model with specific factors owned by a few concentrated firms, political pressure to prevent an FTA is reduced the more ‘balanced’ is potential trade between the partner countries, due to offsetting political pressures from exporters and importers. To try to capture the spirit of Grossman–Helpman’s analysis, we also re-estimated specification 7 adding the absolute value of the difference in the logarithms of the two countries’ average trade flows in 1958–1960. The result was that differences in trade volumes had a negative relationship with the probability of an FTA, but was statistically insignificant. However, with both trade variables included, only the bilateral trade level was significant (at the 1% level).

In sum, the inclusion of CO2 emissions, the level of trade, and the imbalance of trade had no perceptible impact on the coefficient estimates of main specification 7 (or their statistical significance). None of the estimated FTA predictions were altered materially; even with all three additional variables, the model predicted 238, rather than 243, of the existing FTAs, and 1115, rather than 1114, of the ‘No FTAs’. This evidence is consistent with the Goldberg and Maggi (1999) result that consumers’ welfare had predominant weight in US trade policy. In the interest of parsimony and to focus on ‘pure economic’ determinants, we ignored including these variables subsequently.

7. Partial effects of RHS variables on response probabilities

As discussed earlier, the probit estimates cannot reveal the quantitative effect of a change in any RHS variable on the probability of an FTA. Given the standard normal cumulative distribution function, G(·), the partial effect on the response probability of FTA (denoted p_{xj}) to a one standard deviation (S.D.) change in any variable x_j, $\hat{\sigma}_{xj}$, is

$$p_{xj} = G\left[\hat{\beta}_o + \sum_{i \neq j} \hat{\beta}_i \bar{x}_i + \hat{\beta}_j (\bar{x}_j \pm \hat{\sigma}_{xj})\right] - G\left[\hat{\beta}_o + \sum_{i \neq j} \hat{\beta}_i \bar{x}_i + \hat{\beta}_j \bar{x}_j\right]$$

where $\bar{x}_i$ denotes the mean level of x_i.

Note that p_{xj} is sensitive to the levels of the elements of x. This accords with our theoretical model. This issue is illustrated most transparently by reconsidering Fig. 1 in Section 5. The net welfare gain from an FTA from being natural rather than unnatural trading partners is sensitive to the level of intercontinental transport costs (b). Analogous nonlinearities arise in our generalization of the FSW model. For instance, we expect a one S.D. increase in economic size to have a larger effect on the probability of an FTA for natural partners than unnatural ones[18]. Similarly, the effects of an increase in economic size disparities, differences in capital–labor ratios, bilateral distance, and remoteness are

[18] Consider how the effect of an increase in economic size on the net welfare gain from FTAs is sensitive to whether the countries are natural or unnatural trading partners. Figs. 2 and 3 in Section 5 illustrate this. In Figs. 2 and 3, assuming $b=0.10$ and $a=0.05$, the net welfare gain from a natural or unnatural FTA for the medium-sized countries is negative. Suppose absolute factor endowments increase for each country pair (from 75 to 250). The percentage net welfare gain from an FTA from the increase in the factor endowment rises from −1.38 to 2.06%, or by 3.44%, for the natural pair. By contrast, the percentage net welfare gain from an FTA from increasing the factor endowment rises from −1.60 to 1.44%, or by only 3.04%, for the unnatural pair.

Table 2
Response probabilities to a one S.D. (σ) change in RHS variables for natural trading partners (evaluated at the mean level of remote)[a]

Variable	$P(\text{FTA}=1\mid\text{natural partners})=0.867$	
	$-\sigma$	$+\sigma$
NATURAL	0.384 (0.302, 0.472)	0.994 (0.984, 0.998)
REMOTE	0.859 (0.804, 0.903)	0.873 (0.814, 0.911)
RGDP	0.780 (0.693, 0.850)	0.926 (0.873, 0.961)
DRGDP	0.938 (0.895, 0.966)	0.751 (0.663, 0.825)
DKL	0.663 (0.568, 0.749)	0.964 (0.930, 0.983)
DROWKL	0.952 (0.909, 0.977)	0.712 (0.615, 0.796)

[a] Values in parentheses denote the 95% confidence interval for the associated response probability estimate.

sensitive to levels of other variables. Following convention, mean values of the RHS variables are used for levels.

One complication arises in estimating the partial effects on the response probabilities for the particular vector of RHS variables, x, in our model by using mean values for the levels. One of the RHS variables, REMOTE, is the product of a continuous variable and a binary variable. Thus, the variable has the value of two countries' distance from the ROW when the pair share a continent, but 0 if not on the same continent. The mean value of this variable is economically meaningless. To account for this, we estimate the partial effects on the response probabilities for two scenarios, one with the mean value of NATURAL and the mean value of REMOTE when the two countries are on the same continent, and one with the mean value of NATURAL and 0 as the value of REMOTE when they are not.

Tables 2 and 3 present the response probabilities under these two alternative scenarios for a one S.D. change in each of the RHS variables along with (in parentheses) the 95% confidence interval associated with the respective response probability. Table 2 presents the response probabilities for continental trading partners. For ease of reference, we note that at the mean level of all RHS variables the probability of an FTA among natural partners is 0.867[19]. A one S.D. increase (decrease) in the closeness of such partners increases (decreases) this probability by 0.127 (0.483). The differential partial effect is due, of course, to the nonlinear functional relationships. Not surprisingly, a S.D. change in distance has an economically and statistically significant effect on the probability of an FTA among natural partners. A S.D. increase (decrease) in the remoteness of two natural partners from the ROW increases (decreases) the probability of an FTA by 0.006 (0.008).

Geographic proximity is not the only factor influencing the probability of an FTA. Changes in the level of or disparity between countries' real GDPs have economically and statistically significant impacts on $P(\text{FTA}=1)$. For instance, a S.D. increase in the level of real GDPs increases the response probability by 5.9% points, approximately half the effect of a S.D. increase in closeness. S.D. changes in the difference between real GDPs and the differences between capital–labor ratios all have economically and statistically significant impacts of approximately the same magnitudes as real GDP levels.

[19] For NATURAL and REMOTE, we used the means of the variables only for natural partners.

Table 3
Response probabilities to a one S.D. (σ) change in RHS variables for unnatural trading partners (evaluated at remote = 0)[a]

Variable	P(FTA = 1|unnatural partners) = 0.012	
	$-\sigma$	$+\sigma$
NATURAL	0.000014 (0.000001, 0.00010)	0.086 (0.057, 0.126)
RGDP	0.005 (0.002, 0.012)	0.028 (0.015, 0.050)
DRGDP	0.071 (0.045, 0.107)	0.010 (0.004, 0.022)
DKL	0.0009 (0.0002, 0.0033)	0.041 (0.023, 0.069)
DROWKL	0.013 (0.006, 0.028)	0.0007 (0.0002, 0.0024)

[a] Values in parentheses denote the 95% confidence interval for the associated response probability estimate.

Table 3 reports the response probabilities for unnatural country pairs. Not surprisingly, at the mean level of all RHS variables the probability of an unnatural FTA is about 1%[20]. A S.D. increase in closeness causes this probability to rise from 0.012 to 0.086, reinforcing the importance of economic geography in the likelihood of an FTA; this effect is statistically significant. Economic factors still manage a role in influencing the likelihood of an unnatural FTA. A S.D. rise in the level of real GDPs increases the response probability of an FTA by 1.6% points; this effect is economically and statistically significant. A S.D. decrease in the absolute difference between real GDPs of unnatural partners has a similar economically and statistically significant positive effect on the probability of an FTA (6% points). Increases in the differences between capital–labor ratios also have economically and statistically significant effects on P(FTA = 1).

Thus, the response probability estimates confirm that economic characteristics as well as geography have economically and statistically significant impacts on the probability of an FTA.

8. Interpreting the results

> If governments maximized the welfare of their citizens, prospective moves toward regional free trade would almost surely do more good than harm to the members of the free trade areas. (Krugman, 1991b, p. 21)

> This is an empirical question on which Krugman offers little supportive evidence. (Bergsten 1991, p. 48)

The original 'Krugman vs. Krugman' debate yielded unambiguous conclusions. In a world with symmetric economies and no transport costs, bilateralism was bad; in the same world with prohibitive intercontinental transport costs, bilateralism was good. FSW illustrated that the outcome depends upon the degree of intercontinental transport costs.

[20] For REMOTE we used zero, and for NATURAL we used the mean of the variable only for unnatural partners. Response probabilities are not reported for REMOTE in Table 3 since this has a value of zero here.

Drawing upon empirical data for intercontinental transport costs (external to the model), FSW concluded that regionalization may have become excessive.

In a world with asymmetric economies, we cannot make sweeping statements that bilateralism is ‘good’ or ‘bad’. The focus of this paper has been on explaining and predicting FTAs bilaterally based upon pure economic characteristics (of member and nonmember countries). However, as Krugman’s quote suggests, we can make limited statements about the net welfare gain or loss for the member countries.

In the context of McFadden’s motivation of qualitative choice models, predicted probabilities of an FTA suggest whether particular pairs of countries should have an FTA based upon economic characteristics that—in the context of the theory—enhance welfare. If the predicted probability of an FTA for a country pair exceeds one-half, this suggests—in this framework—that there is a net welfare gain for the country pair. As the empirical results show, the probability of an FTA exceeded one-half for 243 of the 286 country pairs with FTAs, or 84.97%. The results suggest—in the model’s context—that bilateralism is good for these pairs (though not necessarily for non-members).

Second, although 243 of the FTAs were predicted, 43 of the remaining 286 country pairs with FTAs were not predicted. In the context of the model, this suggests that 15% of the FTAs in our sample were welfare-reducing for the two countries. One might say, for these country pairs, bilateralism was ‘excessive’.

Third, our qualitative choice model also allows us to identify for which country pairs bilateralism might be considered ‘insufficient’. Bilateralism is termed ‘insufficient’ if an FTA is predicted but does not exist (yet). Of 1145 country pairs without an FTA, 1114 pairs were predicted correctly, or 97.29%. We note that 31 country pairs that had no FTA should have such an agreement (according to the model’s predictions); these are shown in Table 4 along with each pair’s predicted probability in parenthesis[21].

Table 5 shows the 43 cases where bilateralism was ‘excessive,’ that is, where an FTA existed in 1996 but the model’s prediction probability was less than one-half. Five cases involve agreements between Algeria with EC members and ten cases involve agreements between Egypt and EC members; these agreements went into force in 1976 and 1977, respectively, although evidence suggests that Algeria’s and Egypt’s imports from the EC still face high tariffs. Eight cases involve Turkey with EC members; the EC-Turkey agreement was notified to the GATT/WTO in 1995, legally entered into force January 1996, and is still ‘under examination’. Evidence suggests this agreement is effective[22]. Thus, although 15% of the FTAs in existence were not predicted, it is

[21] Of these 31 cases, 11 would become members of an FTA if the Free Trade Agreement of the Americas (FTAA) evolves into an FTA. Six cases involve members of the Asian Pacific Economic Cooperation (APEC) forum. While APEC is not considered an FTA, discussion has centered around members forming an FTA by 2020. Finally, seven cases involve Romania and Bulgaria, which became members of the Central European Free Trade Agreement (CEFTA) in 1997 and 1998, respectively. Thus, 24 of the 31 cases are pairs involved in potential (or, in the 2 years after 1996, actual) FTAs.

[22] We thank Francois Benaroya of the French Trade Ministry for information on Algeria, Egypt and Turkey.

Table 4
Cases of insufficient bilateralism

1	Panama–Venezuela (0.792)
2	Costa Rica–Ecuador (0.539)
3	Costa Rica–Venezuela (0.764)
4	Mexico–Honduras (0.556)
5	Mexico–Guatemala (0.863)
6	Mexico–El Salvador (0.756)
7	Mexico–Nicaragua (0.619)
8	Venezuela–Guatemala (0.604)
9	Venezuela–Brazil (0.645)
10	Peru–Chile (0.948)
11	Peru–Argentina (0.507)
12	Japan–South Korea (0.924)
13	Japan–Philippines (0.728)
14	Hong Kong–Singapore (0.646)
15	Hong Kong–South Korea (0.805)
16	Hong Kong–Philippines (0.716)
17	South Korea–Philippines (0.578)
18	Bulgaria–Czechoslovakia (0.763)
19	Bulgaria–Hungary (0.946)
20	Bulgaria–Poland (0.756)
21	Bulgaria–Romania (0.998)
22	Bulgaria–Turkey (0.514)
23	Romania–Poland (0.756)
24	Romania–Hungary (0.926)
25	Switzerland–Algeria (0.919)
26	Switzerland–Egypt (0.758)
27	Iraq–Turkey (0.711)
28	Iran–Iraq (0.988)
29	Iran–Indonesia (0.557)
30	Iran–Turkey (0.938)
31	Nigeria–South Africa (0.682)

important to note that 23 of the 43 cases of 'excessive' bilateralism can be explained solely by FTAs between the EC and Algeria, Egypt and Turkey.

We close this section addressing three points. First, with the literature on FTAs having been largely a theoretical one, empirical evaluation of FTAs has largely fallen into two camps: CGE models of trade and trade policy, and econometric analyses of the trade flow impacts of FTAs. Common to both approaches—and different from ours—is that FTAs are exogenous. CGE analyses generally focus on the trade creation and trade diversion impacts of an FTA, calculating the impacts in terms of a share of GDP. As is well known, however, CGE studies are essentially, as Baldwin and Venables (1995) note, 'theory with numbers'. Such analyses provide a quantitative articulation of what the underlying theoretical model suggests, but do not explain the formation of FTAs.

Econometric analyses of the impacts of FTA tend largely to explore the ex post effect of an FTA on trade flows, often using 'gravity equations,' such as in Bergstrand, (1985), Bergstrand (1989) and Frankel (1997). While these models have indicated successfully gross trade creation and diversion from an FTA, one still cannot make welfare statements. As with CGE models, gravity equations do not explain the endogenous

Table 5
Cases of excessive bilateralism

1	Algeria–Denmark (0.417)
2	Algeria–Germany (0.275)
3	Algeria–Ireland (0.465)
4	Algeria–Sweden (0.199)
5	Algeria–UK (0.321)
6	Egypt–Iraq (0.031)
7	Egypt–Belgium (0.356)
8	Egypt–Denmark (0.308)
9	Egypt–France (0.497)
10	Egypt–Germany (0.169)
11	Egypt–Ireland (0.164)
12	Egypt–Netherlands (0.364)
13	Egypt–Portugal (0.088)
14	Egypt–Spain (0.224)
15	Egypt–Sweden (0.178)
16	Egypt–UK (0.195)
17	Turkey–Norway (0.125)
18	Turkey–Belgium (0.379)
19	Turkey–Denmark (0.254)
20	Turkey–Germany (0.186)
21	Turkey–Netherlands (0.387)
22	Turkey–UK (0.214)
23	Turkey–Portugal (0.033)
24	Turkey–Spain (0.244)
25	Turkey–Sweden (0.226)
26	Portugal–Hungary (0.336)
27	Portugal–Bulgaria (0.481)
28	Portugal–Romania (0.384)
29	Chile–Mexico (0.022)
30	Chile–Brazil (0.174)
31	Chile–Paraguay (0.318)
32	Chile–Ecuador (0.468)
33	Bolivia–Brazil (0.097)
34	Bolivia–Ecuador (0.334)
35	Bolivia–Colombia (0.163)
36	Bolivia–Mexico (0.004)
37	Colombia–Nicaragua (0.147)
38	Colombia–Mexico (0.194)
39	Argentina–Venezuela (0.484)
40	Brazil–Paraguay (0.248)
41	Philippines–Singapore (0.412)
42	Philippines–Indonesia (0.400)
43	Thailand–Indonesia (0.105)

formation of FTAs. We see our approach as a complement to these alternative approaches in providing quantitative insight about FTAs.

Second, we note that our statements about whether bilateralism is excessive or insufficient abstract from the issue of bilateralism versus multilateralism. Given the model, when all countries are symmetric forming natural FTAs on all continents is welfare inferior to multilateral tariff liberalization. However, one can also show that (for certain transport costs) a natural FTA between a country pair may be welfare superior for that pair to their elimination of tariffs on imports from all countries, or even to world free trade. Our econometric analysis does not address this issue.

Third, we note Leamer's quote, "Give me data or give me death". Leamer (1998) noted that answers to questions such as the one in this paper should "be sought using four different methodologies: theory, calibration, indirect estimation, and direct observation" (p. 149). This paper has attempted intentionally to address the issue of bilateralism using all four methodologies. We have constructed a fairly parsimonious model of international trade with intra-industry trade as well as Heckscher–Ohlin trade in a setting with explicit transportation costs. Despite parsimony, the complexity of the model requires calibration to determine qualitative theoretical relationships. Turning to the qualitative choice framework, we apply observations on FTAs and economic characteristics of countries to determine the predictability of FTAs for particular pairs and to draw inferences about the net welfare gain or loss for these pairs. We find that country pairs that have bilateral FTAs tend to have those economic characteristics that should enhance economic welfare for the pair. Using direct observations, we find evidence that individual cases of 'excessive' bilateralism are constrained to a few plausible pairs of countries.

9. Conclusions

The main purpose of this study was to develop an econometric model that explains the 'pure economic' determinants of FTAs and that also predicts successfully the likelihood of pairs of countries forming FTAs. This is the first econometric model, to our knowledge, that predicts FTAs based upon an explicit general equilibrium model of world trade of multiple countries on multiple continents. It provides a economic benchmark for future political economy models to enhance the explanation of FTA determinants.

The main conclusions of the study are that the potential welfare gains and likelihood of a FTA between a pair of countries are higher: (i) the closer in distance are two trading partners; (ii) the more remote a natural pair is from the ROW; (iii) the larger and more similar economically (i.e. real GDPs) are two trading partners by exploiting economies of scale in the presence of differentiated products; (iv) the greater the difference in capital–labor endowment ratios between two countries due to the gains from traditional comparative advantages (i.e. Heckscher–Ohlin trade); and (v) the less is the difference in capital–labor endowment ratios of the member countries relative to that of the ROW due to less inter-industry trade diversion. These factors have economically and statistically significant effects on the probability of an FTA.

One measure of overall fit of a probit model is how well the model predicts correctly the outcome. Of the 1431 country pairs in our sample, 286 country pairs had an FTA and 1145 pairs did not have an FTA in 1996. We predicted correctly 243 of the 286 FTAs, or 84.97%. Also, 1114 of the 1145 pairs without an FTA are predicted correctly, or 97.29%.

Is bilateralism good? Unlike the restrictive symmetric models of Krugman and FSW, we cannot make any sweeping statement. While we predict 85% of FTAs in our sample in 1996, we find that 43 of the 286 FTAs in 1996 were not predicted, suggesting that 15% of the FTAs in that year were 'excessive' in a strict interpretation of the results. Yet, two important caveats are worth noting. First, of these 43 cases, 23 are agreements between the EC with Algeria, Egypt, and Turkey. Thus, half of the cases of excessive bilateralism are limited to three particular countries (and the Algeria and Egypt agreements may not even be effective). Second, we found 31 cases where agreements should exist (in the model's context) but none did, suggesting for these pairs bilateralism is insufficient.

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