Geographical Extension of Free Trade Zones as Trade Liberalization: A Numerical Simulation Approach

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Abstract

We consider progressive geographical expansion of free trade zones within countries as a form of trade liberalization and compare observationally equivalent liberalization involving changes in the coverage of a free trade zone for a fixed tariff rate, and tariff reductions applying to all trade if there are no free trade zones in the country (in the sense of generating similar changes in trade volumes). Our work is motivated by China's approach to service trade liberalization in banking and other areas of progressive additions of cities to automatic licence treatment for foreign entities. We use numerical simulation methods to compare conventional national tariff reductions to trade liberalization achieved through the geographical expansion of free trade zones in terms of welfare impacts. Either the size of the free trade zone with a fixed tariff, or the tariff rate given the size of the free trade zone can be endogenously determined so as to yield observational equivalence in the sense of trade volume impacts across trade policy changes. Numerical results overwhelmingly indicate larger welfare costs from imposing geographically restrictive schemes since a higher tariff applies to a smaller fraction of trade, and distortions within country trade also apply. Numerical policy analyses using a conventional tariff-equivalent ad valorem modeling approach to evaluate the impacts of liberalizing geographical barriers can thus be highly misleading. We explore both pure exchange and with production cases, and relate our discussion to earlier literature on free trade zones.

JEL classification: F13, F17.

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1. Introduction

This paper analyses the geographical extension of preexisting free trade zones as trade liberalization, and assesses how it compares to more conventional trade liberalization involving the lowering of a national tariff. We assume that countries exist (China being one example) where it is administratively feasible to operate movable internal trade barriers, and further assume that some mechanism exists for the progressive enlargement of free trade zones within countries. This can be through the sequential addition of cities or portions of an economy to a preexisting free trade (or export processing) zone. Given the present administrative structure in China, we assume that such schemes are possible to implement even though in reality they may be hard to administer. Vietnam and other countries with strong administrative control mechanisms and embedded provincial structures also seem to fit this characterization.

The paper is motivated by the form that progressive liberalization will take during the implementation period for China's WTO accession commitments in key service areas such as banking, insurance, and telecoms.[2] For these service items, protection through a tariff is not feasible as there is no customs clearance for international trade in the relevant service. Prior to WTO accession, China's domestic markets in these areas are protected by regulatory arrangements which rely on licences and limits on the extent of foreign participation (typically, the degree of ownership in joint ventures). Since licences are inherently discrete instruments of protection, they have effectively been converted into continuous instruments of progressive liberalization in these service areas by allowing for an expansion in their geographical coverage over the five-year implementation period

[2] See Whalley (2003) for a policy based discussion of these commitments and their possible impacts.

(allowing more cities over time where foreign presence is allowed). Limits on allowable foreign participation (and ownership) are also to be progressively raised over time.[3] Here, we do not explicitly consider services due to the added complexity of allowing for intertemporal intermediation, but instead limit ourselves to trade in goods, but the same themes that we emphasize in our analysis of trade in goods are in our view also likely apply to services liberalization.

Previous work on free trade zones [Hamada (1974), Rodriguez (1976), Hamilton and Svensson (1982), Miyagiwa (1986), Young and Miyagiwa (1987), Young (1987, 1992), Din (1994)] assesses the implications of zones of fixed size in the presence of existing distortions (e.g. tariffs, production taxes, access to foreign capital, unemployment, subsidies in import competing sectors) and the general conclusions on the welfare effects of free trade zones are mixed. Hamada (1974) assumes that tariffs on final goods prevailing in the rest of the economy are removed when a free trade zone is formed and shows that increased foreign investment in such a zone reduces national income. Hamilton and Svensson (1982) extend Hamada's model to study welfare effects of capital inflows either into the free trade zone or into the tariff zone and also conclude that both types of capital flow will lower the host country's welfare. In the presence of Harris-Todaro urban unemployment, Young and Miyagiwa (1987) show that the national income of the host country will increase as a result of the elimination of tariffs on imported intermediate inputs in the free trade zone. Young (1992) derives conditions for optimal wage and taxation policies for the free trade zone in the presence of unemployment. Din (1994) assumes that there is a non-traded intermediate good sector

[3] This is principally the vehicle used for liberalization in telecoms.

and showes that increased foreign investment in the free trade zone can generate increase national income.

Our approach and interest differs from this literature in two ways. First, we consider cases where the size (and hence the border) of the free trade zone can be varied inside the economy. Second, we numerically evaluate the welfare implications of increasing the size of free trade zones and compare this to more conventional forms of trade liberalization such as a reduction in a national tariff rather than assessing the theoretically implications of forming free trade zones and seeking general qualitative results.

In what follows, we evaluate the welfare impacts of two types of trade policy changes under a treatment where they have observationally equivalent impacts in the sense of implied identical changes in trade volumes. To do this, we calibrate a numerical general equilibrium trade model of a small open economy to a base case free trade equilibrium data set. We then introduce both a free trade zone and a tariff zone into a conventional model and compare the outcome to that associated with the introduction of a trade volume equivalent national tariff. In the first experiment, while the tariff applies to international trade for only a portion of the economy also to trade internally between the free trade and protected zones. Subsequent trade policy changes reflect changes in the size of the free trade zone while the tariff rate in the tariff zone remains unchanged. In more conventional analysis, the tariff applies only at the national border and the rate is varied.

The numerical simulations we report show that the welfare changes of observationally equivalent trade policy changes differ greatly across the two cases (by factors of over 2). There is larger loss from the first type of intervention, reflecting both the use of a higher tariff rate on a smaller portion of trade, and the introduction of distortions across the divide between the free trade zone and the rest of the economy. We also explore the size of these differences both for pure exchange economies and models with production. Larger differences in effects occur in the latter case due to added distortions of the location of mobile factors across the two zones.

We conclude from our analysis that if trade liberalization is achieved through geographical expansion of free trade zones, policy analyzes which study such liberalization in national tariff equivalent terms can be highly misleading. Although more complex intertemporal and spatial models are needed to study the services liberalizations associated with Chinese WTO accession (banking, telecom, transportation), our analysis nonetheless suggests that analyzing liberalization of this form in tariff equivalent terms (as is typically done in the modelling literature equally) seems likely not to be a satisfactory way to proceed.

The rest of the paper is organized as follows. Section 2 describes a pure exchange economy model which permits the analysis of trade liberalization through geographical expansion of free trade zones. Section 3 extends the model to a production case. Section 4 performs numerical experiments to compare the welfare impacts of the two types of observationally equivalent trade liberalization discussed above. Section 5 concludes the paper.

2. A Single-Country Pure Exchange Economy With Both External and Movable Internal Barriers to Trade

We consider a simple single-country pure exchange trade model with both international barriers to trade and internally movable barriers and fixed endowments of traded goods. The latter define a zone in which free international trade can occur, while trade between the zone and the rest of the economy involves the same tariff as applies to international trade. For simplicity we exclude non-traded goods from the analysis.

We assume that the country is divided into two zones, a free trade zone and a tariff zone. No tariffs apply in the free trade zone, while in the tariff zone there are ad valorem tariffs both on international trade and trade between the zones. To simplify matters, we treat the relative size of the two zones as being represented by the relative endowments of goods in each zone expressed in proportional terms. Thus, if the economy wide endowment is 10 units of good 1 and 20 units of good 2, and consumers in the free trade zone have 6 units of good 1 and 12 units of good 2, while those in the tariff zone have 4 and 8 units, the tariff zone is treated as covering 40% of the whole country.

Because we allow the relative size of the two zones to vary throughout the whole country, it further simplifies things to assume all consumers have identical homothetic preferences, and hence in both zones. We also normalize the size of the whole economy to 1. In the example above, the sizes of the free trade and tariff zones are 0.6 and 0.4 respectively.

If Y_i defines the aggregate endowment of good i for the whole economy, and λ is the size of the tariff zone (and $(1-\lambda)$ of the free trade zone), the aggregate endowments of goods in each zone are given by:

$$Y_i^T = \lambda Y_i \quad \text{and} \quad Y_i^F = (1-\lambda) Y_i \qquad (i = 1,\ldots,N); \quad 0 \le \lambda \le 1 \tag{1}$$

where superscript *T* stands for the tariff zone and *F* for the free trade zone.

To facilitate welfare analysis of alternative trade policies, we assume that the relative sizes of the free trade and tariff zones also reflect the relative sizes of the population in the zones. There are therefore λ and 1-λ consumers in the tariff and free trade zones respectively, and λ can change. We further assume that the aggregate endowments of each good in each zone are evenly distributed.

We assume for simplicity that all consumers have the identical CES preferences:

$$U = \left[\sum_i (\alpha_i)^{\frac{1}{\sigma}} (X_i)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \qquad (i = 1,\ldots,N) \tag{2}$$

where α_i is the consumption share of good *i*; X_i is the demand for good *i*; σ is the elasticity of substitution. In this economy, utility-maximizing demands for goods depend upon the amount of income spent in each zone.

Since consumer prices differ across the zones, we write the aggregate demands in each zone as:

$$X_i^j = \frac{\alpha_i I^j}{(P_i^j)^{\sigma} \sum_i \alpha_i (P_i^j)^{1-\sigma}} \qquad (i = 1,\ldots,N); \quad (j = F, T) \tag{3}$$

where X_i^j is the aggregate demand for good *i* in zone *j*, I^j is the income spent in zone *j*, and P_i^j is the price of good *i* in zone *j*.

The income in each zone, I^j, is given by:

$$I^F = \sum_{i=1}^{N} P_i^j y_i^F + \gamma^F R \quad \text{and} \quad I^T = \sum_{i=1}^{N} P_i^j y_i^T + \gamma^T R \tag{4}$$

where γ^j denotes the share of national tariff revenue R collected in the tariff zone accruing to zone *j*; $\sum_{j=F,T} \gamma^j = 1, \quad \gamma^j \geq 0.$[4] Hence, the aggregate demand of good i for the whole economy is the sum of the aggregate demands in each zone:

$$X_i = X_i^F + X_i^T \qquad (i = 1,..., N) \tag{5}$$

Defining the net trades of each good in the tariff zone as $M_i^T = X_i^T - Y_i^T$ $(i = 1,..., N)$; P_i^W as the world price of good *i*; and t_i as the tariff on good *I;* the national tariff revenue, *R*, is given by:

$$R = \sum t_i P_i^W \max(M_i^T, 0) \tag{6}$$

The aggregate net import of each good for the whole country, M_i, is given by the sum of net imports for each good entering each zone:

$$M_i = \sum_j M_i^j \qquad (i = 1,..., N); \quad (j = F, T) \tag{7}$$

Since the country is modelled as a small open price-taking economy with no non-traded goods, it is simple to characterize an equilibrium for that formulation. Given world prices of goods, any excess demands for goods are absorbed by imports from (or exports to) the world market. Trade balance is implied by Walras' Law, which automatically follows from utility maximizing behaviour subject to budget constraints. Given λ, an equilibrium for this economy can also be easily computed. Alternatively, given a target tariff revenue R^* and a tariff rate t in the tariff zone, λ can be endogenously determined as the relative size of the two zones needed to meet the revenue requirement and the tariff rate.

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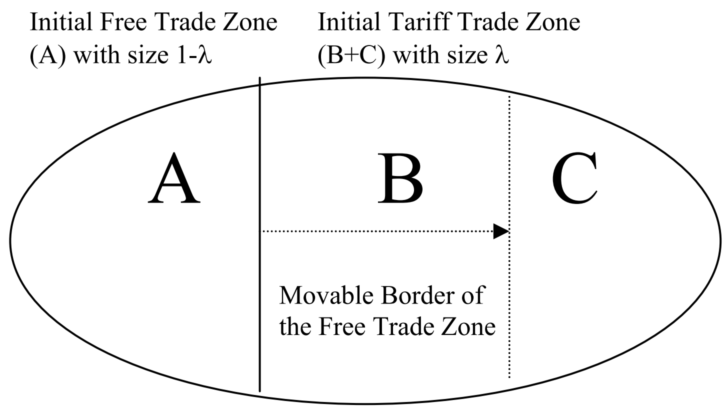
[4] Our numerical experiments in Section 4 assume that the tariff revenue collected in the tariff zone is only distributed to that zone. In this case, $\gamma^F = 0$ and $\gamma^T = 1$.

Figure 1: Movable Tariff and Free Trade Zones in a Small Open Price-taking Economy



Trade liberalization in this economy can involve the geographical expansion of the free trade zone, a change in the tariff rate, or some combination of these. Area A in Figure 1 represents an initial free-trade zone and area B plus C an initial tariff zone. If we increase the size of the free trade zone from $1-\lambda$ to $1-\lambda'$ for a given tariff rate (where $\lambda > \lambda'$), the size of the free trade zone increases to area A plus B while the tariff zone shrinks to area C. Since we assume the relative size of the zones also reflects the relative sizes of populations, under the change in the size of the free trade zone to $1-\lambda'$, there are $1-\lambda$, $\lambda-\lambda'$ and λ' consumers in area A, B and C respectively. The only welfare changes for consumers in areas A and C arise from income effects as aggregate tariff revenues change, since after the geographical liberalization Area A is still in the free trade zone and Area C is still in the tariff zone. Welfare changes for consumers in Area B result both from tariff revenue income effects but also from effects of price changes in moves from the tariff zone to the free trade zone.

To evaluate welfare impacts on consumers located in each of these areas, we first compute a general equilibrium before and after a trade policy change (i.e. such as the change from λ to λ' respectively) and obtain consumption of each good in both the free trade and tariff zones before and after the trade policy change. Since endowments are evenly distributed within each zone and the relative sizes of zones reflect relative population sizes, we can easily compute consumption before and after liberalization in each of the areas (A, B and C). We can then compute Hicksian money metric welfare measures of the welfare changes for consumers located in each of these 3 areas. The welfare change for the whole economy is then computed by summing these money metric measurements which we then express as a % of the economy-wide pre-change income.

3. A Production Economy Model Allowing For Both External and Internal Barriers to Trade

The pure exchange economy in the previous section can be extended to a with production case by specifying a production technology, and again considering a small open economy with both international barriers to trade and movable internal barriers for a free trade zone. Our production economy in this case consists of two factors of production, one being a mobile factor and the other immobile. The immobile factor is specific for each sector in each zone while the mobile factor can move across sectors and between zones. We assume that the country is again divided into a free trade zone and a tariff zone. There are no international trade restrictions in the free trade zone while there are ad valorem tariffs in the tariff zone both on international trade and trade between the zones. As the free trade zone changes in size, the amount of the fixed factor in the zone correspondingly changes.

The relative size of the two zones in this case is given by the endowments of the immobile factors in each zone expressed once again in simple proportional terms. For instance, if we assume that the economy wide endowments of the sector specific immobile factor for sector 1 and sector 2 are 10 and 20 units respectively, if the free trade zone has 6 units of immobile factor in sector 1 and 12 units in sector 2, while the tariff zone 4 and 8 units are involved, the tariff zone is treated as 40% of the economy. Under this treatment, we can again normalize the size of the whole economy to 1 so that the sizes of the tariff and free trade zones are 0.4 and 0.6 respectively.

Let $\overline{E}_i$ denote the economy-wide endowment of the immobile factor in sector *i* producing good *i*. The endowments of fixed factor located in each zone are then given by:

$$\overline{E}_i^T = \lambda\overline{E}_i \qquad \text{and} \qquad \overline{E}_i^F = (1-\lambda)\overline{E}_i \qquad (i = 1,...,N); \quad 0 \le \lambda \le 1 \qquad (8)$$

where the superscripts *T* stands for the tariff zone and *F* for the free trade zone and, λ is again the size of the tariff zone and (1-λ) is the size of the free trade zone.

We assume technology in each sector is decreasing returns to scale in the mobile factor:

$$Y_i^j = A_i^j (F_i^j)^{\theta_i} \qquad (i = 1,...,N); \quad (j = F, T) \qquad (9)$$

where $\theta_i < 1$ and the superscript *j* represents the zone-type and the subscript *i* stands for the good-type, Y_i^j is the output of good *i* in zone *j* and A_i^j is a scale parameter in production, F_i^j represents the mobile factor used in zone *j* for production of good *i*. Rents accrue to the fixed factor $\overline{E}_i^j$.

Profit maximization yields the requiring demand functions for the mobile factor in each sector in each zone as:

$$F_i^j = \frac{\theta_i P_i^j Y_i^j}{R^j} \qquad (i = 1,...,N); \quad (j = F, T) \qquad (10)$$

where P_i^j is the price of good *i* in zone *j* and R^j is the price of the mobile labor in zone j. Prices for the mobile factor differ across the zones because consumers take into account the different costs of goods in deciding where to locate and sell their factor endowments and consume goods (see below).

As in Section 2, the relative sizes of the free trade and tariff zones also reflect the size of populations in the two zones. Aggregate endowments in each zone are again assumed evenly distributed, and consumers have identical CES preference as in Section 2. There are thus λ and 1-λ consumers in the tariff and free trade zones respectively.

Income accruing in each zone now includes returns to the fixed factors owned by consumers located in that zone. Individual utility, demands and income can be again represented by equations (2), (3) and (4) respectively. The aggregate income and demands in each zone are given by equations (5) and (6) modified to include factor incomes, and the economy-wide demands and net imports of each good are again represented by equation (7) and (9) respectively.

A general equilibrium for this economy is characterized by prices of the mobile factor in the zones (R^F and R^T) such that given the sizes of tariff and free trade zones, λ and $1-\lambda$, the following conditions hold:

1. The national market for the mobile factor clears:

$$\sum_j \sum_i F_i^j = \overline{F} \qquad (i = 1,...,N); \quad (j = F,T) \qquad (11)$$

2. Consumer price-adjusted returns to mobile factors across the zones are equalized:

$$\frac{R^F}{P^F} = \frac{R^T}{P^T} \qquad (12)$$

where P^F and P^T are cost-of-living indices for consumers located in the free trade and tariff zones respectively.

This cost of living adjustment reflects the feature that mobile factor owners (e.g. labor) consume goods where they reside. In the CES case, these indices are given by:

$$P^j = \left(\sum_i \alpha_i (P_i^j)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \qquad (j = F, T) \qquad (13)$$

where α_i is the consumption share of good i in preferences, P_i^j is the price of good i in zone j, and σ is the elasticity of substitution.

In equilibrium, any excess demands for goods are absorbed by imports from (or exports to) the world market, and balanced trade is implied by Walras' Law.

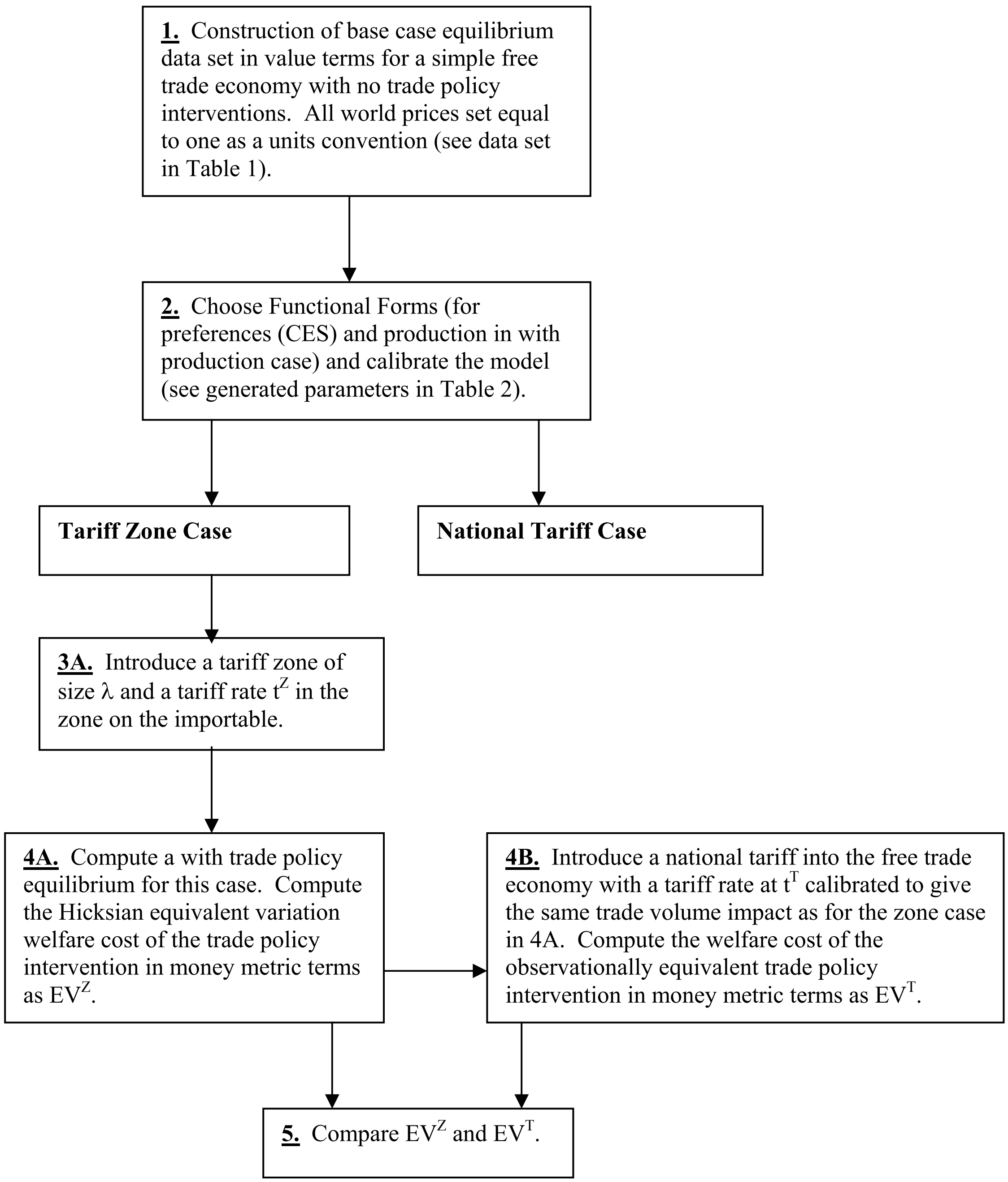
As with the pure exchange case, we can evaluate the welfare impacts of introducing trade impact observationally equivalent tariff zones (λ, and a tariff rate) and lower national tariffs with no free trade zone. We can also change the size of the tariff zone from λ to λ' for a given tariff rate. As in Figure 1 in Section 2, we can consider increasing the size of the free trade zone to area A plus B, shrinking the tariff zone to area C. Since there is a production and mobile factor in this case, welfare impacts for areas A and C now not only reflect income effects as aggregate tariff revenues change and relative commodity price effects, but also from effects of the reallocation of the mobile factor. The welfare impact for area B will be larger in the with production case as it changes from being part of the tariff zone and becomes part of the free trade zone and the amount of the mobile factor used in the zone also changes. Free trade zones thus will also affect the spatial distribution of the mobile factor. Following a similar approach to that described in Section 2, we can compute welfare changes for consumers located in each of these areas for any given trade policy change, and sum the money metric measures to obtain the welfare change for the whole economy. We can also express such measures as a % of the economy-wide pre-policy -change income.

4. Results from Some Observationally Equivalent Numerical Policy Experiments

This section reports results from some numerical experiments performed using the equilibrium structures set out above. Our aim is to compare the welfare consequences of trade liberalization achieved through conventional national tariff reductions to those generated by geographical expansion of free trade zones. We evaluate the welfare impacts of these two types of trade policy under a treatment that they are constructed to be observationally equivalent in the sense of generating identical changes in trade volumes. We consider both pure exchange economy and production economy models.

Our aim is not to generate general qualitative results which we believe are not easily obtainable and are anyway not our main focus. Rather, we assess how far one might be misled by analyzing what is in reality zone-based liberalization but is represented instead in national tariff equivalent terms. Our numerical results inevitably depend on the model structure we use and the parameters we employ and are offered as suggestive rather than definitive. For that reason, we perform also sensitivity analysis on the cases we analyze. We use a simple example in which there are two goods, one being the exportable and the other the importable.

Figure 2. Flow Chart Outlining the Procedures Used in Constructing Observationally Equivalent Numerical Experiments Comparing National and Zone Based Trade Policy Changes (Similar Procedures Used for Pure Exchange and With Production Cases)



The procedures used for our numerical experiments are set out in the flowchart presented in Figure 2. We begin by calibrating a conventional single-country price-taking trade model without trade policy interventions to a free trade base case data set. In the case of a pure exchange economy, the model is as described in Section 2, with the size of the tariff zone set equal to 0 (i.e. $\lambda=0$). For a production economy, the model is as described in Section 3, with the size of the tariff zone set equal to 0.

We evaluate the welfare impacts of two types of trade policy change. In the first case (the tariff zone case), we introduce a tariff zone of size λ equal to 0.55 and a tariff rate t^Z of 0.6 in the zone for the importable. We then compute a with zone equilibrium for this case, and compare it to the original free trade equilibrium to generate a money metric measure of welfare impact of the trade policy change of EV^Z. In the second case (the national tariff case), we introduce an observationally equivalent national tariff t^T into the free trade calibrated model giving the same impact on trade volumes as in the tariff zone case. This trade-impact equivalent national tariff rate is calculated to be about 0.3 for both pure exchange and with production cases. We then compute a money metric measure of the welfare impact of this intervention EV^T and compare this to EV^Z.[5] Table 1 presents the base case data we use for our experiments, one for a pure exchange economy and the other for an economy with production. Table 2 gives the value parameters that are generated by calibration of the relevant model to data. We

[5] Our numerical experiments start from a free trade regime and consider two different trade policy interventions (i.e. a tariff zone case and a national tariff case) and compare their welfare impacts. Alternatively, we can also start from these two trade policy interventions and then consider trade liberalization and compare the welfare gains. In the tariff zone case, trade liberalization is achieved by expanding the sizes of the free trade zone. In the national tariff zone case, it is achieved by a conventional national tariff reduction.

summarize the results for the two types of trade policy change in Tables 3 and 4 for the pure exchange and with production economies respectively.

Table 1. Base Case Data Used to Represent A Free Trade Equilibrium for A Pure Exchange and A With Production Economy in Observationally Equivalent Numerical Trade Policy Experiments

A. Value Data for Pure Exchange Economy		B. Value Data for Production Economy	
Consumption of Importable Commodity	180	Consumption of Importable Commodity	180
Endowment of Importable Commodity	100	Production of Importable Commodity	100
Imports	80	Imports	80
		Use of Mobile Factor in Producing the Importable Commodity	60
Consumption of Exportable Commodity	70	Use of Immobile Factor in Producing the Importable Commodity	72
Endowment of Exportable Commodity	150		
Exports	80	Consumption of Exportable Commodity	70
		Production of Exportable Commodity	150
World Price of Importable	1.0	Exports	80
World Price of Exportable	1.0	Use of Mobile Factor in Producing the Exportable Commodity	100
		Use of Immobile Factor in Producing the Exportable Commodity	100
		Endowment of Mobile Factor	160
		Endowment of Immobile Factor Used in the Importable Sector	72
		Endowment of Immobile Factor Used in the Exportable Sector	100
		Price of Importable Commodity	1.0
		Price of Exportable Commodity	1.0
		Price of Mobile Factor	1.0
		Price of Immobile Factor in the Importable Sector	1.0
		Price of Immobile Factor in the Exportable Sector	1.0

Table 2. Model Parameter Values Generated by Calibration to Data in Table 1 and Used in Numerical Experiments

A. Pure Exchange Economy Model			B. Production Economy Model		
Exogenous Parameters			**Exogenous Parameters**		
Elasticity of Substitution (σ)	1.5		Elasticity of Substitution (σ)	1.5	
Calibrated Parameters			**Calibrated Parameters**		
	Exportable	Importable		Exportable	Importable
Consumption Shares (α_i)	0.2	0.8	Consumption Shares (α_i)	0.2	0.8
			Scale Parameter in Production (A_i)	1.5	1.5
			Mobile Factor Share in Production (θ_i)	0.6	0.4

Table 3. Welfare Effects of Trade Policy Changes with Observationally Equivalent Responses in Export/Import Volumes

	(1) Tariff Zone Case	(2) National Tariff Case	Welfare Differential: (1)/(2)
	Money Metric Welfare Impacts (Hicksian EV as % of Basecase Income)		
Pure Exchange Economy	**-1.7**	**-1.0**	**1.7**
Production Economy	**-3.4**	**-1.5**	**2.3**

Table 3 reports the welfare impacts of these policy interventions in terms of Hicksian money metric welfare measures. In the pure exchange case, the welfare costs in imposing a geographical restrictive tariff scheme (the tariff zone case) are almost 2 times larger than those from a conventional national tariff with observationally equivalent trade effects (the national tariff case). This reflects both the use of a higher tariff rate on a smaller portion of trade, and the introduction of distortions across the divide between the free trade zone and the tariff zone when modeling the tariff zone case. On the other hand, there is a relatively lower national tariff applying at the national border and there are no internal distortions within the country. Thus, welfare impacts of observationally equivalent trade policy changes differ across the two cases.

For the production economy, welfare differences from the two cases are even larger, with the welfare costs from the tariff zone case more than 2 times larger than those in the national tariff case. This reflects the added distortion of the location of the mobile factor across the free trade and tariff zones in the model with production. In this case, trade liberalization through geographical expansion of the free trade zone not only eliminates distortions of trade in goods across the free trade zone and the tariff zone and across the national border, but also removes distortions of mobile factor allocations between the free trade zone and the tariff zone. Welfare gains from such liberalizations are thus typically larger than those from conventional national tariff reductions, if both types of liberalization are constructed to generate the same response in trade volume.

We have performed sensitivity analyses for these numerical experiments to analyze how the exogenous choice of the elasticity of substitution affects the differential welfare cost of these two types of trade policy changes. Table 4 reports simulation results for a range of elasticities of substitution for both pure exchange and production economies.

Table 4. Sensitivity Analyses of Welfare Effects of Trade Policy Changes with Observationally Equivalent Responses in Export/Import Volumes to Different Values of Elasticities of Substitution

	Elasticity of Substitution				
	0.5	0.75	1.5	2.0	2.5
	Exchange Economy				
Money Metric Welfare Impacts (Hicksian EV as % of Income)					
(1) Tariff Zone Case	-0.5	-0.8	-1.7	-2.4	-3.2
(2) National Tariff Case	-0.3	-0.4	-1.0	-1.5	-1.9
Welfare Differential: (1)/(2)	**1.7**	**1.7**	**1.7**	**1.7**	**1.6**
	Production Economy				
Money Metric Welfare Impacts (Hicksian EV as % of Income)					
(3) Tariff Zone Case	-2.4	-2.6	-3.4	-3.9	-4.6
(4) National Tariff Case	-1.0	-1.1	-1.5	-1.9	-2.3
Welfare Differential: (3)/(4)	**2.5**	**2.4**	**2.2**	**2.1**	**2.0**

The results with CES preferences indicate that a higher (lower) elasticity of substitution implies higher (lower) magnitudes of both own price and cross price elasticities, and these augment (lessen) the welfare impacts of price changes from trade interventions. In the pure exchange economy case, the welfare differential across cases is relatively insensitive to the choice of elasticity of substitution. Numerical experiments indicate that both cases have similar percentage increases (decreases) in welfare when a higher (lower) elasticity of substitution is used, resulting in a stable welfare differential.

The production economy experiments indicate that the welfare differentials decrease (increase) mildly with higher (lower) elasticities of substitution.

The quantitative implications of these sensitivity analyses suggest similar results to those of the base case experiments. The welfare costs of imposing geographical restrictive schemes are substantially larger than imposing national tariffs. The welfare impacts of observationally equivalent trade liberalization through geographical expansion of free trade zones will likely be significantly larger than the liberalization through conventional national tariff reductions. Welfare differentials are larger in a production economy due to the added distortion of the location of mobile factor across the free trade and tariff zones.

5. Concluding Remarks

This paper compares trade liberalization through the geographical expansion of free trade zones to that achieved by conventional national tariff reductions. Our analysis is motivated by the form that services liberalization with expansion of geographical coverage of services takes. Our results suggest that there are substantial differences between numerical policy analyses using conventional tariff-equivalent ad valorem modeling approach to evaluate the impacts of liberalizing geographical barriers and explicit modeling of such policies. Although more complex intertemporal and spatial models are needed to adequately study actual services liberalization (banking, telecom, transportation), our analysis clearly suggests that analyzing liberalizations of this form for economies such as China in tariff equivalent terms (as is typically done in the modelling literature equally) is probably not to be a satisfactory way to proceed.

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