Borders, Trade and Welfare

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Introduction

In the era of globalization, are borders just arbitrary lines on the map? Recent evidence shows that borders inhibit huge volumes of trade. Further economic integration can very substantially increase world trade and welfare. We demonstrate this point with several applications.

National borders mark differences in institutions, policies and regulations that have economic significance. The significance of these policies becomes immediately clear when comparing countries to regions within countries that are not separated by national borders. Regions within countries are clearly more integrated: they have more synchronized business cycles, they engage in more extensive risksharing, they trade more with each other, their growth rates converge faster, their inflation rates are more similar.[1]

This chapter is concerned with how the policies, institutions, and regulations that separate nations provide barriers to the free flow of goods. Some policies are specifically aimed at erecting such barriers. All other trade restricting effects of national borders ultimately can be understood to reflect 'policy', with the proviso that much institutional trade friction is not easily changed. We will discuss estimates of the size of these border barriers, as well as their impact on trade levels and on welfare. The analysis provides insights into the implications of removing the policy related barriers, either unilaterally, or through customs unions or currency unions.

Two commonly used tools to evaluate the effects of border barriers are gravity equations and computable general equilibrium models. Gravity equations generally find that borders have a substantial negative effect on trade, while integration has a positive effect. But the estimated equations are a very crude tool for policy analysis because they

are based on ad hoc specifications that can be seriously questioned on theoretical grounds. The ad hoc nature of standard gravity equations also precludes welfare analysis. Computable general equilibrium (CGE) models are potentially more useful for policy analysis but they have two drawbacks: (1) they are simulated rather than estimated, and (2) they are almost always based on a very large black box consisting of dozens to hundreds of equations. The first characteristic makes it difficult to know how reliable is the simulation model while the second characteristic makes it difficult to evaluate what drives the findings. Many CGE models have been applied to evaluate the impact of NAFTA, but almost always the implied effect on Mexican trade is only a small fraction of what we have seen in reality. Moreover, these models have the additional problem that while they capture the policy barriers of interest, such as tariffs under NAFTA, they omit other relevant trade barriers. We find that these other barriers are several to many times the size of formal trade barriers and their presence alters the proper analysis of the impact of removing formal barriers.

The goal of this chapter is to provide a general understanding of how border barriers affect trade and welfare in a simple framework developed in our previous work[2]. We discuss three specific applications: (i) the effect of estimated total border barriers on trade and welfare among OECD countries, (ii) the effect of currency unions on trade and welfare, and (iii) the removal of tariff barriers under NAFTA. The framework deploys a theoretically grounded gravity model as a full general equilibrium model which is estimated (meeting objection (1)) and yet is simple enough to open the black box (meeting objection (2)).

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[1] See Hess and van Wincoop (2000).
[2] See Anderson and van Wincoop (2001).

Types of Trade Costs

The nature of trade costs is important to our modeling and to our applications. Different types of costs require different treatments. We deploy a two-way classification, dividing costs into those that are related to national borders and those that are not, and further dividing border costs into those that generate rents (payments above opportunity cost) and those which do not.

Non-border costs are largely natural trade costs that arise from distance and geographical irregularity interacting with the most efficient transport and communications technology. While most analysis on international trade policy ignores these non-border barriers, they are important even if one's interest is in the implications of border barriers. The non-border barriers generally reduce the effect of border barriers on trade and welfare. We will show that they also have implications for the terms of trade response to a reduction in border barriers.

Most international trade policy leads to border costs that involve rents. With tariffs the rent accrues to the government, and is rebated to the general public through tax and spending policy. Export and import quotas also involve rents, accruing to the license holders. A host of more devious nontariff barriers (discriminatory use of standards and the like) also lead to rents for private beneficiaries.

Most border barriers (see below for evidence) result from factors unrelated to trade policy, and do not generate rents. Differences in languages, cultures, customs, and regulations all impose barriers to trade that are specific to borders. Some of these barriers, such as differences in regulations and product standards, may be relatively easy to harmonize. Others, such as language and cultural differences, may be much more

difficult to remove. Some barriers may only be removed after extreme measures such as complete political integration.

The distinction between rent-bearing and non-rent-bearing trade costs is fundamental. Non-rent border barriers generate trade costs that involve real resources, such as gathering information about foreign regulations, hiring lawyers familiar with foreign laws, learning foreign languages and adjusting product designs to make them consistent with foreign customs and regulations. Barriers involving rents involve a transfer between those who pay the rent and those receiving the rent.

Non-rent border barriers have larger welfare implications than do tariffs and quotas. With non-rent border costs the higher price that the consumer pays for imports is a payment for real resources. In contrast, a tariff offsets the higher cost a consumer pays for imported goods with an increase in tariff revenue, which somehow gets rebated to the general public. Tariffs or quotas have welfare effects only as a result of the gap they create between marginal social costs and benefits. A reduction in the tariff will expand imports, an activity for which the marginal benefit exceeds the marginal cost. This raises real income by reducing 'dead weight loss'.

Although in most of what follows we will assume that tariffs and quotas are the main border barriers involving rents, some other border barriers may involve rents as well. For example, the anti-McDonald's campaign of José Bové and his allies presumptively protects inefficient French farmers and restaurateurs. One way to think about this is as a disinformation campaign about McDonald's. It involves no real resource costs and has exactly the same outcome as the imposition of a tariff or quota on imports from McDonald's. Another possible example is the deliberately insular customs among local

business persons, making it difficult for foreign exporters to penetrate the market. Here it depends on what drives these insular customs. If they are the result of tight business relationships due to small distances between the firms, the resulting trade barriers may not be related to borders at all. If the insular customs are related to language and other cultural traits, they lead to non-rent border barriers. On the other hand, if the deliberately insular customs are the result of misinformation about doing business with foreigners, its effect is the same as that of a quota.

In the applications presented below, we have examples of reductions in both kinds of costs. As for rent-bearing costs, we analyze the effects of the reduction in tariffs resulting from NAFTA. We also analyze two examples of rent-free costs. The first involves border costs among OECD countries in 1993.[3] Since formal trade barriers among industrialized countries are not very high, we think of these mostly as non-rent border barriers, but for sensitivity analysis we will also consider the welfare implications if instead they were tariffs. Second, we report on the effects of joining currency unions.[4] The use of different moneys across borders can form a barrier as there are costs in exchanging currencies in spot and forward markets and traders face uncertainty about currency movements that cannot always be hedged. A common currency also leads to greater transparency of price differentials.

Understanding the Effects of Border Barriers

What factors determine the implications of border barriers for trade and welfare? We will employ a very simple theoretically grounded gravity equation that we developed in

[3] These are estimated in Anderson and van Wincoop (2001).

recent work, which easily lends itself to addressing these questions in a variety of different contexts.[5] The theory tells us that after controlling for size, trade between two countries depends on *relative* trade barriers. What matters is the bilateral barrier between the countries relative to the average trade barriers each country faces with all its trading partners, which we refer to as "multilateral resistance".

The basic idea from the exporters' point of view is that each country produces a certain quantity of goods that needs to be sold somewhere. Relatively more goods will be sold to the countries with which border barriers are relatively low compared to other trading partners. The basic idea from the importers' point of view is that each country demands the goods of each other country, but relatively more goods will be purchased from countries for which the importer's trade barriers are relatively low. The Anderson and van Wincoop model rigorously shows that size-adjusted bilateral trade depends on the ratio of bilateral resistance to the product of the multilateral resistances of each partner.

We utilize the estimated model as a computable general equilibrium model in order to simulate the effects of changes in various border barriers on trade flows and welfare. The commonly used empirical gravity equations are in contrast both estimated inconsistently and unable to be used for general equilibrium simulations. The typical setup assumes that only bilateral barriers matter for trade between two regions or countries. Some more recent work has nodded at the problem of barriers between a country and all of its partners, but it does so in a way inconsistent with the theory.[6]

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[4] This is based on Rose and van Wincoop (2001).
[5] See Anderson and van Wincoop (2001). A theoretical gravity equation was first developed by Anderson (1979).
[6]See the discussion in Anderson and van Wincoop (2001), page 12.

The implications of the policy experiments considered below are more easily understood by first discussing some general properties of the theoretical model. We consider the effect of changes in non-rent border barriers. The presence of rents mainly affects welfare results, discussed in the next section. The model implies the following characteristics for size-adjusted trade (the bilateral flow divided by the product of importer and exporter GDP and multiplied by world GDP):

1. *Border barriers lead to a larger percentagewise increase in size-adjusted domestic trade in small countries than in large countries.*

Countries either export the goods they produce or sell them domestically. Border barriers only affect international trade, therefore reducing the relative barrier of domestic trade. Small countries rely more on exports than large countries, so that border barriers raise their average trade barrier more and the relative barrier of domestic trade is reduced more. This leads to a larger increase in domestic trade of small countries.

There is another way to look at this, which leads to the same conclusion. In a world consisting of a large and a small country, a given reduction in trade between them leads to an identical absolute increase in domestic trade within both countries. But since the level of domestic trade is much smaller in the small country, the percentagewise increase in domestic trade is much larger for the small country.

2. *Border barriers reduce size-adjusted trade between large countries more than between small countries, but they have a larger effect on the welfare of small countries.*

Since border barriers raise average trade barriers more for small countries, the relative barrier between small countries rises less than between larger countries. Therefore trade drops less among small than large countries.

The welfare effect is in contrast larger for small countries. It can be shown that welfare, measured in real units of a consumption basket, is inversely related to the average trade barrier a country faces. Small countries rely more on international trade, so that border barriers raise their average trade barrier more than for large countries, resulting in a bigger decline in welfare. This is a familiar theme in international trade analysis: small countries get most of the gain from trade.

3. *The rise in size-adjusted trade among the members of a regional trade agreement (RTA) is smaller the larger the size of the union. On the other hand, the welfare effect is larger the bigger the union.*

The average trade barrier for the members of a RTA drops more the bigger the size of the union. Therefore relative trade barriers between those members drop less the bigger the union's size, leading to a smaller rise in trade among the union's members. On the other hand, the bigger drop in average trade barriers for a large RTA leads to a bigger rise in welfare. A world union has the largest possible effect on welfare, but the smallest effect on trade.

This also illustrates how the traditional empirical gravity approach, which only controls for bilateral barriers, can lead to misleading conclusions. For the same drop in border barriers in a small RTA as in a large RTA, the traditional gravity approach would predict that the impact on trade is the same.

4. *The rise in size-adjusted trade among the members of a RTA is smaller the higher the level of pre-union trade among its members. But the welfare effect is larger the higher the level of pre-union trade.*

This result is closely related to the previous one about the size of the union. A reduction in border barriers among a set of countries reduces their average trade barriers more the greater their level of pre-union trade. If the countries are located far apart and are trading little to start with, a reduction in border barriers between them will have much less of an effect on their average trade barriers. As discussed above, a larger reduction in average border barriers leads to a smaller effect of the RTA on trade, but a bigger effect on welfare.

5. *The effect of border barriers on trade and welfare is smaller the larger the non-border trade barriers.*

This result arises because non-border trade barriers, such as transport or communication costs, lead to a home bias in trade. It is most easily understood by considering the extreme of very high non-border barriers due to prohibitive transport costs. In that case there would be a low level of international trade even in the absence of border costs. The increase in international trade that can be achieved by removing border barriers is naturally very small.

The Role of Rents

The implications of border barriers for trade are very similar with and without rents, but the welfare implications are different. In order to compare welfare effects of borders with and without rents it is useful to decompose the welfare effect of lowering

border barriers into three components: (i) the direct welfare impact measured at the old terms of trade and trade levels, (ii) the welfare impact associated with a change in trade levels, (iii) the welfare impact associated with a change in the terms of trade.

With non-rent border barriers there is a direct impact on welfare that we will refer to as the resource effect. A drop in border barriers implies that fewer resources are wasted on trade costs, which lowers consumer prices and raises welfare. But when there are rents the direct welfare impact is zero. A reduction in tariffs lowers consumer prices, but the resulting welfare impact is exactly offset by lower tariff revenues.

The second welfare effect, associated with a change in trade levels, applies to both border barriers with rents and without rents. In the absence of rents this welfare effect is simply a result of an optimal change in product demands following a change in border barriers. The welfare impact is therefore always positive. It is a second order effect as product demands were optimal at the old level of border barriers. But we will see that this welfare impact can nonetheless be very big since estimated border barriers are large.

When there are rents, there is a first order effect on welfare associated with a change in trade levels. This welfare effect was illuminated in the classic Viner (1950) analysis of free trade agreements focusing on trade creation and trade diversion. By taking the point of view of a small country contemplating joining the agreement, the terms of trade is constant and the only welfare effects come through changes in trade levels. Viner noted that regional free trade agreements are simultaneously a move toward free trade, creating added trade volume, and a move away from free trade, diverting trade from the rest of the world (ROW) to a partner. Trade creation increases welfare while trade diversion reduces it.

Figure 1 presents a version of his analysis. The world prices of the rest of the world (ROW) and partner goods are set equal to one. The initial uniform tariff is *t.* The RTA removes the tariff on the partner good and shifts the demand for the ROW good inward. The area of box TD represents the welfare effect of trade diversion. Each unit of diverted trade has a marginal social benefit equal to the domestic price $1+t$ while its marginal social cost is equal to the world price, 1. The net benefit of a unit of diverted trade is therefore equal to the tariff, *t*. The total loss TD is the product of the drop in trade with the ROW and the net benefit, *t*, from this trade. It is also equal to the loss of tariff revenue on diverted trade. The area of the triangle TC represents the welfare gain from trade creation. Each unit of created trade on the interval from the old to the new volume has a marginal social benefit equal to the domestic price associated with the given volume. This is read off the demand schedule at each volume on the interval. The marginal social cost is equal to the world price. The last unit of created trade has zero net benefit while the first unit has a net benefit equal to the tariff. The average net benefit of the created trade is one half times the tariff.[7] The area TC measures the average net benefit from trade times the increase in trade with the partner.

The desirability of a free trade area to the small country depends on the net of TC and TD. It is ambiguous in general, being positive as trade creation dominates trade diversion. The trade creation benefit is more likely to be larger than the trade diversion loss the smaller the level of trade with the ROW before the RTA, which can be a result of either a high level of tariffs before the RTA or other high trade barriers with the ROW.

The final welfare effect is the result of terms of trade changes. It is common to believe that only large countries can affect their terms of trade through tariffs on imported

[7] That is, one half times zero plus one half times the tariff.

goods. Strictly speaking no country is small in the gravity model since, similarly to most applied general equilibrium models, each country is assumed to produce unique goods. Nevertheless, tiny countries would have little effect on their terms of trade in a frictionless world. If tariffs were the only trade barriers that exist, since they are low, small countries would again have little power over their terms of trade. But as we have pointed out, there are many other trade barriers, both border barriers and non-border barriers, which swamp the tariff barriers in effect. These all lead to a home bias in trade. Even a small country therefore buys a disproportionately large fraction of its own goods and can therefore affect its terms of trade substantially by changing tariffs on imported goods. A drop in a nation's own tariff will ordinarily lead to a terms of trade deterioration, while a drop in the tariffs of trading partners will lead to a terms of trade improvement.

In the applications below we will decompose the welfare effect into each of the components described above.

Application #1: Border Barriers among OECD countries

Tables 1 and 2 report some results based on estimation of the theoretical gravity equation in Anderson and van Wincoop for US states, Canadian provinces and twenty other OECD countries (denoted ROW). Table 1 reports the tariff equivalent of estimated border barriers assuming an elasticity of substitution equal to five among goods of different countries. The welfare results in Table 2 also depend on this elasticity. In contrast the trade change numbers of Table 1 are not sensitive to the elasticity. The estimation assumes that the border barriers are symmetric and that they are equal among

the entire set of ROW countries.[8] The model also allows for non-border barriers through trade costs that depend on distances between regions and countries.

Most of the border barriers have a tariff equivalent in the neighborhood of 50%. Even if the elasticity of substitution were as high as 10, which is above most estimates in the literature, the border barriers would still be around 20%. It is therefore clear that the policies, institutions and regulations that separate nations create very large barriers to trade across borders.

Table 1 also reports the increase in international trade achieved by the removal of all border barriers. We are able to compute these numbers by solving the general equilibrium model both before and after the removal of all the border barriers. The removal of border barriers raises trade between the US and Canada by 79%, while raising trade among ROW countries on average by 41%. While these are substantial numbers, the enormous size of the reported border barriers might be expected to cause much larger trade changes. The explanation is that trade between countries is not determined by the absolute size of the border barriers, but rather by relative trade barriers. While borders raise barriers between any pair of countries, they also raise barriers of each partner with all their other trading partners (only domestic barriers are unaffected by borders). This significantly dampens the effect of borders on relative barriers and therefore on trade. For example, trade between the US and Canada would have increased by a factor five if we removed the bilateral border barrier between them while keeping constant the average trade barriers that both countries face with all their trading partners.

US-Canada trade rises a bit more than trade among other OECD countries, even though the US-CA barrier is a little lower. This is because the US is a large country, so

[8] See Anderson and van Wincoop (2001) for details.

that its average trade barrier is less affected by borders. This leads to a more substantial drop in relative trade barriers that the US faces with other countries, and therefore a bigger rise in trade. Trade between the US and ROW countries rises even more since ROW countries tend to be larger than Canada.

It is useful to cast these findings in the context of the so-called "trade home bias puzzle". Estimation of empirical gravity equations has found enormous effects of borders on trade. One well known finding is that, after controlling for distance, trade between Canadian provinces is twenty times larger than between provinces and US states.[9] Partially, as we have shown in our recent work, this is a result of estimating a mis-specified equation, which focuses on bilateral rather than relative trade barriers. To a large extent it is also the result of a very large increase in domestic trade. Our earlier work showed that borders raise trade between Canadian provinces by a factor 6. As discussed above, for small countries border barriers significantly reduce the relative barrier associated with domestic trade, leading to a large increase in domestic trade. It is therefore misleading to interpret the trade home bias numbers that have been reported in the traditional gravity literature as indicators of the effect of borders on *international* trade.

Table 2 reports the increase in welfare following the removal of border barriers, measured as the percentage rise in the real level of consumption. The number for ROW refers to an unweighted average of the percentage welfare increase of the twenty other OECD countries. These results show that the estimated border barriers have enormous welfare effects, as large as 52% for Canada. The numbers depend on the assumed elasticity of substitution of 5, but even for a high elasticity of 10 Canadian welfare would

still rise by 20% if all border barriers were removed. As anticipated above, the welfare effect is smaller for a large country such as the United States as it relies less on international trade. Nonetheless even the US stands to gain significantly from a reduction in border barriers.

The breakdown of the welfare effect into the three components discussed above shows that they are all important.[10] The resource effect is the biggest, about half of the total welfare effect for the US and ROW countries and slightly less for Canada. Even though the trade effect is technically a second order effect, the welfare improvement associated with it is nonetheless very large, as much as 13% for Canada. This is because the size of the border barriers is big. For a small change in border barriers the welfare improvement associated with the change in trade patterns would be small compared to the resource and terms of trade effect (which are both first order effects).

The terms of trade effect is negative for the US, while positive for Canada and the average of the ROW countries. The latter hides the fact that the largest ROW countries, Japan, Germany and France, experience negative terms of trade effects, while the smaller ones experience a terms of trade improvement. As expected, large countries gain from trade restrictions. The relative price of goods from small countries will rise when border barriers are removed since they rely more on exports for the sale of their goods. Lower border barriers raise export demand and the price.

We have assumed that the estimated border barriers are non-rent barriers. As a form of sensitivity analysis it is useful to compute the welfare implications if instead the

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[9] See McCallum (1995).

[10] If one sums the numbers in the three columns that provide the breakdown, they do not exactly add up to the total in the first column. That is because the numbers in the

estimated barriers were tariff barriers. In that case the welfare increase is 2.9% for the US, 30% for Canada and 16.8% for ROW countries. So even if rents were involved in some of the estimated border barriers, they still have very large welfare effects. These numbers are close to the welfare effects in Table 2 when subtracting the resource effect, which does not apply with rent barriers.

The results reported here depend on our estimate of non-border barriers, which in the model is captured by distances within and between regions and countries. If there were no distance related barriers, the welfare effects would be even larger: 19% for the US, 75% for Canada and 58% on average for ROW countries. Reductions in the costs of transportation and communication therefore make the existing border barriers only more important.

One might argue that these large welfare improvements are not realistically attainable since the policy experiment we have conducted here, the removal of all border barriers, is not easy to achieve in practice. We will therefore now turn to a policy experiment that is more easily implemented, the formation of currency unions.

Application #2: Currency unions

Rose and van Wincoop have applied the theoretical gravity model to determine the size of the border barrier associated with the use of different currencies across national borders, as well as its effects on trade and welfare.[11] The analysis is based on a large dataset of 137 countries, of which 36 are part of currency unions. Existing currency unions, such as the CFA Franc zone in Africa and the East Caribbean Currency Area, are

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breakdown columns are cumulative. For example, for Canada 0.517=1.183*1.129*1.135-1.

relatively small, but provide potentially useful information about the extent to which currency unions reduce border barriers. This information can then be applied to evaluate the impact of other currency unions that are not yet in existence.

With an elasticity of substitution among goods equal to five, the tariff equivalent of the national money border barrier is found to be 26%. This implies that about half of the total border barriers reported in Table 1 may be attributable to the use of different currencies.

Table 3 reports some implications of this for EMU and a couple of dollarization scenarios. Trade among the existing twelve EMU members would rise by 59%, while welfare would rise by 11%. While the effect on trade is significant, it is dampened by the fact that these countries already had high trade levels among each other before EMU. As discussed above, the larger the size of a currency union and the higher the trade levels before the union, the smaller its effect on trade and the larger its effect on welfare. The table shows that an expansion of EMU to all fifteen EU members would reduce the trade increase to 40%, while raising the rise in welfare to 14%.

The dollarization scenarios also show substantial increases in both trade and welfare. When comparing different countries that could dollarize, those with closer trade relationships with the US face a smaller increase in trade but a larger increase in welfare once the dollar is adopted. The comparison is quite stark when comparing Argentina and Canada. Argentinian trade with the US is expected to rise by 132%, while Canadian trade with the US is expected to rise by only 38%. Nonetheless the Canadians experience a much larger increase in welfare of 30%, versus 3.3% for Argentina.

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[11] Rose and van Wincoop (2001).

The final row of the table shows that the biggest possible monetary union, among all countries in the world, would raise trade by only 10%, but leads to a very large average increase in welfare of 21%.

There is another piece of evidence which also suggest that the impact of national borders is closely linked with the use of different currencies across borders. It has been found that relative prices of the same goods are much more volatile across cities in different countries than across cities in the same country, even after controlling for distance.[12] This evidence has been closely linked to nominal exchange rate volatility across locations in different countries. By itself this does not necessarily imply, though, that the use of different moneys across borders provides a barrier to trade.

Application #3: NAFTA

In the final application of our theoretical gravity model we consider the implications of tariff removals as part of the North American Free Trade Agreement (NAFTA). Negotiations leading to NAFTA began in June 1990, an accord was signed in December 1992 and the agreement went into effect on January 1, 1994. For some goods the existing tariffs were removed immediately, while for others there was a gradual phase-out, ranging from five to fifteen years. Average tariffs on US exports to Mexico were 18.6% before NAFTA, with an average phase-out time of 5.6 years. Average tariffs on Mexican exports to the US were 5.9%, with an average phase-out time of 1.4 years.[13]

Figure 2 presents the actual size-adjusted trade flows among the NAFTA partners from 1985-99. The inescapable conclusion is that NAFTA spectacularly affected partner

[12] See Engel and Rogers (1996, 2000).
[13] See Kowalczyk and Davis (1998), page 236-239.

trade flows. A plausible model of integration must explain the near doubling of the US-Mexican size adjusted trade. Notably, the Computable General Equilibrium models deployed prior to NAFTA very substantially underpredict the effect of NAFTA.[14]

In order to evaluate the implications of NAFTA we conduct the following exercise. We start from the world model of twenty-two OECD countries for which we estimated total (non-rent) border barriers in 1993. We then add Mexico to this model, allowing for both non-rent and tariff barriers between Mexico and other countries. We assume that the non-rent barriers between the US and Mexico are of the same size as between the US and Canada, while the non-rent barriers between Mexico and all other countries are the same as between Canada and other countries. It is assumed that all tariffs on Mexican imports and exports are the same as those between Mexico and the US. We then consider the implications of a removal of all tariffs on trade between Mexico and the US and between Mexico and Canada. This is done by solving the general equilibrium model before and after the removal of the tariffs.

The results are reported in Tables 4 and 5. The effect on size-adjusted trade levels is shown in Table 4. The model predicts an increase in exports from Mexico to the US of 59% and an increase in exports from the US to Mexico of 74%. The same changes are predicted with regards to trade with Canada. These numbers correspond quite closely to the data. Figure 2 shows the size-adjusted trade levels between all three NAFTA pairs. Here trade is measured as the average of exports and imports. There is good reason to only look at the average of exports and imports in the data since Mexico experienced

[14] See Hufbauer and Schott, 1992, pp58-9 for predicted NAFTA trade flow changes from a set of models. The estimates imply growth of US-Mexican trade ranging from 5% to 25%. The data implies growth of 80% or more.

large real exchange rate movements that affected the difference between exports and imports (the trade balance).

In 1993, which we use as the pre-NAFTA year, Mexico-US trade was 40% lower than US-Canada trade. In the model Mexico-US trade was 41% lower than US-Canada trade. In the data Mexico-US trade rises by 85% from 1993 to 1999, which is quite close to the trade increase predicted by the model reported in Table 1. In 1999 US-Mexico trade remains 20% lower than US-Canada trade in the data, while in the model it is 5% lower. The model therefore does a reasonable job in explaining both relative trade levels and changes in trade levels.

Note by the way that almost all of the increase in US-Mexico trade occurs in one year, 1995. This is a bit deceptive though since Mexico experienced a large devaluation that lowered its GDP when measured in dollars. Since most of its trade is priced in dollars, this devaluation by itself leads to a large jump in the size-adjusted trade measure shown in Figure 2. Without the devaluation the size-adjusted trade level would likely have increased more gradually. A comparison of 1993 to 1999 data is therefore most relevant.

The model predicts that Mexican exports to the other OECD countries (ROW) rise by 19%, while Mexican imports from ROW countries drop by 25% (fourth and fifth rows of Table 1). The drop in imports from ROW countries is a result of trade diversion, while the rise in exports to ROW countries is the result of the predicted drop in the relative price of Mexican goods. The relative price of Mexican goods falls (the Mexican terms of trade deteriorates) because Mexican consumers switch to buying more products from the US and Canada after the removal of tariffs on those imports. Even though

Mexico is a small country, a change in import tariffs affects its terms of trade due to the fact that (i) Mexicans produce differentiated products and (ii) Mexican consumers themselves purchase a relatively large fraction of Mexican output as a result of large border and non-border barriers (most of which are not tariff barriers). In the data both size-adjusted exports to ROW countries and imports from ROW countries rise after NAFTA, but this is likely the result of a reduction in trade barriers with ROW countries independent of NAFTA.

Table 4 also reports to what extent the trade changes are the result of the removal of Mexican import tariffs versus the removal of US and Canadian tariffs on Mexican exports. Not surprisingly given its much bigger size, most of the trade changes result from the removal of the Mexican import tariffs. It is noteworthy that the removal of either set of tariffs raises trade in both directions. This is a result of general equilibrium considerations. For example, while one would expect lower Mexican import tariffs to raise Mexican imports, the resulting drop in the relative price of Mexican goods also raises Mexican exports.

The welfare effects of NAFTA, reported in table 5, are quite revealing. Removal of Mexican tariffs results in trade creation that raises welfare by 1.4%, offset slightly by trade diversion that lowers welfare by 0.2%. But the removal of Mexican tariffs leads to a deterioration in Mexico's terms of trade that results in a 2.5% drop in welfare. The terms of trade deterioration overwhelms the gains from trade creation, leading on balance to a 1.3% welfare drop. The removal of the US and Canadian tariffs shifts demand toward Mexican goods, however, and results in a terms of trade improvement that improves welfare by 1.1%. The overall net effect is a loss of 0.3%. The US and Canada experience

a small 0.1% improvement in welfare, while welfare of ROW countries is virtually unaffected.

These welfare effects are very small compared to those in Table 2. Partially this is because in Table 2 we considered the removal of non-tariff barriers among OECD countries, which also have a significant resource effect. But as noted earlier, even if the estimated barriers among OECD countries were tariff barriers, the welfare gains would still be large, for example 16.8% for ROW countries. There are several reason why the effect on Mexican welfare is so small in Table 5. First, if tariffs on Mexican exports had been the same as on Mexican imports, the model predicts that Mexican welfare would rise by 1.5%. Second, if additionally we remove the non-rent border barriers, NAFTA would raise Mexican welfare by 5.9%.

Finally, if on top of this we raise the tariffs to 50%, which is the size of the border barriers reported in Table 1, removing these tariffs would raise Mexican welfare by 14.8%. So to summarize, the effect on Mexican welfare is small because (i) tariffs rates are asymmetric (much higher on Mexican imports than exports), (ii) the tariffs are much smaller than the non-tariff border barriers, and (iii) the presence of non-tariff border barriers dampens the welfare effect of tariff reductions.

Conclusion

We have shown that policies associated with borders are very costly, even in a world with low formal trade policy barriers. The potential for deep integration even between such closely associated countries as Canada and the US remains astonishingly large. Small countries have much more to gain from integration than large countries, but even huge countries such as the US will earn substantial benefit from deep integration.

The large size of the estimated border barriers points to the need for more research to understand what the costs are and why they are so high. The benefit of currency unions in our work provides a useful clue, but the implied costs are very high compared to intuitive notions of the cost of exchange rate uncertainty and foreign exchange.

Methodologically, our work indicates that further development and use of the gravity model is likely to yield useful insights. Its attractiveness combines ease of estimation, success in prediction and the consistency and power of readily understood general equilibrium structure.

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Table 1 Impact of Border Barriers on Trade of OECD countries

	Tariff Equivalent of Border Barriers (in percent)	% Change in Trade due to Borders
US-CA	49	79
US-ROW	52	150
CA-ROW	78	117
ROW-ROW	51	41

Table 2 Increase in Welfare OECD countries when Borders are Removed

	Total	due to resource effect	due to increased trade	due to terms of trade changes
US	6.4	3.2	4.7	-1.5
CA	51.7	18.3	12.9	13.5
ROW	37.3	18.3	8.7	6.4

Table 3: Impact of Currency Unions on Trade and Welfare

	% Trade Increase	% Welfare Increase
EMU for current 12 members	59	11.1
EMU for all 15 EU members	40	14.4
Argentina dollarizes	132	3.3 (Argentina)
Mexico dollarizes	53	24.3 (Mexico)
Canada dollarizes	38	29.7 (Canada)
World monetary union	10	21.3

Table 4 Impact of NAFTA on Trade

	% Rise in Exports		
	Removal Mexican tariffs	Removal US,CA tariffs	Removal all tariffs
Mexico to US	38	17	59
US to Mexico	61	9	74
Mexico to Canada	38	16	59
Canada to Mexico	61	9	74
Mexico to ROW	36	-12	19
ROW to Mexico	-30	8	-25
US to Canada	-0.8	0.0	-0.9
Canada to US	-0.9	-0.1	-0.7

Table 5 Impact of NAFTA on Welfare

		% Change in Welfare		
		Removal Mexican tariffs	Removal US,CA tariffs	Removal all tariffs
Mexico	Total	-1.3	1.1	-0.3
	Due to: 1. Trade Creation	1.4		
	2. Trade Diversion	-0.2		
	3. Terms of Trade Changes	-2.5	1.1	
US		0.1	-0.03	0.1
CA		0.1	-0.03	0.1
ROW		0.00	-0.01	-0.01

Figure 1: Trade Creation and Diversion

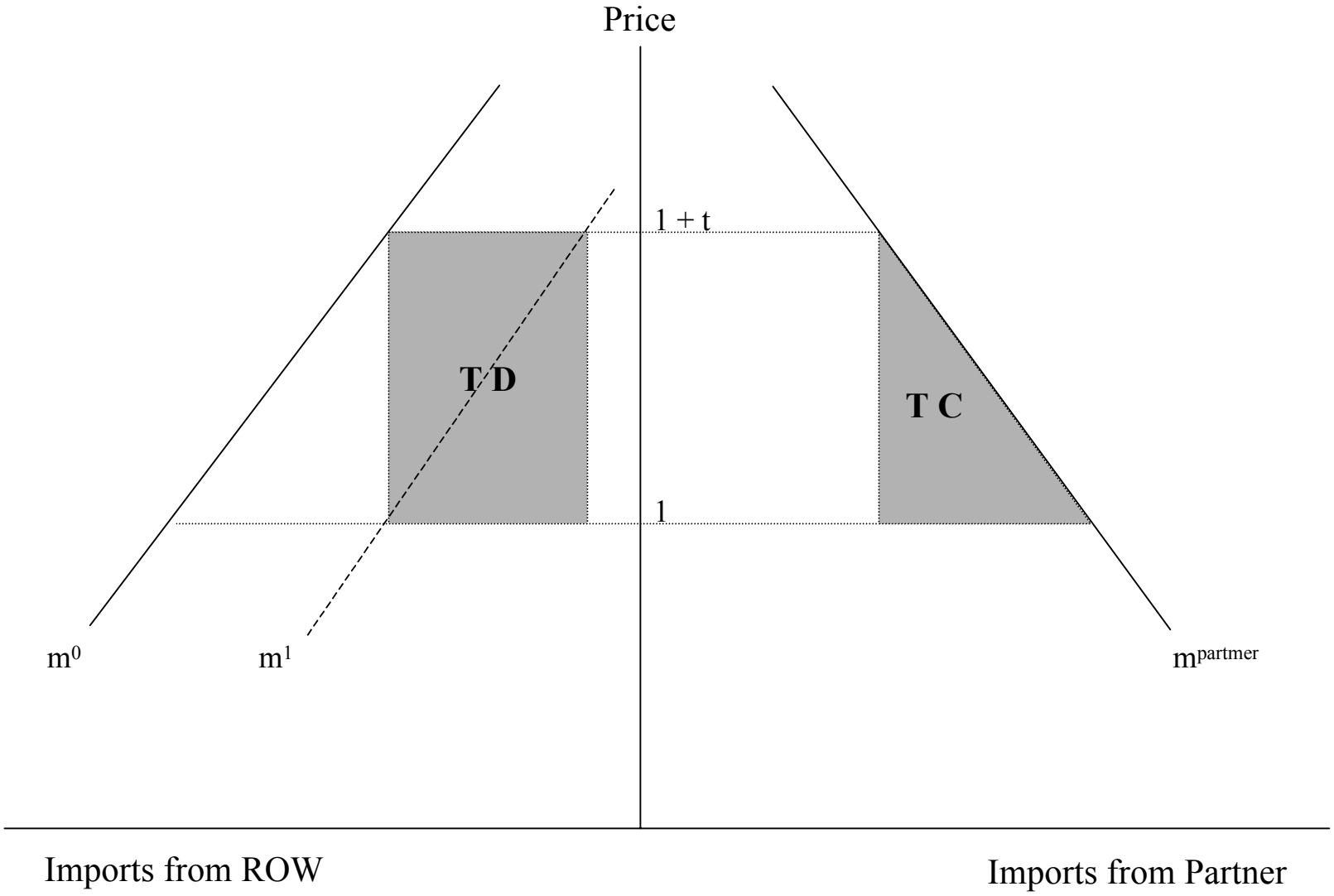

Figure 2 Size adjusted bilateral trade levels

$$\left(\frac{\text{Exports i to j + Imports i from j}}{2}\right) \times \left(\frac{GDP_{world}}{GDP_i * GDP_j}\right)$$