Australian Government

Productivity Commission

Bilateral and Regional Trade Agreements

Supplement to Research Report

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An Econometric Analysis of the Links Between the Formation of Trade Agreements and Merchandise Trade

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About this supplement

The terms of reference for the Productivity Commission's study into *Bilateral and Regional Trade Agreements* required the Commission to assess, among other things, the impact of bilateral and regional trade agreements (BRTAs) on trade flows.

To assist in addressing this issue, the Commission has undertaken two streams of quantitative economic modelling. One was the analysis of the prospective effects of reductions in trade and investment barriers on trade flows and aggregate levels economic activity and income. That work utilised the GTAP general equilibrium model of the global economy, with results reported in a separate supplement.

The other stream — the subject of this supplement — is an econometric analysis. It examines the effects of 27 representative trade agreements, as implemented, on the value of actual merchandise trade flows using a comprehensive trade database over the period 1970 to 2008. In the analysis, the effects of an agreement were assessed by comparing the levels of bilateral and regional trade before and after an agreement entered into force, while controlling for other determinants of trade. The analysis is intended to shed light on the association between broad BRTA design features and the significance and direction of influence that these have on trade flows. For example, it makes it possible to draw a distinction between the effects of agreements with relatively strong bilateral or regional preferential arrangements (such as NAFTA and EEC) and those more oriented towards open or non-discriminatory principles (such as ASEAN and APEC).

The methodology used by the Commission, and the results obtained, are described in chapters 3, 4 and 5. To provide context for the Commission's analysis, some key trends in BRTA formation are set out in chapter 1, and some previous empirical studies are discussed in chapter 2.

This supplement has benefitted from the input of participants at a workshop, which was held on 17 May 2010, and from three referees: Associate Professor Robert Bruenig (Research School of Economics, Australian National University); Associate Professor Russell Hillberry (Department of Economics, University of Melbourne); and Emeritus Professor Ron Duncan (Crawford School of Economics & Government, Australian National University).

This supplement supports the Commission's report on Bilateral and Regional Trade Agreements, which was released on 13 December 2010.

1   Some trends in trade and BRTAs

The Commission's study on *Bilateral and Regional Trade Agreements* was conducted against the backdrop of a rapid increase over recent years in the number and reach of BRTAs worldwide. With this growth has come some debate about the impact of BRTAs on trade flows.

To provide some context for the econometric studies presented in the chapters that follow, this chapter outlines key trends in the formation of BRTAs and the share of trade links between countries that they potentially cover. It also outlines some difficulties in using simple statistical observations to seek to determine whether, and how, BRTAs affect trade flows.

Growth in the number and coverage of trade agreements[1]

Since the early 1960s, the number of trade agreements in force and notified to the WTO has grown from 9 to almost 280, more than 200 of which deal with merchandise trade.[2] More than half of these agreements have been finalised since 1990 (figure 1.1). In addition to the agreements notified to the WTO, there are a substantial number of other regional and bilateral agreements that influence trade relations between countries (for example, APEC and those agreements between some

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[1] The Commission was asked to examine the impacts of 'bilateral and regional trade agreements' (BRTAs). BRTAs is interpreted to include agreements, including 'free trade agreements' and 'customs unions', between one or more countries involving the provision of tariff or other trade preferences to members of the agreement. In addition, for the purposes of the Commission's study, the term is also interpreted to include agreements between trading partners to lower their own trade barriers with respect to all parties (including those outside the agreement) either according to arrangements bound under the agreement, or on a voluntary basis, such as was agreed by APEC members in the 1994 Bogor Declaration.

[2] In 1962, the agreements in force comprised: the Central American Common Market (CACM), European Free Trade Association (EFTA), the Treaty of Rome (from which the EU evolved), EFTA–Finland Association, the Latin American Free Trade Area (LAFTA), the Canada–Australia trade agreement, the Ghana–Upper Volta trade agreement, the EEC–Greece interim agreement and the Equatorial Customs Union (comprised of the Central African Republic, Chad, Congo and Gabon).

The WTO reports 204 agreements pertaining to merchandise trade notified to the WTO and in-force in 2010, but this underestimates the actual number of agreements in-force as many are not notified to the WTO. In 2006, there were at least 130 agreements not notified to the WTO (Medvedev 2006).

members of the former Soviet Union). As well as increasing in number, the scope of agreements has expanded from covering tariff preferences in merchandise trade to including many non-merchandise trade provisions.

Figure 1.1 **Number of agreements notified to the WTO in force, 1960 — 2010**[a]
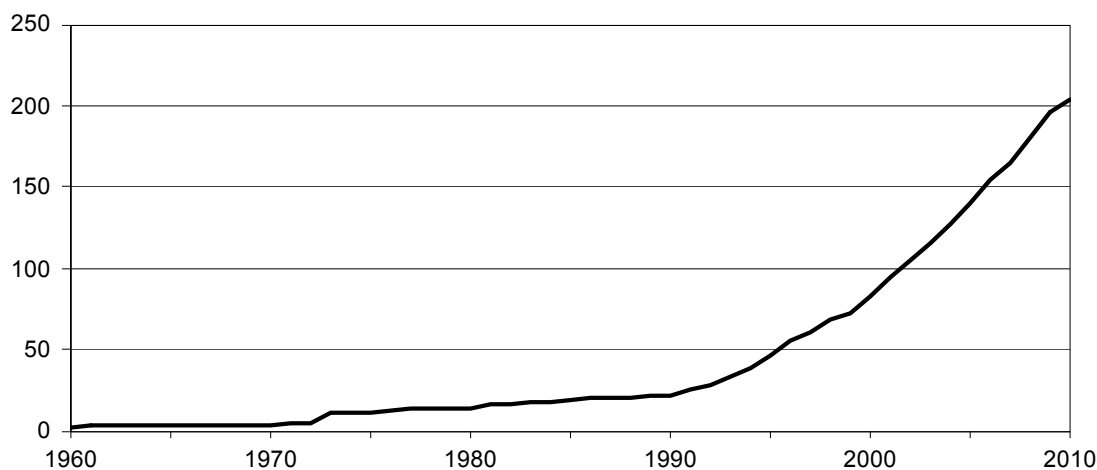
a Only agreements pertaining to merchandise trade.
Source: WTO (2010).

The spread of BRTAs has led to a significant increase in the number of global trade relationships potentially affected by preferential arrangements — both directly (trade between members) and indirectly (trade between members and non-members):

- The potential share of global trade directly affected by one or more trade agreements increased from 23 per cent in 1970 to approximately 49 per cent of global trade flows in 2008 (figure 1.2 left panel).[3]

- The potential share of global trade directly and indirectly affected by trade agreements increased from 75 per cent in 1970 to more than 99 per cent in 2008 (figure 1.2 right panel).[4]

- Available information also indicates that the proportion of trade, by value, that may be directly influenced by two or more agreements has steadily increased.

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[3] Direct influence refers to trade between countries which have one or more trade agreements in place. However, it should be noted that the figure represents total trade between trade agreement members, rather than the share of that trade that is granted preferences under BRTAs.

[4] Indirect influence refers to trade between countries where only one of the countries is a member of any particular trade agreement.

Figure 1.2 **Trade agreements influence on global merchandise trade, 1970 — 2008**[a]

Direct influence (member to member)   *Direct and indirect influence (member to member and member to non-member)*

One agreement   Two or more agreements
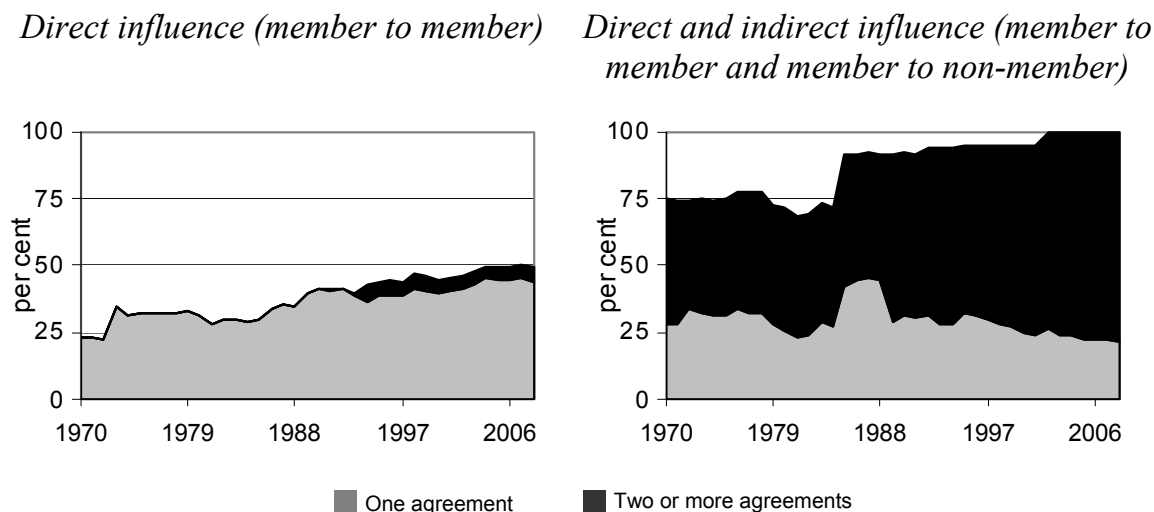
a Per cent of merchandise trade (in current USD[5]) based on trade between all countries included in the UN Comtrade database and 416 agreements (223 in force and notified, 88 expired and notified and 105 not notified to the WTO)[6]. Does not include APEC.

Source: Trade data from UN Comtrade, trade agreements compiled from WTO (2008) and Medvedev (2006).

Historically, because of the economic size and extent of bilateral trade between European economies, and to a lesser extent South American economies, the formation in the decades following the Second World War of agreements such as the EU, EFTA and the Central American Common Market (CACM) resulted in a significant portion of global merchandise trade occurring between BRTA members.

The share of global trade occurring between members expanded substantially during the late 1980s and rose further with the formation of regional agreements such as ASEAN and NAFTA, and numerous bilateral agreements, to just under half of global merchandise trade by 2008.

This rapid increase in the number of BRTAs in force globally has led to many overlapping agreements (multiple agreements which share common members); in 2008 more than 5 per cent global merchandise trade was between countries that shared membership of two or more BRTAs (figure 1.2, left hand panel).

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5 Non-US currencies are converted to US dollars using an average annual exchange rate, calculated by weighting the monthly exchange rate with the monthly value of trade.

6 Using a comprehensive sample of trade agreements and the UN's Comtrade database, it is possible to estimate the proportion of bilateral trade links and volume of global trade flows that are potentially influenced by bilateral and regional trade agreements. The sample was compiled from a WTO sourced list of all notified trade agreements (311 in-force and expired) and from Medvedev (2006) for 105 trade agreements not notified to the WTO.

Impacts on merchandise trade between BRTA members?

The establishment of a trading agreement, or expansion of membership of existing BRTAs, is not *necessarily* associated with an increase in the importance of trade between member economies (figure 1.3). For example:

- Following the formation of the Australia–New Zealand Closer Economic Relations Trade Agreement (ANZCERTA), the share of trade between Australia and New Zealand remained fairly stable (at around 5 per cent of the combined trade of Australia and New Zealand in current US dollars).

- Intra-group trade shares for the NAFTA economies increased from an average of 24 per cent in the 4 years prior to the agreement to approximately 30 per cent in the early 2000s before falling to approximately 26 per cent in 2008.

Figure 1.3   Intra-group merchandise trade shares of major BRTAs[a]
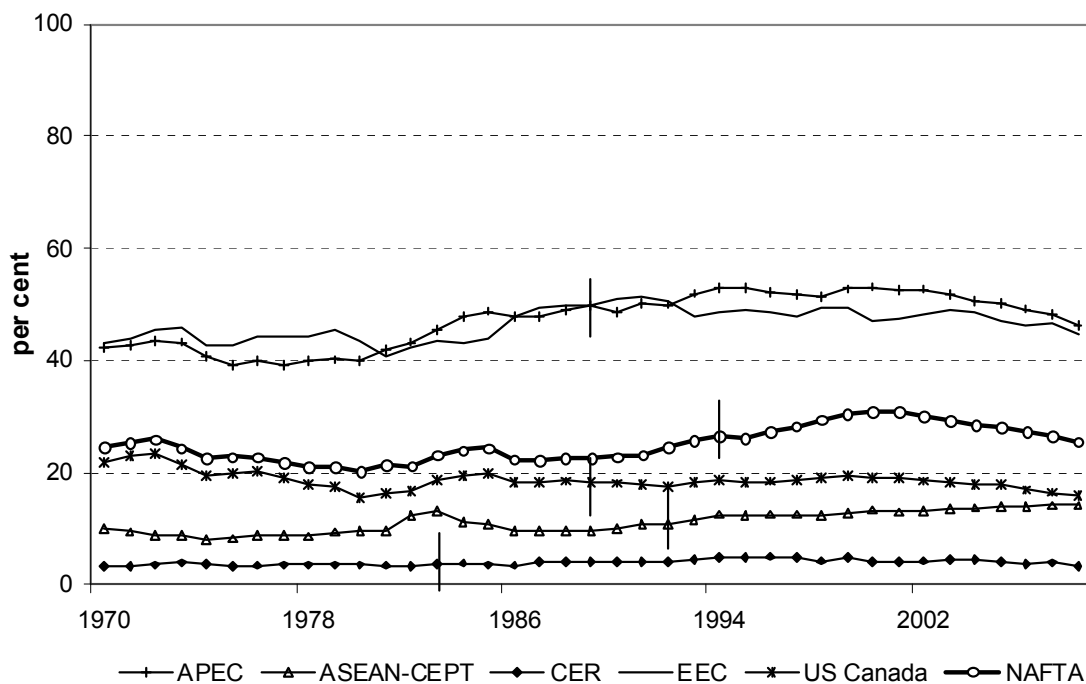
a For the purposes of this figure, 'membership' of each agreement for the entire period 1970 - 2008 includes all countries that were members of the agreement for at least one year between 1970 and 2008. Share of trade is calculated as the share of trade in current $US between 'members' as a percentage of their total trade.

Source: Commission estimates using UN Comtrade data.

Overall, simple statistical observation reveals no consistent pattern between the formation of a BRTA and the magnitude of trade between BRTA member economies relative to the total trade of those economies. Even when there is an association with increased trade between economies and the formation of the

agreement, the association does not necessarily imply causality. Other factors may be at work, including economic size and propensity to trade, economic stimulus arising from general micro-economic reform programs (such as unilateral MFN tariff reductions and other trade reforms, and competition policy reforms) and improved macroeconomic stability.

A more sophisticated analysis is therefore required to separate the impact of BRTA formation and membership from the influence of other factors.

2   Some previous empirical studies

The substantial variability in the incidence and reach of preferential trading arrangements over the last 40 years (chapter 1), together with the availability of extensive data on merchandise trade, provide a basis for the econometric estimation of the impact of trade agreements on trade between members and between members and non-members. Suitably aggregated, such estimates could also shed light on the likely impacts of agreements on global merchandise trade levels.

Numerous studies have sought to make such estimates, typically using models of trade. One of the most commonly applied econometric models, the 'gravity' model of trade, is an empirical model of trade between countries that allows examination of the effects of policies that affect trade while abstracting from the effects of other factors which may also affect trade flows (box 2.1).

Box 2.1   Gravity models of trade

The gravity model is the primary *ex post* econometric technique used to examine the determinants of trade flows. As implied by the name, the gravity model is a model of trade flows based on an analogy with the law of gravity in physics – relating trade between two countries to their size and the distance between them (Anderson 1979).

The gravity model has been shown to be consistent with a number of theoretical models of international trade (see, for example, Anderson and van Wincoop 2003). In its simplest form, trade between two countries is determined by a number of factors, including the supply conditions at the origin of trade, demand conditions at the destination and various other stimulating and restraining forces on trade. Further information on gravity models is provided in Appendix A.

Gravity model studies have been undertaken for a wide range of BRTAs. In turn, there have been a number of reviews of the econometric literature on BRTAs. While not attempting to be comprehensive, this chapter presents some findings from the empirical literature to date.

Importantly, while the gravity model is used widely, there is no de-facto standard with respect to its implementation, specification and estimation. There is thus scope for significant variation in methodology, data selection and other factors that may affect the estimated results of the same agreement across studies. While keeping this

scope in mind, it is helpful to explore methodological approaches and commonalities in the estimated effects of trade agreements across the literature, and the broad picture that emerges.

Results from some selected studies

Early work on the impacts of preferential trade agreements (the ECC and EFTA) by Aitken (1973) suggested that agreements created trade in early years but, in later years, were likely to divert trade. Since that time, a vast literature has developed on the impacts of BRTAs more generally. This section details a few of the recent studies on these issues.

Bayoumi and Eichengreen (1995) examined the EEC and EFTA agreements. The authors found that the impact on members changed over the life of the agreements. Their examination of EFTA found that overall, it was trade creating, while the EEC created trade between members but also had trade diversionary effects.

Bilateral agreements between the European Union (EU or EEC) 15 and Central and Eastern European countries (Bulgaria, Hungary, Poland and Romania) have also been the subject of analysis. Sova and Sova (2009) found that these agreements were trade creating for the partners. Further, while not specifically modelling extra-group effects, the authors also found that the trade importance of the EU for these countries increased dramatically over the period of operation.

In a broad ranging study, DeRosa (2007) explored the effects of a number of trade agreements identified by the WTO over the period 1970-1999 and concluded that the 'majority in force today are trade creating rather than trade diverting'. However, the analysis did not take into account the size of the effects in terms of global trade, so did not provide an insight into the net effects of individual agreements.

Carrere (2002) examined trade data for 130 countries over the period 1962-1996 to explore the impact of regional trade agreements — EEC, Andean, NAFTA, CACM, MERCOSUR, ASEAN, EFTA and LAIA. Using a gravity model, Carrere found that overall, while agreements created trade between members, they also had significant trade diversionary impacts. However, the ASEAN and LAIA agreements were found to be the only agreements associated with trade creation (both intra- and extra-group) over the period.

In a study of regional trade agreements between developing countries, Coulibaly (2007) also found mixed effects of trade creation between members and

non-members.[1] All agreements examined, with the exception of the South Asia Preferential Trade Agreement, were found to create trade between members. However, as with other studies, the ASEAN agreement was found to be associated with trade creation both between members and between members and non-members.

In a later study, Armstrong and Drysdale (2009) employed a stochastic frontier model to explore the relative trade and investment performance of a range of major regional trading blocs — APEC, ASEAN, NAFTA, EU, Andean and MERCOSUR. Their results suggested, amongst other things, that trade diversion is associated with the discriminatory regional trading blocs such as NAFTA, MERCOSUR, Andean and the EU. APEC and ASEAN, on the other hand, show increased trade amongst members and non-members. The study did not find evidence of trade diversion in the latter agreements. The paper also suggests an 'APEC effect' to explain how consultative processes around economic interests can contribute to trade (and investment) openness.

Chang and Winters (2002) examined the price effects of Mercosur on both members and non-members using a sample of HS 6-digit data. They found strong price pass-through for some members (for example Chile) and corresponding reductions in export prices from some non-members (for example Japan). They found evidence to suggest that even for non-member exporters supplying a member market, the price effects of an agreement could be quantitatively significant.

There are also a number of studies which have focused on the US–Canada and NAFTA agreements in some detail, and with varying results. For example:

- Clausing (2001) examined the US–Canada trade agreement using HS 10-digit US import data. The study found that significant intra-group trade creation was associated with the formation of the agreement — intra-group trade levels were estimated to be 26 per cent higher than could be expected in the absence of the agreement. Further, Clausing found no evidence of trade diversion.

- In another study using HS 10-digit data, Romalis (2005) obtained different results. Examining the US–Canada and NAFTA agreements, Romalis (2005) found that while both agreements were associated with increased trade between partners, trade diversion was significant. In the case of NAFTA, the significance of the trade diversion was such that it resulted in a welfare loss for Mexico.

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[1] Coulibaly (2007) examined the following agreements: the Economic Community of West Asia; South African Development Community; Andean agreement; CACM, MERCOSUR; ASEAN; and South Asia Preferential Trade Agreement.

- USITC (2002) compared Mexico's import demand responsiveness to tariff preferences under NAFTA with import demand responsiveness under the pre-NAFTA Generalised System of Preferences (GSP). The study found that Mexico's import demand responsiveness increased following the implementation of NAFTA, attributing the change to increased confidence accompanying the NAFTA tariff cuts.

- Using more aggregated trade data, in a follow-on study from Coulibaly (2007), Coulibaly (2009) also examined the impact of NAFTA. This study found that while NAFTA was associated with increased trade between members, it had mixed effects on exports and imports between members and non-members with the agreement being associated with increased imports from non-members into the group, while exports from members to non-members declined.

Previous reviews of the literature

A number of broad ranging reviews have examined the broader question of the general relationship between BRTAs and trade flows.

In reviewing a range of studies of BRTAs, Adams et al. (2003) found that the majority of previous studies estimated almost all BRTAs to be net trade creating rather than net trade diverting. The authors however noted a number of methodological issues affecting the results across the studies they surveyed, including:

- use of cross sectional econometric analysis which could not correct for unobservable (that is, country-specific or time dependent) fixed effects;

- the absence of accounting for the timing of the establishment of an agreement;

- the omission of other determinants of bilateral flows including tariff preferences and relative price changes); and

- the exclusion of the effects of trade agreements on trade with non-members.

They suggested that the findings could be sensitive to the treatment of these issues.

A meta-analysis of the literature conducted by the World Bank (2005) of 17 research studies covering over 250 estimates of the overall impact of agreements on intra- and extra-regional trade indicates that:

> … although agreements typically have a positive impact on intra-regional trade, their overall impact is uncertain. Actual experience reinforces that there can be no presumption that a preferential trade agreement will be trade creating. (p. 63)

Heydon and Woolcock (2009) also discuss a number of findings from existing literature on the impact of BRTAs on trade flows. They conclude that:

> Overall, the findings of ex post studies produce a fairly mixed picture, indicating that some PTAs boosted intra-bloc trade significantly, whereas others did not. There is some evidence that external trade is smaller than it might otherwise have been in at least some of the groupings, but the picture is mixed enough so that it is not possible to conclude whether trade diversion has been a major problem. (p. 221)

Cipollina and Salvatici (2010) conducted a meta analysis of 85 gravity model-based studies of trade agreements. They too found that most BRTAs were estimated to be net trade creating. Nevertheless, their findings indicate that typically the estimated effect of trade agreements is less positive when fixed effect models are utilised, suggesting a failure to adequately control for country-specific fixed effects creates a positive bias in the results obtained.

Drawing on the reviews by Adams et al. and Cipollina and Salvatici, the estimated impact of a number of selected major agreements is presented in table 2.1. Generally, the results obtained for most of the selected agreements are consistent, with most variation seen in the extra-group effects. In this regard, the ASEAN agreement is the only one reported to be associated with both positive intra-group and extra-group effects. Negative or mixed results on extra-group trade are reported for the other selected agreements. This suggests that the characteristics of BRTAs themselves, the broader circumstances surrounding the introduction of agreements and the composition of the membership have confounding influences on potential outcomes.

Table 2.1   **Analysis of the direction of estimated effects of selected trade agreements**

	Adams et al. (2003).		*Cipollina and Salvatici (2010)*
	Intra-group	Extra-group	Intra-group [a]
ASEAN	Positive	Positive	Positive
EU	Positive	Mixed	Positive
EFTA	Same effect as EU, but smaller magnitude		
US–Canadian			Negative
NAFTA	Mixed	Negative	Positive
Mercosur	Positive	Negative	Positive
ANDEAN	Mixed	Negative	Positive
CER	Positive	Negative	

[a] Cipollina and Salvatici do not provide results for extra-group effects.

The World Bank (2005) also analysed the impact of a number of agreements and noted that the broader policy context in which a BRTA is designed and implemented is crucial in determining its effects. It found that agreements which

have been designed to complement a general program of economic reform appear to have been the most effective in raising trade. Further, barriers outside the BRTA affect the performance of the BRTA itself:

> … the most important ingredient for success is low trade barriers with all global partners. Most-favored-nation (MFN; i.e., nondiscriminatory) liberalization, which creates more trade, is the fastest and most efficient way to increase intraregional trade. In addition, agreements that minimize excluded products expand the scope for positive net benefits through competition and trade creation. (World Bank 2005, p. 57)

The World Bank suggested that one way to measure the potential impact of trade agreements is to examine changes in the share of imports from regional partners as a share of total imports to a region. The World Bank found that intra-regional import trade shares increased substantially around the formation of some agreements (figure 2.1). For example, intra-NAFTA trade grew from around 30 per cent of member trade in the 1980s to 50 per cent by the late 1990s, while trade between MERCOSUR members doubled over the same period.[2] The World Bank noted that, in these cases, intra-regional trade had been growing strongly before agreements were signed. It also cautioned that in many cases the increase in intra-regional trade could reflect the impact of unilateral and multilateral reform in addition to regional trade liberalisation.

Figure 2.1   **Evolution of the share of intra-regional imports in total imports**
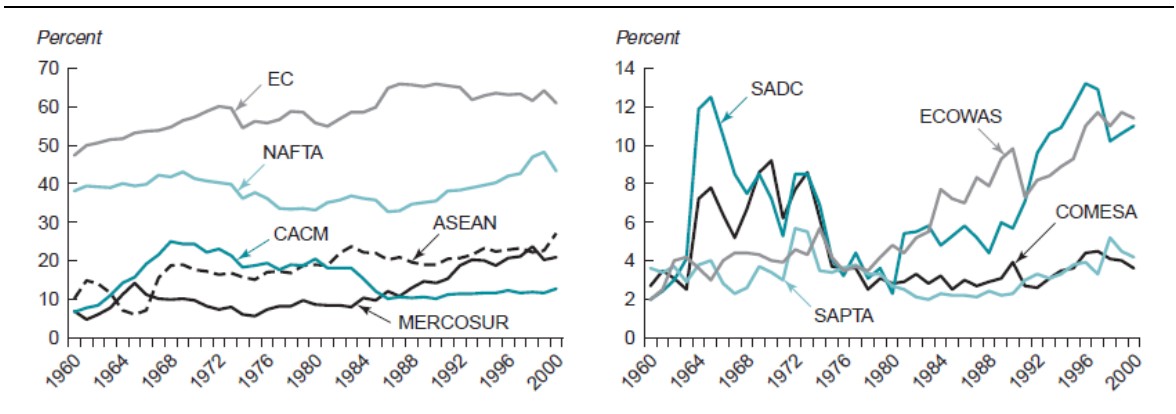
Source: World Bank (2005).

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2 It should be noted that the analysis in World Bank (2005) relates to intra-regional imports as a share of members' total imports. This is in contrast to figure 1.3 in chapter 1 which shows intra-regional *trade* as a share of members' total imports *and* exports.

Summing up

Overall, using a variety of methods, many studies of BRTAs have found that agreements are associated with higher trade between partners. The rationale for these findings is traced back to a reduction in barriers to trade and investment, either on a preferential or non-discriminatory basis.

However, evidence on the trade diversion effects is more mixed, with findings on both the significance and existence of such effects varying between studies and techniques employed. Despite this, results consistently indicate that agreements such as ASEAN have tended to be associated with positive impacts on both intra- and extra-group trade.

3   The Commission's empirical approach

Drawing on recent developments in the econometric literature, the Commission has conducted an econometric study of the effect of 27 BRTAs on bilateral trade flows. Supporting the model is a database of bilateral trade flows, GDP and other relevant variables for more than 140 countries over a 40 year period.

This chapter describes the Commission's empirical approach, including the coverage of agreements, the empirical methodology used and some limitations of the approach. More detail on the methodology used is provided in appendixes to this supplement. The results of the econometrics are discussed in chapters 4 and 5.

3.1   Coverage of agreements

As indicated above, 27 agreements have been included in this study (table 3.1). The agreements have been chosen for inclusion on the basis that either:

- Australia is a member (ANZCERTA, Australia–PNG, SPARTECA and APEC);

- they are likely to affect trade flows of Australia or its major trading partners (including the EEC, EFTA, ASEAN and NAFTA); or

- they are representative of a cross section of BRTAs (including agreements involving the EEC and third countries, and agreements involving Central and South American countries such as CACM, MERCUSOR and Chile–MERCUSOR).

The sample has also been selected to provide coverage of different agreement styles that are within the scope of the Commission's study, ranging from bilateral and regional preferential agreements with varying external tariffs (such as ANZCERTA and NAFTA), to agreements with a common external tariff (that is, customs unions such as the EEC), to non-reciprocal agreements with a development focus (such as Australia–PNG and SPARTECA) and non-preferential agreements based on open regionalism (APEC). It is intended that such coverage will add to the variation in results and contribute to the assessment of the impact of BRTAs.

Table 3.1   **BRTA membership and dynamics**

Agreement	Countries included in the group[a]	Date of effect
APEC	Australia, Brunei, Canada, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, USA, Singapore, Thailand; Chile (from 1994); China and Hong Kong, China (from 1991); Mexico, Papua New Guinea (from 1993); Peru, Russian Federation, Vietnam (from 1998)	1989
ASEAN CEPT	Indonesia, Malaysia, Singapore, Philippines and Thailand; Lao PDR, Myanmar, Vietnam (from 1997)	1992
ANZCERTA	Australia, New Zealand	1983
Australia–PNG	Australia, Papua New Guinea	1977
SPARTECA	Australia, Fiji, New Zealand, PNG, Solomon Islands	1981
EEC 27	Belgium, Luxembourg, France, Germany, Italy, Netherlands; United Kingdom, Denmark, Ireland (from 1973); Greece (from 1981); Spain, Portugal (from 1986); Austria, Finland, Sweden (from 1995); Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia, Slovak Republic (from 2004); Bulgaria, Romania (from 2007)	1958
EEC–Poland	EEC, Poland	1994 to 2003
EEC–Romania	EEC, Romania	1995 to 2006
EEC–Swiss	EEC, Switzerland	1973
EEC–Egypt	EEC, Egypt	1978
EFTA	Norway, Switzerland; Austria (to 1995); Denmark, United Kingdom (to 1972); Portugal, Sweden (to 1985); Finland (From 1986 to 1995), Iceland (from 1970)	1960
EFTA–Hungary	EFTA, Hungary	1993 to 2003
EFTA–Poland	EFTA, Poland	1992 to 2003
EFTA–Israel	EFTA, Israel	1992
CEFTA	Hungary, Poland, Czechoslovakia (and its successor states) (to 2004); Slovenia (from 1996 to 2006); Romania (from 1997 to 2006); Bulgaria (from 1999 to 2003); Croatia (from 2003); Albania, Bosnia and Herzegovina, Moldova, Montenegro, FYR Macedonia, Serbia, Kosovo (from 2007)	1994
US–Canada	United States, Canada	1989 to 1993
NAFTA	United States, Canada, Mexico	1994
Andean	Bolivia, Colombia, Ecuador, Venezuela; Peru (from 2006)	1994
CACM	Costa Rica, Guatemala, Honduras, Nicaragua, El Salvador	1993
LAIA	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Paraguay, Venezuela; Cuba (from 1999)	1980
MERCOSUR	Argentina, Brazil, Paraguay, Uruguay	1991
Bolivia–Mexico	Bolivia, Mexico	1995
Costa Rica–Mexico	Costa Rica, Mexico	1995
Chile–Colombia	Chile, Colombia	1993
Group of three	Colombia, Mexico, Venezuela	1995
Bolivia–MERCOSUR	Bolivia, Mercosur	1996
Chile–MERCOSUR	Chile, Mercosur	1996

a GDP data availability may mean that not every country is included in the regression analysis.

3.2 Methodology

The analysis makes use of the widely applied gravity model of trade. As noted earlier (box 2.1), in the gravity model, trade between two countries is determined by a number of factors, including the supply conditions at the origin of trade, demand conditions at the destination and various other stimulating and restraining forces on trade. At its basic level, trade between two countries is positively related to their economic size (represented by GDP) and inversely related to their 'resistance' to trade (such as the distance between them). Following more recent empirical developments, the Commission's application augments the basic model through an 'asymmetric bilateral trade fixed effect' to represent other relevant explanatory variables which influence trading patterns between countries, including language, colonial linkages and trade and economic policies (box 3.1).

The international trade data adopted for the study covers the value of bilateral merchandise trade between more than 140 countries drawn from the UN Comtrade database. Estimates of the value of GDP were drawn from the World Bank World Development Indicators, while membership of BRTAs was drawn from information included on the World Trade Organization's database of participation in regional trade agreements and relevant reference data for individual agreements. Details of the series included in the panel data supporting the econometric and statistical analysis are reported in Appendix C.

In line with current practice, and following a detailed examination of alternative statistical models, the Poisson estimator was adopted to estimate the gravity model in this study. Under certain conditions, the Poisson distribution is more suited than other estimators to data where the dependent variable can take the value of zero, although where a large proportion of observations of the dependant variable take that value there is some scope for bias (see Appendix B). Sensitivity tests undertaken as part of the study indicated that results were not sensitive to the treatment of zero trade flows, supporting the use of the Poisson estimator in this study. Appendix D provides results of this, and other sensitivity testing undertaken.

Box 3.1   Overview of the gravity model used in this study

The underpinnings of initial applications of the gravity model were broadly based on an analogy of gravity under which the level of trade between countries is positively related to their size and inversely related to the (economic) distance between them. As consideration of the gravity model and its application has evolved, it has been shown to be consistent with a number of theoretical models of international trade.

In a recent study, Anderson and van Wincoop (2003) derived a theoretical gravity model under the assumptions of constant elasticity of substitution (CES) consumer preferences and goods differentiated by origin, while Helpman, Melitz and Rubinstein (2008) extended the model in the context of international trade in differentiated products in which firms face fixed and variable costs of exporting. Broadly, in each framework, demand for imports is related to aggregate income, relative incomes and trade costs, while export supply is related to the size of the exporting economy. Per capita income is also used to account for differences in the composition of trade (with lower income countries importing a greater share of basic foods and higher income countries importing a greater share of processed foods and electronic equipment).

Anderson and van Wincoop also introduced a multilateral resistance (MR) term to the gravity model to take into account relative prices. This term is a complex function of prices and is specific to each country.

The gravity model used in this study follows these broad frameworks. The gravity equation takes the form:

$$E[trade_{it}] = \exp\left(\begin{array}{c} \beta_1 \ln(SGDP_{it}) + \beta_2 \ln(SIMILARITY_{it}) + \beta_3 \ln(REL\_INC_{it}) \\ + \sum_k \delta_1^k D1_{it}^k + \sum_k \delta_2^k D2_{it}^k + \sum_k \delta_3^k D3_{it}^k + \sum_{t-1} \psi^t T + \alpha_i \end{array} \right)$$

That is, estimated trade flows between country *a* and country *b* (*a≠b*), denoted as *i*, in year *t*, depend on the log of the sum of GDPs of country *a* and *b* (S*GDP*), the log of the similarity of the size of each country's economy (*SIMILARITY*) and the relative incomes in each country (*REL_INC*). In addition, a dummy variable approach is adopted to represent BRTA membership and the impacts on intra- and extra-group trade. The coefficient on *D1^k* represents the estimated impact (time invariant) of membership of BRTA *k* on flows between member countries (intra-group), while the coefficients on *D2^k* and *D3^k* represent the estimated impact (time invariant) of BRTA membership on imports and exports respectively between members and non-members (extra-group). The time dimension on the D1, D2 and D3 variables indicates that BRTA membership is allowed to vary over the sample period. Time-dummies (*T*) and an asymmetric country fixed effect (α_i) also control for changes in the global level of trade from year to year and the average asymmetric multilateral trade resistance between countries over the sample period, respectively.

In the model, trade and GDP are expressed in current price terms, in exchange rate adjusted US dollars.

3.3   Potential limitations

While the study covers a large number of agreements, uses a rich database and embodies recent developments in the econometric estimation, the following aspects need to be borne in mind when interpreting the resultant estimates.

Some potentially important policy-related factors are not assessed in this study. In particular, the study does not examine:

- the possible endogeneity of changes in trade flows and the formation of agreements; for example, trade agreements may be implemented due to increases in trade between partners where growth in trade, and the trade agreement itself, are the result of other factors such as policies that are tied to domestic reform;

- the trade adjustment path between when an agreement enters into force and when the full effects of an agreement are realised; and

- the separate effects of agreements, for example direct reductions in barriers to trade and investment versus other broader provisions of agreements, including trade facilitation measures and rules of origin.

Further, the achievement of meaningful estimates of the association between the formation of agreements and trade flows depends on controlling for factors that coincide with the establishment and operation of a trade agreement included in the model. Thus, there may be some scope for bias in the results, particularly where there are unobserved factors that:

- affect the same countries as the BRTA does over the same period; and

- are not related to the factors controlled for by the model.

While it is not possible to directly test the degree of potential bias caused by unobserved factors, the results of more generalised sensitivity testing, including re-estimating the model over different sample periods and varying the sample of trade agreements, have been used in this study to assess the robustness of the results to changes in the estimating environment. Overall, the broad results are stable over the sensitivity tests conducted.

Taking into account the model specification and the sensitivity testing, the gravity model used in this supplement provides a nuanced comparison of trade before and after the formation of an agreement, after controlling for other factors that influence trade (including activity levels and trade costs).

4   Estimates of the effect of individual agreements

The gravity model described in chapter 3 provides estimates of the common change in trade flows following the formation of an agreement, while holding other factors (such as GDP, relative income levels and country-specific effects) fixed.

Section 4.1 presents the estimated effect of the 27 agreements on trade *between members* as proportional changes (proportional to the level of trade between the members of each agreement). However, in examining only the estimated effect of each agreement on trade between members, the results presented in section 4.1 reflect only a partial examination of the total estimated effect of each agreement.

To understand how agreements may affect broader trade outcomes, it is necessary to consider the *net effects* of the agreements — their influence on trade between members and non-members *in addition* to their effect on trade between members. Section 4.2 presents this analysis, and discusses the estimated effects of each agreement.

4.1   Agreement formation and trade between members

The individual effects of the 27 agreements are shown in figure 4.1. The estimated effects on trade between members (in proportional change terms) range from -0.378 for the EFTA-Israel agreement to 1.367 for the Bolivia-Mexico agreement.[1]

Of the 27 agreements included in the gravity model, 22 were estimated to be associated with higher bilateral trade between members (intra-group trade) than would otherwise prevail. Although the magnitude of the 22 positive estimates vary, their results are in line with a-priori expectations of the effect of lowering barriers to merchandise trade.

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[1] Coefficients should be interpreted as an approximation of the estimated proportional change in trade flows following the formation of a trade agreement, holding other factors fixed.

Figure 4.1 **Estimated effects of BRTA groupings on intra-group trade flows**

Estimated proportional change on trade between members, share of members total trade

■ Estimated proportional effect on intra-group trade (LHS)   ☑ Intra-group share of members total trade (RHS)
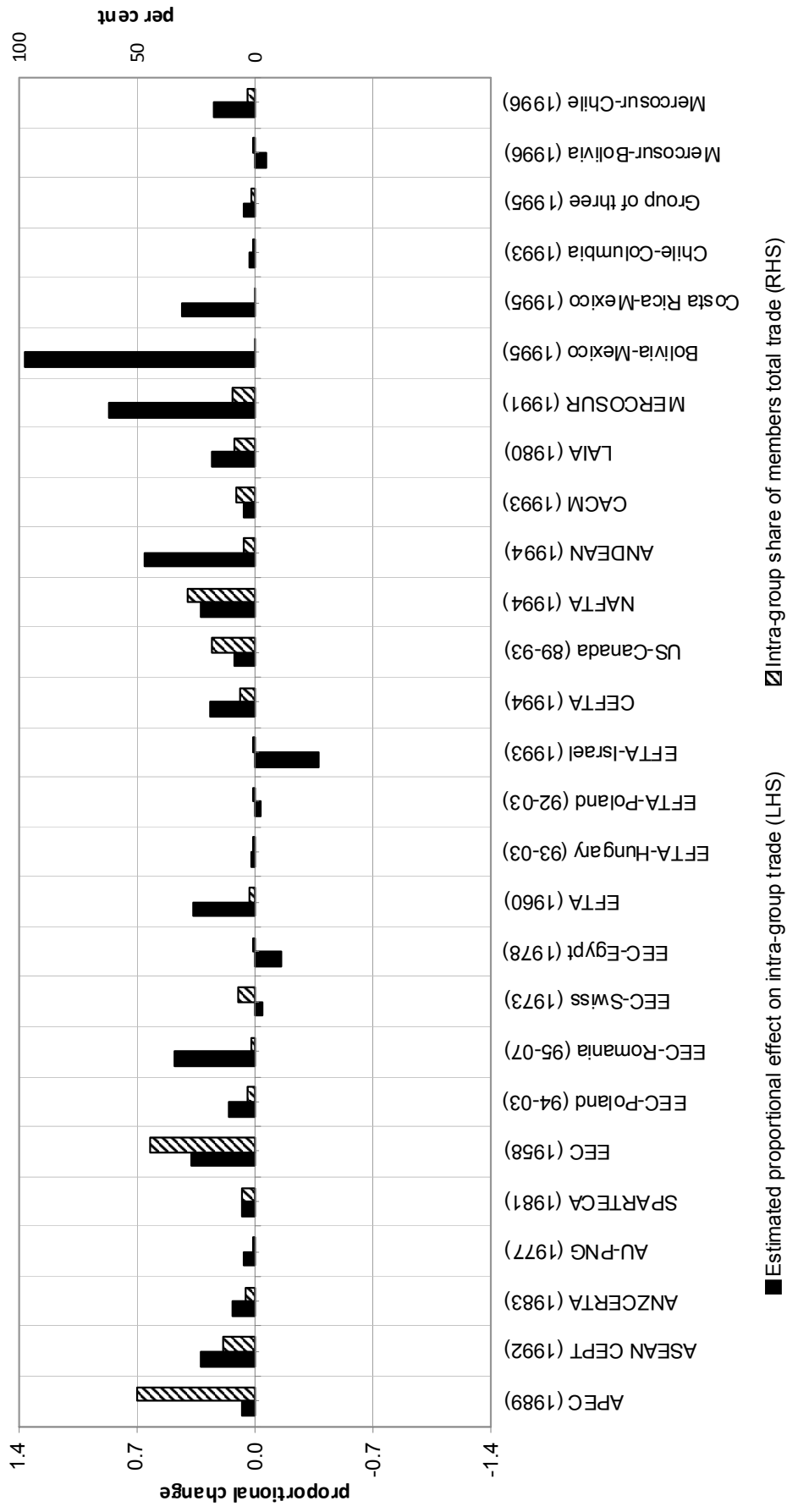
Sources: Gravity model estimates and UN Comtrade database. All coefficient results from gravity model are significant at the 1 per cent level.

For five agreements, however, it was estimated that the formation of the agreement was associated with lower levels of trade between members than would otherwise be expected. The five agreements are:

- The EEC–Switzerland Association Agreement, in operation since 1973. The agreement served as an alternative to full Swiss membership of the European Union.

- The EEC–Egypt Association Agreement, signed in 1978. The agreement provided a basis for the gradual liberalisation of trade and set out the conditions for economic, social and cultural cooperation between the European Union and Egypt. The agreement had a range of non-trade objectives (such as adherence to democratic principles and fundamental rights).

- The EFTA–Poland agreement, in force for approximately 10 years prior to Poland joining the EEC in 2004.

- The EFTA–Israel agreement, entered into force in 1993.

- The Mercosur–Bolivia agreement, entered into force in 1996.

In the case of the EEC–Switzerland agreement, the negative result could be related the expansion of the EEC, and the reducing importance of trade with Switzerland for the newer members of the expanded EEC.[2] For the other agreements, the cause of the negative intra-group trade effect is not as clear, although confounding factors such as those associated with the results pertaining to the EEC–Switzerland agreement are likely to be important.

Because the estimates in figure 4.1 are presented as changes proportional to the level of trade between the members of each agreement, and in view of the significant variation in the levels of trade between the members of each agreement, caution is required when examining these results across agreements (box 4.1).

To assist with assessing the influence of each agreement on its members trade, the share of intra-group trade in members' total trade is also presented in figure 4.1. This provides an indication of how much scope there is for each agreement to influence its members' total trade. Aside from a moderation in the magnitude of the estimated effect as the share of intra-group trade in total trade increases, there is not a clear relationship between the 'importance' of an agreement (in terms of its share of intra-group trade in members' total trade) and its estimated effect on intra-group trade (see figure 4.2).

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[2] Since 1973, the EEC has grown in importance as a share of Switzerland's total trade, but the share of trade with Switzerland as a total of EEC trade fell from 1.03 per cent to 0.76 per cent. This is likely to have placed downward pressure on the estimated trade effects associated with the operation of the agreement and is likely to contribute to the negative result observed.

Box 4.1   **Effects estimated as proportional changes**

It is common practice to present the results obtained from gravity models of trade as proportional changes in trade between members. While such estimates provide one indication of the effects of agreements, caution is needed when comparing the effects across agreements because each agreement relates to a unique set of trade flows, with the estimated proportional changes having different denominators.

For example, comparing the estimated effects of the Bolivia–Mexico agreement to the estimated effects of the European Economic Community (EEC):

- the Bolivia–Mexico trade agreement was estimated to be associated with an average increase in trade between members of 140 per cent. However, trade between Bolivia and Mexico averaged less than one fifth of one per cent of their total trade over the life of the agreement; and

- the EEC was estimated to be associated with a smaller average increase in trade between members, of 37 per cent, but trade between the EEC members averaged around 47 per cent of their total trade over the life of the agreement.

A comparison of the estimated proportional changes, ignoring its relative coverage, may make the Bolivia–Mexico agreement appear to be associated with a greater increase in trade than the ECC. However, while the EEC had a smaller estimated effect, it covered a larger share of its members' total trade, and so it appears to have been more influential on its members' total trade flows.

Figure 4.2   **Relationship between estimated intra-group effect and intra-group trade as a share of members' total trade**

Estimated proportional change on trade between members, share of members total trade
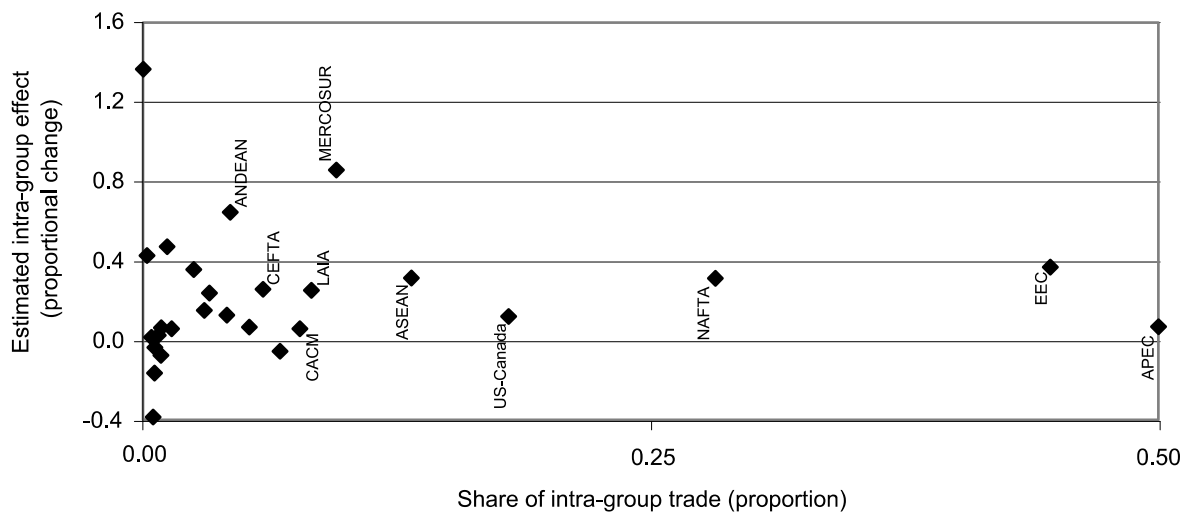
Sources: Gravity model estimates and international trade data.

4.2 The net effect

BRTAs have the potential to affect trade with non-members as well as members. Some preferential agreements are explicitly designed to shift trade from non-members to members — for example the EEC, the largest customs union in place today, enforces common external tariffs with open borders between members. Even where preferential agreements are not designed with this objective, it is inevitable that the implementation of preferences will affect trade with non-members. Other arrangements such as those agreed through APEC, which are designed to increase the competitiveness of their members by encouraging trade liberalisation on a non-discriminatory basis, will also affect trade with non-members as well as members.

To examine the <u>net</u> effect of each agreement examined in this study, the Commission has disaggregated the estimated effects of each agreement in two ways:

- a distinction is made between the agreement's effect on trade between members (the intra-bloc effect) and its effect on trade between members and non-members (the extra-bloc effect); and

- in addition, for the extra-bloc effect, a distinction is made between the direction of trade under consideration.

This second distinction is necessary because each agreement may affect exports from members to non-members differently from the way in which it affects imports from non-members to members. For example, the introduction of improved customs processing on a non-discriminatory basis for all countries participating in an agreement would affect bilateral trade between members, and imports from non-members to members, but not exports from members to non-members.

The estimated net impacts of trade agreements on global trade are presented in figure 4.3 and table 4.1. The effects are presented using a common denominator (global trade flows) so that each of the components can be compared.[3] In addition, a common denominator allows comparison of the effects across agreements.

The largest single impact is estimated to arise from the expansion of intra-group trade amongst members of the EEC, a long standing customs union with progressively expanding membership. The other major positive impacts are estimated for the ASEAN–CEPT and APEC, while the mixed effects estimated for

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[3] The effect of the BRTAs on world trade is shown as the estimated proportional change in trade flows (dummy variables D1, D2 and D3) multiplied by the level of trade covered by those flows. For the analysis, the base is taken as the counterfactual, that is, trade levels without the estimated effects of the 27 BRTAs.

NAFTA on global trade indicate that, in some cases, a positive effect on trade within the group could be substantially offset by lower exports to countries outside the group.

Table 4.1   Estimated effect of BRTAs on global trade, 2008[a]

Name	Intra-group: Imports and exports	Extra-group: imports to the group	Extra-group: exports from the group
	% change	% change	% change
APEC (1989)	2.54	1.60	1.88
ASEAN–CEPT (1992)	0.60	0.67	1.42
ANZCERTA (1983)	0.01	-0.12	-0.23
AU–PNG (1977)	0.00	0.08	-0.24
SPARTECA (1981)	0.01	-0.07	-0.28
EEC (1958)	10.65	1.17	0.73
EEC–Poland (1994-03)[a]	0.17	-0.04	-0.03
EEC–Romania (1995-06)[a]	0.22	0.01	0.00
EEC–Swiss (1973)	-0.10	-0.06	-0.03
EEC–Egypt (1978)	-0.04	0.08	0.03
EFTA (1960)	0.01	0.33	0.16
EFTA–Hungary (1993-03)[a]	0.00	0.12	0.10
EFTA–Poland (1992-03)[a]	-0.00	-0.03	-0.12
EFTA–Israel (1993)	-0.01	-0.02	0.06
CEFTA (1994)	0.01	0.06	0.02
US–Canada (1989-93)[a]	0.72	0.41	0.26
NAFTA (1994)	2.49	0.85	-1.71
Andean (1994)	0.09	0.04	0.16
CACM (1993)	0.00	0.12	-0.00
LAIA (1980)	0.28	-0.28	1.27
MERCOSUR (1991)	0.30	0.29	-0.13
Bolivia–Mexico (1995)	0.00	1.38	0.43
Costa Rica–Mexico (1995)	0.01	0.08	0.83
Chile–Columbia (1993)	0.00	0.20	-0.15
Group of three (1995)	0.01	-0.88	-0.37
Mercosur–Bolivia (1996)	-0.00	-0.01	-0.01
Mercosur–Chile (1996)	0.03	-0.05	0.17

a The effects of 5 agreements not operational in 2008 are estimated for the final year of operation. All estimates are significant at the 1 per cent level.

Source: Gravity model estimates and Commission calculations.

Figure 4.3   **Estimated net effect of BRTAs on global trade, 2008**

Proportional change
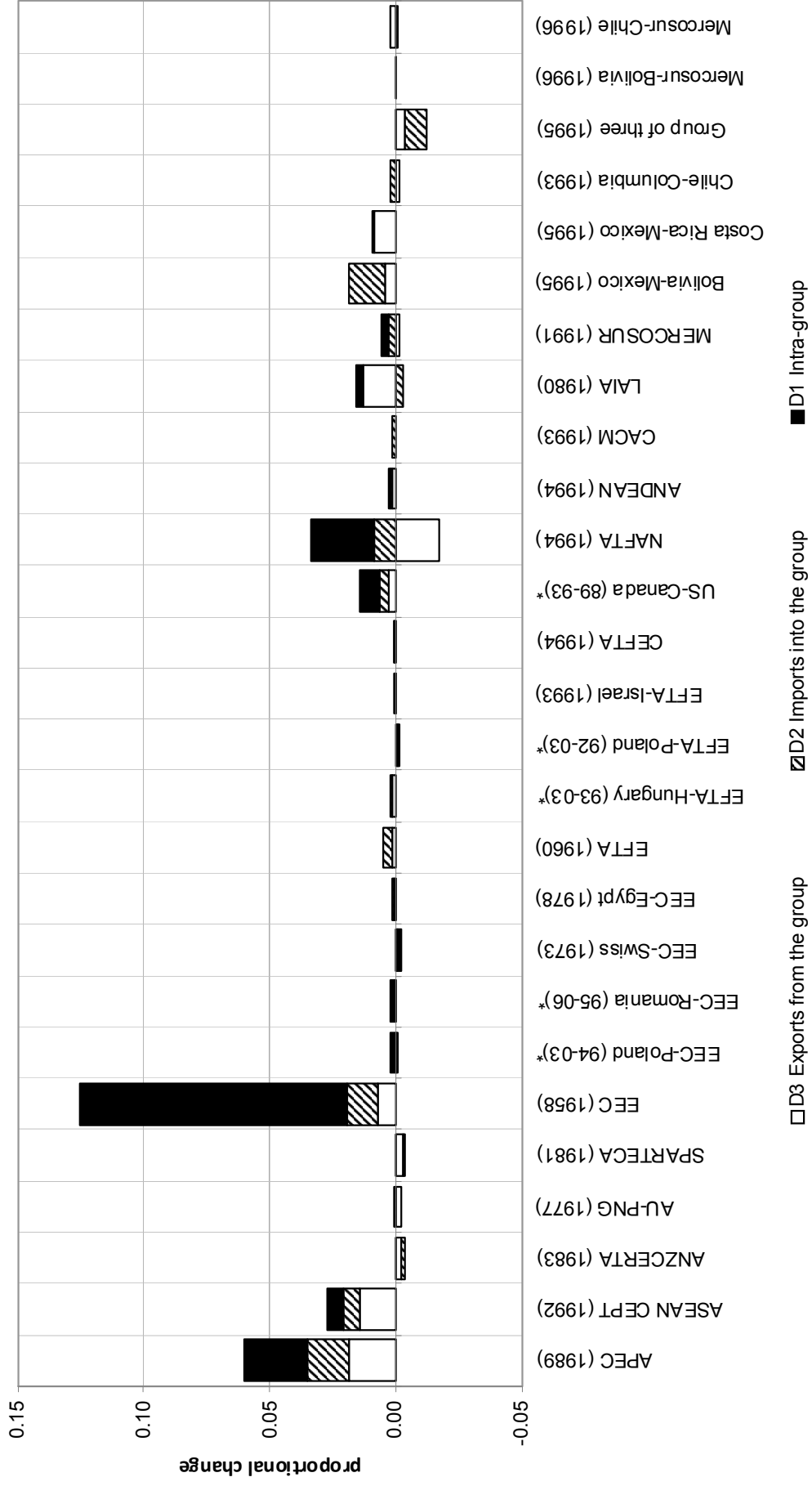
Note: * indicates those agreements not in operation in 2008 where the estimated effect is shown for their final year of operation.

Source: Gravity model estimates and Commission calculations.

Region-by-region results

The nature of individual agreements, according the broad groupings of agreements, together with the estimates of the impact of each group on global trade, are reported below.

Asia–Pacific region agreements

The APEC agreement was established in 1989 as an initiative to enhance economic growth and to strengthen the Asia–Pacific community. APEC operates as a forum for facilitating economic growth, cooperation, trade and investment in the Asia–Pacific region on the basis of voluntary commitments and open dialogue. The 21 members account for a significant proportion of world population (40 per cent), GDP (54 per cent) and trade (44 per cent).

The Association of South East Asian Nations was established in 1967 as a forum for regional cooperation. The ASEAN-CEPT was not established until 1992, but while preferential in name, many of the concessions were multilateralised (Hill and Menon 2010).

The non-binding APEC grouping and the ASEAN-CEPT agreement share a number of commonalities. They are both designed to encourage trade and competition between members *and* between members and non-members. Both agreements are also large (ASEAN CEPT covers 10 countries while APEC includes 21). Six members of ASEAN are also members of APEC.

Figure 4.4　**Asia-Pacific BRTAs, estimated effects 2008**

Proportional change, global trade
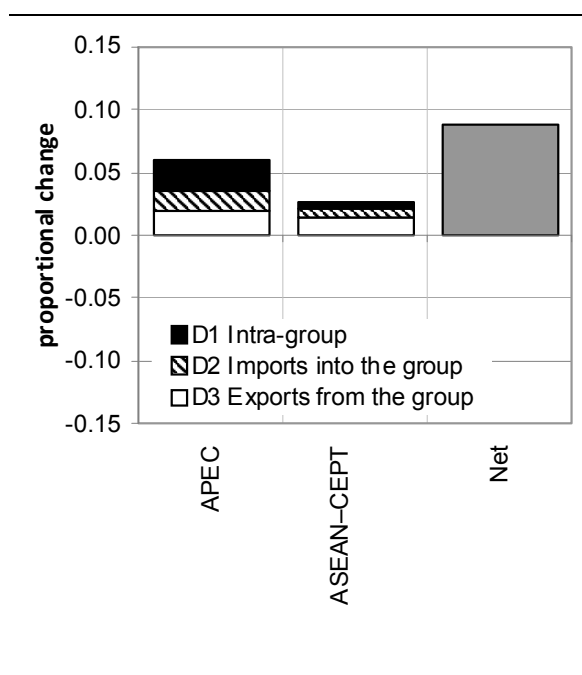
Both agreements are estimated to have created trade between members and between members and non-members (figure 4.4). The net estimated effect is an almost 9 per cent increase in global trade due to these agreements. Comparing the estimated effect on trade between members and trade between members and non-members shows that, in the case of APEC, almost 60 per cent of the estimated increases in trade is estimated to occur between members and non-members and, in the case of

ASEAN, more than three quarters of the estimated increases in trade is due to an increase in trade between members and non-members.

North American agreements

The purpose of the US–Canada free trade agreement was to eliminate barriers to trade in goods and services between Canada and the United States, encourage competition, liberalise investment and lay the foundation for further bilateral and multilateral cooperation. It was, however, superseded by NAFTA after 4 years of operation, and prior to the full phase in of the tariff concessions.

In 1993, the last year of operation of the US–Canada free trade agreement, the agreement is estimated to have increased global trade by 1.39 per cent. Almost half of this estimated increase is associated with an increase in trade between members and non-members.

In contrast, NAFTA, the United States' largest trade agreement, was designed to increase trade between members in a strongly preferential manner, is estimated to have had mixed effects on trade. While NAFTA is estimated to have increased trade between members and increased imports from non-members, approximately 50 per cent

Figure 4.5 **North-American BRTAs, estimated effects 2008**

Proportional change, global trade

of this gain is offset by an estimated decrease in exports from members to non-members. NAFTA is estimated to have resulted in a net increase in global trade of 1.64 per cent, only 0.25 per cent greater than the estimated net effect of the US–Canada agreement in the final year of its operation.
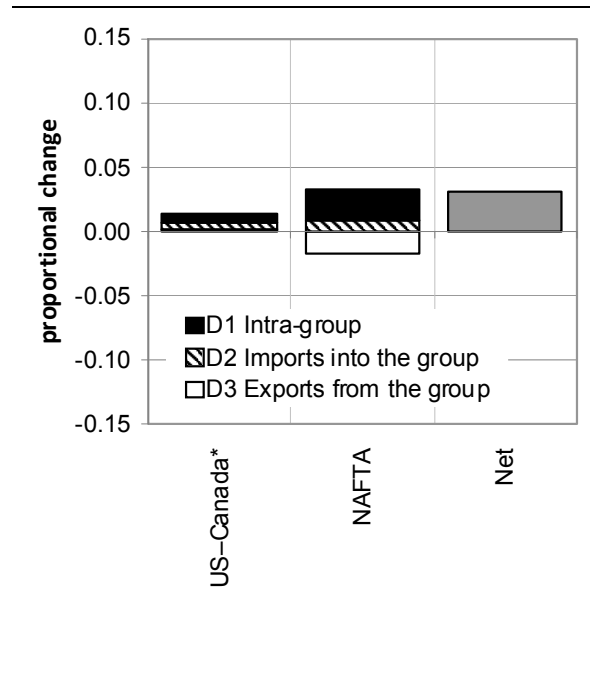
European Economic Community (EEC) and related agreements

The EEC was established in 1957 by Belgium, France, Italy, Luxembourg, Netherlands and West Germany (with the signing of the Treaties of Rome).

In terms of country membership, the EEC is the largest regional agreement examined and is significant for its unique features. The agreement has served to integrate the economies of its members, encouraging trade through the removal of all internal tariffs, harmonized standards and a common currency. Through its common external tariff, it has also strongly focussed activity within the region.

Figure 4.6 **EEC and related BRTAs, estimated effects 2008**

Proportional change, global trade
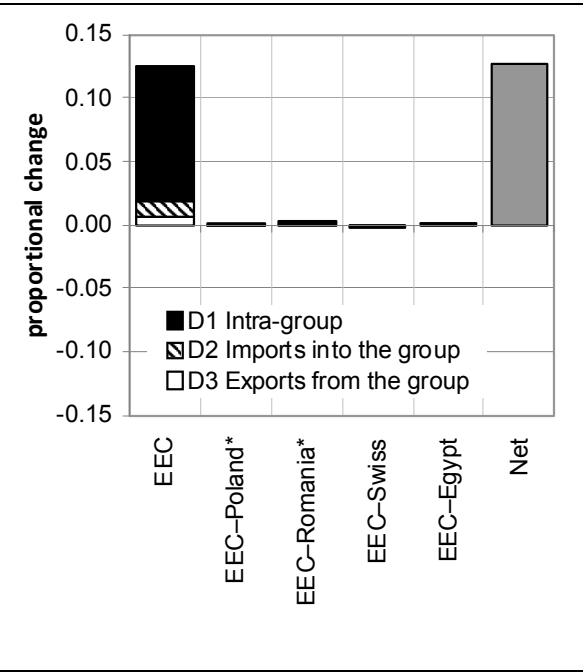
The EEC has not been a 'static agreement' — the coverage of the agreement has expanded and membership has grown from an initial 6 countries to now include 27, with more countries in the processes of joining.

Part of the accession process of the EEC typically involves prospective members signing trade agreements with the EEC. For example, the EEC and Poland signed a trade agreement 10 years prior to Poland's accession.

The estimated effect of the EEC on global trade is the largest of all the agreements examined, with an estimated net increase in global trade of around 12.5 per cent in 2008.

This increase is predominantly comprised of an estimated increase in trade between members of the agreement (almost 85 per cent of the estimated gain) — a small estimated increase in trade between members and non-members makes up the remainder.

While the estimated trade creating effects of the EEC are unambiguous, the estimated effects of its association agreements with Poland and Romania and its bilateral trade agreements with Switzerland and Egypt are less clear.

The two transition agreements (EEC association agreements with Poland and Romania) are estimated to have increased global trade by 0.09 per cent and 0.23 per cent respectively. While both agreements are estimated to have had a positive effect

on trade between the respective countries, the association agreement with Poland is estimated to have decreased trade with non-members.[4]

The EEC–Swiss agreement is estimated to have resulted in a small decrease in both trade between the EEC and Switzerland and Switzerland and the rest of the world, with the estimated net effect a decrease in global trade of 0.20 per cent. In context, however, these results conform to the trade patterns over the period of the agreement (see footnote 2, page 25)

While the EEC–Egypt agreement is estimated to have increased trade between Egypt and the rest of the world by 0.11 per cent of global trade, this is partially offset by an estimated decrease in trade between Egypt and the EEC of 0.04 per cent of global trade for a net increase in global trade of 0.07 per cent.

European Free Trade Association (EFTA) and related agreements

The EFTA agreement was established in 1960 (through the Stockholm Convention) as a political alternative to the EEC by those countries which did not join the EEC. Membership shrunk in the two decades to the mid-1990s as many of the EFTA member countries joined the EEC. All remaining members now have some form of integration agreement with the EEC.

Unlike the EEC, EFTA did not feature a common external tariff. The estimated effect of EFTA is positive (albeit small given the current membership) and is predominantly due to an estimated increase in trade with non-members, estimated to be approximately 50 times as large in 2008 as the estimated effect of EFTA on trade between members.

The CEFTA agreement (entering into force in 1994) also served as a precursor to EEC membership for a number of countries (all original members are now EEC members), and membership now predominantly comprises the Balkan states. CEFTA membership criteria included WTO membership, an association agreement with the European Union and free trade agreements with other CEFTA members.

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[4] In the case of association agreements between a single country and the members of an existing trade agreement, the extra-group effects are specified to exclude the change in trade with non-members for the existing trade agreement. For example, in the case of the EEC–Poland agreement, the estimated change in imports from non-members is estimated as the change in imports to Poland from non-EEC economies excluding the estimated change in imports to EEC economies from countries other than Poland, as this effect is already captured in the estimated effects of the EEC itself.

The estimated effect of the CEFTA agreement is similar to that of the EFTA agreement — positive, predominantly due to estimated increases in imports into the group from non-members and exports out of the group to non-members which are approximately 8 times larger than the estimated effect of the agreement on trade between members in 2008.

Similar to the EEC, since its inception EFTA has pursued bilateral agreements with a range of partners, both in Europe and beyond. The estimated effects of these agreements are mixed: the EFTA–Hungary agreement is estimated to have increased global trade by 0.22 per cent in its final year of operation, while the EFTA–Poland agreement is estimated to have decreased global trade by 0.15 per cent in its final year of operation. The EFTA–Israel agreement is estimated to have decreased trade between EFTA and Israel and decreased imports to Israel from the rest of the world, but these effects are offset by an increase in exports from Israel to the rest of the world, for a net positive effect of a 0.03 per cent increase in global trade.

Figure 4.7   **EFTA and related BRTAs, estimated effects 2008**

Proportional change, global trade
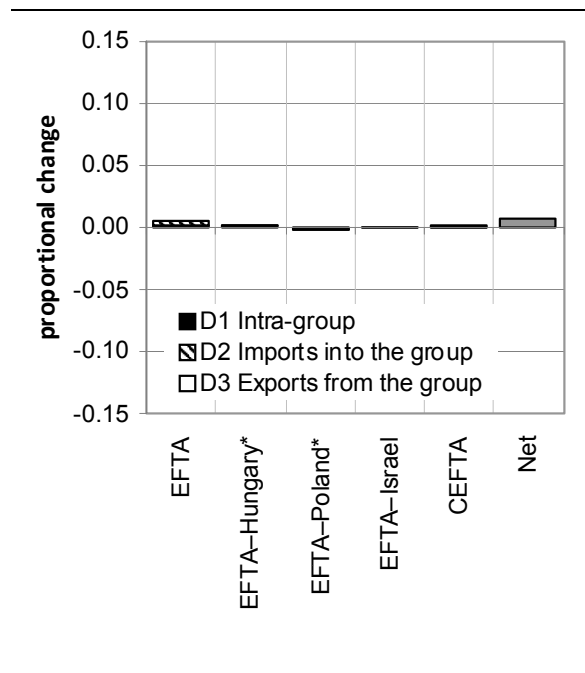
Central and South American regional agreements

The Andean Community was designed to increase integration between Central American countries. In 1993, a free trade zone between the members entered into full operation and, in 1994, a common external tariff was approved.[5] While the estimated effects of Andean are small in comparison with larger groupings such as the EEC, the estimated increase in trade between members and non-members is approximately twice as large as the estimated increase in trade between members.

The CACM was formed to facilitate regional economic development through free trade and economic integration between Costa Rica, Guatemala, Honduras,

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[5]   The agreement is modelled from 1994, allowing examination of the effects of the 'customs union' and 'free trade area' in isolation from the earlier regional grouping.

Nicaragua and El Salvador in 1961. Following a period of suspension commencing in 1985, it was reformed in 1993 and remains in place today.[6] The membership of the agreement means that the estimated increase in trade between members does not have a significant impact on global trade levels. However, the estimated increase in imports from non-members to members of the agreement is estimated to have increased world trade by approximately 0.14 per cent.

Figure 4.8   **Central and South American BRTAs, estimated effects 2008**

Proportional change, global trade
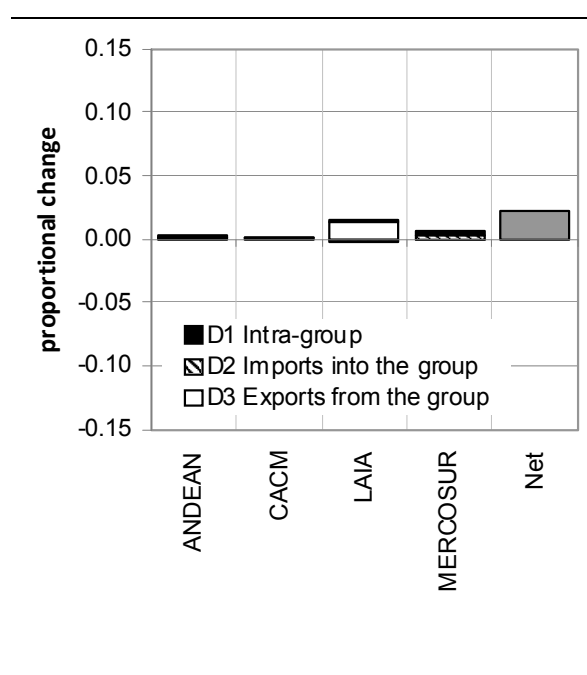
The LAIA, formed in 1980 and replacing LAFTA, is designed to promote regional tariff preferences granted to products originating in the member countries, based on the tariffs in force for third countries. Its membership encompasses 12 Latin American economies and encapsulates both the MERCOSUR and Andean countries.

The agreement is estimated to have increased global trade by 1.27 per cent in 2008. This increase is entirely due to an estimated increase in exports from members to non-members — the estimated increase in trade between members is offset to some extent by an estimated decrease in imports from non-members.

The MERCOSUR agreement is estimated to have increased global trade by 0.46 per cent, comprised of an increase in trade between members and imports from non-members offset by approximately one quarter by an estimated decrease in exports to non-members.

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6   The agreement is modelled from 1993, allowing examination of the reformed agreement. A sensitivity test which models the earlier incarnation of the agreement is included in Appendix D. For more details regarding the CACM, see Bulmer-Thomas (1998).

Other Central and South American agreements

In addition to the regional agreements in place, there are a number of more 'traditional' bilateral style agreements in operation in Central and South America.

The two Mexican bilaterals with Bolivia and Costa Rica are estimated to have increased trade between members and between members and non-members. The agreements are estimated to have increased global trade by 1.81 per cent and 0.92 per cent respectively — with the vast majority of the gains due to increases in trade with non-members.

The Chile–Colombia and Group Of Three agreements (Colombia, Mexico and Venezuela) are estimated to have had mixed effects, with the former estimated to have a small positive effect on global trade (0.05 per cent) and the latter estimated to have decreased global trade by 1.23 per cent.

Similarly, two of MERCOSUR's bilateral agreements (Bolivia and Chile) have had mixed effects, with the former estimated to have had a negligible (but negative) effect on global trade and the latter estimated to have increased global trade by 0.15 per cent.

Figure 4.9 **Other Central and South American BRTAs, estimated effects 2008**

Proportional change, global trade

Australian agreements

ANZCERTA is the main instrument governing the economic relationship between Australia and New Zealand. All tariffs and quantitative restrictions on trade were eliminated by 1990 and later reviews widened the scope of the agreement to include services and harmonisation of standards.

The estimated effect of ANZCERTA is mixed, with an estimated increase in trade between Australia and New Zealand, offset by an estimated decrease in trade with the rest of the world of 0.35 per cent.

The Australian–Papua New Guinea trade agreement was a non-reciprocal agreement that gave duty free access to Australia for PNG exports. Its estimated effect is also mixed, with an estimated increase in imports to members of 0.08 per cent of world trade more than offset by an estimated decrease in exports of 0.24 per cent of global trade, or a net decrease in global trade of 0.15 per cent.

SPARTECA, similar to the Australia–PNG agreement, grants non-reciprocal access to Australia and New Zealand for Forum Island countries. The agreement is also estimated to have had mixed effects with an estimated increase in trade between members more than offset by an estimated decrease in trade between members and non-members of 0.35 per cent.

Figure 4.10 **Australian BRTAs, estimated effects 2008**

Proportional change, global trade

5   Agreement orientation and style

Chapter 4 explored the individual effect of the 27 agreements on global trade flows, placing the estimated effects of each agreement in context with a brief discussion of the apparent objectives or purpose of each agreement (section 4.3). This chapter seeks to shed light on the association between broad BRTA design features and the significance and direction of influence that these have on trade flows. It considers the effect of agreement formation on the 'trade orientation' of members and the association between trade orientation and agreement style.

5.1   Agreement orientation

For the purpose of this supplement, the trade orientation of an agreement is characterised by the comparison of two measures — relative 'trade coverage' and 'balance of effects' (box 5.1). Using these measures, agreements are characterised as either 'inward orientated' — if the change in trade *between* members is estimated to be greater than would be expected (given the actual level of trade between the members of the agreement relative to their trade with non-members) — or 'outward oriented' otherwise. Agreements estimated to be associated with a change in trade between members in line with what is expected are characterised as 'neutral'.

The trade orientation of 11 of the larger agreements examined in this supplement is shown in figure 5.1. A general trend in the results is that as relative importance of intra-group trade increases (trade coverage, estimated by the ratio of intra-group trade to extra-group trade), so does the relative importance of projected changes in intra-group trade (balance of effects, estimated by the ratio of estimated intra-group to extra-group effects). That is, agreements that cover a greater amount of their members' trade are generally more 'inward orientated'.

This trend is particularly evident for the cases of Mercosur, the US–Canada agreement, NAFTA and the EEC agreement:

- The trade coverage ratio of the Mercosur agreement was 0.11 while its balance of effects ratio was 1.87.

- The trade coverage ratio of the US-Canada agreement was 0.22 with a balance of effects ratio of 1.09.

Box 5.1   **Characterising the trade orientation of an agreement**

To determine the trade orientation of an agreement, two measures — the 'trade coverage' ratio and 'balance of effects' ratio — are derived:

- The *trade coverage ratio* of each agreement provides a benchmark indicator of how important trade between the members of an agreement is as a share of their total trade.
  - It is computed as the average ratio of the actual levels of intra-group trade to extra-group trade for the years in which the agreement was in force over the period 1970 to 2008.
  - For example, a ratio greater than one indicates that trade between the members of the agreement comprises at least half of the agreement members' total trade, that is, the level of intra-bloc trade is equal to or exceeds that of extra-bloc trade.

- The *balance of effects ratio* of each agreement indicates the relative size of the estimated effect of the agreement on trade between members in comparison to its net estimated effect on trade between members and non-members.
  - It is computed as the ratio of the estimated intra-group effect on global trade to the net estimated extra-group effect on global trade.
  - A ratio greater than one indicates that the agreement is estimated to have had a greater effect on trade between members than it is to have had on trade between members and non-members. A ratio less than one indicates it had a lesser effect.
  - A negative ratio indicates that the direction of the estimated change in intra-group trade is offset by the estimated change in extra-group trade, either towards more outward oriented trade (intra-group effect negative, extra-group effect positive) or more inward oriented (intra-group effect positive, extra-group effect negative).

Using these criteria, the trade orientation of each agreement can be characterised (see below).

Criteria for assessing the trade orientation of an agreement

Criteria — 'Trade coverage' (x) versus 'Balance of effects' (y)	Trade orientation
x < y	Inward oriented
x ≈ y	Neutral
x > y > 0	Outward oriented
y < 0	Positive intra-group effect: inward oriented
	Negative intra-group effect: outward oriented

- The NAFTA agreement has a trade coverage ratio of 0.39 but a balance of effects ratio of negative 2.91 (the negative indicates the estimated change in intra-group trade is in the opposite direction to extra-group trade).

- The second largest agreement examined in this supplement was the EEC, with a trade coverage ratio of 0.45 and a balance of effects ratio of 5.61.

The general trend was less evident for the ASEAN–CEPT agreement, where the trade coverage ratio of the ASEAN–CEPT agreement was 0.15 but its balance of effects ratio was only 0.29; this places it relatively close to the 'neutral' line in figure 5.1.

An exception to this general pattern is APEC, where the level of trade between members was approximately the same as the level of trade between members and non-members (giving it a trade coverage ratio of 1.0, the largest of the 27 agreements examined), while the estimated increase in trade between members was around one quarter smaller than the increase in trade between members and non-members (balance of effects ratio of 0.73), resulting in it being characterised as 'outward oriented'.

Figure 5.1   **Trade orientation of selected regional agreements**[a]
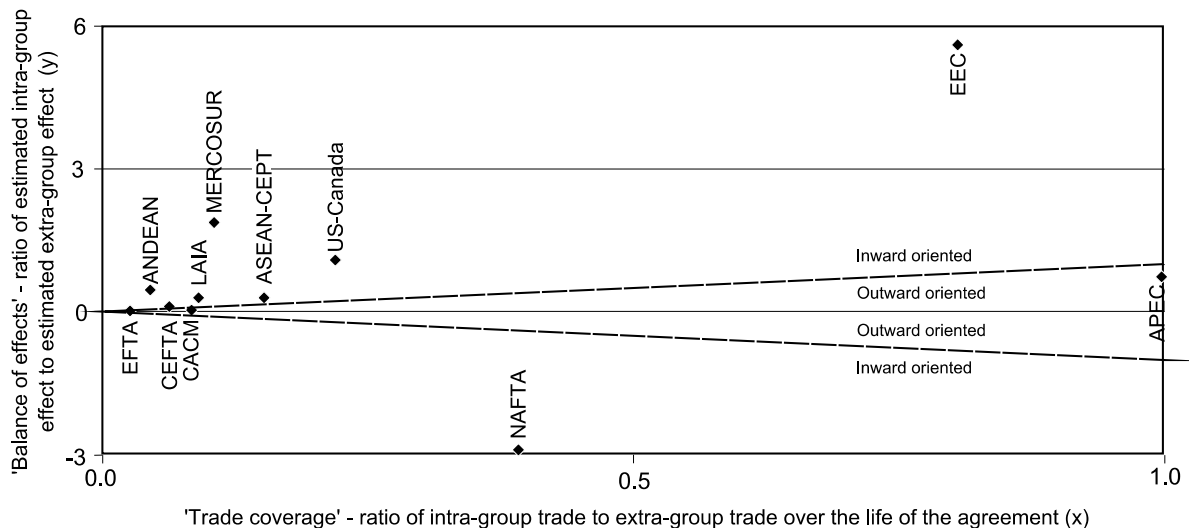
a US–Canada is included for comparison with NAFTA. The dotted lines indicate a 'neutral' focus.
Source: Table 5.2.

The results for each of the 27 agreements examined in this supplement are shown in table 5.1.

Table 5.1   **Agreement balance, coverage and orientation**

Description	Trade coverage ratio (x)	Balance of effects ratio (y)	Trade orientation
EFTA–Hungary	0.00	0.00	Neutral
Bolivia–Mexico	0.00	0.00	Neutral
Costa Rica–Mexico	0.00	0.01	Neutral
EEC–Egypt *	0.01	-0.33	Outward oriented
EFTA–Israel *	0.01	-0.28	Outward oriented
AU–PNG	0.01	-0.01	Inward oriented
Group of three	0.01	-0.01	Inward oriented
EFTA–Poland **	0.01	0.01	Neutral
Chile–Columbia	0.01	0.01	Neutral
Mercosur–Bolivia **	0.01	0.14	Inward oriented
EEC–Romania	0.01	23.32	Inward oriented
EEC–Poland	0.03	-2.23	Inward oriented
EFTA	0.03	0.02	Outward oriented
Mercosur–Chile	0.03	0.26	Inward oriented
ANZCERTA (CER)	0.04	-0.04	Inward oriented
Andean	0.04	0.45	Inward oriented
SPARTECA	0.06	-0.03	Inward oriented
CEFTA	0.06	0.11	Inward oriented
EEC–Swiss **	0.07	1.08	Inward oriented
CACM	0.08	0.03	Outward oriented
LAIA	0.09	0.29	Inward oriented
MERCOSUR	0.11	1.87	Inward oriented
ASEAN–CEPT	0.15	0.29	Inward oriented
US–Canada	0.22	1.09	Inward oriented
NAFTA	0.39	-2.91	Inward oriented
EEC	0.80	5.61	Inward oriented
APEC	1.00	0.73	Outward oriented

* indicates agreements with an estimated decrease in intra-group trade. ** indicates agreements with an estimated decrease in both intra- and extra-group trade.

Source: Gravity model estimates, Commission calculations and UN Comtrade database.

5.2   Agreement style

While the vast majority of BRTAs in force today are designed to be preferential in nature, there are a number of notable exceptions. The patterns explored above provide some indication of the range of effects that both preferential and non-preferential agreements can have on trade flows. Identification of these features, which determine whether an agreement is likely to simply re-mix existing trade flows, encourage trade between members without discouraging trade with non-members or even boost trade between both members and non-members, may assist in the evaluation of different approaches to BRTAs. This section discusses the various styles of agreements examined in this supplement and draws some

observations to the extent that the estimated effects correspond with the measure of trade orientation developed above.

Preferential bilateral and regional agreements

Most BRTAs in force are preferential in nature and seek to reduce barriers to trade between members while not extending these reductions to non-members. Two well known preferential agreements are NAFTA and ANZCERTA (both characterised as inward oriented). Their estimated effects and corresponding trade orientation are illustrative of some of the characteristics of typical preferential agreements more broadly:

- The NAFTA agreement was estimated to have been associated with a increase in trade between members; however, this effect was partly offset by reductions in trade with non-member countries. The results suggests that the preferential nature of this agreement brings with it some costs: for NAFTA members, while the agreement is estimated to have been net trade creating, it also appears to have 'reshuffled' a significant amount of trade between sources.

- While the ANZCERTA agreement was estimated to have had little overall impact on global trade flows, it was estimated to be associated with an increase on trade between members. Despite this, it was also estimated to have had a negative impact on Australia's and New Zealand's trade with the rest of the world. In this sense, the analysis suggests that the preferential nature of the agreement appears to have, to some extent, altered the focus of some exporters (and importers) in these economies to the smaller markets within the agreement, foregoing some of the potential gains that would have otherwise been expected from exploring even greater trading opportunities in markets elsewhere.

Open regionalism

Open regionalism has been pursued as a model of increasing economic integration within a region while increasing competitiveness with the rest of the world (for example, through encouraging unilateral trade facilitation and liberalisation or increasing regional integration with a focus on competition and efficiency). There are three such agreements in the 27 modelled:

- APEC is a non-preferential undertaking, without legal binding, designed to encourage unilateral liberalisation and the general competitiveness of its members. While some have suggested that the common reforms that have improved competitiveness are a result of domestic policies for which the member countries have undertaken similar reforms (those which have achieved a

common effect), it should be noted that the APEC process is also regarded as having played a facilitating role in reducing trade barriers and the empirical results from this supplement suggest that agreements which favour a non-preferential approach, and which seek to establish a cooperative forum intended to promote openness among members, had positive impacts on trade flows generally.

- The ASEAN–CEPT agreement, while preferential, is an example of a 'preference-light' agreement that is loosely based on the principle of open regionalism. It allows for non-preferential reductions in tariffs by countries to receive credit as preferential concessions, thereby allowing them preferential access to other member countries, and embodies other characteristics which make it a relatively open agreement, although slightly inward oriented (box 5.2).

- The Central American Common Market (CACM) was originally formed in the 1960s as a model of closed regionalism. Following a number of regional crises, it was abandoned in the mid 1980s. It reformed in 1993 with the purpose of pursuing open regionalism (and it is the outcome of this later formulation that is modelled in this supplement). The agreement is categorised as outward oriented.

Box 5.2   **The ASEAN agreement**

In 1992, members of ASEAN agreed on the ASEAN Free Trade Area which was embodied by the Common Effective Preferential Tariff (CEPT) scheme. Given the importance of non-member trade, and members' desire to not have overly binding conditions enforced on them through the agreement, the scheme has several features which have lead to it being considered as 'open' or 'preference light'. These include:

- a low value Regional Value Content Rules of Origin (RoO) of 40 per cent;

- the ability of members to offer tariff reductions on an MFN basis and qualify for preferential access to other member markets; and

- the exclusion of agricultural products (ASEAN 2010).

Given the conditions of the CEPT scheme, the importance of non-member trade, and the focus on matters that extend past border barriers (such as providing a forum for discussion on economic and regional development), the ASEAN agreement has been argued to represent an example of open regionalism (Hill and Menon 2010). During the period of the agreement, members' MFN tariffs have been reduced significantly and, in practice, only around 10 per cent of member trade makes use of the concessional arrangements — notwithstanding the margin of preference still remains significant on some products and the relatively liberal RoO. The agreement also provides an ongoing forum for pursuing economic and regional development issues, including trade facilitation measures.

Customs union / common market

The common market approach shares similarities with an open regionalism approach, but typically involves deeper integration (for example, allowing freer movement of natural persons) and common barriers with third parties.

- The estimated net effect of the EEC on global trade is positive, and its trade orientation (inward oriented) appears consistent with that of a customs union featuring a common external tariff.

- Similarly, the Andean agreement is categorised as inward oriented — it too operates as a customs union or common market.

- The Latin American Integration Agreement (LAIA), originally established as a free trade area in the 1960s, was reformed as a regional integration agreement in 1980. The latter variant is modelled in this study, and is categorised as inward oriented.

Agreements with developing coutnries

Agreements focused on facilitating economic development typically provide non-reciprocal tariff concession for developing country members to the developed country market. Such agreements aim to foster economic development and enhance cooperation between members.

Two of Australia's development–focussed agreements are modelled in this supplement — the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) and the Papua New Guinea Australia Trade and Commercial Relations Agreement (PATCRA).

Both agreements are estimated to be relatively inwardly oriented, and not to have increased overall levels of trade.

- The results indicate that the Australia-Papua New Guinea agreement led to an increase in imports into the two countries, but this is estimated to be more than offset by a decrease in exports to other countries, resulting in a net decrease in global trade.

- Similarly, the SPARTECA agreement was associated with an increase in trade between members, again more than offset by a estimated decrease in trade with non-members.

These results may be driven by a lack of reform of barriers in the developing countries, given the one-sided nature of the agreements. Further, to the extent that they resulted in preferential access beyond Australia's relatively low MFN rates, the

agreements may have focussed the smaller heavily resource constrained nations on exporting to Australia (and New Zealand), perhaps away from (faster growing) markets that otherwise would have represented even greater prospects for them.

A   Econometric specification

A.1   Introduction to the gravity model

The gravity model is the primary *ex post* econometric technique used to examine the determinants of trade flows. As implied by the name, the gravity model is a model of trade flows based on an analogy with the law of gravity in physics – relating trade between two countries to their size and the distance between them (Anderson 1979).

The gravity model has its origins in early work by Tinbergen (1962) and Poyhonen (1963) based on 'ad hoc but intuitive theorizing' (Deardorff 1984). In its simplest form, the model explains exports (X_{ij}) from country i to country j in terms of their GDPs (Y_i, Y_j), the distance between them (D_{ij}) and other factors affecting trade between them ($c_i c_j$):

$$X_{ij} = c_i c_j \frac{(Y_i)^a (Y_j)^b}{D_{ij}^f} \qquad (1)$$

Taking the log-linearized form allows parameter estimates to be obtained using ordinary least squares (OLS) and other econometric estimation techniques [where $c=ln(c_i c_j)$ and is a constant]:

$$\ln(X_{ij}) = c + a\ln(Y_i) + b\ln(Y_j) - f\ln(D_{ij}) \qquad (2)$$

In an augmented gravity model, trade between two countries is determined by supply conditions at the origin of trade, demand conditions at the destination of trade, and various stimulating or restraining forces on trade.

For this study, variables included in the model were chosen based on approaches used in existing literature, and their importance to trade flows. The variables chosen and relevant literature is presented in section A.2.

A.2 Variables used in the model

Trade flows are influenced by a number of factors. Broadly these factors can be categorised into two groups:

- *country specific determinants of trade* — country characteristics such as their size, relative income, consumer tastes and level of development.

- *trade agreement related characteristics* — including whether or not a country has been part of regional or bilateral trade agreement(s).

Determinants of trade

Economic size

In its simplest form, the gravity model of trade specifies that trade flows increase as the GDPs of the trading partners increase as GDP provides an indicator for the level of demand in the importing country and level of supply in the exporting country.

The specification used in this supplement follows Adams et al. (2003), who reviewed the theory and applicability of a number of 'size variables' and selected three variables — the sum of bilateral GDPs, the absolute differences in GDP per capita and the similarity in country size between the country-pairs. They noted that these variables captured not only the aggregate size of the trading partners but also the expenditure capabilities and taste preferences of each partner.

Resistance to trade – distance and other factors

Trade flows between two countries are reduced as the economic distance between them increases. For example, to the extent that geographical distance is a proxy for transfer costs, two countries geographically close to each other will trade more than two identical countries which are further apart. However, a number of other factors contribute to 'economic' distance which more fully embodies the costs associated with trading with other countries. Such other factors may include:

- transport prices (port, rail and air infrastructure);

- quarantine procedures;

- consumer tastes, language, cultural heritage; and

- geography, for example whether a country is landlocked or an island.

Many studies using the gravity model of trade include a number of dummy variables to control for these factors — for example Soloaga and Winters (2001) include variables to indicate if the pair of countries share a border, share a language or if either or both are islands.

However, controlling for these factors using individual variables introduces the risk of omitted variable bias, as it is likely that not all relevant characteristics will be included. This is further complicated as some economic factors affecting trade flows are inherently difficult to measure or are unobservable in trade flow data (for example, a preference or otherwise for produce made in a neighbouring country, efficiency in customs clearance and domestic policies and macroeconomic conditions). While difficult to measure and control for, these factors may still have a systematic influence on trade between countries. Trade patterns may also be influenced by military purchases, unusual production concentrations (such as crude oil) and non-economic factors such as wars, bans, and political and cultural relationships.

In addition, controlling for these country-specific effects individually imposes the restriction that the country-specific factors affect trade in a uniform manner across all countries. Relaxing this assumption, Cheng and Wall (2005) applied symmetric country pair fixed effects. These fixed effects replace all time-invariant country-pair specific factors such as distance and adjacency and, additionally, they control for *all* country-pair time-invariant specific effects which may affect trade flows, reducing the risk of omitted variable bias. While this approach removes the restriction that such factors affect trade uniformly for all countries, in assuming that the effects are constant, it only captures the *average* effect over the sample period.

Such symmetric country-pair fixed effects assume that the unobserved factors affecting trade are *symmetric* in nature — that is they affect exports from country A to country B in the same way as they affect imports from country B to country A. Relaxing this assumption, *asymmetric* time-invariant country-pair fixed effects are specified, which are consistent with the asymmetric nature of the multilateral resistance terms from Anderson and van Wincoop (2003) (discussed below).

Multilateral resistance

Anderson and van Wincoop (2003) derive theoretical foundations for the gravity model of trade and provide important insights into the drivers of trade flows: that trade between two countries depends on the cost of trading between the two countries *relative* to the cost of each country trading with its other trading partners. They noted that in the absence of explicit multilateral resistance terms (which are

not readily available), country-specific fixed effects provide consistent estimates of model parameters but may be less efficient than estimating the full model.

Baier and Bergstrand (2009) undertake a Monte Carlo simulation to systematically test a number of alternative methods for approximating the multilateral resistance term, including time-invariant fixed effects, and find that time-invariant fixed effects should also generate unbiased estimates.

Asymmetric time-invariant country-pair fixed effects are used for this purpose. However, the use of time-invariant fixed effects has some drawbacks. Novy (2008) notes that using *time-invariant* fixed effects (versus time-varying fixed effects) as a proxy for multilateral resistance may introduce misspecification, the level of which depends on the degree to which multilateral resistance of a particular country changes over the time period of interest. For some countries (for example, the United States) he finds that multilateral resistance does not change significantly over the period 1970-2000, but for other countries (for example, Korea) he finds that multilateral resistance does vary substantially.

While this limitation remains in the specification of the model, the sensitivity of results to the choice of different time period (and therefore the assumption of time-invariant multilateral resistance) was tested by estimating the model for different time periods (see Appendix D). These sensitivity tests indicated that the coefficients on variables were generally stable across simulations, indicating that asymmetric time-invariant fixed effects provide a suitable proxy for time-varying multilateral resistance, in this analysis.

Time dummy variables

Given the potential for global events to influence the level of trade of all countries, both positively (for example, completion of the Uruguay Round of trade negotiations) and negatively (for example a global financial crisis), year dummy variables are included. These capture changes in the levels of trade common to all countries in each year.

Capturing the effect of trade agreements

Typically, the impact of trade agreements on trade flows is examined by adding bilateral or regional trade agreement-specific binary dummy variables to the augmented gravity model.

Aitken (1973) was one of the earliest studies to apply the gravity model in examining the effect of trade agreements on trade flows, specifying a single dummy variable to capture the changes in trade between members of the EU and EFTA respectively.[1]

Later work, for example Bayoumi and Eichengreen (1995), added a second dummy variable to estimate the additional effect of changes in trade (imports and exports) from members of an agreement to countries not part of the agreement.

Soloaga and Winters (2001) extended the two dummy variable approach with a third dummy variable in order to differentiate the additional effects of a trade agreement on imports to members (from members and non-members) and on exports from members (to members and non-members). They argued that the effect of a trade agreement may have asymmetric effects on exports and imports.

Following Carrere (2002), a modified version of the Soloaga and Winters (2001) three dummy variable approach is used, where the second and third dummy variables exclude trade with members. This allows the estimation of the effects of a trade agreement on three categories of trade flows:

- trade between members;

- imports to members from non-members; and

- exports from members to non-members.

Alternatives to the dummy variable approach

Dummy variables provide a broad indication of the effect of trade agreements on trade: they capture a common change in trade flows, irrespective of whether the change is due to lower tariffs or other factors which influence trade. Examination of the direct effects of reductions in specific trade costs would benefit from a more focussed approach on each trade cost of interest.

However, given that trade agreements typically affect trade through more than changes in tariffs, a dummy variable approach is pursued in this supplement. Any *common* changes in levels of trade not related to other factors controlled for by the model, that *persist* over the period of the agreement, would be captured by the dummy variables. Results presented from estimations using dummy variables should be interpreted with this in mind.

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[1] Dummy variables are binary variables which takes the value of zero or one, so named because of their simple form. Dummy variables identify an event or phenomenon of interest (for example a trade agreement), and hence allow the estimation of its effects.

B   Econometric estimation

This appendix sets outs the estimation strategy used to estimate the impact of trade agreements on trade flows.

B.1   Early approaches to estimating the model

Early approaches to estimating the parameters of the gravity model can be characterised by small samples — typically less than 40 countries and only a few years worth of data. Further, these early studies typically applied ordinary least squares (OLS) or panel regression techniques to a log-linearized form of the model — for example Aitken (1973), McCallum (1995) and Baier and Bergstrand (2001).

These techniques are still commonly used in gravity model estimation, despite a number of recent studies identifying a range of reservations from applying these approaches, as identified by Adams et al. (2003), Baldwin and Taglioni (2006), Ghosh and Yamarik (2004, 2005) and Hillberry (2009).

This appendix addresses these issues below.

Accounting for zero trade flows

More recent work has benefited from the availability of increasingly comprehensive bilateral trade samples. However, one feature of these increasingly comprehensive samples, in particular, requires careful treatment.

As the country coverage of a sample of bilateral trade flows increases, the number of *potential* trade links increases. For example, in a 10 country sample, there are 45 potential bilateral trade links — in a 50 country sample there are 1225 potential links.[1]

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[1] Calculated as $(c^2-c)/2$ where c is the number of countries in the sample. Bilateral trade links refer to links without specifying if they are bi-directional or uni-directional trade flows – see Lui (2007).

If every country traded with every other country across the world, there would be no bilateral links without some trade. This is not the case. There are many country-pairs which do not trade with each other due to a broad range of trade barriers and other factors. As such, many bilateral trade links record zero trade flows.

This can create obstacles for estimating the impacts of trade agreements on trade flows and the inclusion of a significant number of zero trade flows without appropriate consideration may result in biased estimates (Santos Silva and Tenreyro 2006).

Can zero trade flows be discarded?

Helpman, Melitz & Rubinstein (2008) develop a theoretical model of trade which features both intensive (increasing trade between existing products or firms) and extensive (increases in trade due to the creation of new products or firms) trade margins and is consistent with a number of stylized features of actual trade flow data (such as zero trade flows). At an aggregated level, their theoretical model represents new and existing trade between countries rather than firms. They do not test the Poisson method themselves, but they state that a Poisson estimator (as used by Santos Silva and Tenreyro (2006)) would be consistent with their own method.

They show that studies that discard bilateral trade links for which no trade occurs are likely to derive biased results as a consequence. That is, focussing solely on bilateral trade links where trade *always* occurs biases downwards the estimated effect of trade barriers because, they argue, it is the barriers which act as constraints at the extensive margin (stopping the development of new trade flows) which are the most costly.

Their model is also consistent with another empirical observation that larger economies typically trade with a larger number of partner countries. They note that since 1970, the majority of the growth in trade occurred among countries that traded with each other in 1970 (prior to 1970 it was the growth of new trade links).

According to this finding, incorrect treatment of zero flows in the model estimation may lead to bias in the estimated coefficients of the explanatory variables.

In order to test the sensitivity of the results to the inclusion of zero trade flows, the sensitivity of the results to dropping the zero trade flow observations is examined in appendix D.

B.2 The Poisson estimator

As noted, recent studies exploring the prevalence of zero trade flow observations find that discarding this information will bias the results. Further, they also note that it is not appropriate to use standard OLS or panel regression techniques in the presence of a significant number of zero trade flows — an alternative estimator is required if there is a significant number of zero trade flow observations.

A number of studies, for example Adams et al. (2003) and Felbermayr and Kohler (2004), test the appropriateness of alternative estimators in the presence of zero trade flows. These suggest that the Tobit estimator is superior to a standard OLS approach.

However, more recent work has shown that, in some situations, the Tobit estimator may not be appropriate as it assumes that the dependent variable follows a censored or truncated normal distribution. But zero bilateral trade flows are typically not the product of censoring or truncation — zero trade flows occur for specific reasons. The factors which determine whether or not two countries trade may be different from the factors which determine the level of trade between two countries.

Liu (2007) makes a strong case as to why zero trade flows should be included in the estimation of the gravity model and suggests a Poisson regression model as most appropriate. Using the Poisson estimator, he estimates a gravity model on a large panel dataset to examine the effects of the formation of the WTO on world trade. A number of other recent studies also suggest the Poisson estimation procedure as an alternative based on a number of its characteristics — for example its ability to handle zero trade observations without a truncated distribution assumption and the non-linear functional form making it better suited to trade flow data.

The Poisson estimator

The Poisson estimator has traditionally been used in count data models (for example, the number of items in a queue) where zero values are frequent. In such cases, the dependent variable is assumed to be normally distributed. The Poisson probability function takes the form:

$$\Pr(Y = y_i \mid x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!} \tag{3}$$

That is, each observation of the dependent variable y_i is distributed under a Poisson distribution with parameter λ_i related to the independent variables x_i. The most common formulation for λ_i is the log-linear formulation $\ln \lambda_i = x_i'\beta$ and it follows that the expected value of the dependent variable is given by $E[y_i \mid x_i] = \exp(x_i'\beta)$ (Green 2008).

It can be shown that the estimated coefficients from the Poisson model are semi-elasticities or proportional changes:

$$\frac{\partial \ln E[y \,|\, x]}{\partial x_1} = \beta_1 \qquad (4)$$

Studies have suggested that the Poisson model is more appropriate in the context of examining trade flows due to it being a more consistent estimator as zero trade flows are assumed to be generated outcomes rather than a product of censoring or truncation. The standard Poisson estimator assumes that any zero trade-flows in the data are produced by the same 'data generating process' as the non-zero trade flows. Thus it assumes that variables in the model lead to both trade flows and zero trade flows. However, some studies suggest the usefulness of the Poisson model alone may be limited in the presence of a large number of zero trade flows.

Martin and Pham (2008) use a Monte Carlo simulation to examine the use of the Poisson estimator in the gravity model of trade where zero trade flows are present. They caution against using the Poisson estimator in the presence of a large proportion of zero trade flows (around 50 per cent), but when they reduce the number of zero trade flows in their simulations to between 30 and 50 per cent, they find a 'dramatic improvement' in both linear and non-linear models, although they do not mention the results for the Poisson regression specifically.

Westerlund and Wilhelmsson (2009) also conduct a Monte Carlo simulation to compare the Poisson estimator against others — with approximately 10 per cent zero trade flows — and conclude that the fixed effects Poisson estimator is expected to yield more accurate results.

Burger et al. (2009) also caution that if there are a significant number of zeros in the data, the standard Poisson estimator may be biased:

> The most important cause of "non-Poissonness" is that some zeros in the data are produced by a different process than the remaining counts (including some of the other zeros), e.g., the complete lack of trade between pairs of countries because of a lack of resources (in which case the trade probability is identically zero by definition), compared to the lack of trade between pairs of countries due to the distances and differences in preferences and specializations (in which case the trade probability is theoretically different from zero). (p. 12)

Taking these limitations into account, all country-pairs which do not trade over the full 1970 to 2008 period are excluded from the regression, leaving only those country-pairs which record at least one bilateral trade flow over the period. This reduces the number of zero-trade flow observations from approximately 29 per cent to 23 per cent.

C   Database construction

C.1   Trade data

Trade data was taken from the UN Comtrade database for the period 1970-2008 (data are available for 1962 to 2009, but is less complete outside the selected time period). Total trade, in thousands of current US dollars, for all available reporters and all available partner countries in both the import and export direction was downloaded.

Obtaining as much data as possible means that some bilateral links (for example, trade between Australia and the United States) may have up to four recorded trade flows for a particular year (exports to Australia and imports from Australia, reported by the United states, and vice versa), while others may only have one (imports to Bermuda from Kazakhstan, reported by Kazakhstan). In the case where both trade partners report the same trade flow, they never report the same value. This is a well known feature of international trade flows (Feenstra et al. 2005).

Some studies use a decision rule (for example, only use trade flows reported by the importer) to remove observations which do not match — in practice sometimes removing half of the potential observations. The asymmetric structure of the fixed effects detailed in appendix A allows us to include flows reported by both the importer and the exporter, without excluding any observations. Further, the broad results are not sensitive to the exclusion of either export or import flows from the full complement of data.

Once obtained, the raw trade flow data are transformed in three steps:

1. The native format of the Comtrade database is to report an import or export trade flow from the perspective of a 'reporter' and a 'partner'. The nomenclature is modified so that the trade flows are reported as a trade flow from an 'exporter' to an 'importer', retaining the information about which party is reporting the trade flow.

2. A number of observations pertaining to country aggregations and anomalies are removed from the data, such as 'world', 'bunkers', 'special categories', amongst others.

3. The raw Comtrade data does not include zero trade flows; these are generated based on the principle that if a country was recorded as receiving at least one export or import flow in a particular year, but it is not recorded as trading with another country, a zero-trade flow is inserted. In that way, changes to the country composition of the world (for example, the break up of the USSR) are reflected each year.

C.2 GDP values

GDP and GDP per capita are taken from the World Bank's World Development Indicators and matched to the bilateral trade flow data so that the bilateral trade flow observations include GDP and GDP per capita for both importer and exporter. Current price GDP in US dollars is used, matching the current US dollar valuation of the dependent variable and avoiding the potential biases inherent with using price indices as identified by Baldwin & Taglioni (2006).[1]

The three GDP related variables are:

- Log of sum of GDPs - $\ln(GDP_{it} + GDP_{jt})$

- Log of absolute differences in GDP - $\ln\left(1 - \left(\dfrac{GDP_{it}}{GDP_{it} + GDP_{jt}}\right)^2 - \left(\dfrac{GDP_{jt}}{GDP_{it} + GDP_{jt}}\right)^2\right)$

- Difference of the logs of GDP per capita - $abs\left[\ln(GDP\_C_{it}) - \ln(GDP\_C_{jt})\right]$

[i denotes the exporter, j the importer and t the year].

C.3 Dynamic coding of BRTAs

Following Adams et al. (2003), the BRTAs included in the analysis are coded into the database using three dummy variables as described in appendix A. The variables are coded dynamically so that they reflect the starting (and ending) years of agreements and include changes in membership as they happen.

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[1] It should be noted that results are sensitive to a change in GDP valuation (for example, constant price valuation). Most sensitivity occurs in the year dummy variables (more so than the BRTA variables), leading us to suspect that the year dummy variables are 'soaking up' some of the variability in valuation (a price effect). See Baldwin and Taglioni (2006) for further details.

Each BRTA is coded into the database using three variables (figure C.1):

- The first captures the change in trade between members of the agreement and takes the value of one if both importer and exporter are members of the BRTA in that year and zero otherwise (D1).

- The second captures the change in imports to members of the agreement from non-members and takes the value of one if the importer is a member of the BRTA and the exporter is not a member of the agreement and zero otherwise (D2).

- The third captures the change in exports from members of the agreement to non-members and takes the value of one if the exporter is a member of the BRTA and the importer is not a member of the agreement and zero otherwise (D3).

Figure C.1   **BRTA variable coding, US–Canada example**
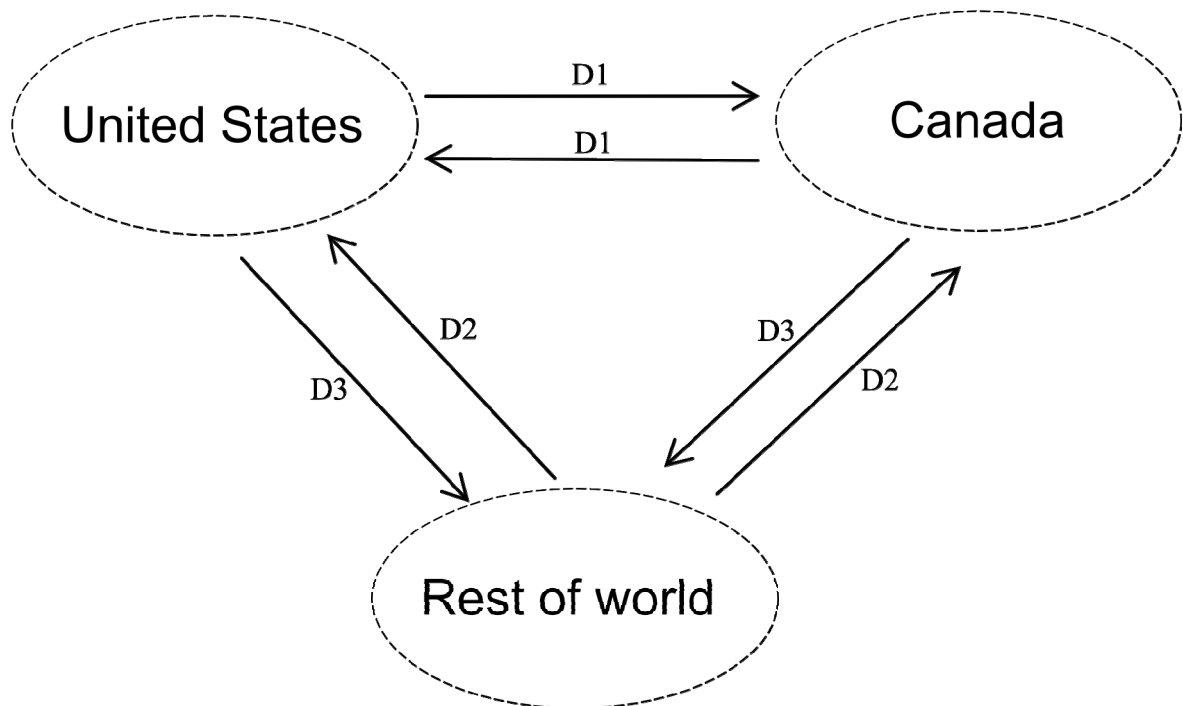
C.4   Summary statistics

Table C.1   **Summary statistics, full country sample**

Variable name	Observations	Mean	Standard dev.	Min.	Max.
Trade, thousands of US dollars, current prices	1139283	245852	2930102	0	4.E+08
SGDP	1139283	11.14	1.97	3.49	16.77
SIMILAR	1139283	-2.42	1.74	-11.63	-0.69
REL_INC	1139283	1.76	1.26	0.00	6.71

Table C.2   **Summary statistics, top 65 countries only**

Variable name	Observations	Mean	Standard dev.	Min.	Max.
Trade, thousands of US dollars, current prices	217539	1201755	6612906	0	4.E+08
SGDP	217539	12.61	1.38	6.32	16.77
SIMILAR	217539	-1.42	0.87	-7.60	-0.69
REL_INC	217539	1.48	1.09	0.00	5.89

D   Sensitivity testing

To test the sensitivity and suitability of the Poisson estimator to running a regression with 23 per cent zero trade flows, the benchmark regression with zero trade flows dropped was fitted. The results remain broadly stable and this is interpreted as an indication that the Poisson estimator is not biased by the number of zero trade flows in the data (table D.1).

To test the sensitivity of the results to the selection of BRTAs, 23 BRTAs were dropped from the benchmark model, leaving only APEC, ANZCERTA, EEC and NAFTA remaining. The results align broadly with the benchmark results, with the estimated effects of NAFTA most stable (table D.2). The coefficient on the D2 variable of the EEC changes from positive 0.07 to negative 0.02, potentially indicating some interaction between the EEC and the association agreements and other European agreements included in the benchmark regression. A second sensitivity test with no BRTAs (macro variables only) also shows broadly similar results to the benchmark regression.

To test the sensitivity of the results to country sample selection the benchmark model was fitted with reduced country coverage. The variations in country coverage tested were the full database (all countries available – benchmark) and the top 85, 65 and 45 countries ranked by trade value. The results are stable to the reduction in country coverage, with some larger changes in coefficients in last of these sensitivity tests (table D.3).

To test the sensitivity of the results to the time period selection, the benchmark model was run while successively restricting the time period of the sample (table D.4).

The results are sensitive to variation in time period, including some changes in sign which were not observed in earlier sensitivity tests.

Two factors may be contributing to this sensitivity. The first is that the effects of the BRTAs are relative to the time period under observation, and that the estimated effects of particular BRTAs are somewhat sensitive to exogenous events, such as the petrol price hikes of the 1970s, the collapse of the former Soviet Union in 1990,

the Asian financial crisis of the late 1990s, and the accession of China to the WTO in 2002.

Taking a longer time horizon, such events look more 'random'. It is also possible that the relationship between the level of GDP and the level of trade flows has changed over time, as production processes, technology and transport infrastructure have developed, and this has not been captured by the time dummy variable. One option to explore may be to interact time dummy variables with the GDP variables.

The second factor is that, for some countries, multilateral resistance may change over time (see appendix A). Given the fixed effects specification used in the model, it is not currently possible to determine the specific factors driving the sensitivity of the results to changes in time period.

A final sensitivity test is the replacement of the Central American Common Market in operation from 1993 with its earlier incarnation, which operated from 1960 to 1985 (table D.5).

Table D.1 **Exclusion of zero trade flows**

Poisson regression, dependent variable trade in current price USD, 1970 - 2008

	Benchmark	Benchmark, Zero trade flows excluded
SGDP	1.45	1.45
SIMILAR	0.71	0.71
REL_INC	-0.19	-0.20
APEC 1	0.07	0.04
APEC 2	0.08	0.05
APEC 3	0.09	0.06
ASEAN CEPT 1	0.32	0.33
ASEAN CEPT 2	0.12	0.13
ASEAN CEPT 3	0.24	0.24
ANZCER 1	0.13	0.16
ANZCER 2	-0.08	-0.05
ANZCER 3	-0.15	-0.11
AU PNG 1	0.07	0.07
AU PNG 2	0.06	0.06
AU PNG 3	-0.17	-0.17
SPARTECA 1	0.07	0.07
SPARTECA 2	-0.04	-0.05
SPARTECA 3	-0.18	-0.20
EEC 1	0.37	0.37
EEC 2	0.07	0.06
EEC 3	0.05	0.04
EEC POLAND 1	0.16	0.17
EEC POLAND 2	-0.14	-0.14
EEC POLAND 3	-0.15	-0.14
EEC ROMANIA 1	0.48	0.48
EEC ROMANIA 2	0.05	0.04
EEC ROMANIA 3	0.01	0.00
EEC SWISS 1	-0.05	-0.04
EEC SWISS 2	-0.15	-0.15
EEC SWISS 3	-0.04	-0.04
EEC EGYPT 1	-0.16	-0.17
EEC EGYPT 2	0.26	0.24
EEC EGYPT 3	0.20	0.14
EFTA 1	0.36	0.35
EFTA 2	0.14	0.13
EFTA 3	0.05	0.05
EFTA HUNGARY 1	0.02	0.02
EFTA HUNGARY 2	0.20	0.20
EFTA HUNGARY 3	0.19	0.19
EFTA POLAND 1	-0.03	-0.04
EFTA POLAND 2	-0.04	-0.05
EFTA POLAND 3	-0.17	-0.18

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Table D.1   **(continued)**

Poisson regression, dependent variable trade in current price USD, 1970 - 2008

	Benchmark	Benchmark, Zero trade flows excluded
EFTA ISRAEL 1	-0.38	-0.38
EFTA ISRAEL 2	-0.04	-0.05
EFTA ISRAEL 3	0.12	0.11
CEFTA 1	0.26	0.26
CEFTA 2	0.14	0.13
CEFTA 3	0.09	0.08
US Canada 1	0.13	0.15
US Canada 2	0.03	0.05
US Canada 3	0.02	0.04
NAFTA 1	0.32	0.35
NAFTA 2	0.06	0.09
NAFTA 3	-0.20	-0.17
ANDEAN 1	0.65	0.65
ANDEAN 2	0.05	0.04
ANDEAN 3	0.13	0.12
CACM 1	0.06	0.05
CACM 2	0.36	0.36
CACM 3	-0.02	-0.03
LAIA 1	0.26	0.25
LAIA 2	-0.06	-0.08
LAIA 3	0.23	0.21
MERCOSUR 1	0.86	0.86
MERCOSUR 2	0.18	0.18
MERCOSUR 3	-0.07	-0.06
CHILE COLOMBIA 1	0.03	0.06
CHILE COLOMBIA 2	0.26	0.26
CHILE COLOMBIA 3	-0.17	-0.16
BOLIVIA MEXICO 1	1.37	1.35
BOLIVIA MEXICO 2	0.60	0.59
BOLIVIA MEXICO 3	0.18	0.17
COSTA RICA MEXICO 1	0.43	0.44
COSTA RICA MEXICO 2	0.03	0.04
COSTA RICA MEXICO 3	0.34	0.34
GROUP OF THREE 1	0.07	0.07
GROUP OF THREE 2	-0.31	-0.30
GROUP OF THREE 3	-0.11	-0.11
MERCOSUR BOLIVIA 1	-0.07	-0.06
MERCOSUR BOLIVIA 2	-0.60	-0.58
MERCOSUR BOLIVIA 3	-0.28	-0.27
MERCOSUR CHILE 1	0.24	0.27
MERCOSUR CHILE 2	-0.13	-0.13
MERCOSUR CHILE 3	0.33	0.34

Table D.1   (continued)

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	Benchmark, Zero trade flows excluded
Dummy 1971	-0.06	-0.06
Dummy 1972	-0.10	-0.11
Dummy 1973	-0.13	-0.14
Dummy 1974	-0.01	-0.01
Dummy 1975	-0.14	-0.14
Dummy 1976	-0.14	-0.14
Dummy 1977	-0.18	-0.19
Dummy 1978	-0.28	-0.29
Dummy 1979	-0.30	-0.30
Dummy 1980	-0.32	-0.31
Dummy 1981	-0.30	-0.30
Dummy 1982	-0.35	-0.35
Dummy 1983	-0.38	-0.38
Dummy 1984	-0.34	-0.34
Dummy 1985	-0.38	-0.38
Dummy 1986	-0.54	-0.53
Dummy 1987	-0.58	-0.58
Dummy 1988	-0.60	-0.59
Dummy 1989	-0.65	-0.64
Dummy 1990	-0.72	-0.70
Dummy 1991	-0.77	-0.76
Dummy 1992	-0.83	-0.81
Dummy 1993	-0.84	-0.82
Dummy 1994	-0.82	-0.81
Dummy 1995	-0.84	-0.83
Dummy 1996	-0.86	-0.85
Dummy 1997	-0.81	-0.81
Dummy 1998	-0.81	-0.80
Dummy 1999	-0.81	-0.81
Dummy 2000	-0.73	-0.73
Dummy 2001	-0.77	-0.77
Dummy 2002	-0.81	-0.80
Dummy 2003	-0.86	-0.85
Dummy 2004	-0.86	-0.86
Dummy 2005	-0.87	-0.86
Dummy 2006	-0.86	-0.85
Dummy 2007	-0.92	-0.91
Dummy 2008	-0.95	-0.94
Observations	1,139,283	853,468
AIC	3.67E+10	3.56E+10
Correlation with benchmark	-	1.00

Note: All results are significant at the 1 per cent level. *BRTA*1 variables is trade within the BRTA, *BRTA*2 variable is imports into the BRTA from non-members and *BRTA*3 variable is exports from the BRTA to non-members.

Table D.2   **Effect of variation in explanatory variables**

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	*Selected PTAs*	*Macro variables only*
SGDP	1.45	1.48	1.50
SIMILAR	0.71	0.74	0.75
REL_INC	-0.19	-0.18	-0.18
APEC 1	0.07	0.16	
APEC 2	0.08	0.10	
APEC 3	0.09	0.12	
ASEAN CEPT 1	0.32		
ASEAN CEPT 2	0.12		
ASEAN CEPT 3	0.24		
ANZCER 1	0.13	0.06	
ANZCER 2	-0.08	-0.14	
ANZCER 3	-0.15	-0.38	
AU PNG 1	0.07		
AU PNG 2	0.06		
AU PNG 3	-0.17		
SPARTECA 1	0.07		
SPARTECA 2	-0.04		
SPARTECA 3	-0.18		
EEC 1	0.37	0.21	
EEC 2	0.07	-0.02	
EEC 3	0.05	0.02	
EEC POLAND 1	0.16		
EEC POLAND 2	-0.14		
EEC POLAND 3	-0.15		
EEC ROMANIA 1	0.48		
EEC ROMANIA 2	0.05		
EEC ROMANIA 3	0.01		
EEC SWISS 1	-0.05		
EEC SWISS 2	-0.15		
EEC SWISS 3	-0.04		
EEC EGYPT 1	-0.16		
EEC EGYPT 2	0.26		
EEC EGYPT 3	0.20		
EFTA 1	0.36		
EFTA 2	0.14		
EFTA 3	0.05		
EFTA HUNGARY 1	0.02		
EFTA HUNGARY 2	0.20		
EFTA HUNGARY 3	0.19		
EFTA POLAND 1	-0.03		
EFTA POLAND 2	-0.04		
EFTA POLAND 3	-0.17		

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Table D.2   **(continued)**

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	*Selected PTAs*	*Macro variables only*
EFTA ISRAEL 1	-0.38		
EFTA ISRAEL 2	-0.04		
EFTA ISRAEL 3	0.12		
CEFTA 1	0.26		
CEFTA 2	0.14		
CEFTA 3	0.09		
US Canada 1	0.13		
US Canada 2	0.03		
US Canada 3	0.02		
NAFTA 1	0.32	0.31	
NAFTA 2	0.06	0.03	
NAFTA 3	-0.20	-0.23	
ANDEAN 1	0.65		
ANDEAN 2	0.05		
ANDEAN 3	0.13		
CACM 1	0.06		
CACM 2	0.36		
CACM 3	-0.02		
LAIA 1	0.26		
LAIA 2	-0.06		
LAIA 3	0.23		
MERCOSUR 1	0.86		
MERCOSUR 2	0.18		
MERCOSUR 3	-0.07		
CHILE COLOMBIA 1	0.03		
CHILE COLOMBIA 2	0.26		
CHILE COLOMBIA 3	-0.17		
BOLIVIA MEXICO 1	1.37		
BOLIVIA MEXICO 2	0.60		
BOLIVIA MEXICO 3	0.18		
COSTA RICA MEXICO 1	0.43		
COSTA RICA MEXICO 2	0.03		
COSTA RICA MEXICO 3	0.34		
GROUP OF THREE 1	0.07		
GROUP OF THREE 2	-0.31		
GROUP OF THREE 3	-0.11		
MERCOSUR BOLIVIA 1	-0.07		
MERCOSUR BOLIVIA 2	-0.60		
MERCOSUR BOLIVIA 3	-0.28		
MERCOSUR CHILE 1	0.24		
MERCOSUR CHILE 2	-0.13		
MERCOSUR CHILE 3	0.33		

Table D.2   (continued)

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	Selected PTAs	Macro variables only
Dummy 1971	-0.06	-0.07	-0.07
Dummy 1972	-0.10	-0.13	-0.13
Dummy 1973	-0.13	-0.15	-0.14
Dummy 1974	-0.01	-0.03	-0.02
Dummy 1975	-0.14	-0.17	-0.16
Dummy 1976	-0.14	-0.16	-0.16
Dummy 1977	-0.18	-0.21	-0.21
Dummy 1978	-0.28	-0.32	-0.32
Dummy 1979	-0.30	-0.34	-0.34
Dummy 1980	-0.32	-0.36	-0.36
Dummy 1981	-0.30	-0.35	-0.36
Dummy 1982	-0.35	-0.39	-0.40
Dummy 1983	-0.38	-0.41	-0.43
Dummy 1984	-0.34	-0.37	-0.40
Dummy 1985	-0.38	-0.42	-0.45
Dummy 1986	-0.54	-0.57	-0.59
Dummy 1987	-0.58	-0.62	-0.63
Dummy 1988	-0.60	-0.64	-0.66
Dummy 1989	-0.65	-0.70	-0.66
Dummy 1990	-0.72	-0.77	-0.73
Dummy 1991	-0.77	-0.83	-0.78
Dummy 1992	-0.83	-0.87	-0.83
Dummy 1993	-0.84	-0.88	-0.83
Dummy 1994	-0.82	-0.87	-0.81
Dummy 1995	-0.84	-0.88	-0.82
Dummy 1996	-0.86	-0.90	-0.84
Dummy 1997	-0.81	-0.85	-0.79
Dummy 1998	-0.81	-0.84	-0.78
Dummy 1999	-0.81	-0.85	-0.79
Dummy 2000	-0.73	-0.77	-0.70
Dummy 2001	-0.77	-0.81	-0.74
Dummy 2002	-0.81	-0.84	-0.78
Dummy 2003	-0.86	-0.90	-0.84
Dummy 2004	-0.86	-0.91	-0.84
Dummy 2005	-0.87	-0.91	-0.85
Dummy 2006	-0.86	-0.91	-0.85
Dummy 2007	-0.92	-0.97	-0.91
Dummy 2008	-0.95	-1.00	-0.94
Observations	1,139,283	1,139,283	1,139,283
AIC	3.67E+10	3.75+E10	3.86E+10
Correlation with benchmark	-	0.87	0.86

Note: All results are significant at the 1 per cent level.

Table D.3   **Effect of changes in country coverage**

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	*Top 85*	*Top 65*	*Top 45*
SGDP	1.45	1.48	1.50	1.51
SIMILAR	0.71	0.75	0.77	0.75
REL_INC	-0.19	-0.19	-0.19	-0.20
APEC 1	0.07	0.06	0.07	0.07
APEC 2	0.08	0.08	0.09	0.12
APEC 3	0.09	0.08	0.08	0.10
ASEAN CEPT 1	0.32	0.31	0.30	0.26
ASEAN CEPT 2	0.12	0.12	0.11	0.10
ASEAN CEPT 3	0.24	0.23	0.23	0.21
ANZCER 1	0.13	0.22	0.21	**a**
ANZCER 2	-0.08	-0.10	-0.11	-0.07
ANZCER 3	-0.15	-0.13	-0.13	-0.10
AU PNG 1	0.07			
AU PNG 2	0.06	0.04	0.05	-0.04
AU PNG 3	-0.17	-0.18	-0.17	-0.20
SPARTECA 1	0.07	-0.03	-0.03	
SPARTECA 2	-0.04	-0.01	-0.01	0.01
SPARTECA 3	-0.18	-0.19	-0.20	-0.23
EEC 1	0.37	0.40	0.46	0.52
EEC 2	0.07	0.08	0.11	0.15
EEC 3	0.05	0.05	0.08	0.10
EEC POLAND 1	0.16	0.13	0.11	0.07
EEC POLAND 2	-0.14	-0.16	-0.20	-0.19
EEC POLAND 3	-0.15	-0.18	-0.25	-0.21
EEC ROMANIA 1	0.48	0.48	0.48	
EEC ROMANIA 2	0.05	0.06	0.06	
EEC ROMANIA 3	0.01	0.01	0.00	
EEC SWISS 1	-0.05	-0.06	-0.05	-0.07
EEC SWISS 2	-0.15	-0.16	-0.16	-0.17
EEC SWISS 3	-0.04	-0.05	-0.04	-0.06
EEC EGYPT 1	-0.16	-0.18		
EEC EGYPT 2	0.26	0.25		
EEC EGYPT 3	0.20	0.24		
EFTA 1	0.36	0.38	0.43	0.50
EFTA 2	0.14	0.16	0.18	0.22
EFTA 3	0.05	0.06	0.09	0.12
EFTA HUNGARY 1	0.02	0.01	-0.01	-0.01
EFTA HUNGARY 2	0.20	0.19	0.17	0.16
EFTA HUNGARY 3	0.19	0.18	0.17	0.28
EFTA POLAND 1	-0.03	-0.02	0.00	-0.01
EFTA POLAND 2	-0.04	-0.02	-0.02	-0.01
EFTA POLAND 3	-0.17	-0.15	-0.14	-0.06

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Table D.3 (continued)

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	*Top 85*	*Top 65*	*Top 45*
EFTA ISRAEL 1	-0.38	-0.39	-0.39	-0.39
EFTA ISRAEL 2	-0.04	-0.05	-0.04	-0.05
EFTA ISRAEL 3	0.12	0.09	0.09	0.09
CEFTA 1	0.26	0.30	0.42	0.19
CEFTA 2	0.14	0.16	0.22	0.28
CEFTA 3	0.09	0.11	0.16	0.13
US Canada 1	0.13	0.14	0.13	0.12
US Canada 2	0.03	0.04	0.03	0.00
US Canada 3	0.02	0.03	0.03	0.01
NAFTA 1	0.32	0.33	0.33	0.33
NAFTA 2	0.06	0.07	0.06	0.05
NAFTA 3	-0.20	-0.19	-0.19	-0.20
ANDEAN 1	0.65	0.61	0.46	
ANDEAN 2	0.05	0.05	0.06	0.04
ANDEAN 3	0.13	0.13	0.23	-0.10
CACM 1	0.06	-0.38		
CACM 2	0.36	0.38		
CACM 3	-0.02	-0.02		
LAIA 1	0.26	0.26	0.28	0.14
LAIA 2	-0.06	-0.06	-0.07	-0.08
LAIA 3	0.23	0.23	0.24	0.26
MERCOSUR 1	0.86	1.10	1.10	1.12
MERCOSUR 2	0.18	0.18	0.19	0.21
MERCOSUR 3	-0.07	-0.07	-0.09	-0.13
CHILE COLOMBIA 1	0.03	0.02	-0.06	
CHILE COLOMBIA 2	0.26	0.26	0.25	0.33
CHILE COLOMBIA 3	-0.17	-0.20	-0.29	-0.23
BOLIVIA MEXICO 1	1.37			
BOLIVIA MEXICO 2	0.60	0.63	0.64	0.65
BOLIVIA MEXICO 3	0.18	0.17	0.51	0.49
COSTA RICA MEXICO 1	0.43	0.41		
COSTA RICA MEXICO 2	0.03	0.02		
COSTA RICA MEXICO 3	0.34	0.34		
GROUP OF THREE 1	0.07	0.10	0.22	0.29
GROUP OF THREE 2	-0.31	-0.32	-0.32	-0.33
GROUP OF THREE 3	-0.11	-0.10	-0.12	-0.09
MERCOSUR BOLIVIA 1	-0.07			
MERCOSUR BOLIVIA 2	-0.60			
MERCOSUR BOLIVIA 3	-0.28			
MERCOSUR CHILE 1	0.24	0.25	0.28	0.25
MERCOSUR CHILE 2	-0.13	-0.14	-0.14	-0.21
MERCOSUR CHILE 3	0.33	0.35	0.40	0.35

Table D.3 **(continued)**

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark	Top 85	Top 65	Top 45
Dummy 1971	-0.06	-0.07	-0.07	-0.07
Dummy 1972	-0.10	-0.11	-0.11	-0.10
Dummy 1973	-0.13	-0.15	-0.16	-0.16
Dummy 1974	-0.01	-0.03	-0.05	-0.05
Dummy 1975	-0.14	-0.17	-0.19	-0.21
Dummy 1976	-0.14	-0.16	-0.19	-0.21
Dummy 1977	-0.18	-0.21	-0.25	-0.25
Dummy 1978	-0.28	-0.31	-0.35	-0.36
Dummy 1979	-0.30	-0.33	-0.37	-0.37
Dummy 1980	-0.32	-0.36	-0.40	-0.40
Dummy 1981	-0.30	-0.34	-0.39	-0.38
Dummy 1982	-0.35	-0.39	-0.43	-0.41
Dummy 1983	-0.38	-0.41	-0.44	-0.44
Dummy 1984	-0.34	-0.37	-0.40	-0.39
Dummy 1985	-0.38	-0.40	-0.43	-0.41
Dummy 1986	-0.54	-0.57	-0.61	-0.58
Dummy 1987	-0.58	-0.62	-0.66	-0.64
Dummy 1988	-0.60	-0.64	-0.68	-0.66
Dummy 1989	-0.65	-0.70	-0.75	-0.72
Dummy 1990	-0.72	-0.76	-0.82	-0.80
Dummy 1991	-0.77	-0.81	-0.87	-0.85
Dummy 1992	-0.83	-0.88	-0.94	-0.91
Dummy 1993	-0.84	-0.89	-0.94	-0.93
Dummy 1994	-0.82	-0.87	-0.93	-0.92
Dummy 1995	-0.84	-0.90	-0.97	-0.95
Dummy 1996	-0.86	-0.92	-0.99	-0.98
Dummy 1997	-0.81	-0.87	-0.94	-0.92
Dummy 1998	-0.81	-0.86	-0.93	-0.91
Dummy 1999	-0.81	-0.87	-0.93	-0.92
Dummy 2000	-0.73	-0.78	-0.85	-0.84
Dummy 2001	-0.77	-0.82	-0.89	-0.88
Dummy 2002	-0.81	-0.86	-0.93	-0.92
Dummy 2003	-0.86	-0.92	-0.99	-0.99
Dummy 2004	-0.86	-0.93	-1.00	-1.00
Dummy 2005	-0.87	-0.93	-1.01	-1.01
Dummy 2006	-0.86	-0.93	-1.01	-1.01
Dummy 2007	-0.92	-0.99	-1.07	-1.07
Dummy 2008	-0.95	-1.02	-1.11	-1.11
Observations	1,139,283	327,141	215,539	120,168
AIC	3.67E+10	3.07E+10	2.79E+10	2.18E+10
Correlation w/ benchmark	-	0.94	0.93	0.92

Note: All results are significant at the 1 per cent level. [a] New Zealand is not included in the top 45 countries worldwide in order of value of trade, and so the D1 variable is dropped from the regression.

Table D.4 **Effect of variation in time period**

Poisson regression, dependent variable trade in current price USD

	Bench-mark	1970-1997	1970-1998	1970-1999	1970-2000	1970-2001	1970-2002	1970-2003	1970-2004	1970-2005	1970-2006	1970-2007
SGDP	1.45	1.12	1.13	1.14	1.14	1.14	1.16	1.19	1.24	1.30	1.36	1.40
SIMILAR	0.71	0.90	0.89	0.88	0.85	0.83	0.8	0.77	0.74	0.72	0.70	0.69
REL_INC	-0.19	0.04	0.02	0.00	-0.02	-0.03	-0.06	-0.09	-0.13	-0.15	-0.18	-0.20
APEC 1	0.07	0.11	0.10	0.10	0.10	0.09	0.09	0.10	0.11	0.10	0.09	0.09
APEC 2	0.08	0.06	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.08
APEC 3	0.09	0.07	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.10	0.10
ASEAN CEPT 1	0.32	0.15	0.18	0.21	0.25	0.27	0.29	0.31	0.33	0.34	0.34	0.33
ASEAN CEPT 2	0.12	0.16	0.16	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.13
ASEAN CEPT 3	0.24	0.12	0.16	0.19	0.21	0.22	0.23	0.24	0.24	0.25	0.25	0.24
ANZCER 1	0.13	0.13	0.14	0.15	0.17	0.18	0.18	0.18	0.16	0.15	0.15	0.13
ANZCER 2	-0.08	-0.10	-0.10	-0.09	-0.08	-0.08	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08
ANZCER 3	-0.15	-0.12	-0.13	-0.14	-0.14	-0.12	-0.12	-0.12	-0.14	-0.15	-0.15	-0.16
AU PNG 1	0.07	-0.14	-0.14	-0.13	-0.12	-0.11	-0.09	-0.08	-0.05	-0.02	0.02	0.06
AU PNG 2	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05
AU PNG 3	-0.17	-0.16	-0.16	-0.17	-0.17	-0.17	-0.17	-0.17	-0.18	-0.18	-0.18	-0.17
SPARTECA 1	0.07	0.05	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.08	0.08
SPARTECA 2	-0.04	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03	-0.04
SPARTECA 3	-0.18	-0.15	-0.15	-0.15	-0.15	-0.15	-0.16	-0.16	-0.17	-0.17	-0.18	-0.18
EEC 1	0.37	0.31	0.34	0.35	0.37	0.38	0.38	0.38	0.41	0.40	0.39	0.39
EEC 2	0.07	-0.04	-0.03	-0.02	0.00	0.01	0.01	0.02	0.06	0.06	0.06	0.07
EEC 3	0.05	0.01	0.03	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.06
EEC POLAND 1	0.16	0.21	0.25	0.26	0.27	0.26	0.27	0.31	0.24	0.21	0.19	0.17
EEC POLAND 2	-0.14	-0.14	-0.13	-0.13	-0.15	-0.17	-0.18	-0.16	-0.17	-0.16	-0.15	-0.14
EEC POLAND 3	-0.15	-0.28	-0.29	-0.32	-0.35	-0.37	-0.39	-0.36	-0.26	-0.22	-0.19	-0.16
EEC ROMANIA 1	0.48	0.69	0.72	0.74	0.76	0.78	0.80	0.86	0.81	0.77	0.78	0.54
EEC ROMANIA 2	0.05	0.07	0.01	-0.05	-0.10	-0.13	-0.14	-0.11	-0.05	-0.02	0.04	0.04
EEC ROMANIA 3	0.01	-0.03	-0.08	-0.12	-0.15	-0.19	-0.22	-0.19	-0.19	-0.17	-0.18	-0.04

Table D.4 (continued)

Poisson regression, dependent variable trade in current price USD

	Bench-mark	1970-1997	1970-1998	1970-1999	1970-2000	1970-2001	1970-2002	1970-2003	1970-2004	1970-2005	1970-2006	1970-2007
EEC SWISS 1	-0.05	-0.06	-0.06	-0.06	-0.05	-0.05	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05
EEC SWISS 2	-0.15	-0.17	-0.17	-0.17	-0.17	-0.16	-0.16	-0.16	-0.15	-0.15	-0.15	-0.15
EEC SWISS 3	-0.04	-0.15	-0.14	-0.13	-0.11	-0.11	-0.11	-0.11	-0.09	-0.08	-0.07	-0.06
EEC EGYPT 1	-0.16	0.00a	-0.03	-0.06	-0.11	-0.15	-0.18	-0.20	-0.20	-0.18	-0.17	-0.17
EEC EGYPT 2	0.26	0.25	0.23	0.22	0.20	0.20	0.20	0.20	0.22	0.23	0.24	0.25
EEC EGYPT 3	0.20	0.10	0.12	0.12	0.11	0.11	0.12	0.13	0.14	0.12	0.12	0.15
EFTA 1	0.36	0.30	0.31	0.33	0.34	0.35	0.35	0.36	0.39	0.39	0.38	0.38
EFTA 2	0.14	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.16	0.15	0.15	0.15
EFTA 3	0.05	0.07	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.07	0.07
EFTA HUNGARY 1	0.02	0.09	0.12	0.12	0.11	0.09	0.07	0.11	0.01	0.00	0.01	0.02
EFTA HUNGARY 2	0.20	0.33	0.44	0.49	0.53	0.53	0.53	0.57	0.37	0.28	0.25	0.22
EFTA HUNGARY 3	0.19	0.43	0.57	0.64	0.68	0.70	0.69	0.75	0.51	0.40	0.31	0.24
EFTA POLAND 1	-0.03	0.29	0.34	0.36	0.38	0.38	0.39	0.43	0.19	0.09	0.05	0.01
EFTA POLAND 2	-0.04	0.52	0.53	0.52	0.50	0.47	0.45	0.45	0.13	0.05	0.02	-0.02
EFTA POLAND 3	-0.17	0.21	0.20	0.17	0.14	0.12	0.10	0.12	-0.04	-0.07	-0.12	-0.15
EFTA ISRAEL 1	-0.38	-0.28	-0.30	-0.31	-0.32	-0.33	-0.34	-0.34	-0.35	-0.35	-0.36	-0.37
EFTA ISRAEL 2	-0.04	-0.02	-0.04	-0.03	-0.04	-0.04	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02
EFTA ISRAEL 3	0.12	0.00	0.01	0.03	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.13
CEFTA 1	0.26	-0.40	-0.31	-0.21	-0.09	0.02	0.09	0.05	0.22	0.26	0.27	0.25
CEFTA 2	0.14	0.11	0.08	0.10	0.12	0.15	0.17	0.15	0.17	0.17	0.14	0.13
CEFTA 3	0.09	-0.05	-0.09	-0.06	-0.02	0.02	0.06	0.03	0.07	0.07	0.08	0.08
US Canada 1	0.13	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.08	0.10	0.11
US Canada 2	0.03	-0.04	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	0.00	0.01	0.02
US Canada 3	0.02	-0.03	-0.03	-0.04	-0.04	-0.04	-0.03	-0.03	-0.02	-0.01	0.00	0.01

Table D.4 (continued)

Poisson regression, dependent variable trade in current price USD

	Bench-mark	1970-1997	1970-1998	1970-1999	1970-2000	1970-2001	1970-2002	1970-2003	1970-2004	1970-2005	1970-2006	1970-2007
NAFTA 1	0.32	0.35	0.38	0.40	0.41	0.41	0.40	0.38	0.36	0.35	0.33	0.32
NAFTA 2	0.06	-0.05	-0.02	0.01	0.03	0.04	0.05	0.05	0.05	0.05	0.06	0.06
NAFTA 3	-0.20	-0.05	-0.05	-0.06	-0.08	-0.09	-0.10	-0.13	-0.16	-0.18	-0.20	-0.20
ANDEAN 1	0.65	0.64	0.69	0.72	0.76	0.80	0.81	0.81	0.81	0.79	0.62	0.66
ANDEAN 2	0.05	-0.03	-0.02	-0.03	-0.04	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	0.02
ANDEAN 3	0.13	-0.16	-0.16	-0.12	-0.10	-0.09	-0.10	-0.09	-0.09	-0.08	0.02	0.09
CACM 1	0.06	-0.04	0.01	0.02	0.02	0.04	0.05	0.05	0.06	0.07	0.03	0.05
CACM 2	0.36	0.19	0.22	0.24	0.23	0.24	0.26	0.29	0.30	0.32	0.34	0.36
CACM 3	-0.02	0.03	0.04	0.03	0.01	-0.01	-0.02	-0.03	-0.03	-0.02	-0.03	-0.03
LAIA 1	0.26	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.21	0.22	0.24	0.25
LAIA 2	-0.06	-0.09	-0.09	-0.08	-0.08	-0.08	-0.08	-0.07	-0.07	-0.06	-0.06	-0.06
LAIA 3	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.22	0.22	0.23	0.23
MERCOSUR 1	0.86	0.65	0.69	0.70	0.72	0.73	0.75	0.78	0.81	0.83	0.84	0.85
MERCOSUR 2	0.18	0.09	0.11	0.12	0.13	0.13	0.14	0.15	0.16	0.16	0.16	0.16
MERCOSUR 3	-0.07	-0.28	-0.30	-0.30	-0.30	-0.28	-0.24	-0.19	-0.15	-0.11	-0.09	-0.08
CHILE COLOMBIA 1	0.03	0.03	0.08	0.14	0.18	0.22	0.25	0.27	0.25	0.20	0.08	0.00
CHILE COLOMBIA 2	0.26	0.26	0.27	0.28	0.29	0.30	0.30	0.31	0.31	0.30	0.30	0.28
CHILE COLOMBIA 3	-0.17	-0.06	-0.03	-0.02	-0.03	-0.02	-0.02	-0.02	-0.04	-0.06	-0.12	-0.17
BOLIVIA MEXICO 1	1.37	1.05	1.06	1.10	1.15	1.22	1.25	1.27	1.29	1.29	1.27	1.29
BOLIVIA MEXICO 2	0.60	0.61	0.61	0.64	0.68	0.68	0.67	0.65	0.63	0.61	0.60	0.60
BOLIVIA MEXICO 3	0.18	0.18	0.19	0.16	0.14	0.17	0.16	0.13	0.10	0.09	0.11	0.12
COSTA RICA MEXICO 1	0.43	0.03	0.12	0.21	0.25	0.26	0.32	0.38	0.44	0.45	0.45	0.44
COSTA RICA MEXICO 2	0.03	-0.08	-0.06	-0.05	-0.05	-0.05	-0.03	-0.01	0.01	0.01	0.02	0.03
COSTA RICA MEXICO 3	0.34	0.20	0.26	0.32	0.34	0.33	0.33	0.36	0.37	0.36	0.36	0.36

Table D.4   (continued)

Poisson regression, dependent variable trade in current price USD

	Bench-mark	1970-1997	1970-1998	1970-1999	1970-2000	1970-2001	1970-2002	1970-2003	1970-2004	1970-2005	1970-2006	1970-2007
GROUP OF THREE 1	0.07	0.12	0.05	-0.04	-0.11	-0.14	-0.14	-0.15	-0.13	-0.08	0.02	0.06
GROUP OF THREE 2	-0.31	-0.19	-0.19	-0.22	-0.27	-0.28	-0.29	-0.31	-0.31	-0.30	-0.29	-0.30
GROUP OF THREE 3	-0.11	0.04	-0.05	-0.09	-0.09	-0.13	-0.13	-0.12	-0.10	-0.08	-0.09	-0.09
MERCOSUR BOLIVIA 1	-0.07	-0.33	-0.35	-0.40	-0.46	-0.47	-0.41	-0.35	-0.27	-0.17	-0.11	-0.09
MERCOSUR BOLIVIA 2	-0.60	-0.28	-0.23	-0.30	-0.40	-0.46	-0.49	-0.51	-0.53	-0.53	-0.55	-0.59
MERCOSUR BOLIVIA 3	-0.28	-0.09	-0.15	-0.16	-0.18	-0.24	-0.22	-0.19	-0.14	-0.14	-0.18	-0.23
MERCOSUR CHILE 1	0.24	-0.02	-0.05	-0.05	-0.01	0.03	0.07	0.12	0.16	0.20	0.23	0.25
MERCOSUR CHILE 2	-0.13	-0.05	-0.06	-0.11	-0.14	-0.15	-0.17	-0.19	-0.21	-0.21	-0.22	-0.19
MERCOSUR CHILE 3	0.33	-0.06	-0.11	-0.11	-0.08	-0.05	-0.02	0.01	0.07	0.12	0.22	0.30
Dummy 1971	-0.06	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05	-0.06
Dummy 1972	-0.10	-0.02	-0.03	-0.03	-0.02	-0.02	-0.03	-0.04	-0.05	-0.06	-0.08	-0.09
Dummy 1973	-0.13	0.02	0.01	0.01	0.01	0.01	0.00	-0.01	-0.03	-0.06	-0.09	-0.11
Dummy 1974	-0.01	0.18	0.17	0.17	0.17	0.17	0.16	0.15	0.12	0.09	0.05	0.03
Dummy 1975	-0.14	0.08	0.08	0.07	0.08	0.07	0.06	0.04	0.01	-0.03	-0.07	-0.10
Dummy 1976	-0.14	0.10	0.09	0.09	0.09	0.09	0.08	0.06	0.03	-0.02	-0.06	-0.09
Dummy 1977	-0.18	0.10	0.09	0.09	0.09	0.09	0.07	0.05	0.01	-0.04	-0.10	-0.13
Dummy 1978	-0.28	0.05	0.04	0.04	0.04	0.04	0.02	-0.01	-0.05	-0.12	-0.18	-0.23
Dummy 1979	-0.30	0.09	0.08	0.07	0.08	0.07	0.05	0.02	-0.03	-0.11	-0.18	-0.23
Dummy 1980	-0.32	0.11	0.09	0.09	0.09	0.09	0.07	0.03	-0.03	-0.11	-0.19	-0.24
Dummy 1981	-0.30	0.11	0.10	0.10	0.10	0.10	0.08	0.04	-0.02	-0.10	-0.18	-0.23
Dummy 1982	-0.35	0.06	0.05	0.05	0.05	0.05	0.03	-0.01	-0.07	-0.15	-0.23	-0.28
Dummy 1983	-0.38	0.05	0.03	0.03	0.03	0.03	0.00	-0.04	-0.09	-0.17	-0.25	-0.31
Dummy 1984	-0.34	0.10	0.09	0.09	0.09	0.08	0.06	0.02	-0.04	-0.13	-0.21	-0.27
Dummy 1985	-0.38	0.09	0.08	0.07	0.07	0.07	0.04	0.00	-0.07	-0.15	-0.24	-0.30
Dummy 1986	-0.54	-0.01	-0.02	-0.03	-0.03	-0.04	-0.07	-0.12	-0.19	-0.29	-0.39	-0.45
Dummy 1987	-0.58	-0.01	-0.03	-0.03	-0.03	-0.04	-0.07	-0.13	-0.20	-0.31	-0.42	-0.49

Table D.4 (continued)

Poisson regression, dependent variable trade in current price USD

	Bench-mark	1970-1997	1970-1998	1970-1999	1970-2000	1970-2001	1970-2002	1970-2003	1970-2004	1970-2005	1970-2006	1970-2007
Dummy 1988	-0.60	0.01	-0.01	-0.02	-0.02	-0.03	-0.06	-0.12	-0.20	-0.31	-0.42	-0.50
Dummy 1989	-0.65	-0.01	-0.03	-0.04	-0.04	-0.05	-0.08	-0.15	-0.23	-0.35	-0.47	-0.55
Dummy 1990	-0.72	-0.03	-0.05	-0.06	-0.06	-0.07	-0.11	-0.18	-0.27	-0.39	-0.52	-0.61
Dummy 1991	-0.77	-0.06	-0.09	-0.09	-0.09	-0.11	-0.15	-0.21	-0.31	-0.44	-0.57	-0.66
Dummy 1992	-0.83	-0.09	-0.12	-0.13	-0.13	-0.15	-0.19	-0.26	-0.36	-0.49	-0.63	-0.72
Dummy 1993	-0.84	-0.10	-0.13	-0.14	-0.15	-0.16	-0.20	-0.27	-0.37	-0.50	-0.64	-0.73
Dummy 1994	-0.82	-0.08	-0.12	-0.13	-0.14	-0.15	-0.19	-0.26	-0.36	-0.49	-0.62	-0.71
Dummy 1995	-0.84	-0.07	-0.11	-0.12	-0.13	-0.14	-0.18	-0.26	-0.36	-0.49	-0.63	-0.72
Dummy 1996	-0.86	-0.07	-0.11	-0.12	-0.13	-0.14	-0.19	-0.26	-0.36	-0.51	-0.65	-0.74
Dummy 1997	-0.81	-0.02	-0.06	-0.07	-0.08	-0.09	-0.14	-0.22	-0.32	-0.46	-0.60	-0.69
Dummy 1998	-0.81		-0.05	-0.07	-0.07	-0.09	-0.13	-0.21	-0.31	-0.45	-0.59	-0.69
Dummy 1999	-0.81			-0.06	-0.07	-0.09	-0.13	-0.21	-0.31	-0.45	-0.60	-0.69
Dummy 2000	-0.73				0.02	0.00	-0.05	-0.12	-0.23	-0.37	-0.52	-0.61
Dummy 2001	-0.77					-0.03	-0.08	-0.16	-0.26	-0.41	-0.55	-0.65
Dummy 2002	-0.81						-0.10	-0.18	-0.29	-0.44	-0.58	-0.68
Dummy 2003	-0.86							-0.20	-0.31	-0.47	-0.62	-0.73
Dummy 2004	-0.86								-0.29	-0.45	-0.62	-0.73
Dummy 2005	-0.87									-0.44	-0.61	-0.72
Dummy 2006	-0.86										-0.60	-0.72
Dummy 2007	-0.92											-0.77
Dummy 2008	-0.95											
Observations	1,139,283	644,023	684,827	728,512	775,045	821,750	867,713	914,168	961,369	1,009,187	1,056,064	1,100,225
AIC	3.67E+10	1.29E+10	1.42E+10	1.55E+10	1.70E+10	1.85E+10	2.00E+10	2.2E+10	2.44E+10	2.72E+10	3.03E+10	3.34E+10
Correlation with benchmark	-	0.68	0.70	0.71	0.72	0.73	0.77	0.81	0.90	0.95	0.98	1.00

a Not significant. All other results are significant at the 1 per cent level.

Table D.5 **Central American Common Market sensitivity test**

Poisson regression, dependent variable trade in current price USD, 1970 - 2008

	Benchmark (CACM operating from 1993 onwards)	Benchmark except CACM operating from 1960 to 1985
SGDP	1.45	1.45
SIMILAR	0.71	0.71
REL_INC	-0.19	-0.19
APEC 1	0.07	0.07
APEC 2	0.08	0.08
APEC 3	0.09	0.09
ASEAN CEPT 1	0.32	0.32
ASEAN CEPT 2	0.12	0.12
ASEAN CEPT 3	0.24	0.24
ANZCER 1	0.13	0.13
ANZCER 2	-0.08	-0.08
ANZCER 3	-0.15	-0.15
AU PNG 1	0.07	0.07
AU PNG 2	0.06	0.06
AU PNG 3	-0.17	-0.17
SPARTECA 1	0.07	0.07
SPARTECA 2	-0.04	-0.04
SPARTECA 3	-0.18	-0.18
EEC 1	0.37	0.37
EEC 2	0.07	0.06
EEC 3	0.05	0.05
EEC POLAND 1	0.16	0.16
EEC POLAND 2	-0.14	-0.14
EEC POLAND 3	-0.15	-0.15
EEC ROMANIA 1	0.48	0.48
EEC ROMANIA 2	0.05	0.05
EEC ROMANIA 3	0.01	0.01
EEC SWISS 1	-0.05	-0.05
EEC SWISS 2	-0.15	-0.15
EEC SWISS 3	-0.04	-0.05
EEC EGYPT 1	-0.16	-0.16
EEC EGYPT 2	0.26	0.26
EEC EGYPT 3	0.20	0.20
EFTA 1	0.36	0.36
EFTA 2	0.14	0.14
EFTA 3	0.05	0.05
EFTA HUNGARY 1	0.02	0.02
EFTA HUNGARY 2	0.20	0.20
EFTA HUNGARY 3	0.19	0.19
EFTA POLAND 1	-0.03	-0.03
EFTA POLAND 2	-0.04	-0.04
EFTA POLAND 3	-0.17	-0.17

Table D.5 **(continued)**

Poisson regression, dependent variable trade in current price USD, 1970 - 2008

	Benchmark (CACM operating from 1993 onwards)	Benchmark except CACM operating from 1960 to 1985
EFTA ISRAEL 1	-0.38	-0.38
EFTA ISRAEL 2	-0.04	-0.04
EFTA ISRAEL 3	0.12	0.12
CEFTA 1	0.26	0.26
CEFTA 2	0.14	0.14
CEFTA 3	0.09	0.09
US Canada 1	0.13	0.13
US Canada 2	0.03	0.03
US Canada 3	0.02	0.02
NAFTA 1	0.32	0.32
NAFTA 2	0.06	0.06
NAFTA 3	-0.20	-0.19
ANDEAN 1	0.65	0.65
ANDEAN 2	0.05	0.05
ANDEAN 3	0.13	0.13
CACM 1	**0.06**	**0.18**
CACM 2	**0.36**	**-0.25**
CACM 3	**-0.02**	**0.12**
LAIA 1	0.26	0.26
LAIA 2	-0.06	-0.06
LAIA 3	0.23	0.23
MERCOSUR 1	0.86	0.86
MERCOSUR 2	0.18	0.17
MERCOSUR 3	-0.07	-0.06
CHILE COLOMBIA 1	0.03	0.03
CHILE COLOMBIA 2	0.26	0.26
CHILE COLOMBIA 3	-0.17	-0.17
BOLIVIA MEXICO 1	1.37	1.16
BOLIVIA MEXICO 2	0.60	0.43
BOLIVIA MEXICO 3	0.18	0.13
COSTA RICA MEXICO 1	0.43	0.66
COSTA RICA MEXICO 2	0.03	0.21
COSTA RICA MEXICO 3	0.34	0.39
GROUP OF THREE 1	0.07	0.06
GROUP OF THREE 2	-0.31	-0.31
GROUP OF THREE 3	-0.11	-0.11
MERCOSUR BOLIVIA 1	-0.07	0.03
MERCOSUR BOLIVIA 2	-0.60	-0.46
MERCOSUR BOLIVIA 3	-0.28	-0.23
MERCOSUR CHILE 1	0.24	0.24
MERCOSUR CHILE 2	-0.13	-0.13
MERCOSUR CHILE 3	0.33	0.33

Table D.5   (continued)

Poisson regression, dependent variable trade in current price USD, 1970 – 2008

	Benchmark (CACM operating from 1993 onwards)	Benchmark except CACM operating from 1960 to 1985
Dummy 1971	-0.06	-0.06
Dummy 1972	-0.10	-0.10
Dummy 1973	-0.13	-0.13
Dummy 1974	-0.01	-0.01
Dummy 1975	-0.14	-0.14
Dummy 1976	-0.14	-0.14
Dummy 1977	-0.18	-0.18
Dummy 1978	-0.28	-0.28
Dummy 1979	-0.30	-0.30
Dummy 1980	-0.32	-0.32
Dummy 1981	-0.30	-0.31
Dummy 1982	-0.35	-0.35
Dummy 1983	-0.38	-0.38
Dummy 1984	-0.34	-0.34
Dummy 1985	-0.38	-0.38
Dummy 1986	-0.54	-0.54
Dummy 1987	-0.58	-0.58
Dummy 1988	-0.60	-0.60
Dummy 1989	-0.65	-0.65
Dummy 1990	-0.72	-0.72
Dummy 1991	-0.77	-0.77
Dummy 1992	-0.83	-0.83
Dummy 1993	-0.84	-0.84
Dummy 1994	-0.82	-0.82
Dummy 1995	-0.84	-0.84
Dummy 1996	-0.86	-0.86
Dummy 1997	-0.81	-0.81
Dummy 1998	-0.81	-0.81
Dummy 1999	-0.81	-0.81
Dummy 2000	-0.73	-0.73
Dummy 2001	-0.77	-0.77
Dummy 2002	-0.81	-0.81
Dummy 2003	-0.86	-0.86
Dummy 2004	-0.86	-0.86
Dummy 2005	-0.87	-0.87
Dummy 2006	-0.86	-0.86
Dummy 2007	-0.92	-0.92
Dummy 2008	-0.95	-0.95
Observations	1,139,283	1,139,283
AIC	3.67E+10	3.67E+10
Correlation with benchmark	-	0.97

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