An Enhancement of Modern Free Trade Area Theory*

Earl L. Grinols†
Peri Silva‡

October 2003

Abstract

This paper constructs a simplified framework for analyzing the welfare effects of free trade areas. We provide an alternative proof of the Panagariya-Krishna proposition on free trade areas, shortening the proof, covering a broader set of circumstances, and showing that the necessary income flows to guarantee welfare gains to all members are paid out of each country's own tariff revenues. The paper provides a close parallel to the important Kemp and Wan custom union theory.

JEL classification numbers: D6, F15

Keywords: Free trade areas, rules of origin, welfare analysis.

*We are grateful to Giovanni Facchini for helpful discussions. The views expressed here are those of the authors and do not necessarily reflect those of the institution to which they are affiliated.

†Professor of Economics, Department of Economics, University of Illinois, 1206 S. 6th Street, Champaign, Illinois 61820, grinols@uiuc.edu, 217-244-6678 fax

‡Department of Economics, University of Illinois, 1206 S. 6th Street, Champaign, Illinois 61820, pasilva@uiuc.edu, 217-244-6678 fax

1 Introduction

Panagariya and Krishna (2002) have performed a great service to the economics profession, indeed to any country considering a free trade area (FTA), by showing that rules of origin can be chosen to support necessarily welfare-enhancing formation of free trade areas. Their contribution does for FTAs what Kemp and Wan (1976) did for customs unions twenty six years earlier. For decades, economists worried about their inability to guarantee that customs union or free trade area formation would lead to welfare gains for all countries involved. Kemp and Wan (1976) showed that the appropriate selection of a common external tariff guaranteed that an associated Pareto superior equilibrium would exist for customs union members. Grinols (1981, 1984) (see also Kowalczyk and Sjostrom (2000)) showed how to compute the cross country payments that were necessary and sufficient to support the Pareto improvement in the sense that such payments were always feasible and sufficient to support a Pareto improving equilibrium, and in some cases were the only payments that could do so.

Free trade areas, in which member countries are free to set external tariffs independently, are politically attractive compared to customs unions which require members to agree to a common external tariff. As described in Panagariya and Krishna (2002), the inability of Kemp and Wan's methodology to apply to free trade areas was a great disappointment. There the matter rested for a quarter century.

However, just as the key to guaranteeing welfare gains for customs unions depends on appropriately selecting the common external tariff, the key to supporting welfare-enhancing free trade areas is selecting the *rules of origin* appropriately. Member country external tariffs can vary by country, as long as they are selected to induce the same external trade flows for the member country with non-union members that initially prevailed, a mild condition likely to be palatable both to the FTA member and to its trading partners. As is often the case with pioneering papers, however, the original demonstrations and proof can be greatly simplified. This paper therefore provides an alternative, abridged, proof of the Panagariya-Krishna proposition in the hope of making this important result both more transparent and accessible to a wider audience.

2 Model

2.1 Notation

Consider an FTA formed from two countries, a home country and a foreign country which we index by H and F, respectively. The rest of the world is indexed by W. Government intervention in both economies consists of applying duties on imports and exports. These may vary by country. We assume that each country H and F selects its tariffs in conjunction with formation of the FTA to freeze its external trade with country W at the pre-FTA level.

Following standard general equilibrium practice, we characterize goods both by their description and location. We do not need to make any prior distinctions between inputs and outputs: all goods may be used as inputs in the production of other goods as well as enter utility as final consumption. Each country produces K types of goods. Some of a country's output may be consumed at home and some transported to other locations. Changing a good's location converts it into a different commodity. Goods produced in country H and consumed in country F, for example, have prices $p_{_{HF}} \epsilon R_+^K$ that generally differ from goods produced in country F and consumed in country F, $p_{_{FF}} \epsilon R_+^K$. Grouping by country of final destination, the $9K \times 1$ vector of prices satisfies

$$p \equiv \begin{pmatrix} p_{_{HH}} \\ p_{_{FH}} \\ \hline p_{_{WH}} \\ \hline p_{_{HF}} \\ p_{_{FF}} \\ \hline p_{_{WF}} \\ \hline p_{_{HW}} \\ p_{_{FW}} \\ p_{_{WW}} \end{pmatrix} = p^W + t = p^W + \begin{pmatrix} 0 \\ 0 \\ \hline t_{_{WH}} \\ \hline 0 \\ 0 \\ \hline t_{_{WF}} \\ \hline t_{_{HW}} \\ t_{_{FW}} \\ 0 \end{pmatrix}$$

where p^W is the vector of world prices, t is the vector of FTA tariffs, and $t_{ij} \epsilon R^K$ is the vector of tariffs applied to goods originating in country i and whose location of final use is country j. Country H selects tariffs $t_{_{WH}}$ and $t_{_{HW}}$ while country F selects tariffs $t_{_{WF}}$ and $t_{_{FW}}$.

Identifying goods by location as well as type is fully general, allowing for special cases as dictated by the production and transportation technology and equilibrium. For example, if oil produced in Norway "a" and Kuwait "b" and consumed in the US "c" should happen to be perfect substitutes, then the prices

of these goods will be the same $p_{oil,ac} = p_{oil,bc}$ and Norwegian and Kuwaiti oil will enter utility as the sum $\text{oil}_{ac} + \text{oil}_{bc}$.

We are also able to track the effects of different tariffs by FTA members. A good of type k produced in the rest of the world and consumed in FTA country H has price p_{kWH} which differs from the world price by country H's tariff on imports of good k from country W. The $9K \times 1$ vector of producer prices in FTA countries is given by q. Since tariffs are the only tax, internal producer and consumer prices are the same $p = q$.

Country i's net production vector is $y^i \epsilon R^{9K}$. A positive coordinate in y^i is an output and a negative element is an input. The external trade vector is denoted by $z^i \epsilon R^{9K}$. A positive element of z^i is an imported good and a negative element is an exported good. Endowments are denoted by $\omega^i \epsilon R^{9K}$. Many coordinates of the vectors x^i, y^i, ω^i and z^i will be zero. For example, external trade in goods produced and consumed in the same country is zero, $z_{ii} = 0 \, \epsilon \, R^K$.

2.2 Rules of Origin

Equilibrium prices must be consistent with production technology, including transportation technology, which is a form of production. Panagariya and Krishna's rules of origin eliminate inconsistencies.

Assumption 1 *A good or service may enter duty free into one FTA country from the other if and only if it contains strictly positive value added of the sending FTA country. If the good is "new" (neither produced nor consumed in the pre-FTA equilibrium), it may pass duty free into one FTA country from the other if and only if it contains 100 percent value added of the sending FTA country.*

Following Panagariya-Krishna, also assume that FTA members choose their tariff to freeze their trade with country W, that perfect competition prevails, and that there is an optimizing representative consumer in countries H and F.

Assumption 2 *FTA countries choose tariffs so that their post-FTA trade with the rest of the world (country W) is unchanged from the pre-FTA level.*

Assumption 3 *Perfect competition prevails.*

Assumption 4 *The representative consumer in each country maximizes utility subject to his budget constraint.*

We are ready to analyze the welfare consequences of FTA formation. Before doing so, however, let us use our labelling to verify with an example that the rules of origin and choice of tariffs allow prices to vary appropriately. For example, assume that rugs are produced in one or more countries, and that some or all countries can mimic the rug types of some or all other countries. Assume that rugs are transported costlessly. A produced rug contains positive value added of the producing country. Thus, a Persian rug consumed in FTA countries H or F could have several prices depending on its origin. It could have price:

I. $q_{Persian,HH}$ if produced in country H,

II. $q_{Persian,FF}$ if produced in country F,

III. $p^W_{Persian,WW} + t_{Persian,WH}$ if produced in country W, imported by H,

IV. $p^W_{Persian,WW} + t_{Persian,WF}$ if produced in country W, imported by F.

How do we know these prices are consistent in equilibrium? First, recall that the tariffs (or trade subsidies) in H and F are set so that each trades with W the same quantity of rugs as before FTA formation. Since the rules of origin prevent Persian rugs from being imported from W and sent duty free to the other FTA member, prices described in III and IV do not need to be equal. Rules of origin, however, allow producers in the FTA to sell their product in the FTA unified market at the location of highest price, thus

$$q_{Persian,HH} = q_{Persian,FF} = p^W_{Persian,WW} + Max[t_{Persian,WH}, t_{Persian,WF}]$$

is the implied relation between prices that is consistent and is supported by the rules of origin in equilibrium. Nonzero transportation costs can be accommodated if desired.[1]

3 Welfare Analysis

Let superscript 0 refer the *ex ante* (pre-FTA) situation and superscript 1 to the *ex post* (post-FTA) situation.

[1] $q_{Persian,HH} + g_{HF} = q_{Persian,FF} + g_{FH} = p^W_{Persian,WW} + Max[t_{Persian,WH} + g_{WH}, t_{Persian,WF} + g_{WF}]$ where g_{ij} is the cost of transporting one unit of the good from country i to country j. Note that transportation costs are zero if no trade flows exist in the direction of the stated transportation cost.

Proposition 1 *(Panagariya and Krishna) Let countries H and F form a free trade area satisfying assumptions 1-4. Then, if transfers between members are allowed the free trade area is welfare enhancing to both.*

Proof: Let $u^{i0}, u^{i1}, e^i\left(p^1, u^{i1}\right)$ be pre-FTA utility, post-FTA utility, and the expenditure function for FTA member i in the post-FTA situation, respectively. The change in welfare upon FTA formation for member i is:

$$\Delta W^i = e^i(p^1, u^{i1}) - e^i\left(p^1, u^{i0}\right) = S_C^i + S_P^i + S_T^i \tag{1}$$

where $S_C^i = p^1 \cdot x^{i0} - e^i\left(p^1, u^{i0}\right)$, $S_P^i = q^1 \cdot (y^{i1} - y^{i0})$, $S_T^i = p^1 \cdot (z^{i1} - z^{i0})$, and the identities $e^i(p^1, u^{i1}) = p^1 \cdot x^{i1} = p^1 \cdot y^{i1} + p^1 \cdot w^i + p^1 \cdot z^{i1}$ and $x^{i0} = y^{i0} + w^i + z^{i0}$ were used in deriving (1).

$S_P^i \geq 0, S_C^i \geq 0$ by assumptions 3 and 4, respectively. Thus,

$$\Delta W^H + \Delta W^F \geq S_T^H + S_T^F = p^1 \cdot \left[\left(z^{H1} - z^{H0}\right) + \left(z^{F1} - z^{F0}\right)\right] = 0$$

and the result follows. □

The last equality derives from the three facts that the trade of a good produced and consumed in the same country is zero, the export of one member corresponds to the import of the other for goods traded between FTA members, and trade between country W and an FTA member is frozen. The key to the result is the use of terms S_C^i and S_P^i, which codify the implications of consumer and producer optimization, respectively, for welfare changes. $S_C^i \geq 0$ because an optimizing consumer selects the least costly consumption bundle to provide utility u^{i0}. Its cost must necessarily be less than or equal to the cost of bundle x^{i0}, which also generates utility u^{i0}. Similarly, $S_P^i \geq 0$ because firms maximize profits, implying $q^1 \cdot y^{i1} \geq q^1 \cdot y^i$ for any feasible y^i including y^{i0}.

We note a number of advantages to our approach. First, the proof is simple. Second, defining goods by location allows us to easily include transportation cost considerations as exemplified in section 2. Third, the framework is robust to the inclusion of factors of production in the utility function—any factor may have inelastic supply or not—and to the existence of non-tradable goods. Fourth, the coverage of intermediate goods in the analysis does not require special treatment since any commodity can be used as a final or as an intermediate good.[2] Fifth,

[2]Panagariya and Krishna's original treatment disregards transportation cost considerations. Allowing factors of production in the utility function requires that their equation (2) be rewritten as a function of firms' profits and tariff revenues. Since goods are homogenous, the inclusion of non-tradables would imply that producer prices among FTA members could vary,

the simplicity of the framework allows additional issues to be addressed and the result to be placed in context of other known results. The next section provides two examples.

4 Two Comments: Self-financing Transfers, More Gains in Move to Customs Unions

If we presume that each nation is entitled to keep the tariff revenues it collects on trade flows entering its own borders, then there is no need of further cross-country transfers.[3] Assuming tariff retention, and using the fact that world prices have been fixed, $p^{W1} = p^{W0}$, the discussion of equation (1) implies

$$\begin{aligned} \Delta W^H - S_C^H - S_P^H &= (p^{W1} + t^1) \cdot z^{H1} - (p^{W0} + t^1) \cdot z^{H0} \\ &= T^{H1} - t^1 \cdot z^{H0} \\ &= T^{H1} - t^1_{WH} \cdot z^{H0}_{WH} - t^1_{HW} \cdot z^{H0}_{HW} \\ &= 0 \end{aligned} \tag{2}$$

where T^{H1}stands for country H's post-FTA tariff revenue and the last term follows from the fact that trade with the non-FTA rest of the world, $z^{H0}_{WH} = z^{H1}_{WH}$ and $z^{H0}_{HW} = z^{H1}_{HW}$, is fixed by selection of country H's tariffs. S_C^H and S_P^H are non-negative, as already explained, so country H welfare rises without need of any other transfers. An identical analysis applies to country F.[4]

Proposition 1 is closely related to the Kemp-Wan result on customs unions as follows. Replace assumptions 1 and 2 by

---

requiring a different proof. Consequently, Panagariya and Krishna sketch changes in section 4 to deal with intermediate goods. The framework here handles these matters automatically.

[3]To our knowledge, Feenstra (2002) was first to notice this fact. He describes the result as saying that there is no need for cross-country transfers. This is technically true if one assigns tariff revenues to the country of collection. In contrast, however, a customs union treats tariff revenues as property of the union as a whole. The country or port of collection is immaterial.

[4]In a tariff distorted world economy, Kemp (2000) showed that the formation of an FTA where members choose their tariffs to keep their joint trade flows with the rest of the world constant is welfare enhancing. In this case the proof of proposition 1 remains correct. However, cross country transfers might become necessary because a member might have tariff revenue losses, and, in the absence of transfers, a loss in welfare. Algebrically, term $T^{H1} - t^1_{WH} \cdot z^{H0}_{WH} - t^1_{HW} \cdot z^{H0}_{HW}$ in proposition 2 might be nonzero because the assumption that each member chooses tariffs to keep its trade flows with the rest of the world constant is not satisfied.

Assumption 5 *Customs union countries choose common external tariffs so that their post-FTA trade with the rest of the world (country W) is unchanged from the pre-FTA level,* $\left[\left(z^{H1}+z^{F1}\right)-\left(z^{H0}+z^{F0}\right)\right]=0$.

Proposition 2 *(Kemp and Wan) Let countries H and F form a customs union satisfying assumptions 3, 4, 5. Then, if transfers between members are allowed the customs union is welfare enhancing to both.*

Proof: Change in welfare for member i upon union formation is given in (1). $S_P^i \geq 0, S_C^i \geq 0$ by assumptions 3 and 4, respectively. Thus,

$$\Delta W^H + \Delta W^F \geq S_T^H + S_T^F = p^1 \cdot \left[\left(z^{H1}-z^{H0}\right)+\left(z^{F1}-z^{F0}\right)\right] = 0$$

where the last equality follows from assumption 5.□

The similarity of the proofs of Propositions 1 and 2 is obvious. Since union members have a common external tariff and there are no restrictions to trade between member countries, prices I-IV in the example of section 2 are all equal, and there is no need for rules of origin.

Since trade with respect to the rest of the world is frozen in both cases, Proposition 2 shows that the move from an FTA to a customs union is welfare enhancing. The reverse is not true, since a custom union already satisfies the requirements of an FTA equilibrium.

5 Conclusion

Selecting FTA member tariffs to freeze each member's trade flows with the rest of the world, coupled with rules of origin that any good may move duty free within the FTA if it contains internal value added, implies that the FTA is necessarily welfare-enhancing. No cross country transfers are needed if countries retain tariffs collected on the trade crossing their border. The proof in section 3 greatly shortens the proof provided by Panagariya and Krishna, covers a broader set of circumstances, and provides a parallel to Kemp and Wan customs union theory.

References

[1] Feenstra, Robert (2002) *Advanced International Trade: Theory and Evidence*, Manuscript.

[2] Grinols, Earl (1981) "An Extension of the Kemp-Wan Theorem on the Formation of Customs Unions," *Journal of International Economics,* 11, 1981, 259-266.

[3] Grinols, Earl (1984) "A Thorn in the Lion's Paw: Has Britain Paid Too Much for Common Market Membership?" *Journal of International Economics,* 16, 3/4, 271-294.

[4] Kemp, Murray and Henry Y. Wan (1976) "An Elementary Proposition on the Formation of Customs Unions," *Journal of International Economics,* 6, 95-97.

[5] Kemp, Murray (2000) "Welfare Comparisons of Customs Union and Other Free Trade Associations", *Pacific Economic Review*, 5, 1, 1-3.

[6] Kowalczyk, Carsten and Tomas Sjostrom (2000) "Trade as Transfers, GATT and the Core," *Economics Letters,* 66, 163-169.

[7] Panagariya, Arvind and Pravin Krishna (2002) "On Necessarily Welfare-Enhancing Free Trade Areas," *Journal of International Economics,* 57, 353-367.