The University of Nottingham

research paper series

Theory and Methods

Research Paper 2006/14

The Trade Structure Effects of Endogenous Regional Trade Agreements

by

Hartmut Egger, Peter Egger and David Greenaway

The Centre acknowledges financial support from The Leverhulme Trust under Programme Grant F114/BF

GEP
Leverhulme Centre
for Research on Globalisation and Economic Policy

The Authors

Hartmut Egger is Assistant Professor at the University of Zurich and an External Research Fellow of the Leverhulme Centre for Research on Globalisation and Economic Policy. Peter Egger is Professor of Economics at the Ludwig-Maximilians-University of Munich, Ifo member, and External Research Fellow of the Leverhulme Centre for Research on Globalisation and Economic Policy. David Greenaway is Professor of Economics and Director of GEP, University of Nottingham.

Acknowledgements

David Greenaway acknowledges financial support from The Leverhulme Trust under Programme Grant F114/BF.

The Trade Structure Effects of Endogenous Regional Trade Agreements

by

Hartmut Egger, Peter Egger and David Greenaway

Abstract

This paper formulates an empirical model to estimate the impact of endogenous new RTA membership on trade structure. The likelihood of new RTA membership is influenced by economic fundamentals such as country size, factor endowments and trade and investment costs. In a sample of country-pairs covering mainly the OECD economies we find a particularly strong effect of endogenous RTAs on intra-industry trade in a difference-in-difference analysis based on matching techniques. We identify an RTA-induced impact on the intra-industry trade share of about 40 percent of its average level. The associated trade volume effects are similar to previous research on trade volume effects of endogenous RTAs. Overall, this indicates that RTA membership might reduce inter-industry trade not only in relative but also in absolute terms and that the trade volume effect is due to the associated growth in trade within industries.

Key words: regional integration; trade effects; intra industry trade.

JEL classification: F15, F13

Outline

Non-Technical Summary

The voluminous literature on the consequences of regional trade agreements (RTAs) for welfare and trade is one of the central building blocks of research in international economics. While it is well understood theoretically under which conditions positive welfare effects of RTAs arise, empirical research has treated these agreements as exogenous for more than four decades. Implicitly, country-pairs have been viewed as being randomly assigned rather than self-selected into RTAs. Only recently have trade economists paid attention to their endogeneity when analyzing trade volume effects This line of research confirms that (i) RTAs foster bilateral trade on average when controlling for endogeneity and (ii) their exogenous treatment is not justified from an econometric viewpoint and leads to downward biased estimates of their impact on trade volumes.

However, it is not yet clear what the associated trade structure effects are. Do RTAs mainly stimulate gains from specialization as would be reflected in a growth of the share of inter-industry trade? Or do they mainly foster gains associated with scale economies and product differentiation which would show up in a growth of the share of intra-industry trade? In the 1960s, a central issue was whether the formation of the European community between the late 1950s and mid 1960s would (driven by gains from inter-industry specialization) or would not (due to increased trade within industries) have important distributional consequences through the convergence of wages across countries and lead to an income loss of labour in the capital-abundant economies. Given that trade volumes tend to increase if country-pairs self-select into RTAs, what are the associated consequences for trade structure? It is this paper's purpose to study this question empirically.

To motivate our empirical analysis, we categorize the major factors steering the welfare effects of RTAs based on existing theoretical work. This forms the basis for an empirical model to estimate the likelihood of self-selecting into RTAs. Rather than analyzing the cross-sectional variation in RTA membership we focus on new RTA membership, which helps in avoiding bias from omitted time-invariant variables. Furthermore, we focus on the consequences of new RTA membership on the change in the bilateral intra-industry trade share rather than the volume of trade. And we consider the impact of new RTA membership within a narrowly defined time window around new membership to obtain unbiased estimates of the contemporaneous impact.

Our empirical strategy rests on difference-in-difference matching techniques that are based on the idea of "selection on observables". This approach is particularly suited for problems where it is hard to identify any outside instruments that are correlated with the treatment variable (in our case, new RTA membership) but uncorrelated with the outcome variable (the intra-industry trade share). For a sample of mainly OECD economies and RTA events since 1970, we estimate an endogenous treatment effect of new RTA membership on intra-industry trade shares that amounts to about four percent when using the preferable estimates. The share of intra-industry trade amounts to about eleven percent on average in the considered time span and country-sample. Hence, it increases by about 40 percent in response to new RTA membership.

1 Introduction

The voluminous literature on the consequences of regional trade agreements (RTAs) for welfare and trade is one of the central building blocks of research in international economics. While the conditions under which positive welfare effects of RTAs arise are well understood theoretically, empirical research has treated these agreements as exogenous for more than four decades. Implicitly, country-pairs have been viewed as being randomly assigned rather than self-selected into RTAs. Only recently have trade economists paid attention to their endogeneity when analyzing trade volume effects (Baier and Bergstrand, 2002, 2006; Magee, 2003). This line of research confirms that (i) RTAs foster bilateral trade on average when controlling for endogeneity and (ii) their exogenous treatment is not justified from an econometric viewpoint and leads to downward biased estimates of their impact on trade volumes.

However, it is not yet clear what the associated trade structure effects are. Do RTAs mainly stimulate gains from specialization as would be reflected in a growth of the share of inter-industry trade? Or do they mainly foster gains associated with scale economies and product differentiation which would show up in a growth of the share of intra-industry trade? It is surprising that these questions have not yet surfaced in research on the trade effects of endogenous RTAs. In the 1960s, a central issue was whether the formation of the European community between the late 1950s and mid 1960s would (driven by gains from inter-industry specialization) or would not (due to increased trade within industries) have important distributional consequences through the convergence of wages across countries and lead to an income loss of labour in the capital-abundant economies (Grubel and Lloyd 1975 and Greenaway and Milner 1986).[1] Given that trade volumes tend to increase if country-pairs self-select into RTAs, what are the associated consequences for trade structure? It is this paper's purpose to study this question empirically.

To motivate our empirical analysis, we categorize the major factors steering the welfare effects of RTAs based on existing theoretical work. This forms the basis for an empirical model to estimate the likelihood of self-selecting into RTAs. Rather than analyzing the cross-

[1] In this respect, Krugman (1981, pp. 959-960) notes that "*much of the expansion of trade in the postwar period has taken place without sizable reallocation of resources or income-distribution effects*", which is "*particularly noticeable in the cases of the EEC [European Economic Community] and the North American automobile pact*".

sectional variation in RTA membership (Magee, 2003) we focus on new RTA membership, which helps in avoiding bias from omitted time-invariant variables. Furthermore, we focus on the consequences of new RTA membership on the change in the bilateral intra-industry trade share rather than the volume of trade. And we consider the impact of new RTA membership within a narrowly defined time window around new membership to obtain unbiased estimates of the contemporaneous impact.

Our empirical strategy rests on difference-in-difference matching techniques that are based on the idea of "selection on observables". As will become clear later, this approach is particularly suited for problems where it is hard to identify any outside instruments that are correlated with the treatment variable (in our case, new RTA membership) but uncorrelated with the outcome variable (the intra-industry trade share). For a sample of mainly OECD economies and RTA events since 1970, we estimate an endogenous treatment effect of new RTA membership on intra-industry trade shares that amounts to about four percent when using the preferable estimates. The share of intra-industry trade amounts to about eleven percent on average in the considered time span and country-sample. Hence, it increases by about 40 percent in response to new RTA membership. The effects on trade volumes are similar to the lagged treatment effects reported in Baier and Bergstrand (2006), who use a larger sample of countries and a different empirical approach.

The remainder of the paper is organized as follows. Section 2 provides a review of the relevant literature on endogenous RTA formation and its consequences for trade. Section 3 lays out a detailed discussion of the problems and cures of self-selection in general with particular emphasis on matching. There, we also discuss our database and the specification of the estimated models. Sections 4 and 5 report on the major empirical findings and Section 6 provides an extensive discussion of their robustness. Section 7 concludes with a brief summary of the main findings.

2 Relationship to Existing Literature

The literature on RTAs is rooted in Viner's (1950) seminal work on *trade creating* and *trade diverting* effects of RTAs. Since then, the welfare effects associated with RTAs have formed a central block of interest in international economics. In particular, the recent wave of new RTA formation has led to a revival of academic research in this area (see Bagwell and Staiger, 1997; Bond, Riezman, and Syropoulos, 2004). Following Baier and Bergstrand (2004), the welfare effects of trade liberalization are influenced by three categories of economic determinants: economic geography, inter-industry trade forces, and intra-industry trade forces.

First, the importance of *economic geography* factors was clearly articulated by Krugman (1991) and Frankel, Stein, and Wei (1995, 1996). Trade diversion – and, hence, the likelihood of a welfare loss from RTAs – is weaker the more remote the integrating countries are from the rest of the world (ROW), whilst trade creation should be greater for geographically proximate partners. Similar effects of economic geography factors on welfare are identified in recent work on RTAs with multinational firms (see Ludema, 2002). As pointed out by Bhagwati (1993) and Krishna (2003), the theoretical insight that proximity between trading partners renders positive welfare effects of RTA-formation more likely itself builds upon two premises, namely that "*geographically proximate countries have higher volumes of trade than more distant ones do and (...) that trade blocs between countries that already trade disproportionately are less likely to divert trade*" (Krishna, 2003, pp. 203-204).

Second, if *inter-industry* trade is quantitatively important, trade creation is greater the more different the integrating countries' relative factor endowments; and trade diversion is smaller the more similar they are within the RTA relative to the ROW. In a Heckscher-Ohlin model, trade gains are larger if countries differ significantly in their relative factor endowments. In this case, an RTA "*between a developed and a developing country is more likely to improve welfare, because of the substantial underlying difference in factor endowments, than an agreement between two developing or two developed countries*" (Krueger, 1999, p. 116).

Third, if *intra-industry* trade is important, country size becomes a key determinant of the welfare effects. Positive effects are more likely the larger and more similar the integrating countries are in their economic sizes, while negative welfare effects are possible if the size of the ROW is significant (Baier and Bergstrand, 2004). Furthermore, relative factor endowments are then less important or may even exhibit different effects as in the Heckscher-Ohlin model (Levy, 1997).

We will follow the literature by associating higher positive welfare effects with a higher likelihood of a country participating in an RTA. In these circumstances, theoretical work indicates that RTA membership is determined by the same fundamentals as trade volumes.

This has two consequences for our empirical analysis. First, there is self-selection into RTAs, which needs to be accounted for to obtain unbiased estimates of RTA effects on trade. This problem has not been addressed in studies on the RTA-induced effects on trade volumes until recently, when the problem of endogenous selection into RTAs has been recognized in the literature on bilateral trade volumes (Baier and Bergstrand, 2002, 2006; Magee, 2003).[2] Second, since RTAs and trade are co-determined by the same exogenous observables, this limits the range of available econometric techniques for empirical analysis (Baier and Bergstrand, 2006).

This paper contributes to the empirical literature on RTA effects in the following ways. First, it investigates trade structure effects, which have not so far been on the research agenda. Second, it uses a different econometric method, namely matching, to account for endogeneity. As noted above, general equilibrium theory indicates that RTAs and trade are co-determined by the same exogenous variables, which renders standard instrumental variable procedures problematic. For instance, Baier and Bergstrand (2006, p. 14) point out that the instrumental variables approach "*is not a reliable method for addressing the endogeneity bias of the FTA [free trade area] binary variable in a gravity equation*". They even find that a control function procedure as derived in Heckman (1978) eventually gives very unstable results. A reasonable alternative that has not been used before in the context of RTA effects is matching, which explicitly builds on the idea of selection on observables and does not require outside instruments. Third, we consider the possible relevance of multinational firms. Even though multinationals have attracted considerable attention in the profession over the last two decades (Markusen, 1995, 2002), they play a far less prominent role in the RTA literature, with Ludema (2002) being a notable exception.[3] We account for the possible role of multinationals in two ways. On the one hand, foreign investment costs affect the self-selection into RTA membership together with the other fundamentals. On the other hand, profit repatriation can lead to unbalanced goods trade, which warrants the use of a trade imbalance-adjusted index of intra-industry trade.[4] To see this, consider the original Grubel-Lloyd (1971, 1975) index on intra-industry trade share, which can be formulated as follows,

---

[2] As pointed out by Baier and Bergstrand (2006), neglecting the endogeneity of RTA formation has severe consequences and leads to a substantial downward bias of the trade flows effect by a factor of five.

[3] This is the more surprising as the literature on multinationals identifies "tariff-jumping" as an important motive for foreign direct investment (see Smith, 1987; Motta, 1992).

[4] See Bergstrand (1983) for an early contribution.

$$GLI_{ij} = \sum_k \frac{2 \times \min\left(\text{export}_{ijk}, \text{import}_{ijk}\right)}{\sum_k \text{export}_{ijk} + \sum_k \text{import}_{ijk}} \tag{1}$$

where i and j are country indices and k refers to industries. Now consider a simple one-good model, where goods trade is balanced by repatriated profits of foreign subsidiaries. Then, the Grubel-Lloyd index (GLI) in (1) deviates from unity although all goods trade occurs within the same industry. Following Grubel and Lloyd (1971) and Egger, Egger, and Greenaway (2004) we can adjust this index for trade imbalances to obtain an unbiased measure of intra-industry trade in the presence of multinational firms:

$$CGLI_{ij} = \sum_k \frac{2 \times \min\left(\text{export}_{ijk}, \text{import}_{ijk}\right)}{\sum_k \text{export}_{ijk} + \sum_k \text{import}_{ijk} - \left|\sum_k \text{export}_{ijk} - \sum_k \text{import}_{ijk}\right|} \tag{2}$$

which is not affected by a trade-imbalance bias, i.e., it gives a value of unity in our example with a single good.

3 Data and Empirical Methodology

In this section we introduce our database, describe the econometric techniques available to avoid a self-selection bias, and discuss the empirical approach we use to estimate the impact of endogenous RTAs on the intra-industry trade share.

3.1 Data

Our empirical analysis focuses on the role of new RTA membership for bilateral intra-industry trade shares mainly within the OECD.[5] There are several advantages over considering a broader sample of economies. First, trade data and data on explanatory variables determining trade as well as RTA membership are generally more reliable for industrialised

[5] Our country sample includes 29 OECD members, Hong Kong, and China. A detailed description of the country sample can be found in the Appendix.

countries. Since our Grubel-Lloyd index variable will be constructed from export data only,[6] reliance on high-quality data is important. Second, country-pairs that are not members of the same RTA are more likely to form a relevant control group to compare RTA members within this sample of economies.

The OECD publishes bilateral export data for 31 reporters at the Standard International Trade Classification (SITC), Revision 2, in the *International Trade by Commodity Statistics*. We compute export-based intra-industry trade shares for each available country-pair and year, using 4-digit data. The data are available from 1960 onwards, but we do not use all recorded observations. In particular, the use of consistent annual information on the explanatory variables (physical capital stocks, skilled and low-skilled labour endowments, and trade and investment costs) limits our data-set to the period after 1970. For the sake of consistent estimation, we look at differences in the change in the Grubel-Lloyd index between treated (i.e., new RTA members) and untreated country-pairs (i.e., those pairs that were not part of the same RTA in a given year). This difference-in-difference analysis is able to control for all time-invariant unobserved effects and is most likely to yield consistent RTA parameters after controlling for endogenous selection. However, it is necessary to focus on equal spacing over time of RTAs in the data-set. This means that pre-treatment and post-treatment periods should be of equal length for both the treated and controls when estimating RTA effects on either the corrected (CGLI) or uncorrected Grubel-Lloyd index (GLI). Thus, we construct a biannual window around the phases where new RTA memberships occur and compare the average annual change in Grubel-Lloyd indices between treated and untreated but only for those years with new RTA memberships. Such a procedure is necessary to obtain consistent estimates of the contemporaneous effects of RTAs by avoiding problems associated with autocorrelation in the data (see Bertrand, Duflo, and Mulainathan, 2004).

> Table 1 <

Table 1 provides details on 96 new RTA memberships covered by the data, sorted chronologically. Our difference-in-difference set-up requires that we skip all data except those around the five years with new RTA events. Thus we are interested in estimating the impact of new RTA membership in 1977, 1981, 1986, 1989, 1994, and 1995 on GLI (CGLI) by

[6] Egger, Egger, and Greenaway (2004) provide a comparison of various Grubel-Lloyd-type measures of intra-industry trade. Their analysis supports the use of a measure that is based on exports only, using data from mirror statistics of developed economies.

controlling for self-selection into RTAs. Note that in our data-set there was no exit from RTAs. Therefore, we can think of the selection model as a cross-section of new RTA membership events. We include time dummies for all but one of the six years. In a second step, we construct differences in bilateral Grubel-Lloyd indices (DCGLI for the corrected and DGLI for the uncorrected index) over the periods 1976-1977, 1980-1981, 1985-1986, 1988-1989, 1993-1994, and 1994-1995.

> Table 2 <

Table 2 reports the descriptive statistics for the explanatory variables in the selection model. In general, we rely on lagged levels that are assumed predetermined to explain new RTA membership. The basic variables (GLI, GDP, L, H, K, TC, IC, Dut) and their sources are listed in Table A1 in the Appendix.

3.2 Self-Selection into RTA Membership: Problems and Cures

Existing general equilibrium models of trade are explicit about the endogenous formation of RTAs (see Section 2 and Baier and Bergstrand, 2004, for an overview). One observation from this line of research is that market size, factor endowments, and transport costs determine the associated welfare effects and, hence, the "likelihood" of RTA membership. In the presence of multinational firms, investment costs may also be important for endogenous membership in RTAs. This implies that the same economic fundamentals that determine trade volumes and trade structure at the bilateral level also determine the likelihood of RTA membership.

Membership is typically captured by a dummy variable set at one if two countries participate in the same RTA (in a given year) and zero otherwise. We could think of this as an indicator variable that is one if some latent variable exceeds a critical value. If RTA membership is randomly assigned to country-pairs, we can estimate the (exogenous treatment) effect of RTA membership on intra-industry trade shares or trade volumes simply by OLS. In a data-set that exhibits both cross-sectional and time dimensions, we can consistently estimate the effect of RTA membership by OLS including country-pair fixed effects or by the difference-in-difference estimator. The latter approach compares the change in some outcome variable (e.g., GLI) within a given time span between the treated (new RTA members) and the untreated (non-members). The associated simple comparison of the average change in GLI between the treated and untreated is an unbiased estimate of the RTA-related treatment effect only if a new RTA membership is uncorrelated with the error term (see Wooldridge, 2002, p. 637f.). If there is self-selection into new RTA membership, this is not the case any more. Then, we have to explicitly account for self-selection to retrieve unbiased estimates of the RTA effect.

Most of the available techniques to do so are rooted in the program evaluation literature. Empirical work on international trade has applied some of the available techniques to overcome the bias from self-selection. For instance, Magee (2003) employed a systems estimation approach that relies on the idea of instrumental variable techniques. In contrast to our difference-in-difference approach, which accounts for the effect of new RTA membership on trade, he exploited information on the cross-sectional variation in RTAs. Baier and Bergstrand (2006) use a fixed effects panel model and, alternatively, OLS on differenced data, using trade flows for five-year intervals. In contrast to the difference-in-difference matching procedure applied below, they assume that new RTA membership is uncorrelated with the time-variant error term. If this assumption is violated, the results are affected by a bias from endogenous self-selection similar to cross-section models. Furthermore, with their data-set new RTA membership is unequally spaced within the time intervals considered. For instance, a new RTA membership may occur at the beginning but also the end of the interval so that the estimates of the contemporaneous effects account for weighted time-aggregated effects of RTAs on trade volumes. This can be overcome by constructing the database such that identical spell lengths are considered around each new membership.

Before we proceed with the application, we provide a brief outline of the general problem of self-selection and its possible cures.

Cures for Self-Selection:

There are three lines of research on how to overcome self-selection bias affecting estimates of treatment effects on some outcome variable. These are (i) matching techniques based on metrics such as the propensity score to construct a valid control group (see Rosenbaum and Rubin, 1983, 1984, Imbens, 2004, Abadie, 2005), (ii) control function procedures, where so-called inverse Mills' ratios (one or more) based on the predictions of the selection equation are used in the outcome model to eliminate the bias (see Heckman, 1978, Wooldridge, 2002), or (iii) just-identified instrumental variable procedures that use the estimated selection probabilities as an instrument (see Wooldridge, 2002). Note that both matching and control functions assume *ignorability of treatment* (Rosenbaum and Rubin, 1983) or *conditional mean independence* (Wooldridge, 2002). In informal accounts we might say that any possible correlation between the outcome (intra-industry trade share changes) of the treated and the untreated can then be eliminated by conditioning on a vector of observable variables. This is why several authors have labelled related procedures as ones of *selection on observables* (Heckman and Robb, 1985; Moffitt, 1996).

The Instrumental Variables Approach and Its Assumptions:

Instrumental variable procedures apply relatively strong assumptions about functional form, and typically assume the existence of identifying instruments that are correlated with the selection indicator but not directly with the outcome. It is especially the latter assumption that seems violated from a general equilibrium point of view, where all exogenous variables jointly determine both trade structure and volume and the likelihood of RTA membership. We share this view with Baier and Bergstrand (2006, p. 14) who, in the context of RTA effects on trade volumes, point out that the instrumental variables approach "*is not a reliable method for addressing the endogeneity bias of the FTA [free trade area] binary variable in a gravity equation*".

The Control Function Approach and Its Assumptions:

An important assumption for control function procedures to hold is additive separability of the treatment effect and the control function (see Wooldridge, 2002, p. 612). Also, control functions naturally provide estimates of the *average treatment effect* (ATE; i.e., the expected impact of new RTA membership on intra-industry trade shares of a randomly drawn country-pair in the sample; irrespective of whether it actually entered an RTA or not) but not of the *average treatment effect on the treated* (ATT; i.e., the expected RTA effect on the intra-industry trade share of a country-pair randomly drawn from the group of pairs that actually entered an RTA). In contrast to previous research on empirical trade effects of RTA membership (Magee, 2003; Baier and Bergstrand, 2006), we confine ourselves to mainly estimating ATT (rather than ATE). Hence, we primarily consider RTA effects on new members. In contrast to ATT, ATE does not condition on actual entry into an RTA. But rather, is a weighted average of ATT and the *average treatment effect of the untreated* (ATU; i.e., the estimated impact of a hypothetical new RTA membership on the untreated units).

The Matching Approach and Its Assumptions:

An essential assumption for matching procedures that are based on the propensity score (i.e., the non-linear prediction of the selection equation regarding the probability to be treated) is that the propensity score is smaller than unity throughout. In empirical applications this will commonly lead to a loss of those observations that are treated with certainty. Hence, there is a trade-off between goodness of fit in the selection model and the size of the number of usable observations with support. Note that it is impractical to directly match on many explanatory variables due to the "curse of dimensionality". Therefore, similarity is defined according to some metric that maps the vector of observables into a univariate measure. However, even within the support region, a large number of covariates is problematic, since matching estimators include a bias term of stochastic order $N^{-1/k}$ with N being the number of observations and k denoting the number of covariates. In small samples, the associated bias can be substantial (see Frölich, 2004). To overcome this problem, Abadie and Imbens (2006) suggest a bias-correction that renders the matching estimator $N^{1/2}$-consistent and asymptotically normal. Given this, the difference-in-difference treatment effect of, e.g., RTA membership on the Grubel-Lloyd index can be estimated by comparing the differential change in the Grubel-Lloyd index between the treatment group and the properly constructed control group according to the metric used for matching.

The most commonly used, unit-free metrics for matching are the Mahalanobis distance metric (Cochran and Rubin, 1973, Rosenbaum and Rubin, 1985, Rosenbaum, 1995) and the propensity score metric (Rosenbaum and Rubin, 1983, 1984). The former weights each coordinate of the matrix of covariates proportionately by the inverse variance of that variable; with the latter treatment selection is specified by either a logit or probit model, starting with a latent variable model of the form

$$RTA^{*} = \mathbf{x}\boldsymbol{\beta} + e, \quad RTA = 1[RTA^{*} > 0] \tag{3}$$

where e is a continuously distributed error term symmetric about zero and independent of $\mathbf{x}$, the vector of explanatory variables (the "observables"). The probability model to be estimated can be written as

$$P(RTA = 1 \mid \mathbf{x}) = P(RTA^{*} > 0 \mid \mathbf{x}). \tag{4}$$

We employ both probit and logit models to estimate the parameter vector $\boldsymbol{\beta}$. These provide us with estimates of the propensity score p($\mathbf{x}$). In our case, the latter is to be interpreted as the likelihood of entering an RTA, conditional on the observables. Note that any univariate metric will only establish a useful measure of similarity, if the treated units (new RTA members) and the control units (the comparable subgroup of non-members) are similar with respect to every observable determining the metric. In the matching literature, this is sometimes referred to as the "balancing property". Otherwise, classifying some control country-pair as being similar to a treated one according to the chosen metric can be misleading. To avoid the associated bias, Blundell and Costa Dias (2002) suggest, in the second step, conditioning on those observables for which the balancing property is violated.[7] In our case, the balancing property is not violated according to t-tests as can be seen from Table A2. Hence, this concern should be of minor importance but we can still eliminate any remaining differences by conditioning on the observables.

The vector of estimated propensity scores $\hat{p}(\mathbf{x})$ is used to construct an appropriate control group of non-RTA-member country-pairs with a similar probability of new RTA membership as the actual new RTA members. A single or several similar untreated country-pairs can be matched to each new RTA member. The number of matched control units is either exogenously imposed (in k-nearest neighbour matching estimators such as one-to-one matching) or a critical interval is determined with all untreated countries in the corresponding region around a treated observation's propensity score selected in the control group. Some estimators even use a large amount or all untreated units as controls with their weight declining in the absolute difference to a treated unit's propensity score.

ATT with one-to-one matching is equivalent to running a weighted least squares regression of DCGLI and DGLI on RTA where a frequency weight is assigned to all treated (each of them gets weight one) and control units (a control unit gets a weight corresponding to the number of treated units it was matched onto) and zero to all other untreated observations. Hence, there are as many control observations as treated ones. This may involve a dramatic decline in the number of observations to estimate ATT. Accordingly the quality of one-to-one matching comes at the cost of a loss in efficiency. This shortcoming is overcome by matching more than just one – e.g., five – nearest neighbours to each treated country-pair by assigning the same weight to each of these k-nearest untreated observations regardless of how close they are in terms of their propensity score. This can be further improved by determining a radius around each treated country pair's propensity score. In our case, we choose a radius of 0.1

[7] I.e., running a weighted least squares model of DCGLI and DGLI on RTA that includes the critical covariates of the probit for which the balancing property does not hold.

(i.e., ten percentage points of the likelihood of becoming a new RTA member); within that untreated pairs would be selected into the control group. This implies an endogenous number of matched controls for each treated unit. Accordingly, the treated will differ in terms of the number of matched controls.

Finally, kernel density matching assigns weights that decline in the propensity score difference of the target country-pair to the controls. In large samples, one-to-one matching, k-nearest neighbour matching, radius matching and kernel matching are consistent, since the local neighbourhood of the propensity score for a target country-pair declines with sample size (see Frölich, 2004). In small samples, the efficiency loss with one-to-one matching or the bias from less exact matching can be serious.

4 Estimating Self-Selection into New RTA Membership

Table 3 summarizes the results of various probit model specifications for new RTA membership. In Probits 1-5, we use a common trend and in 6-10 we include time dummies.[8] Probits 1 and 6 use size variables of the same functional form as Helpman (1987), who estimates the determinants of trade structure. Similarity of country size is measured by the similarity of bilateral GDP. This has a positive sign in all specifications, which is in line with theory, pointing to a higher likelihood of RTA membership for similarly sized economies (see Baier and Bergstrand, 2004, p. 47).

> Table 3 <

In Probits 2-5 and 7-10, we employ similarity indices of all three factors. The literature is not conclusive about the nexus between relative factor endowment differences and likelihood of RTA membership (see Section 2). In our empirical application, the coefficient of low-skilled labour is significantly positive, that of human capital is insignificant, and that of physical capital significantly negative. Note that human capital might enter insignificantly due to its

[8] We also could have used logit models instead of probits to estimate the propensity score. Davidson and MacKinnon (2004) suggest to test probit and logit against each other based on a likelihood ratio test. According to the test statistics summarized in Table 3, Logits 1 and 2 are rejected against their probit counterparts. The other logits perform at least as well as their probit counterparts (results are available from the authors upon request). In the sensitivity analysis below we illustrate that the logit and the probit models result in very similar estimates of the endogenous RTA effect on intra-industry trade.

high correlation with physical capital.[9] Alternatively, in Probits 1 and 6 we have deployed a specification using absolute differences in skilled-to-unskilled labour endowments and in capital-to-unskilled labour endowments instead of each factor endowment separately. Then the coefficient of the former is significantly negative and that of the latter is insignificantly positive (similar to the capital-labour coefficient in Baier and Bergstrand, 2004). However, this result does not provide support for Krueger's (1999, p. 116) hypothesis that an RTA "*between a developed and a developing country is more likely to improve welfare*", as our country sample mainly covers OECD members.

The bilateral trade cost variable tends to have a negative impact on the probability of joining an RTA (see Probit 1-4 and 6-9). This result is consistent with the argument in Ludema (2002, p. 336) that "*geographical proximity facilitates trade policy coordination*". However, when accounting for interaction terms between endowment variables and bilateral transport costs, the latter effect becomes insignificant (see Probit 5 and Probit 10).

To account for the role of multinational firms, we include investment cost variables. In particular, we employ the average size of and absolute difference in bilateral investment costs as well as an interaction term between low-skilled labour endowment similarity and the investment cost ratio as determinants of new RTA membership. Use of these variables can be motivated by a model with horizontal multinationals and trade in the longer version of this paper (Egger, Egger, and Greenaway, 2005). The empirical results indicate that all three variables enter significantly, and their coefficients are positive.[10]

Finally, we included duties as a separate control variable. Countries with high tariffs in the initial situation either lose a lot of tariff income from entering an RTA or they incur substantial market pressure from foreign firms entering their market. A negative sign of the respective coefficients may be an indicator that higher initial duties are associated with a negative attitude towards bilateral trade liberalisation. This aspect has so far not been emphasized in empirical work on endogenous RTAs. However, our finding lends support to the so-called Natural Trading Partner Hypothesis, which states that RTAs are "*more likely if countries already have significant bilateral trade*" (Magee, 2003, p. 3).

[9] The insignificance could also be due to measurement problems with this variable; however, alternative data are not available at the required annual level for the time span under consideration.

[10] We have also estimated specifications that included an interaction term between the similarity in capital endowment and the investment costs. However, the respective coefficient turned out to be insignificant.

Since Probit 9 performs best in terms of explanatory power, it is a natural candidate to rely on for matching.[11] MacFadden's Pseudo R^2 indicates that the explanatory power of the model is high. In addition, we note that the null hypothesis of the similarity of the samples of the treated and control observations with respect to the separate controls is not rejected (see Table A2 in the Appendix). Hence, there is no indication of a violation of the balancing property which suggests that the propensity score metric is an unbiased measure of the similarity between the treated and control units.

5 Effect of RTA Membership on the Intra-Industry Trade Share

Table 4 summarizes the findings of descriptive comparison estimates and several matching estimates of ATT. To ensure that the estimated RTA effect does not pick up any bias associated with violation of the balancing property or the omission of relevant determinants of the intra-industry trade share, we additionally control for the observables in the treatment effect regressions following Blundell and Costa Dias (2002). The descriptive comparison is simply an OLS regression of DCGLI and DGLI on RTA. The first two matching estimates – a one-to-one matching and a five-nearest neighbour matching – rely on the Mahalanobis distance metric. These are bias-corrected as suggested by Abadie and Imbens (2006). The others are based on the propensity score: one-to-one matching, five-nearest neighbour matching, radius matching, and kernel matching.

> Table 4 <

We apply each matching approach and, additionally, the descriptive comparison as the benchmark estimator to two different concepts of the intra-industry trade share index. These are the index corrected for multilaterally imbalanced trade due to the activity of MNEs (Egger, Egger, and Greenaway, 2004) and the uncorrected Grubel-Lloyd index.

The findings can be summarized as follows. First, for our difference-in-difference analysis it seems of minor importance whether the corrected or uncorrected index is used. The reason for

[11] It should also be noted that Probit 7-10 (and, similarly, Probit 2-5) can be tested against each other based on likelihood ratio tests. For instance, Probits 7 and 8 are rejected against Probit 9, whereas Probit 9 is not rejected against Probit 10 at the 10% significance level.

this is that the average annual change in CGLI is small as it is for multilateral trade imbalances. Second, the descriptive comparison estimates that ignore selection on observables point to a positive impact on the intra-industry trade share of about 0.6 to 0.8 percentage points which is not significantly different from zero. Third, ignoring self-selection into RTA membership leads to a downward-biased estimate of the impact on either index. Depending on the matching estimator, this downward bias is estimated at between 62 percent (propensity-score-based one-to-one matching) and 86 percent (bias-adjusted one-to-one matching).

Since the number of covariates is relatively large, this could affect the quality of the propensity score estimates. Hence, the bias-adjusted Mahalanobis metric-based estimates might be more trustworthy. The impact of new RTA membership seems quantitatively important and amounts to almost 40 percent (bias-adjusted one-to-one matching) of the average level of the corrected index in the sample. This is also remarkable as we know from Table 2 that the change in the two intra-industry trade share indices was about zero on average around new RTA membership events. A positive effect of RTA membership is consistent with insights from Markusen and Maskus (2001), who investigate the role of trade costs for the intra-industry trade share.

How do these estimates compare to the literature on trade effects of endogenous RTAs? Of course, existing research was concerned with RTA effects on trade volumes rather than intra-industry trade shares. It has been found that the net impact of RTAs on trade volumes is positive if self-selection is accounted for. But recent research did not investigate whether RTAs result in gains from specialisation (associated with inter-industry trade) or facilitate trade overlap (associated with a love of variety and economies of scale). Since the approach by Baier and Bergstrand (2006) is closest to ours in focusing on new RTA membership, we confine our comparison to their work. To do so, we applied the matching techniques also to bilateral trade volumes. The results are summarized in the outer right column of Table 4. Note that trade volumes are in logs so that the estimates indicate the log-change in trade volumes associated with a new RTA membership after one year.

For a comparison, two remarks are in order. First, we focus on more or less contemporaneous effects of RTAs, throughout. Hence, their impact may eventually be larger after some “phasing-in” period. However, we do not account for this since it may be hard to isolate the effect of RTAs in later periods from the impact of other effects. Second, we consider a narrowly defined set of industrialised economies for data quality reasons. Third, we consider new RTA events after 1970 for data reasons. With this approach at hand and using bias-adjusted one-to-one matching estimates, we identify an RTA-induced trade volume effect that is close to the lagged RTA effect of 0.19 estimated by Baier and Bergstrand (2006) in specification (3) of their Table 6 (this specification is the most comparable to our analysis by concept).

6 Robustness of the RTA Effect on Intra-Industry Trade Shares

We assess robustness in various ways. First, with respect to (i) the omission of bilateral economic variables, (ii) the use of logit models instead of their probit counterparts to illustrate that the treatment effects are insensitive in this regard, and (iii) block matching as an alternative to the methods used in the previous subsection. Table 5 investigates these when using the change in the trade-imbalance-corrected index (DCGLI) as the outcome variable.[12] Second, we study the relevance of omission of potentially relevant political variables. Third, we consider the role of interdependence of the country-pairs with respect to observable characteristics. Fourth, we compare the ATT with the ATE. Fifth, we allow the ATT to vary across country-pairs depending on the included observable characteristics. Finally, we assess the impact of a new RTA membership on intra-industry trade for each 2-digit SITC category separately.

6.1 Specification of the Selection Equation I (Omission of Relevant Bilateral Economic Variables, Logit vs. Probit, and Block Matching)

The ATT estimates in Table 4 are very robust to alternative model specifications regarding the coverage of economic determinants as in Table 3. This is indicated by the respective estimates for Logits 9 and 10 in Table 5. ATT is much lower only if relevant economic observables are not controlled for in the case of one-to-one matching (for instance, when using the excessively parsimonious binary choice selection Models 6 and 7 in Table 3). Detailed results are available from the authors upon request.

[12] We only report the results for Models 9 and 10 since the others are rejected against these alternatives. The corresponding results for the uncorrected DGLI are very similar and available from the authors upon request.

> Table 5 <

Using logit instead of probit models has no influence on the treatment effects. This can be seen by comparing the different estimates for Logit 9 in Table 5 with their respective counterparts in the first column of Table 3. Finally, using block matching instead of nearest-neighbour, radius, or kernel matching, yields very similar results as other matching estimators. This can bee seen from a comparison of the results at the bottom of Table 5 with the remaining ones.

Based on the levels of log-likelihood and corresponding likelihood ratio tests, Logit 9 is preferable to the estimated alternatives (probits and logits). Due to the possible relevance of a bias-correction in our sample, the Mahalanobis-metric-based one-to-one estimator in the spirit of Abadie and Imbens (2006) might be most reliable among those applied in our case. The results based on the propensity score metric form a lower bound among the considered estimates.

6.2 Specification of the Selection Equation II (Omission of Relevant Political Variables)

We estimated models which included potentially important political variables in the last but one column of Table 5. For instance, Magee (2003) and Baier and Bergstrand (2004) indicate that political and political-economy variables could be important for RTA formation. Our variables reflect the similarity in the political system in two economies, the maximum/minimum number of years that the leading party had been in power, the political orientation (right-wing versus left-wing) of the leading party, the durability of two countries' political systems since the last regime change - an index of political stability, the fractionalization of the legislature, checks and balances in two economies, and an indicator of maximum polarization between the executive party and the four principle parties of the legislature. These data are available at an annual basis from The World Bank (Beck, Clarke, Groffe, Keefer, and Walsh, 2001, 2004) and from the Polity IV Project data-set (Marshall and Jaggers, 2002). The Appendix provides further details. In general, the use of these variables can be motivated from both the political science literature and a political economy point of view.

First of all, it seems reasonable to assume two governments with the same political system or orientation to exhibit a higher likelihood of implementing a trade agreement (see Gowa and Mansfield, 1993, for the role of political-military alliances for free-trade coalitions). We find support for this view in our selection models reported in Table A3 in the Appendix (e.g., note the positive impact of a left-wing government if the other country is left-wing, too; and similarly for right-wing governments). This result is also in line with the empirical finding of Magee (2003) that preferential trade agreements are more likely between two democracies.

Second, previous research on RTA membership has emphasized the role of lobbying for trade protection (Grossman and Helpman, 1995, Ornelas, 2005). All else equal, lobbying should be more successful (and, thus, more likely), the lower the degree of fractionalization in the legislature and the lower the degree of checks and balances. This hypothesis finds some support in our data-set. Furthermore, we find that a longer period in office tends to reduce the likelihood of RTA formation. An intuition for this result may be that lobbying takes some time before it becomes effective. A lower degree of polarization can also be associated with more lobbying. Hence, the significantly negative coefficients of this variable are difficult to interpret against the background of the lobbying literature. Finally, we find that less durable political systems are more likely to liberalize trade in our sample of country-pairs and years. One of the reasons for this might be that more durable economies have liberalized trade in earlier periods. An alternative explanation may be that durable political systems are more vulnerable to lobbying for trade protection.

Since political variables are significant determinants of self-selection into RTAs, it is of interest to what extent their inclusion affects the ATT estimates of new RTA membership on intra-industry trade shares. As can be seen from the column labelled as "Logit[a)]" in Table 5, it turns out that the difference between the original estimates and the ones based on the political variable augmented selection model is rather small, in particular if the propensity score metric is applied. One major reason for this might be seen in the correlation between the political and the trade and investment cost variables. Hence, the relationship in the propensity scores among country-pairs is largely unaffected, leading only to a small change in the effect on intra-industry trade shares.

6.3 Specification of the Selection Equation III (Omitted Interdependence)

In the previous analysis, we assumed that new RTA membership only depends on bilateral determinants. In a multilateral world, we would expect that third-country variables influence both a new RTA membership as well as the bilateral intra-industry trade share (see also Baier and Bergstrand, 2004, for such an argument). To take this issue into account, we constructed GDP-weighted third-market observables for each country-pair. This assumes that the interdependence of country-pairs is positively related to market size. Accounting for third-country variables (the weighted market size, factor endowments, trade costs, etc.) increases the set of explanatory variables substantially, but the probit and logit models can still be estimated. They are summarized in the columns "Probit[c)]" and "Logit[c)]" in Table A3 of the Appendix.

The associated ATT estimates for the preferred Logit model are given in the column labelled "Logit[b)]" in Table 5. First of all, it should be noted that with the large number of explanatory variables at hand, the likelihood of a bias in simple matching models increases. Hence, we should think of the Abadie and Imbens (2006) bias-corrected estimates as the most reliable ones (see the top rows in Table 5). The one-to-one bias-adjusted matching estimate is somewhat lower than the baseline estimate in Logit 9. Also the propensity score based matching estimates are somewhat lower than the ones in Logit 9. It should be noted that we control for the observables in addition to new RTA membership in the regression approach. Hence, the GDP-weighted third-country variables contribute to the change in the Grubel-Lloyd index on their own. Overall, we may conclude that accounting for the market-size-related interdependence of country-pairs does not affect our qualitative results.

6.4 Estimation of Average Treatment Effects (ATE)

Is the treatment effect of the untreated (ATU) – i.e., the RTA effect that would arise from a hypothetical membership of the actual non-members on their intra-industry trade shares – different from ATT? This can be implicitly answered by looking at the resulting average treatment effect (ATE), which is a weighted average of ATT and ATU. The results for the preferred, bias-adjusted, nearest neighbour matching estimators can be summarized as follows. Irrespective of whether we apply nearest or five-nearest neighbour matching, ATE is bigger than ATT, hence, ATU is bigger than ATT. The estimates are higher than the ATT effects, irrespective of whether the change in the corrected (DCGLI) or the uncorrected

(DGLI) index is considered. This indicates that country-pairs with an annual growth in CGLI that is below the average (and also GLI) are more likely to select into RTA membership than other country-pairs. However, the main result of downward-biased RTA effects on intra-industry trade shares from ignoring selection on observables extends to ATE. For ATE an even bigger downward bias is detected than for ATT. The respecitve ATE estimates are available from the authors upon request.

6.5 Heterogeneous Average Treatment Effects of the Treated (ATT) Across Country-Pairs

So far, we assumed that the treatment effect of the treated is symmetric across country-pairs. While it is common to adopt this assumption in empirical work, it is not necessary to do so. In fact, we might assume that the treatment effect of the treated varies itself with the observables rather than exerting a linear impact. For instance, Wooldridge (2002, p. 613) discusses such an estimation procedure in a control function approach. However, it is possible to adopt a similar assumption with propensity-score-based matching, too. The results are summarized in Table 6.

> Table 6 <

Since there are numerous interaction terms, we report some of the moments (mean, median, standard deviation, maximum, and minimum) at the bottom of the table. In general, the parameter estimates point in the direction that the treatment effect of the treated declines with bilateral country size, similarity in bilateral unskilled labour endowments and the level of bilateral trade costs, and it increases with similarity in bilateral capital endowment and bilateral investment costs. The means of the propensity-score-based ATT estimates are slightly smaller than the original ones (see Table 4). The median effect is somewhat higher than the mean, and the standard deviation is quite large. For some countries, the change in DGLI (or GLI) might be even lower as a response to new RTA membership (this will be the case for large country pairs where unskilled labour endowment differences are relatively high and bilateral trade impediments are significant). This is illustrated by the minimum effect amounting to about -0.14 (for one-to-one matching). Not surprisingly, the maximum impact is quite large with an estimated effect of about 0.10. These findings are very robust across matching procedures.

6.6 Average Treatment Effects of the Treated (ATT) for Separate Goods Categories

In the previous analysis, we focused on the treatment effect of new RTA membership on a country-pair's overall share in intra-industry trade. Here, we ask which industries (or commodity categories) contribute the lion's share. Our findings are summarized in Table 7.

> Table 7 <

There, we estimate ATT based on one-to-one propensity score matching for each SITC two-digit industry and we report the one digit industry-specific simple average below the two-digit results. One general observation from this exercise is that in broad terms the impact of RTAs on the intra-industry trade share tends to be lower for homogeneous industries (see the first column block of results in the table) than for differentiated ones (see the second column block of results in the table). Only the mineral fuels, lubricants and related materials category seems to be an outlier in this respect.

Recent theoretical work points out that a non-trivial share of trade volumes is due to the increasing fragmentation of production across borders (Yi, 2003). To some extent, this could happen even within narrowly defined industries (recall that we compute intra-industry trade shares at the 4-digit level). Then, our finding could imply that RTAs stimulate intra-industry trade not only in final but also in intermediate goods (the latter would be consistent also with the model of Ethier, 1982). Although this cannot be viewed as a formal test of the argument, at the very least, the industries in categories 6, 7 and 8 are ones where we would expect trade in differentiated intermediate goods to be important.

7 Conclusions

A great deal of progress has been made in recent years in the empirical analysis of the impact of regional trade agreements (RTAs) on trade. In particular, issues with endogenous selection into RTAs have come into the limelight. Recent research has identified a significantly positive endogenous treatment effect of RTAs on trade volumes and a potentially sizable downward bias of the corresponding exogenous treatment effect. While fundamental issues about the trade volume effects of RTAs seem to be settled, it has not yet been asked whether the RTA-induced increase in trade volumes is due mainly to increasing inter- versus intra-industry trade. Yet this may be of crucial interest not only from an economic but also from a political point of view. In its early stages, research on intra-industry trade developed on the grounds of concerns about the potentially detrimental effects of the formation of the European Community on labour in the capital-abundant integrating economies. The empirical finding of a sizable share in intra-industry trade not only triggered research on New Trade Theory but also helped alleviate fears of job loss associated with regional integration.

This paper sheds light on the impact of endogenous RTA membership on intra-industry trade shares mainly within the OECD since 1970. Most importantly, we detect a positive treatment effect on intra-industry trade shares induced by a new RTA membership, which amounts to about four per cent for our preferred estimates. This is sizable when taking into acount that the four-digit based average of intra-industry trade shares amounts to about eleven per cent on average in the economies in our sample. In general, we conclude from this that the previously identified RTA-induced increase in trade volumes can be mainly attributed to an associated growth in intra-industry trade, at least in the developed economies.

Besides economic determinants of self-selection into RTA membership, which have been put forward by previous theoretical and empirical work, we have also controlled for the influence of political variables. It turns out that political factors are important for RTA membership but that inclusion of these variables does not change the ATT estimates of new RTAs on the intra-industry trade share in an important way. Regarding the sectoral decomposition of the RTA effects, we find that the impact of endogenous new RTA membership on the intra-industry trade share tends to be lower for industries which can be classifed as more or less homogeneous as compared to ones associated with production of differentiated goods.

References

Abadie, Alberto (2005), Semiparametric Difference-in-Differences Estimators, *Review of Economic Studies* 72, 1-19.

Abadie, Alberto and Guido Imbens (2006), Large Sample Properties of Matching Estimators for Average Treatment Effects, *Econometrica* 74, 235-267.

Bagwell, Kyle and Robert W. Staiger (1997), Multilateral Tariff Cooperation During the Formation of Customs Unions, *Journal of International Economics* 42, 91-123.

Baier, Scott and Jeffrey Bergstrand (2002), On the Endogeneity of International Trade Flows and Free Trade Agreements, unpublished manuscript, University of Notre Dame. *http://www.nd.edu/~jbergstr/Working_Papers/EndogeneityAug2002.pdf*

Baier, Scott and Jeffrey Bergstrand (2004), Economic Determinants of Free Trade Agreements, *Journal of International Economics* 64, 29–63.

Baier, Scott and Jeffrey Bergstrand (2006), Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics*, forthcoming. Currently available under the following link: http://www.nd.edu/~jbergstr/Working_Papers/BaierBergstrandDec2005.pdf

Beck, Thorsten, George Clarke, Alberto Groffe, Philip Keefer, and Patrick Walsh (2001), New Tools in Comparative Political Economy: The Database of Political Institutions, The World Bank Economic Review 15, 165-176.

Beck, Thorsten, George Clarke, Alberto Groffe, Philip Keefer, and Patrick Walsh (2004), Database on Political Institutions, The World Bank.

Bergstrand, Jeffrey H. (1983), Measurement and Determinants of Intra-Industry International Trade, in P. K. Matthew Tharakan (ed.), *Intra-industry Trade: Empirical and Methodological Aspects*, Elsevier Science & Technology Books.

Bertrand, Marianne, Esther Duflo, and Sendhil Mulainathan (2004), How Much Should We Trust Difference-In-Differences Estimates, *Quarterly Journal of Economics* 119, 249–275.

Bhagwati, Jagdish (1993), Regionalism and Multilateralism: An Overview, in Jaime de Melo and Arvind Panagariya (eds.), *New Dimensions in Regional Integration*, Cambridge University Press, Cambridge, UK, 22-51.

Blundell, Richard and Monica Costa Dias (2002), Alternative Approaches to Evaluation in Empirical Microeconomics, *Portuguese Economic Review* 1, 91-115.

Bond, Eric W., Raymond G. Riezman, and Constantinos Syropoulos (2004), A Strategic and Welfare Theoretic Analysis of Free Trade Areas, *Journal of International Economics* 64, 1-27.

Cochran, W. G. and Donald B. Rubin (1973), Controlling Bias in Observational Studies: A Review, *Shankhya, Series A* 35, 417–446.

Davidson, Russell and James G. MacKinnon (2004), *Econometric Theory and Methods*, Oxford University Press, New York.

Egger, Hartmut, Peter Egger, and David Greenaway (2004), Intra-Industry Trade with Multinational Firms: Theory, Measurement and Determinants, *GEP Research Paper No. 2004/10*, University of Nottingham.

Egger, Hartmut, Peter Egger, and David Greenaway (2005), Trade Liberalisation with Multinational Firms: Effects on Welfare and Intra-Industry Trade, *GEP Research Paper* 2005/06, University of Nottingham.

Ethier, William J. (1982), National and International Returns to Scale in the Modern Theory of International Trade, *American Economic Review* 72, 389-405.

Frankel, Jeffrey A., Ernesto Stein, and Shang-Jin Wei (1995), Trading Blocs and the Americas: The Natural, the Unnatural, and the Super-Natural, *Journal of Development Economics* 47, 61-95.

Frankel, Jeffrey A., Ernesto Stein, and Shang-Jin Wei (1996), Regional Trading Arrangements: Natural or Supernatural?, *American Economic Review* 86, 52-56.

Frölich, Markus (2004), Programme Evaluation with Multiple Treatments, *Journal of Economic Surveys* 18, 181–224.

Gowa, Joanne and Edward D. Mansfield (1993), Power Politics and International Trade, *The American Political Science Review* 87, 408-420.

Greenaway, David and Chris Milner (1986), *The Economics of Intra-Industry Trade*, Oxford, Blackwell.

Grossman, Gene M. and Elhanan Helpman (1995), The Politics of Free-Trade Agreements, *American Economic Review* 85, 667-690.

Grubel, Herbert G. and Peter J. Lloyd (1971), The Empirical Measurement of Intra-Industry Trade, *Economic Record* 47, 494-517.

Grubel, Herbert G. and Peter J. Lloyd (1975), *Intra-Industry Trade*, London: Macmillan.

Heckman, James J. (1978), Dummy Endogenous Variables in a Simultaneous Equations System, *Econometrica* 46, 931-960.

Heckman, James J. and Richard Jr. Robb (1985), Alternative Methods of Evaluating the Impact of Interventions, in: James J. Heckman (ed.), *Longitudinal Analysis of Labour Market Data*, Econometric Society Monographs series, no. 10, Cambridge University Press, New York, 156-245.

Helpman, Elhanan (1987), Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries, *Journal of the Japanese and International Economics* 1, 62-81.

Imbens, Guido (2004), Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review, *Review of Economics and Statistics* 86, 4–29.

Krishna, Pravin (2003), Are Regional Trading Partners "Natural"?, *Journal of Political Economy* 111, 202-226.

Krueger, Anne O. (1999), Are Preferential Trading Arrangements Trade-Liberalizing or Protectionist?, *Journal of Economic Perspectives* 13, 105-124.

Krugman, Paul R. (1981), Intraindustry Specialization and the Gains from Trade, *Journal of Political Economy* 89, 959-973.

Krugman, Paul R. (1991), The Move Toward Free Trade Zones, in: Policy Implications of Trade and Currency Zones, A Symposium Sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, WY, 7-42.

Levy, Philip I. (1997), A Political-Economic Analysis of Free-Trade Agreements, *American Economic Review* 87, 506-519.

Ludema, Rodney D. (2002), Increasing Returns, Multinationals and Geography of Preferential Trading Agreements, *Journal of International Economics* 56, 329-358.

Magee, Christopher S. (2003), Endogenous Preferential Trade Agreements: An Empirical Analysis, Contributions to Economic Analysis & Policy 2, Article 15.

Markusen, James (1995), Incorporating the Multinational Enterprise into the Theory of Inernational Trade, Journal of Economic Perspectives 9, 169-189.

Markusen, James (2002), *Increasing Returns, Multinationals and the Theory of International Trade.* MIT Press, Cambridge, MA.

Markusen, James and Keith Maskus (2001), A Unified Approach to Intra-Industry Trade and Direct Foreign Investment. *NBER Working Paper* No. 8335. Printed in Peter Lloyd, Herbert Grubel, and Hyun-Hoon Lee (eds.), *The Frontiers of Intra-Industry Trade*, London: Macmillan, 199-219.

Marshall, Monty G. and Keith Jaggers (2002), Polity IV Project: Political Regime Characteristics and Transitions, 1800-2002, Dataset Users' Manual, Center for International Development and Conflict Management, University of Maryland.

Moffitt, Robert A. (1996), Identification of Causal Effects Using Instrumental Variables: Comment, *Journal of the American Statistical Association* 91, 462-465.

Motta, Massimo (1992), Multinational Firms and the Tariff-Jumping Argument, *European Economic Review*, 36, 1557-1571.

Ornelas, Emanuel (2005), Endogenous Free Trade Agreements and the Multilateral Trading System, *Journal of International Economics* 67, pp. 471-497.

Rosenbaum, Paul R. (1995), *Observational Studies*, Springer Verlag, New York.

Rosenbaum, Paul R. and Donald B. Rubin (1983), The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika* 70, 41–55.

Rosenbaum, Paul R. and Donald B. Rubin (1984), Reducing Bias in Observational Studies Using Subclassification on the Propensity Score, *Journal of the American Statistical Association* 79, 516–524.

Rosenbaum, Paul R. and Donald B. Rubin (1985), Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score, *American Statistician* 39, 33-38.

Smith, Alasdair (1987), Strategic Investment, Multinational Corporations and Trade Policy, *European Economic Review*, 31, 89-96.

Viner, Jacob (1950), The Customs Union Issue, Carnegie Endowment for International Peace, New York.

Wooldridge, Jeffrey M. (2002), *Econometric Analysis of Cross-Section and Panel Data*, MIT Press, Cambridge, MA.

Yi, Kei-Mu (2003), Can Vertical Specialization Explain the Growth of World Trade?, *Journal of Political Economy* 111, 52-102.

Appendix

Country Sample

The regression results are based on bilateral trade flows between the following 31 countries: Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Italy, Japan, Republic of Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, USA.

Appendix Tables and Political Variables Data

> Tables A1-A3 <

The political variables are collected from The World Bank's Database on Political Institutions (Beck, Clarke, Groffe, Keefer, and Walsh, 2001, 2004) and from the Polity IV Project data-set (Marshall and Jaggers, 2002). We provide a brief summary of the information on the variables in use based on these sources.

<u>Data from Beck, Clarke, Groffe, Keefer, and Walsh (2001, 2004):</u>

The World Bank's Database on Political Institutions contains 108 variables for 177 countries from 1975 onwards. We use the following variables from this source:

- **SYSTEM**: This variable provides information about the chief executive. It is coded as follows: direct presidential system (0), strong president elected by assembly (1), parliamentary (2). We use the difference of this variable between two countries to obtain a measure of system similarity ("Same system" in Table A3).
- **YRSOFF**: This variable reflects the number of years a country's chief executive has been in office. We employ this variable for each country by using the bilateral maximum and minimum levels separately ("Maximum years in office …" and "Minimum years in office …" in Table A3).
- **1GOVRLC**: This variable indicates whether the largest government party is located at the right, the left, or the center of the political spectrum. We construct four dummy variables based on this information. They indicate whether only one or both parties of a country-pair are right-wing/left-wing.

- **FRAC**: This variable indicates the total fractionalization of a country's legislature and it reflects the probability that two random draws would produce legislators from different parties. Again, we construct two variables ("Maximum level of total fractionalization …" and "Minimum level of total fractionalization …" in Table A3).
- **CHECKS**: This variable reflects the number of veto players and therefore indicates the degree of political control.
- **POLARIZ**: This variable measures the maximum difference of orientation among the parties in government, and it takes on values in between 0 and 2. Similar to the other variables, the maximum and minimum levels at the country-pair level are separately employed.

Data based from Marshall and Jaggers (2002):

The Polity IV Project 2001 reports data for 185 countries from 1800 onwards. We only use a single variable from this source, namely **DURABLE** which is available from 1949 onwards. The durability indicator reflects the number of years since the last (greater) regime transition and, hence, it is a measure of a country's political system stability.

Table 1: Covered New Regional Trade Agreement Memberships

Country 1	Country 2	Entry	Country 1	Country 2	Entry	Country 1	Country 2	Entry
Austria	Belgium	1977	Italy	Portugal	1977	Portugal	Spain	1986
Austria	Denmark	1977	Italy	Sweden	1977	Spain	Sweden	1986
Austria	France	1977	Netherlands	Norway	1977	Spain	Switzerland	1986
Austria	Ireland	1977	Netherlands	Portugal	1977	Spain	United Kingdom	1986
Austria	Italy	1977	Netherlands	Sweden	1977	Canada	USA	1989
Austria	Netherlands	1977	Norway	United Kingdom	1977	Canada	Mexico	1994
Austria	United Kingdom	1977	Austria	Greece	1981	Denmark	Hungary	1994
Belgium	Finland	1977	Belgium	Greece	1981	France	Hungary	1994
Belgium	Norway	1977	Finland	Greece	1981	Germany	Hungary	1994
Belgium	Portugal	1977	France	Greece	1981	Greece	Hungary	1994
Belgium	Sweden	1977	Germany	Greece	1981	Hungary	Ireland	1994
Denmark	Finland	1977	Greece	Iceland	1981	Hungary	Italy	1994
Denmark	Iceland	1977	Greece	Ireland	1981	Hungary	Netherlands	1994
Denmark	Norway	1977	Greece	Italy	1981	Hungary	Portugal	1994
Denmark	Portugal	1977	Greece	Netherlands	1981	Hungary	Spain	1994
Denmark	Sweden	1977	Greece	Norway	1981	Hungary	United Kingdom	1994
Finland	France	1977	Greece	Portugal	1981	Mexico	USA	1994
Finland	Germany	1977	Greece	Sweden	1981	Austria	Czech Republic	1995
Finland	Ireland	1977	Greece	Switzerland	1981	Austria	Hungary	1995
Finland	Italy	1977	Greece	United Kingdom	1981	Czech Republic	Denmark	1995
Finland	Netherlands	1977	Austria	Spain	1986	Czech Republic	Finland	1995
Finland	United Kingdom	1977	Belgium	Spain	1986	Czech Republic	France	1995
France	Norway	1977	Denmark	Spain	1986	Czech Republic	Germany	1995
France	Portugal	1977	Finland	Spain	1986	Czech Republic	Greece	1995
Germany	Iceland	1977	France	Spain	1986	Czech Republic	Ireland	1995
Germany	Norway	1977	Germany	Spain	1986	Czech Republic	Italy	1995
Iceland	Ireland	1977	Greece	Spain	1986	Czech Republic	Netherlands	1995
Iceland	United Kingdom	1977	Iceland	Spain	1986	Czech Republic	Portugal	1995
Ireland	Norway	1977	Ireland	Spain	1986	Czech Republic	Sweden	1995
Ireland	Portugal	1977	Italy	Spain	1986	Czech Republic	United Kingdom	1995
Ireland	Sweden	1977	Netherlands	Spain	1986	Finland	Hungary	1995
Italy	Norway	1977	Norway	Spain	1986	Hungary	Sweden	1995

Table 2: Descriptive Statistics

Variable		Mean	Std. dev.	Minimum	Maximum
	Controls used in probit models (lagged levels)				
Total bilateral GDP: $\ln TGDP_{ij,t-1}:=\ln(GDP_{i,t-1}+GDP_{j,t-1})$	1647	27.273	1.331	23.835	30.099
Similarity in bilateral GDP: $\ln SGDP_{ij,t-1}:=\ln\{1-[GDP_{i,t-1}/(GDP_{i,t-1}+GDP_{j,t-1})]^2-[GDP_{i,t-1}/(GDP_{i,t-1}+GDP_{j,t-1})]^2\}$	1647	-1.591	0.997	-6.204	-0.693
Similarity in bilateral unskilled endowment: $\ln SL_{ij,t-1}:=\ln\{1-[L_{i,t-1}/(L_{i,t-1}+L_{j,t-1})]^2-[L_{i,t-1}/(L_{i,t-1}+L_{j,t-1})]^2\}$	1647	-1.607	1.024	-6.124	-0.693
Similarity in bilateral skilled endowment: $\ln SH_{ij,t-1}:=\ln\{1-[H_{i,t-1}/(H_{i,t-1}+H_{j,t-1})]^2-[H_{i,t-1}/(H_{i,t-1}+H_{j,t-1})]^2\}$	1647	-0.864	0.277	-2.531	-0.693
Similarity in bilateral capital endowment: $\ln SK_{ij,t-1}:=\ln\{1-[K_{i,t-1}/(K_{i,t-1}+K_{j,t-1})]^2-[K_{i,t-1}/(K_{i,t-1}+K_{j,t-1})]^2\}$	1647	-1.581	0.964	-6.095	-0.693
Absolute bilateral difference in skilled-to-unskilled endowment ratios: $AHL_{ij,t-1}:=\|(H_{i,t-1}/L_{i,t-1})-(H_{j,t-1}/L_{j,t-1})\|$	1647	21.498	17.172	0.000	85.530
Absolute bilateral difference in capital-to-unskilled endowment ratios: $AKL_{ij,t-1}:=\|\ln(K_{i,t-1}/L_{i,t-1})-\ln(K_{j,t-1}/L_{j,t-1})\|$	1647	0.784	0.833	0.002	3.418
Bilateral trade costs: $TC_{ij,t-1}$	1647	1.060	0.102	0.786	1.287
Interaction term: $\ln SL_{ij,t-1}\times TC_{ij,t-1}$	1647	-1.727	1.178	-7.520	-0.546
Interaction term: $\ln SK_{ij,t-1}\times TC_{ij,t-1}$	1647	-1.688	1.073	-7.488	-0.545
Average bilateral investment costs: $0.5*IC_{i,t-1}+0.5*IC_{j,t-1}$	1647	37.218	6.346	21.160	58.099
Absolute difference in bilateral investment costs: $abs(IC_{i,t-1}-IC_{j,t-1})$	1647	10.315	7.407	0.036	33.183
Interaction term: $\ln SL_{ij,t-1}\times(IC_{i,t-1}/IC_{j,t-1})$ if $L_{j,t-1}>L_{i,t-1}$ else $\ln SL_{ij,t-1}\times(IC_{j,t-1}/IC_{i,t-1})$	1647	-1.635	1.396	-13.839	-0.351
Exporter duties: $Dut_{i,t-1}$	1469	3.419	3.334	0.000	14.920
Importer duties: $Dut_{j,t-1}$	1469	3.436	3.353	0.000	14.920
	Dependent and control variables in second stage (changes)				
Change in bilateral Grubel-Lloyd index: $DGLI_{ijt}$	1587	-0.010	0.082	-0.640	0.259
Change in trade-imbalance-adjusted bilateral Grubel-Lloyd index: $DCGLI_{ijt}$	1587	-0.011	0.087	-0.716	0.275
New regional trade agreement membership: FTA_{ijt}	1647	0.118	0.322	0.000	1.000

Table 3: Selection Into Entering a Regional Trade Agreement

Explanatory variables:	Probit 1	Probit 2	Probit 3	Probit 4	Probit 5	Probit 6	Probit 7	Probit 8	Probit 9	Probit 10
Total bilateral GDP: ln $TGDP_{ij,t-1}$	-0.279	-0.401	-1.015	-1.029	-1.059	-0.229	-0.357	-1.014	-1.027	-1.053
	-5.78 ***	-7.34 ***	-11.73 ***	-11.74 ***	-11.62 ***	-4.66 ***	-6.40 ***	-10.79 ***	-10.79 ***	-10.68 ***
Similarity in bilateral GDP: ln $SGDP_{ij,t-1}$	0.192	-	-	-	-	0.230	-	-	-	-
	2.60 ***	-	-	-	-	3.04 ***	-	-	-	-
Similarity in bilateral unskilled endowment: ln $SL_{ij,t-1}$	-	0.538	0.998	0.790	-0.308	-	0.543	1.031	0.814	-0.190
	-	4.55 ***	7.24 ***	4.37 ***	-0.32	-	4.49 ***	7.08 ***	4.37 ***	-0.19
Similarity in bilateral skilled endowment: ln $SH_{ij,t-1}$	-	0.580	0.951	0.945	5.860	-	0.546	0.677	0.656	4.170
	-	1.59	2.14 **	2.15 **	1.26	-	1.43	1.45	1.43	0.88
Similarity in bilateral capital endowment: ln $SK_{ij,t-1}$	-	-0.520	-1.322	-1.409	-1.444	-	-0.487	-1.345	-1.433	-1.462
	-	-4.47 ***	-8.90 ***	-9.01 ***	-9.08 ***	-	-4.11 ***	-8.50 ***	-8.69 ***	-8.73 ***
Absolute bilateral difference in skilled-to-unskilled endowment ratios: $AHL_{ij,t-1}$	-0.009	-	-	-	-	-0.012	-	-	-	-
	-2.28 **	-	-	-	-	-3.01 ***	-	-	-	-
Absolute bilateral difference in capital-to-unskilled endowment ratios: $AKL_{ij,t-1}$	0.002	-	-	-	-	0.048	-	-	-	-
	0.02	-	-	-	-	0.54	-	-	-	-
Bilateral trade costs: $TC_{ij,t-1}$	-3.452	-3.297	-1.394	-1.418	-3.848	-3.458	-3.310	-1.563	-1.594	-3.072
	-7.21 ***	-6.84 ***	-2.22 **	-2.26 **	-1.06	-7.07 ***	-6.71 ***	-2.46 **	-2.51 **	-0.84
Interaction term: ln $SL_{ij,t-1} \times TC_{ij,t-1}$	-	-	-	-	1.058	-	-	-	-	0.967
	-	-	-	-	1.16	-	-	-	-	1.04
Interaction term: ln $SK_{ij,t-1} \times TC_{ij,t-1}$	-	-	-	-	-4.676	-	-	-	-	-3.333
	-	-	-	-	-1.06	-	-	-	-	-0.74
Average bilateral investment costs: $0.5^*IC_{i,t-1}+0.5^*IC_{j,t-1}$	0.037	0.040	0.045	0.044	0.044	0.037	0.042	0.044	0.043	0.043
	4.66 ***	5.06 ***	4.19 ***	4.09 ***	4.06 ***	4.56 ***	5.06 ***	3.93 ***	3.83 ***	3.81 ***
Absolute difference in bilateral investment costs: $abs(IC_{i,t-1}-IC_{j,t-1})$	0.018	0.018	0.039	0.043	0.042	0.017	0.017	0.036	0.040	0.040
	2.78 ***	2.78 ***	4.74 ***	5.00 ***	4.97 ***	2.58 ***	2.55 **	4.36 ***	4.65 ***	4.63 ***
Interaction term: ln $SL_{ij,t-1} \times (IC_{i,t-1}/IC_{j,t-1})$ if $L_{j,t-1} > L_{i,t-1}$ else ln $SL_{ij,t-1} \times (IC_{j,t-1}/IC_{i,t-1})$	-	-	-	0.178	0.172	-	-	-	0.186	0.181
	-	-	-	1.63	1.55	-	-	-	1.65 *	1.59
Exporter duties: $Dut_{i,t-1}$	-	-	-0.120	-0.122	-0.124	-	-	-0.126	-0.128	-0.129
	-	-	-6.72 ***	-6.79 ***	-6.85 ***	-	-	-6.83 ***	-6.89 ***	-6.94 ***
Importer duties: $Dut_{j,t-1}$	-	-	-0.124	-0.126	-0.126	-	-	-0.130	-0.132	-0.132
	-	-	-6.96 ***	-7.02 ***	-7.00 ***	-	-	-7.06 ***	-7.12 ***	-7.12 ***
Year Dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Trend	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO
Observations	1647	1647	1297	1297	1297	1647	1647	1297	1297	1297
Log-likelihood	-456.52	-445.53	-322.86	-321.49	-320.39	-440.62	-432.95	-313.74	-312.33	-311.60
Pseudo R^2	0.24	0.25	0.39	0.39	0.39	0.26	0.27	0.40	0.41	0.41
Probit versus logit (Davidson and MacKinnon, 2004; distributed as $\chi^2(1)$)	5.02 **	6.46 **	14.95 ***	15.51 ***	15.36 ***	1.26	2.66	21.91 ***	22.49 ***	22.71 ***

Note: Figures below coefficients are z-statistics. Constant, time trend and year dummies are not reported. ***, **, * denote significance levels of 1%, 5%, and 10%, respectively.

Table 4: Treatment Effect of the Treated From Entering a Regional Trade Agreement on the Intra-Industry Trade Share and Trade Volumes (Based on Probit 9 of Table 3)

Estimator	Corrected GLI	Uncorrected GLI	Volume of trade (log)
Descriptive comparison (no endogenous selection)	0.006	0.008	0.091 ***
Standard error	0.008	0.007	0.034
Mahalanobis distance metric (bias-adjusted):			
One-to-one matching	0.043 ***	0.041 ***	0.172 ***
Standard error	0.012	0.012	0.038
Five nearest neighbor matching	0.018 *	0.017 *	0.204 ***
Standard error	0.009	0.009	0.032
Propensity score metric:			
One-to-one matching	0.016 *	0.016 *	0.096 **
Standard error	0.010	0.009	0.045
Five nearest neighbor matching	0.029 ***	0.025 ***	0.093 ***
Standard error	0.008	0.008	0.036
Radius matching (radius is 0.1)	0.032 ***	0.031 ***	0.086 ***
Standard error	0.005	0.005	0.022
Kernel matching (Epanechnikov kernel; bandwidth=0.06)	0.027 ***	0.026 ***	0.086 ***
Standard error	0.005	0.004	0.021

Note: ***, **, * denote significance levels of 1%, 5%, and 10%, respectively.

Table 5: Sensitivity Analysis of the Treatment Effect of the Treated (ATT) From Entering a Regional Trade Agreement on the Intra-Industry Trade Share (Dependent is the Trade-Imbalance-Corrected Grubel-Lloyd Index; Estimates Based on Propensity Score Metric)

Estimator	Logit 9	Logit 10	Logit[a)]	Logit[b)]
Mahalanobis distance metric (bias-adjusted):				
One-to-one matching	0.043 ***	0.049 ***	0.020 **	0.029 ***
Standard error	0.012	0.013	0.009	0.009
Five nearest neighbor matching	0.018 *	0.020 **	0.020 *	0.029 **
Standard error	0.009	0.009	0.011	0.012
Propensity score metric:				
One-to-one matching	0.035 ***	0.020 *	0.026 **	0.024 **
Standard error	0.008	0.011	0.011	0.012
Five nearest neighbor matching	0.034 ***	0.023 **	0.037 ***	0.025 ***
Standard error	0.005	0.008	0.010	0.009
Radius matching (radius is 0.1)	0.027 ***	0.034 ***	0.030 ***	0.032 ***
Standard error	0.005	0.005	0.005	0.004
Kernel matching (Epanechnikov kernel; bandwidth=0.06)	0.032 ***	0.029 ***	0.033 ***	0.027 ***
Standard error	0.005	0.005	0.005	0.004
An alternative - block-matching:				
Stratification	0.031 ***	0.028 ***	0.016 ***	0.016 ***
Standard error	0.008	0.009	0.006	0.006

Note: ***, **, * denote significance levels of 1%, 5%, and 10%, respectively. - a) Logit model includes political variables. - b) Logit model as in a) plus GDP-weighted observables of third countries. See Table A3 in the Appendix for details.

Table 6: Heterogeneous Treatment Effect of the Treated (ATT) From Entering a Regional Trade Agreement on the Intra-Industry Trade Share
(Specification as in Probit 9 of Table 3; the volume of trade is in logs)

Explanatory variables:	One-to-one matching	Five-nearest neighbours	Radius matching	Kernel matching
Main effect of new regional trade agreement	0.013	0.024 ***	0.027 ***	0.023 ***
	0.011	0.009	0.005	0.005
Interaction terms with:				
Total bilateral GDP: ln $TGDP_{ij,t-1}$	-0.021	-0.016	-0.017 **	-0.017 **
	0.016	0.013	0.007	0.007
Similarity in bilateral unskilled endowment: ln $SL_{ij,t-1}$	-0.065 *	-0.080 ***	-0.060 ***	-0.064 ***
	0.034	0.026	0.015	0.015
Similarity in bilateral skilled endowment: ln $SH_{ij,t-1}$	-0.021	0.077	0.084 **	0.094 **
	0.072	0.061	0.039	0.038
Similarity in bilateral capital endowment: ln $SK_{ij,t-1}$	0.066 *	0.057 **	0.043 ***	0.045 ***
	0.035	0.028	0.016	0.016
Bilateral trade costs: $TC_{ij,t-1}$	0.020	-0.119	-0.095 *	-0.097 **
	0.103	0.085	0.050	0.048
Average bilateral investment costs: $0.5*IC_{i,t-1}+0.5*IC_{j,t-1}$	0.000	0.001	0.002 ***	0.002 ***
	0.002	0.001	0.001	0.001
Absolute difference in bilateral investment costs: $abs(IC_{i,t-1}-IC_{j,t-1})$	0.002	-0.001	0.000	0.000
	0.002	0.002	0.001	0.001
Moments of the marginal effect of a new regional trade agreement				
Mean	0.013	0.023	0.027	0.023
Median	0.028	0.030	0.035	0.032
Std. Dev.	0.046	0.044	0.042	0.043
Minimum	-0.138	-0.152	-0.130	-0.143
Maximum	0.090	0.115	0.106	0.103

Note: ***, **, * denote significance levels of 1%, 5%, and 10%, respectively.

Table 7: Treatment Effect of the Treated From Entering a Regional Trade Agreement on the Intra-Industry Trade Share at the SITC 2-digit and 1-digit Level
(Dependent is the Trade-Imbalance-Corrected Grubel-Lloyd Index; Estimates Based on Propensity Score Metric; One-to-one Matching)

Code	SITC-label	ATT	Std.	Code	SITC-label	ATT	Std.
00	Live animals chiefly for food	0.015	0.018	57	Explosives and pyrotechnic products	-0.020	0.040
01	Meat and meat preparations	-0.013	0.009	58	Artificial resins, plastic materials, cellulose esters and ethers	-0.027	0.016
02	Dairy products and birds'eggs	0.012	0.029	59	Chemical materials and products, n.e.s.	0.042	0.019 **
03	Fish, crustaceans, mollucs, preparations thereof	0.027	0.014 *	**5**	**Chemicals and related products, n.e.s.**	**0.009**	
04	Cereals and cereal preparations	0.017	0.018				
05	Vegetables and fruit	0.010	0.007	61	Leather, leather manufactures, n.e.s. and dressed furskisg	-0.015	0.024
06	Sugar, sugar preparations and honey	0.029	0.031	62	Rubber manufactures, n.e.s.	0.031	0.021
07	Coffee, tea, cocoa, spices, manufactures thereof	0.016	0.022	63	Cork and wood manufactures (excluding furniture)	0.024	0.012 *
08	Feeding stuff for animals, not including unmilled cereals	-0.047	0.022 **	64	Paper, paperboard, articles of paper, paper-pulp/board	0.013	0.011
09	Miscellaneous edible products and preparations	-0.009	0.030	65	Textile yarn, fabrics, made-up articles, related products	0.032	0.011 ***
0	**Food and live animals**	**0.005**		66	Non-metallic mineral manufactures, n.e.s.	0.015	0.009
				67	Iron and steel	0.051	0.014 ***
11	Beverages	-0.009	0.015	68	Non-ferrous metals	0.040	0.020 **
12	Tobacco and tobacco manufactures	-0.017	0.028	69	Manufactures of metal, n.e.s.	0.051	0.013 ***
1	**Beverages and tobacco**	**-0.013**		**6**	**Manufactured goods classified chiefly by material**	**0.027**	
21	Hides, skins and furskins, raw	0.015	0.024	71	Power generating machinery and equipment	-0.011	0.027
22	Oil seeds and oleaginous fruit	0.006	0.024	72	Machinery specialized for particular industries	0.036	0.014 **
23	Crude rubber (including synthetic and reclaimed)	0.051	0.054	73	Metalworking machinery	0.031	0.029
24	Cork and wood	0.004	0.013	74	General industrial machinery & equipment, and parts	0.075	0.016 ***
25	Pulp and waste paper	-0.047	0.027 *	75	Office machines & automatic data processing equipement	0.026	0.020
26	Textile fibres (except wool tops) and their wastes	0.031	0.015 **	76	Telecommunications & sound recording apparatus	-0.041	0.028
27	Crude fertilizers and crude materials (excluding coal)	0.039	0.012 ***	77	Electrical machinery, apparatus & appliances n.e.s.	0.105	0.022 ***
28	Metalliferous ores and metal scrap	0.051	0.021 **	78	Road vehicles (including air-cushion vehicles)	0.017	0.017
29	Crude animal and vegetable materials, n.e.s.	-0.003	0.018	79	Other transport equipment	-0.029	0.032
2	**Crude materials, inedible, except fuels**	**0.016**		**7**	**Machinery and transport equipment**	**0.023**	
32	Coal, coke and briquettes	0.001	0.004	81	Sanitary, plumbing, heating and lighting fixtures	0.108	0.035 ***
33	Petroleum, petroleum products and related materials	0.038	0.025	82	Furniture and parts thereof	0.101	0.028 ***
34	Gas, natural and manufactured	0.000	0.201	83	Travel goods, handbags and similair containers	-0.029	0.031
35	Electric current	0.146	0.253	84	Articles of apparel and clothing accessories	-0.028	0.016 *
3	**Mineral fuels, lubricants and related materials**	**0.046**		85	Footwear	0.035	0.030
				87	Professional, scientific & controling instruments	0.078	0.016 ***
41	Animal oils and fats	-0.016	0.038	88	Photographic apparatus, optical goods, watches	0.019	0.020
42	Fixed vegetable oils and fats	-0.009	0.019	89	Miscellaneous manufactured articles, n.e.s.	0.023	0.013 *
43	Animal-vegetable oils-fats, processed, and waxes	-0.006	0.014	**8**	**Miscellaneous manufactured articles**	**0.038**	
4	**Animal and vegetable oils, fats and waxes**	**-0.010**					
				91	Postal packages not classified according to kind	-0.015	0.020
51	Organic chemicals	0.014	0.017	93	Special transactions not classified according to kind	-0.044	0.040
52	Inorganic chemicals	0.014	0.019	94	Animals, live, zoo animals, dogs, cats etc.	-0.052	0.048
53	Dyeing, tanning and colouring materials	0.016	0.020	95	Arms, of war and ammunition therefor	0.143	0.053 ***
54	Medicinal and pharmaceutical products	0.000	0.018	96	Coin (other than gold) , not being legal tender	-0.002	0.002
55	Essential oils & perfume materials; toilet polishing and cleansing prep.	0.012	0.019	97	Gold, non-monetary	-0.008	0.013
56	Fertilizers, manufactured	0.033	0.045	**9**	**Commodities and transactions not elswhere classified**	**0.004**	

Note: ***, **, * denote significance levels of 1%, 5%, and 10%, respectively. Control variables are included in the second step estimations throughout. 1-digit figures are unweighted averages.

Table A1: Basic Variables and Their Sources

Label	Definition	Source
GLI	Grubel-Lloyd-index	OECD, International Trade by Commodity Statistics
GDP	Gross domesitic product in real U.S. dollars (base 1995)	World Bank, World Development Indicators
L	Unskilled labor (labor force)	World Bank, World Development Indicators
H	Skilled labor (tertiary school enrolment)	World Bank, World Development Indicators
K	Physical capital (perpetual inventory; gross fixed capital formation)	World Bank, World Development Indicators
TC	Bilateral trade costs (bilateral trade-weighted c.i.f./f.o.b.)	OECD, International Trade by Commodity Statistics
IC	Investment costs	BERI
Dut	Import duties	World Bank, World Development Indicators

Table A2: Differences Between Matched and Control Country-Pairs (Based on Probit 9 in Table 3)

Variable	Treated	Controls	Difference: p>|t|
Total bilateral GDP: ln $TGDP_{ij,t-1}$:=ln($GDP_{i,t-1}$+$GDP_{j,t-1}$)	26.261	26.179	0.702
Similarity in bilateral unskilled endowment: ln $SL_{ij,t-1}:=\ln\{1-[L_{i,t-1}/(L_{i,t-1}+L_{j,t-1})]^2-[L_{i,t-1}/(L_{i,t-1}+L_{j,t-1})]^2\}$	-1.135	-1.171	0.673
Similarity in bilateral skilled endowment: ln $SH_{ij,t-1}:=\ln\{1-[H_{i,t-1}/(H_{i,t-1}+H_{j,t-1})]^2-[H_{i,t-1}/(H_{i,t-1}+H_{j,t-1})]^2\}$	-0.783	-0.774	0.705
Similarity in bilateral capital endowment: ln $SK_{ij,t-1}:=\ln\{1-[K_{i,t-1}/(K_{i,t-1}+K_{j,t-1})]^2-[K_{i,t-1}/(K_{i,t-1}+K_{j,t-1})]^2\}$	-1.266	-1.246	0.868
Bilateral trade costs: $TC_{ij,t-1}$	0.990	0.966	0.331
Average bilateral investment costs:0.5*$IC_{i,t-1}$+0.5*$IC_{j,t-1}$	41.374	42.993	0.244
Absolute difference in bilateral investment costs: abs($IC_{i,t-1}$-$IC_{j,t-1}$)	11.724	11.675	0.899
Interaction term: ln $SL_{ij,t-1}\times(IC_{i,t-1}/IC_{j,t-1})$ if $L_{j,t-1}>L_{i,t-1}$ else ln $SL_{ij,t-1}\times(IC_{j,t-1}/IC_{i,t-1})$	-1.197	-1.215	0.896
Exporter duties: $Dut_{i,t-1}$	3.673	4.705	0.258
Importer duties: $Dut_{j,t-1}$	3.687	3.791	0.796
Year dummy for 1981	0.147	0.153	0.885
Year dummy for 1986	0.169	0.277	0.277
Year dummy for 1989	0.011	0.023	0.603
Year dummy for 1994	0.136	0.068	0.329
Year dummy for 1995	0.169	0.090	0.317

Table A3: Selection Into Entering a Regional Trade Agreement (Including Political Variables)

Explanatory variables:	Probit	Logit	Probit[c)]	Logit[c)]
	Economic fundamentals:			
Total bilateral GDP: ln $TGDP_{ij,t-1}$	-1.090	-2.333	-1.787	-3.244
	-9.29 ***	-9.28 ***	-8.45 ***	-7.69 ***
Similarity in bilateral unskilled endowment: ln $SL_{ij,t-1}$	0.853	1.578	4.682	11.157
	5.06 ***	4.66 ***	4.74 ***	5.17 ***
Similarity in bilateral skilled endowment: ln $SH_{ij,t-1}$	0.025	-0.170	-17.197	-23.097
	0.04	-0.14	-4.88 ***	-3.41 ***
Similarity in bilateral capital endowment: ln $SK_{ij,t-1}$	-1.311	-2.672	-6.584	-15.628
	-7.08 ***	-6.9 ***	-6.33 ***	-6.55 ***
Bilateral trade costs: $TC_{ij,t-1}$	-1.317	-2.597	4.578	15.260
	-1.75 *	-1.85 *	0.33	0.58
Average bilateral investment costs: $0.5*IC_{i,t-1}+0.5*IC_{j,t-1}$	0.021	0.040	-0.254	-0.663
	1.08	1.06	-3.89 ***	-4.33 ***
Absolute difference in bilateral investment costs: $abs(IC_{i,t-1}-IC_{j,t-1})$	0.048	0.090	-0.102	-0.273
	4.21 ***	4.15 ***	-2.08 **	-2.56 **
Exporter duties: $Dut_{i,t-1}$	-0.156	-0.323	-0.013	0.111
	-7.00 ***	-7.38 ***	-0.14	0.56
Importer duties: $Dut_{j,t-1}$	-0.161	-0.333	-0.031	0.069
	-7.20 ***	-7.57 ***	-0.33	0.35
	Political variables:			
Same system[a)]	-0.043	0.561	-0.632	-0.897
	-0.22	1.37	-2.68 ***	-1.84 *
Maximum years in office of chief executive within country-pair[a)]	0.019	0.005	0.037	0.049
	0.78	0.11	1.33	0.92
Minimum years in office of chief executive within country-pair[a)]	-0.155	-0.237	-0.263	-0.417
	-2.41 **	-1.94 *	-3.09 ***	-2.55 **
At least one of the two governments is mainly right-wing[a)]	0.283	0.785	0.207	0.675
	1.19	1.7 *	0.76	1.32
Both of the two governments are mainly right-wing[a)]	0.787	1.603	0.966	1.883
	2.93 ***	3.18 ***	3.25 ***	3.28 ***
At least one of the two governments is left-wing[a)]	0.410	1.080	0.356	0.928
	1.7 *	2.39 **	1.33	1.82 *
Both of the two governments are left-wing[a)]	0.891	1.851	0.865	2.065
	3.24 ***	3.31 ***	2.73 ***	3.29 ***
Maximum index of durability[b)]	-0.013	-0.027	-0.015	-0.031
	-4.25 ***	-4.68 ***	-4.01 ***	-4.22 ***
Minimum index of durability[b)]	-0.006	-0.020	-0.001	-0.010
	-1.44	-2.32 **	-0.25	-0.95
Maximum level of total fractionalization in legislature[a)]	-1.330	-3.101	-1.240	-1.761
	-1.29	-1.52	-1.01	-0.72
Minimum level of total fractionalization in legislature[a)]	6.019	12.515	6.063	13.926
	5.29 ***	5.57 ***	4.46 ***	5.08 ***
Maximum index of checks and balances[a)]	-0.005	0.027	-0.017	-0.030
	-0.09	0.24	-0.25	-0.22
Minimum index of checks and balances[a)]	0.418	0.732	0.482	0.826
	4.36 ***	3.83 ***	4.33 ***	3.74 ***
Maximum index of polarization[a)]	-0.105	-0.261	-0.079	-0.372
	-1.08	-1.4	-0.72	-1.66 *
Minimum index of polarization[a)]	-0.351	-0.741	-0.403	-0.838
	-3.05 ***	-3.29 ***	-3.10 ***	-3.33 ***
Pseudo R^2	0.491	0.523	0.583	0.616
Log-likelihood	-259.7	-243.3	-212.6	-195.7

Note: ***, **, * denote significance levels of 1%, 5%, and 10%, respectively. - a) Annual data are from The World Bank (Beck, Clarke, Groffe, Keefer, and Walsh, 2004). - b) Annual data are from the Polity IV Project data-set (Marshall and Jaggers, 2002). - c) Including GDP-weighted third-country effects. The parameters of the constant, the time dummies, and the (jointly significant) GDP-weighted observables are not reported for space reasons.