Modelling Kemp-Vanek Admissibility: The Effects of Free Trade Areas on Non-Members

Robert Waschik
La Trobe University
Victoria, Australia

February 2006

Abstract

Many studies of Free Trade Areas (FTAs) focus on the detailed effects of such Agreements on FTA members, but often use only aggregate measures of trade diversion to evaluate the effects of FTAs on non-members. We use a multi-sector multi-country Numerical General Equilibrium to endogenously determine the tariffs that FTA members would need to charge on non-member trade to maintain FTA-member imports from non-members at their pre-FTA level. This allows us to apply the notion of Kemp-Vanek admissibility in McMillan (1993) to construct an FTA which does not make non-members of the FTA worse off. We then use endogenous tariffs to apply the notion of Kemp-Vanek admissibility using our NGE model to offer some predictions of the effects of an FTA between Australia and China. Results of such experiments are relevant to the current debate under the WTO's Doha Round of trade negotiations over GATT (1994) Article XXIV which evaluates the consistency of FTAs with the WTO.

J.E.L. Classification Codes: F15, F13, C68
Keywords: endogenous tariffs, Kemp-Vanek admissibility, free trade areas, Article XXIV

Correspondence to:
Robert Waschik
Department of Economics and Finance
La Trobe University
Victoria 3086 Australia
Tel.: (+61 3) 9479 5701
Fax: (+61 3) 9479 1654
E-Mail: r.waschik@latrobe.edu.au

1 Introduction

While there has been and continues to be substantial liberalization of trade under the auspices of the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO), more and more countries are pursuing policies of trade liberalization through Preferential Trade Agreements (PTAs). There continues to be serious debate over the issue of whether such PTAs promote deeper liberalization of trade than would be possible through the GATT/WTO and are therefore beneficial, or whether such PTAs generate welfare gains for PTA members at the expense of non-members.

In evaluating whether PTAs are welfare-improving or welfare reducing, theoretical and applied models typically use the notions of trade creation and trade diversion described in Viner (1950). Detailed and disaggregrated measures of trade creation and diversion are routinely used to evaluate whether PTA members benefit by joining a proposed PTA. But when it comes to the effects of a PTA on non-members, many studies ignore the impact of a PTA on non-members, and those that do consider the effects on non-members typically present only aggregate effects. The objective of this paper is to describe a method of evaluating the effects of PTAs which focuses particularly on non-members, and implements a method of constructing PTAs which does not harm non-members, consistent with many theoretical studies in the trade literature on the formation of PTAs. We demonstrate how such a method of constructing PTAs could be implemented in a Numerical General Equilibrium (NGE) model of PTA formation, and apply the notion of Kemp-Vanek admissibility described in McMillan (1993) to our measures of the effects of PTA formation on non-members.

For our purposes it will be important to demonstrate aggregate and disaggregate measures of the welfare effects of PTA formation. Many studies have noted that the commonly applied notions of trade creation and trade diversion are not well suited to this task. For example, Lipsey (1957) writes that while "the distinction between trade creation and trade diversion is fundamental for classifying the changes in production consequent on the formation of a customs union, it is not one on which welfare conclusions can be based", and Harrison *et al* (1993) argue that trade creation and trade diversion do not provide useful measures of the sources of the welfare changes due to PTA formation. As such, we employ the decomposition of welfare changes due to PTA formation into a Home Price effect and a Tariff Revenue effect, developed in Harrison *et al* (1993), when describing the welfare effects of PTA formation in our NGE model.

The plan of the paper is as follows: Section 2 gives a very brief review of the theoretical and applied literature on measuring the effects of PTA formation,[1] to motivate the importance of a detailed focus on the effects of PTAs on non-members, and to describe the theoretical basis for our implementation of Kemp-Vanek admissibility as a measure of the effects of PTA formation on non-members. Section 3 describes the dataset and NGE model used to model PTA formation. To demonstrate how the Kemp-Vanek admissibility criterion can be used to evaluate the effects of PTA formation in practice, we use our NGE model to describe the effects of a potential Free Trade Agreement between Australia and China in Section 4. Concluding comments are offered in Section 5.

2 Measuring the Effects of PTAs

The seminal treatment of PTAs is Viner (1950), which shows that the formation of a PTA can yield gains due to the creation of trade between PTA members as trade barriers on intra-PTA trade are reduced. But these gains may be offset due to trade diversion as some of the increase in intra-PTA trade can come about at the expense of imports from more efficient extra-PTA suppliers. This work has been extended to incorporate models with increasing returns and product differentiation (see Krugman (1991), Bond and Syropoulos (1996), among many others), political economy aspects of PTA formation (Krishna (1998) and Grossman and Helpman (1994), for example), and strategic investment aspects of PTA formation (Freund (2000)). While all of these studies argue that trade creation and diversion are important in understanding which and how PTAs form, the effects of PTA formation are typically ambiguous, since the relative size of trade creation and diversion is in general indeterminate. The welfare effects of PTA formation and the size of trade creation and diversion are an empirical issue.

The most common empirical tool used to estimate the effects of PTAs in *ex post* studies is the gravity equation.[2] Adams *et al* (2003), Cernat (2001), Haveman, Nair-Reichert

[1] For a more detailed literature review, the reader is directed to any of a number of surveys of various approaches to the study of PTAs, including Panagariya (1999) and (2000), Adams *et al* (2003), DeRosa (1998), Harrison, Rutherford and Tarr (2003), Robinson and Thierfelder (2002), Scollay and Gilbert (2000), and Lloyd and MacLaren (2004).

[2] Recent studies by Clausing (2001) and Trefler (2004) present econometric estimates of the effects of the Canada-US Free Trade Agreement (CUSFTA) and do not use a gravity equation to derive results. But these papers present the effect of the CUSFTA on non-member countries only at the most aggregate

and Thursby (2003), Kreinin and Plummer (1998), Krueger (1999), and Linnemann and Verbruggen (1991) are just some of the studies which have used a gravity equation to estimate trade creation and diversion in the NAFTA, MERCOSUR, the Australia-New Zealand CER, ASEAN, various PTAs between primarily developing countries, and the Generalized System of Preferences (GSP) of 1989 between developed and developing countries. But many gravity models suffer from mis-specification and omitted variable bias, since relative price changes are often omitted from such regressions, and models are often estimated using very aggregated data. As noted in Krueger (1999), it is very difficult to control for changes in all relevant variables to isolate the effects of trade creation and diversion. Most importantly, the *ex post* studies available often reach conflicting conclusions, with some studies arguing that the NAFTA (for example) caused significant trade diversion while others argue that NAFTA did not divert trade from non-members to any significant extent.

Numerical General Equilibrium (NGE) models have become popular tools for analyzing the implications of formation or accession to PTAs (see Brown *et al* (2003), Harrison, Rutherford and Tarr (2001), (1997), Rutherford, Rutström and Tarr (1997), and Scollay and Gilbert (2000), among many others). The problem with such *ex ante* studies of PTA formation is that they typically do not focus on the effects of PTA formation on non-members. The counterfactual analysis used implies that PTA imports from non-PTA countries are affected by changes in all variables in the NGE model. Welfare effects for both PTA members and non-members must arise due to both trade creation and trade diversion. As a result, it is problematic to argue that any increases in intra-PTA trade are due to pure trade creation, or to changes in income within the PTA, changes in relative prices between PTA and non-PTA members due to the formation of the PTA (trade diversion), or other relative price or income changes in the new counterfactual equilibrium. Since such NGE models typically include other domestic distortions such as production taxes or subsidies as well as trade distortions, the effects of the formation of a PTA on the welfare and trade volumes of non-members will be due to (i) trade diversion as PTA members substitute duty-free imports from PTA members for imports from non-members on which duties must still be paid, (ii) trade creation to the extent that increases in PTA-member welfare cause PTA members to increase imports from all trading partners, and (iii) second-order effects due to the presence of other distortions. To understand how non-members are affected by the formation of a PTA, it will be necessary to understand

level.

the relative contribution of all of these effects.

PTAs are necessarily discriminatory since trade barriers are reduced or removed only on intra-PTA trade, implying that *cet.par.*, relative prices of goods imported from outside the PTA will rise. PTAs are therefore inconsistent with Article I (MFN) of the GATT, which requires that nations treat all trading partners as they do their *most-favoured* trading partner. Since the inception of the GATT, PTAs have been legitimate exceptions to MFN through Article XXIV, which aims to ensure that as a result of formation of the PTA:

- PTA members remove barriers on substantially all trade between PTA members over a reasonable period of time, and
- duties set by PTA members on non-member trade are not higher or more restrictive than prior to the formation of the PTA

Art.XXIV has proven to be an unreliable tool to evaluate PTAs. Many authors have argued that Art.XXIV is too vague and imprecise to be useful in evaluating PTAs, and Working Parties of the GATT/WTO typically fail to reach a conclusion as to whether or not a given PTA is consistent with the GATT/WTO.[3]

An important criticism of Article XXIV is McMillan (1993), who argues that Art.XXIV focuses on the wrong measures of the effects of PTAs. By concentrating on the level of duties set by PTA members on non-member trade, Art.XXIV targets a variable which only indirectly affects welfare through its effect on trade volumes. McMillan proposes a superior indicator of the effects of a PTA which targets trade volumes with non-members: A PTA would be consistent with the GATT/WTO if it did not result in any reduction in trade between the PTA and non-members. As noted by McMillan, this rule for admissibility of a PTA has a strong theoretical foundation in the work of Vanek (1965), Kemp (1964) and Kemp and Wan (1976). Such a rule would ensure that PTAs result in no trade diversion, implying that PTAs themselves could not make non-members any worse off. McMillan (1993) also argues that in applying Kemp-Vanek admissibility, data should be used at as disaggregated a level as is available.

[3]As an example, paragraph 98 of the Report of the Working Party on the Canada-US Free Trade Agreement (see General Agreement on Tariffs and Trade (1992:76)) notes that: "At the conclusion of its examination of the Agreement, the Working Party ... was unable to reach agreed conclusions as to the consistency of the provisions of the Agreement with the General Agreement."

The objective of this paper is to demonstrate a mechanism which implements the Kemp-Vanek admissibility criterion described in McMillan (1993), using a NGE model of PTA formation. In implementing this admissibility criterion, we will focus on the effects of the formation of a PTA on non-members. As opposed to the typical NGE models of PTAs, we construct a model of PTA formation which results in a PTA which is necessarily Kemp-Vanek admissible, by building a model with endogenous import tariffs which adjust to keep PTA member imports from non-members at their initial level.

2.1 Modelling Kemp-Vanek Admissibility

In order to implement the Kemp-Vanek admissibility criterion described in McMillan (1993), we need to incorporate a mechanism into our PTA experiment which ensures that the volume of imports by members of a PTA from non-members does not change when the PTA is formed. We introduce into our NGE model an endogenous tariff on each commodity imported by each PTA member from each non-member. When we model the effects of a PTA using our NGE model, this endogenous tariff will adjust to keep imports by PTA members from non-members at their pre-PTA (benchmark) levels.[4] Any welfare changes or changes in trade volumes will be due only to trade creation. The FTA will not result in any trade diversion, so it will necessarily be Kemp-Vanek admissible. If we then run the same FTA experiment without endogenous tariffs, we get welfare and trade volume changes where trade can be both created and diverted. We also examine non-member welfare in this simple FTA experiment without endogenous tariffs, to see whether it satisfies the Kemp-Vanek admissibility criterion.

To illustrate, consider Figure 1[5] which shows the effects of an FTA between Australia and China on the demand for imports of manufactures by either Australia or China from their FTA partner (initially D_0^{part}) and the rest of the world RoW (initially D_0^{RoW}). Figure 1 reflects an initial equilibrum where prices are normalized to unity and both Australia and China have base period tariffs on imports of manufactures from the RoW which are lower than tariffs on imports of manufactures from their proposed FTA partner. Before the proposed FTA, Australia or China imports q_0^{part} of manufactures from its proposed

[4] We focus only on the case where PTA members form a Free Trade Area (FTA) and do not choose a Common External Tariff (CET). This eliminates the need to motivate the CU's choice of a CET, an issue deemed to be beyond the scope of this paper. For more on the issue of the CU's choice of a CET, see Melatos and Woodland (2003). See Ohyama (2002) and Panagariya and Krishna (2002) for the extension of the Kemp-Wan theorem to the case of FTA's.

[5] Figure 1 is adapted from Rutherford *et al* (1997).

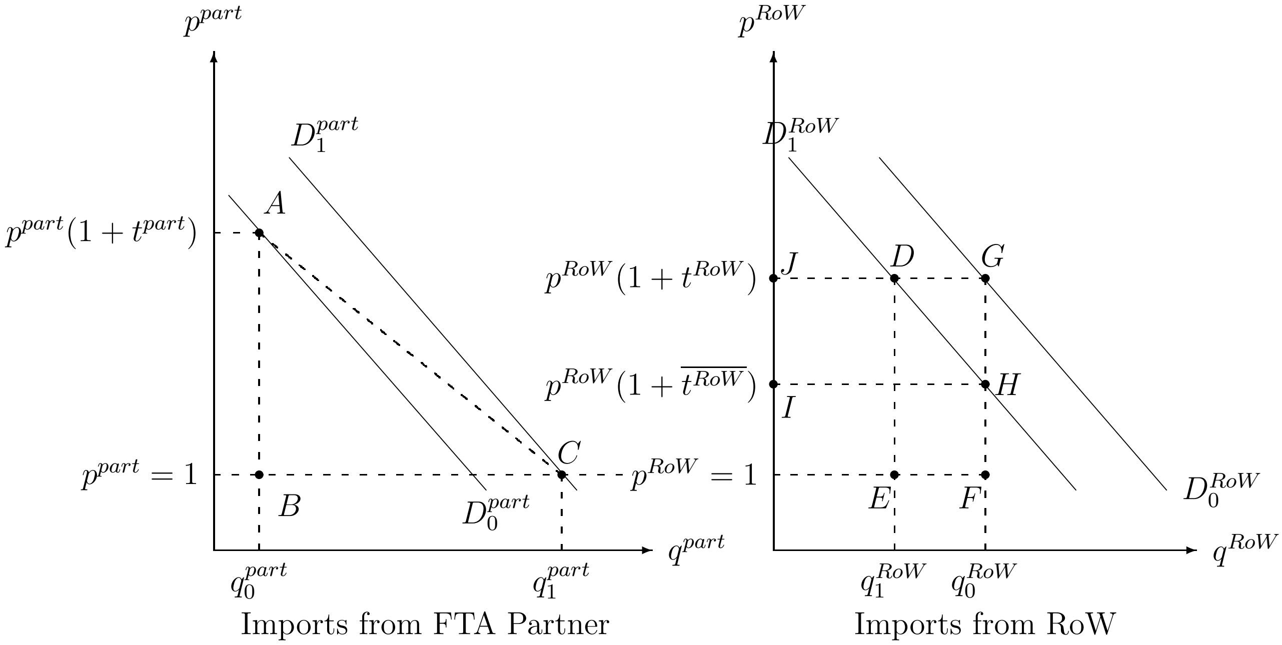

Figure 1: FTA Member Imports of Manufactures

FTA partner (point A), and imports q_0^{RoW} of manufactures from the RoW (point G).

An FTA between Australia and China reduces the Australian and Chinese tariff on imports of manufactures from each other to zero. This shifts each country's import demand curve for manufactures from its FTA partner to the right, from D_0^{part} to D_1^{part}. But the FTA increases the relative price in Australia and China of imports of manufactures from the RoW, so in the right panel, each FTA member's import demand curve for manufactures from RoW shifts to the left, from D_0^{RoW} to D_1^{RoW}. As noted in Rutherford *et al* (1997), this allows us to illustrate the welfare gain due to trade creation as the area ABC in the left panel, and the welfare loss due to trade diversion as the area $DEFG$ in the right panel.

For an FTA to be Kemp-Vanek admissibile, it must not result in any trade diversion. That is, in Figure 1, each FTA member's imports of manufactures from RoW must not fall below their benchmark level q_0^{RoW}. So to eliminate trade diversion, the FTA member will have to reduce its tariff on imports of manufactures from RoW to $\overline{t^{RoW}}$ at point H in Figure 1. As a result, the import demand for manufactures from the FTA partner will not shift as far as D_1^{part}. For the FTA member, the welfare gain due to trade creation will be smaller than ABC, but the welfare loss when trade diversion is eliminated will be

$GHIJ$. This welfare loss on non-member imports may be larger or smaller than the trade diversion area $DEFG$, depending on how far the FTA member needs to drop its tariff on RoW imports in order to eliminate trade diversion.

Consider the difference between the baseline or benchmark tariff on imports by PTA members from non-members, and the endogenous tariff which maintains imports from non-members at pre-PTA levels ($t^{RoW} - \overline{t^{RoW}}$ in Figure 1). If this difference is zero (or very close to zero), then the proposed PTA should not result in any trade diversion. In such a case, Art.XXIV as it is currently written should be sufficient to ensure that the PTA is compatible with the WTO. But if the difference between the initial and endogenous tariff is large, then the tariff on non-member imports needs to be reduced to eliminate the negative effects of the PTA on non-members due to trade diversion. Art.XXIV would be inadequate in protecting non-members from the trade diverting effects of the PTA.

As has been noted in the literature, trade creation and diversion are not useful measures of the sources of welfare changes due to PTA formation. Instead, we adopt the welfare decomposition described in Harrison *et al* (1993). Consider an economy's income-equals-expenditure constraint:

$$e(p, \mu) \quad = \quad r(p, v) + TR + OTR,$$

where p is the domestic price, $e(\cdot)$ is minimum expenditure necessary to achieve welfare level μ at domestic prices p, $r(\cdot)$ is the maximum revenue attainable given domestic prices p and the nation's vector of endowments v, and TR and OTR are import tariff revenue and other tax revenue, respectively. If t is this nation's vector of specific tariffs, $TR = tm$ and $p = p^* + t$, where p^* is the vector of world prices and m is the nation's vector of net imports.

Totally differentiating the income-equals-expenditure constraint yields:

$$\begin{aligned} e_p dp + e_\mu d\mu &= r_p dp + dTR + dOTR \\ e_\mu d\mu &= [r_p - e_p]dp + dTR + dOTR \\ e_\mu d\mu &= -mdp + dTR + dOTR. \end{aligned}$$

The term $-mdp$ is the *Home Price Effect* in Harrison *et al* (1993), while dTR is their *Tariff Revenue Effect*.[6] NGE models of PTA formation commonly incorporate non-tariff distortions such as production taxes or subsidies, so the change in other tax revenue due to the formation of a PTA will generally not be equal to zero.

[6]This decomposition can be written as the familiar sum of volume-of-trade and terms-of-trade effects,

3 Numerical General Equilibrium Model

This section describes the Numerical General Equilibrium model and Benchmark Equilibrium Data Set (BEDS). The dataset is an aggregated version of the beta release of version 6 of the GTAP dataset, described in Hertel (1995), which represents a world trading equilibrium in the year 2001. In any country or region, final goods are produced using four primary inputs—labour, capital, land, and natural resources—and intermediate inputs. The primary factors land and natural resources are specific factors, while capital and labour are perfectly mobile between production sectors. Each region produces, imports and exports all goods. Trade is accommodated using the so-called *Armington assumption*, so that the same goods produced in different regions are imperfect substitutes for one another. The final consumption goods in any region are consumed by a representative consumer in each region who owns all primary factors of production, and supplies all primary factors to the production sector. All primary factors are completely immobile between regions. There are a number of distortions in the initial equilibrium data set, including production taxes, export taxes and import tariffs.

For each sector i, finished goods y_i are produced using intermediate inputs from each sector j x_{ij} and primary inputs: Land H_i, natural resources R_i, labour L_i, and capital K_i. We assume that production technologies display constant returns to scale, and are represented by nested CES production functions of the form:[7]

$$\begin{aligned} y_i &= \left[\sum_j \beta_j z_{ji}^{\frac{\phi_i-1}{\phi_i}} + \beta_V V_i^{\frac{\phi_i-1}{\phi_i}}\right]^{\frac{\phi_i}{\phi_i-1}} \\ \text{where} \quad V_i &= \left[\alpha_H \bar{H}_i^{\frac{\rho_i-1}{\rho_i}} + \alpha_R \bar{R}_i^{\frac{\rho_i-1}{\rho_i}} + \alpha_L L_i^{\frac{\rho_i-1}{\rho_i}} + \alpha_K K_i^{\frac{\rho_i-1}{\rho_i}}\right]^{\frac{\rho_i}{\rho_i-1}}, \qquad \forall\ i \end{aligned}$$

where z_{ji} is the amount of good j used in production of good i. The substitution elasticity between primary inputs, ρ_i, is given in Table A-2.[8] Intermediate inputs x_{ij} and the aggregate value-added V_i are combined using fixed-coefficients production technology, so $\phi_i \rightarrow 0\ \forall\ i$.

as, for example, in Dixit and Norman (1980:153-4), by substituting the expression for the change in the domestic price $dp = dt + dp^*$ and tariff revenue $dTR = mdt + tdm$ to get:

$$e_\mu d\mu \quad = \quad -mdp^* + tdm + dOTR,$$

where $-mdp^*$ is the terms-of-trade effect and tdm is the volume-of-trade effect.

[7]Note that subscripts denoting regions have been suppressed.

[8]These central case values for the elasticity of substitution between primary inputs ρ_i are consistent with those in version 5.4 of the GTAP database, reported in Hertel (1995).

All markets are assumed to be perfectly competitive, with free entry and exit of firms, so economic profits are equal to zero in all industries in equilibrium. Producers take all output and input prices as given, and these are all normalized to unity in the initial equilibrium.

The demand side of each economy is represented by a system of demand functions derived from the solution to the representative consumer's utility maximization problem when utility for the representative consumer in region r is represented by a Cobb-Douglas utility function:

$$U = \prod_i z_i^{\theta_i} \qquad \sum_i \theta_i = 1,$$

where z_i is the consumption of commodity i by the representative consumer. Because we employ a Cobb-Douglas utility function the elasticity of substitution in consumption is equal to one. Of total output of industry i in any region, some amount is exported, and the remainder is consumed within the region.

The model is closed by ensuring that the balance of payments is equal to zero, or that the trade (current account) balance is always equal to the (negative of) capital flows. We use a static model: Aggregate regional investment is treated as exogenous, as are any capital flows between countries. In any region, trade is modelled using nested CES functions which reflect the Armington assumption, so that the same goods produced in a region and imported from other regions are imperfect substitutes for one another:

$$z_i = \left[\gamma_d y_i^{\frac{\nu_i - 1}{\nu_i}} + \gamma_f m_i^{\frac{\nu_i - 1}{\nu_i}}\right]^{\frac{\nu_i}{\nu_i - 1}} \qquad \forall\, i$$

$$m_i = \left[\sum_r \delta_r m_{ir}^{\frac{\tau_i - 1}{\tau_i}}\right]^{\frac{\tau_i}{\tau_i - 1}} \qquad \forall\, i,$$

where $m_i = \sum_r m_{ir}$ is total imports of good i and m_{ir} is imports of good i from region r. Trade in any region can be distorted by the presence of export taxes/subsidies and import tariffs. Import tariffs are a combination of tariffs and tariff-equivalents of quantity restrictions on imports.

The substitution elasticity between goods imported from different regions is τ_i. The aggregate imported good is combined with the domestically produced good with a substitution elasticity given by ν_i, reported in Table A-2.[9] In setting the substitution elasticities between imports from different regions τ_i, we adopt the method used in Jomini

[9] These central case values for the elasticity of substitution between domestic and aggregate imported goods ν_i are consistent with those in version 5.4 of the GTAP database, reported in Hertel (1995).

et al. (1994: 81) and set $\tau_i = 2 \times \nu_i$.[10] As shown in Mansur and Whalley (1984), a region's import demand elasticity for good i will be approximately equal to τ_i, so the size of trade creation and trade diversion will depend upon these substitution elasticities. To show how sensitive results are to specification of these elasticities, we conduct sensitivity analysis by repeating experiments for low ($\nu_i^{lo} = 0.5 \times \nu_i$) and high ($\nu_i^{hi} = 2 \times \nu_i$) values for these independently specified parameters.

4 NGE Model of an Australia-China FTA

As argued in McMillan (1993), it is desireable to describe the effects of a PTA using the most disaggregated data available, since more disaggregated statistics will give more reliable measures of the impact of a PTA on trade flows with non-members.[11] But to begin with, we demonstrate the notion of Kemp-Vanek admissibility in a much more highly aggregated NGE model, to show clearly in a simple model how PTA members can adjust their tariff on non-member trade to eliminate trade diversion. We implement the Kemp-Vanek admissibility criterion using the NGE model of Section 3 to simulate the effects of a Free Trade Agreement between Australia and China. While this example is of current policy relevance,[12] it serves as a useful example for our purposes because it is an FTA between only two countries, one of which is a small developed country and the other a large developing country. This makes it more straightforward to demonstrate and interpret results in a small-dimensional NGE model, and allows us to say something about the disaggregated effects of an FTA in small versus large countries. We begin with the typical NGE model of PTA formation without endogenous tariffs, to see what such a model predicts about the effects of an Australia-China FTA on non-members. Then we repeat the experiment with endogenous tariffs which adjust to hold constant FTA imports from non-members, effectively eliminating any trade diversion.

Import tariffs on Australia-China services trade are all equal to zero in the 2001 GTAP dataset. To keep the model as simple as possible, we aggregate together all countries and regions in the GTAP model other than Australia and China into a single region called

[10]For a discussion of and empirical support for this *Rule of Two*, see Liu *et al* (2004).

[11]A series of disputes between the US and EC due to enlargement of the EC in 1973 and in 1986 provides an excellent example of how measures of the effects of a PTA are affected by the level of aggregation. See McMillan (1993:303).

[12]A Joint Feasibility Study (DFAT (2005)) recommended that negotiations on an FTA between Australia and China would substantially benefit both countries and should begin as soon as possible.

Table 1: Import Tariffs (%)

	Australia	China	RoW
Australia		11.46	7.40
China	8.84		6.14
RoW	4.93	13.66	3.25

the Rest-of-World (RoW), and aggregate together commodities in the GTAP model by supposing that each region produces only two goods: manufactures and services. We model the effects of an Australia-China FTA by setting all import tariffs on Australia-China manufactures trade equal to zero: $tm_{i,s,r} = 0,\ s, r =$ aus, chn. Initial tariffs t_{sr} on manufactures imports from region s into region r are given in Table 1.

Under an Australia-China FTA, Australia reduces its tariff on imports of manufactures from China from 8.84% to 0%, and China reduces its tariff on imports from Australia from 11.46% to 0%. Both Australia and China maintain benchmark tariffs on imports from RoW.

In this simple two-good NGE model, the central case value of the substitution elasticity between domestic and imported manufactured goods is $\nu_{man} = 2.8$, so the substitution elasticity between imports from different regions (which is approximately equal to the import demand elasticity) is equal to $\tau_{man} = 2 * \nu_{man} = 5.6$. Given benchmark prices are normalized to unity, we can use the initial Australia-China tariffs to get a rough approximation of the expected change in the volume of imports due to the Australia-China FTA. Removing Australia's 8.84% tariff on manufactures imports from China should increase the volume of imports by 8.84*5.6 $\approx$ 50%, while removing China's 11.46% tariff on manufactures imports from Australia should increase the volume of manufactures imports by 11.46*5.6 $\approx$ 65%. Changes in the volume of manufactures trade derived from our NGE model of this simple FTA between Australia and China with no endogenous tariffs for this central case (medium) value of the Armington elasticity, along with trade changes under high ($2*\nu_{man} = 5.6$) and low ($0.5*\nu_{man} = 1.4$) values of this elasticity, are given in the lower panel of Table 2.

Welfare results of the simple experiment when there are no endogenous tariffs which adjust to hold constant FTA imports from the RoW are reported in the lower panel of Table 3, labelled "Trade Creation and Trade Diversion". Without endogenous tariffs, the FTA results in both trade creation and trade diversion.

Table 2: Change in Volume of FTA Member Imports (%)

Trade Creation Only

		low elasticity	medium elasticity	high elasticity
% change in	from CHN	21.89	43.51	85.92
AUS imports	from RoW	0.00	0.00	0.00
% change in	from AUS	32.68	73.13	175.73
CHN imports	from RoW	0.00	0.00	0.00

Trade Creation and Diversion

		low elasticity	medium elasticity	high elasticity
% change in	from CHN	25.20	54.93	131.75
AUS imports	from RoW	−1.12	−3.14	−8.98
% change in	from AUS	32.57	74.19	188.50
CHN imports	from RoW	−0.42	−0.96	−2.71

Table 3: Welfare Decomposition in Aggregated 3 Region Model

Trade Creation Only

	high elasticity			medium elasticity			low elasticity		
	AUS	CHN	RoW	AUS	CHN	RoW	AUS	CHN	RoW
Change in Income (%)	0.3108	0.1508	−0.0047	0.1817	0.0545	−0.0019	0.1253	−0.0134	0.0000
Change in Income ($ million)	871.40	968.50	−1109.90	509.60	350.00	−445.90	351.20	−86.30	−2.00
Home Price Effect	2831.39	4020.87	−100.30	2026.65	2487.91	−37.29	1570.46	1857.63	52.92
Tariff Revenue Effect	−2193.96	−3294.23	−108.82	−1676.05	−2229.28	−23.26	−1338.11	−1837.49	−1.46
Other Distortions	233.97	241.86	−900.78	159.00	91.37	−385.35	118.85	−106.44	−53.46

Trade Creation and Trade Diversion

	high elasticity			medium elasticity			low elasticity		
	AUS	CHN	RoW	AUS	CHN	RoW	AUS	CHN	RoW
Change in Income (%)	0.3361	−0.0725	−0.0055	0.2404	−0.0481	−0.0023	0.2088	−0.0767	−0.0004
Change in Income ($ million)	942.50	−466.10	−1295.80	674.00	−308.80	−554.60	585.40	−492.60	−101.70
Home Price Effect	1563.00	1453.62	−1106.96	1174.86	1038.09	−776.82	1047.45	788.66	−570.84
Tariff Revenue Effect	−763.66	−1409.59	−415.38	−609.14	−868.72	−127.64	−558.06	−697.55	−32.50
Other Distortions	143.16	−510.13	226.54	108.28	−478.17	349.86	96.01	−583.71	501.64

Results in the first row of the bottom panel of Table 3 suggest that Australia would see welfare gains of 0.21-0.34% of base period welfare, while China would see a small loss of welfare, between 0.05-0.08% of base period welfare. The larger is the Armington elasticity, the more Australia is like a small open economy, and the larger is Australia's welfare gain from the FTA with China. But China is a much larger economy, so the effect of the FTA on China is much smaller, and China tends to see a small welfare loss due to the small amount of market power that she relinquishes in the FTA.

We can gain further insight by decomposing the welfare effects of the Australia-China FTA into a Home Price effect and a Tariff Revenue effect. For both Australia and China, the positive Home Price effect is larger than the negative Tariff Revenue effect. As we would expect, both the Home Price and the Tariff Revenue effects are larger the larger is the trade elasticity. For Australia, the Home Price effect is generally twice as large as the negative Tariff Revenue effect. The change from Other Distortions is quite small, so Australia sees a welfare gain due to the FTA. But for China, the negative Tariff Revenue effect is only slightly smaller than the positive Home Price effect, so when account is taken of the effects of Other Distortions, China sees a small reduction in welfare due to the FTA.

Finally, results in Table 3 show that the effect of an Australia-China FTA on the rest-of-the-world (RoW) should be very small, with RoW welfare losses never exceeding 0.006% of base period income even under the high elasticity case. It would seem the scope for trade diversion of an Australia-China FTA harming the RoW would be very small. As shown in Table 2, even under the high elasticity case, Australian imports from the RoW fall by less than 9%, and Chinese imports from RoW fall by less than 3%.

To see the implications of this FTA on non-members more clearly, we ask the following question: What is the tariff $\overline{t_{RoW}}$ that Australia and China must charge for the FTA not to divert any trade from the RoW into the FTA? We re-run the NGE model, but now with endogenous tariffs which adjust to completely eliminate any trade diversion. These tariffs which Australia and China would have to charge on imports of manufactures from the RoW to keep constant FTA imports from the RoW are reported in Table 4.

The reduction in tariffs on RoW imports will be greater the larger the trade elasticity, as is demonstrated in Table 4. For central case elasticity values, Australia will need to reduce its tariff on RoW merchandis imports by 200 basis points, from almost 5%

Table 4: Tariffs on RoW Imports to Eliminate Trade Diversion (%)

	Australia	China
benchmark	4.93	13.66
low elasticity	3.42	13.10
med. elasticity	2.79	12.92
high elasticity	1.84	12.47

to just below 3%. But for China, the reduction in tariffs on imports from the RoW is much smaller, only 75 basis points under the medium elasticity case. As shown in Table 2, without endogenous tariffs, the Australia-China FTA would cause a much larger precentage drop in Australian imports from RoW than in Chinese imports from RoW, so the reduction in tariffs needed to eliminate trade diversion is much smaller for China.

Finally, we can consider the welfare effects of the Australia-China FTA if trade diversion is completely eliminated, shown in the upper panel of Table 3. Notice that in each case, the RoW never loses more than 5-thousandths of one percent of base period welfare.[13] In fact, the decomposition of the RoW welfare changes into Home Price and Tariff Revenue effects shows that any welfare loss in the RoW is typically due to other distortions, and is due only to a very small extent to any Home Price or Tariff Revenue effect. In Australia, the reduction in the tariff on RoW manufactures imports reduces the welfare gain of the FTA slightly. But for China, the small welfare loss due to the FTA becomes a small welfare gain when trade diversion is eliminated. For both Australia and China, the reduction in the tariff on RoW imports to eliminate trade diversion makes both the positive Home Price effect and the negative Tariff Revenue effect larger (in absolute value). And in this case, as another distortion (the tariff on RoW imports) is being reduced, the welfare effect from other distortions becomes more positive (less negative).

We now address the final element of Kemp-Vanek admissibility as described in McMillan (1993): That the effect of the PTA be evaluated at as disaggregated a level as possible. We run the same NGE simulation of the removal of all tariffs on Australia-China manufactures trade, using the same GTAP dataset. But now we use the finest sectoral disaggregation available from the GTAP dataset, so instead of only two goods, manufactures and services, we have 57 goods. We also disaggregate the Rest-of-World into 8 separate

[13]Recall that while the volume of imports from the RoW is being held fixed, output prices are changing, so there will be some change to RoW welfare, even when the FTA causes only trade creation and no trade diversion.

regions. The sectoral and regional aggregations are shown in the Appendix, Tables A-1 and A-2. The welfare effects due to the elimination of tariffs on Australia-China trade in this disaggregated model are given in Table 5.[14]

[14] Results in Table 5 are derived under central case values for all elasticities. Complete results are available from teh author on request.

Table 5: Welfare Decomposition in Disaggregated 10 Region Model - Central Case Elasticities

Trade Creation Only

	AUS	CHN	ASE	RNA	EU	ROE	USA	RON	SA	RoW
Change in Income (%)	0.1538	0.0413	0.0448	0.0046	0.0010	0.0021	−0.0103	0.0118	0.0000	0.0015
Change in Income ($ million)	431.40	265.00	156.80	154.70	65.10	14.20	−868.40	120.30	0.40	37.50
Home Price Effect	1510.12	1883.11	−17.32	−89.49	−20.91	1.70	−71.00	15.16	3.71	−24.99
Tariff Revenue Effect	−1147.38	−1509.83	1.56	12.38	−4.00	0.44	−2.36	−2.40	0.09	0.28
Other Distortions	68.66	−108.28	172.56	231.81	90.01	12.06	−795.04	107.54	−3.40	62.21

Trade Creation and Trade Diversion

	AUS	CHN	ASE	RNA	EU	ROE	USA	RON	SA	RoW
Change in Income (%)	0.1921	−0.0096	−0.0737	−0.0129	−0.0031	−0.0012	0.0093	−0.0122	0.0000	−0.0086
Change in Income ($ million)	538.70	−61.70	−258.20	−431.30	−194.20	−8.30	788.80	−125.10	0.00	−221.2
Home Price Effect	1172.40	1266.68	−90.48	−237.67	−156.86	−1.38	84.27	−43.80	−5.97	−186.55
Tariff Revenue Effect	−639.51	−816.00	−2.44	3.55	−14.25	−0.76	3.03	−0.53	−0.79	−0.53
Other Distortions	5.81	−512.38	−165.28	−197.18	−23.09	−6.16	701.50	−80.77	6.76	−34.12

First consider results from the typical NGE model which has no endogenous tariffs, reported in the lower panel of Table 5. The welfare decomposition for Australia and China shows that the changes in welfare for the FTA members are robust to this increase in the level of sectoral and regional disaggregation of the model. All non-members are worse off after the Australia-China FTA, except the USA, which sees a small increase in welfare, due primarily to second-order effects through other distortions. But clearly, not all non-members are affected in the same way by the Australia-China FTA. To illustrate, we use the dramatic example afforded by looking at the effects of the Australia-China FTA on trade in the Cereal Grains industry. China's initial tariff on imports of Cereal Grains from Australia as reported in the GTAP dataset is 90.9%, so it is not surprising that removing this tariff will have dramatic effects on the pattern of Chinese Cereal Grain imports. These change in the volume of imports are reported in Table 6.

Table 6: Chinese Volume of Imports of Cereal Grains (million$US)

	initial imports	low elasticity	medium elasticity	high elasticity
Australia	212.30	508.70	716.25	952.53
ASEAN	1.95	1.25	0.50	0.05
Japan, Korea	0.04	0.03	0.01	0.00
EU	66.53	42.47	16.95	1.84
Rest of Europe	0.15	0.10	0.04	0.01
USA	7.47	4.75	1.89	0.21
Canada, Mexico	109.89	71.83	30.31	3.53
South America	5.24	3.34	1.32	0.14
Rest of World	5.43	3.46	1.38	0.15

Without any change in the Chinese tariff on imports of cereal grains from non-members, the Australia-China FTA leads to massive trade diversion. As we would expect, this trade diversion is greater the higher is the elasticity of demand for imports, and under the high-elasticity case, Chinese imports of cereal grains from non-FTA exporters (particularly Canada and the European Union) are almost completely eliminated. This highlights the importance of the argument in McMillan (1993), that the effects of FTAs be evaluated using the most disaggregated data available. Our initial results from the aggregated two-sector three-region model suggested only small decreases in the volume of imports from the RoW, so we could have concluded that the Australia-China FTA would be Kemp-Vanek admissibile. But results from the more disaggregated model clearly show that the Australia-China FTA leads to considerable trade diversion in some sectors, and would not be Kemp-Vanek admissible.

If we repeat the same experiment but now incorporate endogenous tariffs to keep FTA imports from non-members constant (the upper panel in Table 5), we see that this version of the FTA between Australia and China is Kemp-Vanek admissibile. FTA-member imports from all regions are held constant, and no non-members are worse off as a result of the FTA, except the USA, which sees a small decrease in welfare, again due primarily to second-order effects through other distortions.

We give an example of how the FTA members need to adjust their tariffs to keep non-member imports constant, by continuing to focus on the Cereal Grains industry.[15] Table 7 shows Chinese tariffs on Cereal Grain imports in the initial GTAP dataset, and after the Australia-China FTA, for different values of the Armington-import demand elasticity.

Table 7: Chinese Tariff on Imports of Cereal Grains to Eliminate Trade Diversion (%)

	initial tariff	low elasticity	medium elasticity	high elasticity
Australia	90.90	0.00	0.00	0.00
ASEAN	1.02	−21.18	−29.78	−35.15
Japan, Korea	1.73	−20.60	−29.22	−34.58
EU	90.75	48.86	32.67	22.57
Rest of Europe	0.57	−21.52	−30.06	−35.39
USA	50.26	17.24	4.46	−3.53
Canada, Mexico	90.98	49.03	32.82	22.70
South America	1.06	−21.15	−29.73	−35.10
Rest of World	39.77	9.06	−2.81	−10.23

To avoid trade diversion in the Cereal Grains industry after the Australia-China FTA, China would have to reduce her tariff on cereal grain imports from the EU and Canada[16] by almost 60 percentage points under the central case elasticity specification of the NGE model. It is interesting to note that while Australia does slightly better under the Australia-China FTA and loses some of its welfare gains after applying endogenous tariffs which eliminate trade diversion, China does best under the FTA with endogenous tariffs which is Kemp-Vanek admissible. The Cereal Grains industry is a striking example of a sector where a much more dramatic reduction in the tariff on non-member

[15]Complete results of tariff changes which eliminate trade diversion are available from the author on request.

[16]As noted in Table 6, the vast majority of Chinese Cereal Grain imports are sourced from Australia, Canada, and the EU.

imports is necessary for the FTA to be Kemp-Vanek admissible than was suggested in the aggregated two-good, three-sector model. This highlights the importance of McMillan's (1993) requirement that the effects of an FTA be evaluated at as disaggregated a level as possible in determining whether an FTA is Kemp-Vanek admissible, and if not, how the FTA would need to be changed to make it Kemp-Vanek admissible.

5 Conclusion

The objective of this paper has been to present and demonstrate a method of devising PTAs which are Kemp-Vanek admissible and do not divert trade away from non-members of the PTA. We used the welfare decomposition proposed by Harrison *et al* (1993) to provide detailed overall welfare and sectoral measures of the effects of PTAs, particularly on non-members. We described how to implement a test for admissibility of PTAs from McMillan (1993), whereby any PTA is set up in such a way so that the volume of imports by PTA members from non-members remains unchanged. Such a test ensures that trade diversion due to the PTA is exactly equal to zero. We implemented this admissibility test using a NGE model in which endogenous tariffs adjust to keep constant PTA-member imports from non-members. To demonstrate how this admissibility test could be used to judge PTAs, we employed the NGE model to simulate the effects of a potential Free Trade Agreement between Australia and China.

This method of constructing a PTA which is Kemp-Vanek admissibile provides a detailed sectoral measure of trade diversion which can be used to identify potential trade diversion due to a PTA like the Australia-China FTA. We showed how it was important to evaluate whether a PTA was Kemp-Vanek admissible using the most disaggregated data available. In our model of an Australia-China FTA, the Cereal Grains sector was used to show how a simple Australia-China FTA would result in massive trade diversion. Our Kemp-Vanek admissible model of the Australia-China FTA suggested the extent to which tariffs needed to be reduced to eliminate trade diversion.

It would be worth extending our model to incorporate other features of NGE models of PTAs, including those described in Section 2, and the features of "second-generation" NGE models, described in Lloyd and MacLaren (2004), for example. If our measure of trade diversion were also robust to such extensions, it should prove a useful tool to complement Art.XXIV in evaluating the admissibility of PTAs under the WTO.

References

Adams, R., P. Dee, J. Gali, and G. McGuire (2003), "Trade and Investment Effects of Preferential Trading Arrangements – Old and New Evidence" Productivity Commission Staff Working Paper, Canberra, May.

Bond, Eric and Constantinos Syropoulos (1996) "The Size of Trading Blocs, Market Power and World Welfare Effects" *Journal of International Economics* 40:3-4, 411-37.

Brown, Drusilla, Alan Deardorff, and Robert Stern (June 2003), "Multilateral, Regional and Bilateral Trade-Policy Options for the United States and Japan" *World Economy* 26:6, 803–28.

Cernat, Lucian (2001), "Assessing Regional Trade Arrangements: Are South-South RTAs More Trade Diverting?" *Policy Issues in International Trade and Commodities Study Series No.*16 UNCTAD.

Clausing, Kimberley (Aug. 2001), "Trade Creation and Trade Diversion in the Canada–United States Free Trade Agreement" *Canadian Journal of Economics* 34:3, 677–96.

Department of Foreign Affairs and Trade (March 2005), "Australia-China Free Trade Agreement: Joint Feasibility Study" `http://www.dfat.gov.au/geo/china/fta/feasibility_full.pdf`.

DeRosa, Dean A. (1998), "Regional Integration Arrangements: Static Economic Theory, Quantitative Findings and Policy Guidelines" *Policy Research Working Paper No.* 2007, World Bank.

Freund, Caroline (2000), "Different Paths to Free Trade: The Gains from Regionalism" *Quarterly Journal of Economics* 115:4, 1317-41.

General Agreement on Tariffs and Trade (July 1992), *Basic Instruments and Selected Documents: Supplement No. 38* Geneva: GATT.

Grossman, Gene and Elhanan Helpman (1994), "Protection for Sale" *American Economic Review* 84:4, 835–50.

Harrison, Glenn, Thomas Rutherford, and David Tarr (Oct. 2003), "Rules of Thumb for

Evaluating Preferential Trading Arrangements: Evidence from Computable General Equlibrium Assessments" *World Bank Working Paper* 3149.

Harrison, Glenn, Thomas Rutherford, and David Tarr (July 2001), "Trade Policy Options for Chile: The Importance of Market Access" *World Bank Working Paper* 2634.

Harrison, Glenn, Rutherford, Thomas, and David Tarr (April 1997), "Economic Implications for Turkey of a Customs Union with the European Union" *European Economic Review* 41:3-5, 861–70.

Harrison, G., T. Rutherford and I. Wooton (1993), "An Alternative Welfare Decomposition for Customs Unions" *Canadian Journal of Economics* 26:4 961-68.

Haveman, Jon, Usha Nair-Reichert, and Jerry Thursby (May 2003), "How Effective are Trade Barriers? An Empirical Analysis of Trade Reduction, Diversion, and Compression" *Review of Economics and Statistics* 85:2, 480–5.

Hertel, Thomas W. (ed.) *Global Trade Analysis: Modeling and Applications.* Cambridge: Cambridge University Press, 1995.

Jomini, P.; McDougall, R.; Watts, G.; and Dee, P.S. *The* SALTER *Model of the World Economy: Model Structure, Database and Parameters.* Canberra: Industry Commission, 1994.

Kemp, Murray C. (1964) *The Pure Theory of International Trade* Englewood Cliffs : N.J. Prentice-Hall.

Kemp, Murray C. and Henry J. Wan (1976) "An Elementary Proposition Concerning the Formation of Customs Unions" *Journal of International Economics* 6:1 95–7.

Kreinin, Mordechai and Michael Plummer (Aug. 1998), "*Ex Post* Estimates of the Effects of the European Single Market Programme on the Exports of Developing Countries" *ASEAN Economic Bulletin* 15:2, 206–14.

Krishna, P. (1998), "Regionalism and Multilateralism: A Political Economy Approach" *Quarterly Journal of Economics* 113:1, 227–51.

Krueger, Anne O. (Dec. 1999), "Trade Creation and Trade Diversion Under NAFTA" *NBER Working Paper* 7429.

Krugman, Paul R. (1991), "Is Bilateralism Bad?" in Helpman and Razin (eds.) *International Trade and Trade Policy* Cambridge, Mass.: MIT Press.

Liu, Jing, Channing Arndt, and Thomas Hertel (Sept. 2004), "Parameter Estimation and Measures of Fit in a Global, General Equilibrium Model" *Journal of Economic Integration* 19:3, 626–49.

Lipsey, Richard G. (Feb. 1957), "The Theory of Customs Unions: Trade Diversion and Welfare" *Economica* 24: , 40–6.

Lloyd, Peter J. and Donald MacLaren (Dec. 2004), "Gains and Losses from Regional Trading Agreements: A Survey" *Economic Record* 80:251, 445-67.

Linnemann, Hans and Harmen Verbruggen (1991), "GSTP Tariff Reduction and its Effects on South-South Trade in Manufactures" *World Development* 19:5, 539–51.

Mansur, Ahsan, and John Whalley (1984), "Numerical Specification of Applied General Equilibrium Models: Estimation, Calibration, and Data" in Herbert E. Scarf and John B. Shoven (eds), *Applied General Equilibrium Analysis*, New York: Cambridge University Press, 69–127.

McMillan, J. (1993), "Does Regional Integration Foster Open Trade? Economic Theory and GATT's Article XXIV" in Anderson, K. and R. Blackhurst (eds.) *Regional Integration and the Global Trading System* London: Harvester-Wheatsheaf.

Melatos, M. and A. Woodland (2003) "Pareto Optimal Delegation in Customs Unions" University of Sydney Working Paper.

Ohyama, M. (2002), "The Economic Significance of the GATT/WTO Rules" In: Woodland, A. (ed.) *Economic Theory and International Trade: Essays in Honours of Murray C. Kemp* Edward Elfar, Cheltenham.

Panagariya, A. (2000), "Preferential Trade Liberalization: The Traditional Theory and New Developments" *Journal of Economic Literature* 38:2 287-331.

Panagariya, A. (1999), "The Regionalism Debate: An Overview" *World Economy* 22:4, 477–511.

Panagariya, A. and P. Krishna (2002), "On Necessarily Welfare-Enhancing Free Trade

Areas" *Journal of International Economics* 57: 353-67.

Robinson, Sherman, and Karen Thierfelder (2002), "Trade Liberalisation and Regional Integration: The Search for Large Numbers" *Australian Journal of Agricultural and Resource Economics* 46:4, 585–604.

Rutherford, Thomas, Elisabet Rutström and David Tarr (April 1997), "Morocco's Free Trade Agreement with the EU: A Quantitative Assessment" *Economic Modelling* 14:2, 237–69.

Scollay, Robert and John Gilbert (2000), "Measuring the Gains from APEC Trade Liberalisation: An Overview of NGE Assessments" *World Economy* 23:3, 175–97.

Trefler, Daniel (Sept. 2004), "The Long and Short of the Canada-U.S. Free Trade Agreement" *American Economic Review* 94:4, 870-95.

Vanek, J. (1965), *General Equilibrium of International Discrimination: The Case of Customs Unions* Cambridge, MA: Harvard University Press.

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

Appendix - Tables

Table A-1: Regional Aggregation

Code	Title	Countries/Regions
aus	Australia	Australia
chn	China	China
ASE	ASEAN	Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam
RNA	Rest of North Asia	Japan, Korea
EU	EU	Austria, Belgium, Denmark, Finland, France, Germany, UK, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden
RoE	Rest of Europe	Switzerland, Rest of EFTA, Rest of Europe, Bulgaria, Croatia, Cyprus, Czech Repub, Hungary, Malta, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, Lithuania
usa	USA	United States
RoN	Rest of NAFTA	Canada, Mexico
SA	South America	Colombia, Peru, Venezuela, Rest of Andean Pact, Argentina, Brazil, Uruguay, Rest of South America
RoW	Rest of World	New Zealand, Rest of Oceania, Hong Kong, Taiwan, Rest of East Asia, Rest of Southeast Asia, Bangladesh, India, Sri Lanka, Rest of South Asia, Rest of North America, Chile, Central America, Rest of FTAA, Rest of Caribbean, Albania, Russian Federation, Rest of Former Soviet Union, Turkey, Rest of Middle East, Morocco, Tunisia, Rest of North Africa, Botswana, South Africa, Rest of South African CU, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe, Rest of SADC, Madagascar, Uganda, Rest of Sub-Saharan Africa

Table A-2: Sectoral Disaggregation and Central Case Elasticities from GTAP Data Set

Sector	Cap/ Lab Subst. Elast.	Dom/ Imp Subst. Elast.	Sector	Cap/ Lab Subst. Elast.	Dom/ Imp Subst. Elast.
Paddy rice	0.23	2.2	Leather products	1.26	4.4
Wheat	0.23	2.2	Wood products	1.26	2.8
Cereal grains nec	0.23	2.2	Paper products, publishing	1.26	1.8
Vegetables, fruit, nuts	0.23	2.2	Petroleum, coal products	1.26	1.9
Oil seeds	0.23	2.2	Chemical,rubber,plastic prods	1.26	1.9
Sugar cane, sugar beet	0.23	2.2	Mineral products nec	1.26	2.8
Plant-based fibers	0.23	2.2	Ferrous metals	1.26	2.8
Crops nec	0.23	2.2	Metals nec	1.26	2.8
Cattle,sheep,goats,horses	0.23	2.8	Metal products	1.26	2.8
Animal products nec	0.23	2.8	Motor vehicles and parts	1.26	5.2
Raw milk	0.23	2.2	Transport equipment nec	1.26	5.2
Wool, silk-worm cocoons	0.23	2.2	Electronic equipment	1.26	2.8
Forestry	0.20	2.8	Machinery and equipment nec	1.26	2.8
Fishing	0.20	2.8	Manufactures nec	1.26	2.8
Coal	0.20	2.8	Electricity	1.26	2.8
Oil	0.20	2.8	Gas manufacture, distribution	1.26	2.8
Gas	0.20	2.8	Water	1.26	2.8
Minerals nec	0.20	2.8	Construction	1.40	1.9
Meat: cattle,sheep,goats,horse	1.12	2.2	Trade	1.68	1.9
Meat products nec	1.12	2.2	Transport nec	1.68	1.9
Vegetable oils and fats	1.12	2.2	Sea transport	1.68	1.9
Dairy products	1.12	2.2	Air transport	1.68	1.9
Processed rice	1.12	2.2	Communication	1.26	1.9
Sugar	1.12	2.2	Financial services nec	1.26	1.9
Food products nec	1.12	2.2	Insurance	1.26	1.9
Beverages and tobacco prods	1.12	3.1	Business services nec	1.26	1.9
Textiles	1.26	2.2	Recreation and other services	1.26	1.9
Wearing apparel	1.26	4.4	PubAdmin/Defence/Health/Edu	1.26	1.9