Renegotiating NAFTA: Pros and cons for Canada and Mexico

COMMENTARY

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Written by Dr. Veena Jha and Dr.Badri Narayanan

Executive Summary

As renegotiations of the North American Free Trade Agreement (NAFTA) continue, it is useful to examine the benefits associated with NAFTA and what might happen if NAFTA tariff preferences disappear. This paper uses an economic trade model to simulate the impacts of a 20 per cent tariff increase in North American industries such as energy, steel, cement and automobiles.

Ending NAFTA tariff preferences in these areas would entail migrating tariff levels to multilateral most-favoured nation (MFN) levels, as set out by the World Trade Organization, although most MFN rates fall below the 20 per cent threshold used in this study.

A key finding of this research is that a 20 per cent tariff hike would not trigger significant absolute economic losses in all three countries: the U.S. economy has the most to lose, at roughly USD 3.4 billion a year in terms of GDP, and approximately USD 5 billion in welfare losses. (The concept of welfare is an aggregation of producer and consumer gains and losses. Free trade enhances consumer welfare by making products cheaper, therefore reversal results in consumer losses.)

The biggest industry loss is in the Canadian steel sector, where output declines by some 13 per cent, compared to 6.5 per cent in Mexico. The U.S. would increase its output marginally perhaps for domestic use in appliance sectors and the auto sector.

The simulated tariff hike, coupled with an increase in various non-tariff barriers, would have a small effect on total energy output in Canada, Mexico and the U.S. This is an important finding from a climate change perspective: the use of trade barriers to halt trade in energy and electricity trade would not be an effective tool to reduce carbon-intensive energy output in coal and oil, nor would such a blunt instrument lead to any measurable reduction in greenhouse gas emissions. Moreover, increasing trade barriers would bring about a reduction in renewable energy, and a switch to increased liquefied natural gas (LNG), which would in turn require substantial new investments and a need to significantly increase related infrastructure within each country.

Significant Employment Losses in All Sectors

Due to the lack of a diversified economy and reliance on the U.S. market, Canada would suffer the highest relative decline in employment, followed by Mexico and then the U.S.

Increased trade barriers would see a loss of 600,000 U.S. jobs in the energy sector, 120,000 jobs in Canada and 260,000 jobs in Mexico. In the gas sector, the U.S. would lose over 100,000 jobs versus 26,000 in Mexico and 10,000 in Canada. Nearly 460,000 people would be displaced in the steel industry in the U.S., with 240,000 in Mexico and nearly 75,000 in Canada. In the cement industry, nearly 2 million people would be displaced in the U.S., followed by over 200,000 in Canada and another 200,000 in Mexico. In the auto industry, some 800,000 people would be displaced in Mexico, with 750,000 in the U.S. and nearly 150,000 in Canada. Since cement and steel are important inputs in the shale gas and construction industry, as well as other energy sectors, unemployment in these sectors would affect downstream sectors too.

Effects of a Border Carbon Tax

The study also examined the possible effects of a USD 40 per tonne border carbon tax applied on electricity and a basket of export-intensive, trade-exposed goods—including automobiles, steel and a wide range of agricultural and resource-based products. In the analysis, the U.S. does not use a carbon tax while Canada and Mexico impose a carbon tax on emissions, which they adjust at the border for U.S. imports.

Assuming that exports increase and imports decrease for Canada and Mexico with a border carbon tax, their currencies would appreciate vis-à-vis the U.S. dollar. Exports would become less competitive and imports more competitive, thus negating the effects of the border tax adjustment.

The largest overall gains in this scenario are for Mexico, followed by Canada and the U.S. However, as only energy-intensive trade exposed industries are likely to be affected, the overall changes are smaller than in the case of an overall tariff hike of 20 per cent. Thus, while a border tax adjustment would not compensate Canada and Mexico fully for the output, employment, GDP and welfare losses consequent to a tariff hike under NAFTA, it would go at least halfway towards doing so.

In the end, whether it is a tariff hike or a border carbon tax, all three countries will suffer. The greatest losses, however, will be borne by the United States.

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1.0 Introduction

To understand the implications of renegotiating the North American Free Trade Agreement (NAFTA), it would be necessary to briefly go back to the structure of trade between the three countries in the pre-NAFTA period. Of course a lot has changed since then and trade linkages have become increasingly complex, with China occupying the centre stage for all three countries. Moreover, trade linkages between NAFTA, Europe and Latin America are almost as strong as that with China. NAFTA, however, continues to remain one of the largest free trade areas in the world, both in terms of population and GDP.[1] It involves countries at different stages of development, reflected by their GDP per capita and different sectoral specialization of economic activity, and it is an agreement that resulted in the creation of a cross-border production value chain, as revealed by the large share of intermediate goods and intra-industry trade across members.[2]

The maximum gains from NAFTA, which accrued in the period between 1993 and 2005, augmented aggregate trade by 118 per cent for Mexico, 11 per cent for Canada and 41 per cent for the U.S.[3] Trade amongst NAFTA countries was about USD 1 trillion in 2015, rising from around USD 200 billion in 1993.[4] NAFTA increased the sectoral specialization of export activity in Mexico, as shown by the fact that the share of electrical machinery in total exports increased from 20 to 33 per cent between 1993 and 2005. Both Mexico and Canada saw an increase in the volume of trade, which resulted in real wage increases for all NAFTA members, but Mexico saw the largest gains. U.S. and Canada, which had a diversified export base to begin with, further diversified their exports after NAFTA came into effect. NAFTA also had huge multiplier effects on employment. Recent research has found that, on average, for every 100 jobs U.S. manufacturers created in Mexican manufacturing, they added nearly 250 jobs at their larger U.S. home operations and increased their U.S. research and development spending by 3 per cent.[5]

When welfare effects are disaggregated into terms of trade and volume of trade effects, it was found that most of the gains from NAFTA were on account of an increase in the volume of trade. In fact, trade creation exceeded trade diversion, particularly for Mexico and Canada. Obviously, the maximum gains accrued in sectors that were highly protected before NAFTA, such as textiles, petroleum, electrical machinery and autos with large backward and forward linkages. The rest of the world outside NAFTA gained too because of the integrated supply chains that developed. Further tariff reductions under the World Trade Organization (WTO) were a worldwide phenomenon during this period. In 1993, average tariff rates applied by Mexico, Canada and the U.S. were 12.5, 4.2, and 2.7 per cent, respectively, with a large heterogeneity across sectors. By 2005 they were almost zero between NAFTA members, but on a most-favoured nation (MFN) basis their averages were 7.1, 2.2 and 1.7 per cent, respectively.[6] Thus after 2005, even after netting out the effects of NAFTA, Canada emerged as the largest gainer in terms of welfare, followed by the U.S. and Mexico. The welfare gains were highest in sectors with multiple linkages.

[1] The NAFTA zone accounts for nearly 28 per cent of global nominal GDP in a region that has about 6.5 per cent of global population (2015 data). Scotiabank. (2017, February 17). *The NAFTA success story, global economics: Insights and views.* Retrieved from http://www.gbm.scotiabank.com/scpt/gbm/scotiaeconomics63/2017-02-10_I&V.pdf

[2] Arkolakis, C., Costinot, A., & Rodriguez Clare, A. (2012). *New theories, same old gains?, American Economic Review, 102*(1), 94–130.

[3] Caliendo,, L., & Parro, F. 2014). *Estimates of the trade and welfare effects of NAFTA*. NBER Working Paper No. 18508. Retrieved from http://www.nber.org/papers/w18508

[4] Scotiabank, Feb 17, 2017, op. cit.

[5] Oldenski, L. (2014, July 24). American manufacturing growth since NAFTA. Presentation at Peterson Institute for International Economics. Retrieved from www.piie.com/publications/papers/oldenski20140715ppt.pdf

[6] Caliendo & Parro, 2014, op. cit.

Hence, renegotiating NAFTA would not mean turning the clock back, but rather going to MFN tariffs. While tariff peaks will affect trade in the case of Canada and the U.S., large effects on trade and welfare should not be expected. Of course a lot depends on the sectors and the contours of the renegotiation of NAFTA, but a priori going back to MFN rates should not bring large changes, at least in goods. In a sense, the changes in global tariffs and supply chains have raised the opportunity cost, measured by trade effects, of belonging to NAFTA. However this argument does not account for non-tariff barriers and reduction in trade logistics costs that may have occurred because of NAFTA. Moreover, NAFTA might have even influenced the rate of technological change of each member state and may have raised total factor productivity, which cannot be captured completely by Cumulative General Equilibrium (CGE) modelling.

While the overall effects are expected to be benign, some sectors may be worse off than others as a consequence of the renegotiation of NAFTA. This paper examines the effects of increasing tariff by 20 per cent on steel, cement, autos and electricity on NAFTA countries. The variables that will be examined are output, trade, employment—both skilled and unskilled—and prices. A secondary question would be to see the effects of increased tariffs on clean and renewable energy trade, to the extent possible of both goods and services. Finally, the effects of a border tax adjustment (BTA) imposed by Canada and Mexico on the U.S. will be examined in a number of sectors. These sectors have been chosen because they are all energy-intensive in the production process.

This paper starts with a literature survey of the effects of renegotiating NAFTA, with a particular focus on the sectors outlined above (Section 1). Section 2 then conducts a CGE analysis using a Global Trade Analysis Programme (GTAP) model to understand and analyze the effects of an increase in tariffs by 20 per cent in the electricity sector, particularly on transmission and distribution, as there is a lot of trade between NAFTA countries in all forms of energy. Section 3 examines the effects of the same shock, that is to say a 20 per cent increase in tariffs on steel, cement and autos in the NAFTA countries. Section 4 then examines the economic effects of a BTA of 20 per cent by Canada and Mexico on the U.S. Section 5 draws out some of the main conclusions of the study.

I. Literature Survey

Canada and Mexico send over three-quarters of their exports to the United States, which is equivalent to about 20 per cent of Canadian GDP and 26 per cent of Mexican GDP. By contrast the U.S. only sends a quarter of its total exports to its NAFTA partners, but its supply chain is highly integrated with Canada and Mexico. Products in which the U.S. may have aggressive interests are softwood lumber, agricultural goods and finished food products, whereas these may constitute the defensive interests of Canada and Mexico. Mexico's offensive interests may lie in telecoms, energy and ecommerce. Any unilateral move by the U.S. to impose tariffs on trade with Canada and Mexico would have serious macroeconomic effects on all three countries. A study by Scotiabank shows that, if NAFTA tariffs were to go back to MFN levels in 2017, then Canadian GDP would drop by 0.2 per cent and 0.3 per cent respectively in 2018 and 2019 in comparison to the current forecasts but would recover fully to the current forecasts by 2021.[7] Similarly, in the same scenario, Mexican GDP would drop by 0.5 per cent and 0.1 per cent in 2018 and 2019 respectively but go back to current forecasts by 2021. By comparison, the U.S. would only lose 0.1 per cent of its GDP in 2018 and recover fully by 2019.[8] These effects will not only be restricted to GDP, but will affect manufacturing output, exchange rates, wages, inflation, employment, interest rates and other macroeconomic variables. The effects on Canada and Mexico are likely to be stronger than those on the U.S. These figures are not very large by any standards, nor is the recovery period long enough to warrant concern. Why, then, is the need to renegotiate NAFTA so pressing for the U.S.? In every trade deal, there are winners and losers. The losers often have a more strident role in lobbying governments. These aggregate CGE models show that the gainers and losers compensate each other, in the sense that net losses are not high. But to make a stronger argument, there is a need to disaggregate sectoral effects too.

[7] Scotiabank. (2017, April 10). *Evolving US trade policy: What is at stake for the NAFTA zone.* Global Economics-Insights and Views. Retrieved from http://www.scotiabank.com/corp/downloads/Evolving_US_Trade_Policy-Whats_at_Stake_for_the_NAFTA_Zone.pdf

[8] Ibid.

In order to analyze fully the effects of NAFTA preference withdrawal unilaterally by the U.S., it is also important to see the profile of current U.S. imports with the rest of the world as well as NAFTA countries.

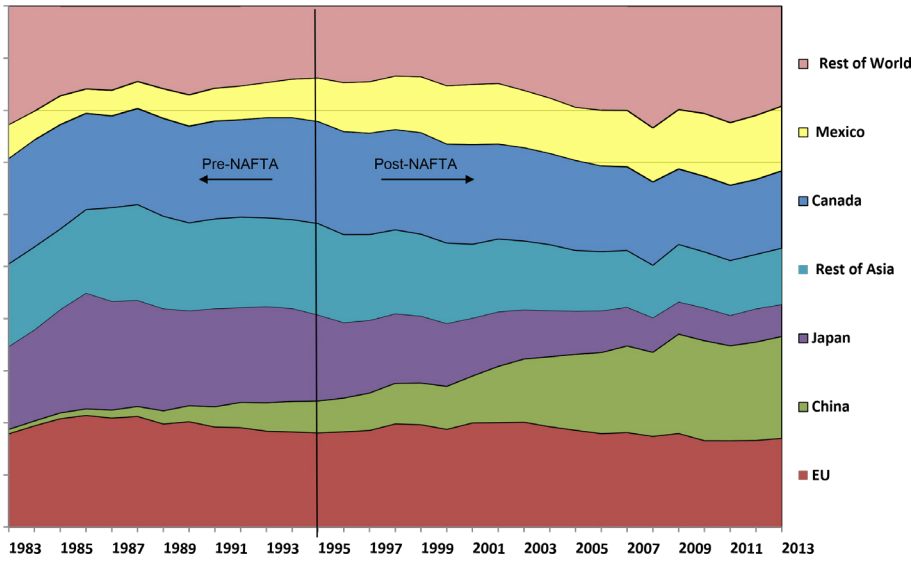

Figure 1. U.S. Merchandise Imports of U.S. by Country and Region[9]

Figure 1 above shows that the change in share of U.S. imports from the NAFTA countries after NAFTA came into effect has been enormous. However, its imports from China have exploded. What is even more interesting is that preference margins for Mexico have been eroding over time, even under NAFTA. Over 40 per cent of the imports from Mexico enter the U.S. at MFN rates, and the average preference margin on NAFTA imports from Mexico to the U.S. was 3.04 per cent, which is actually above U.S. MFN rates.[10] Hence, even if NAFTA tariffs were to be scrapped and MFN tariffs implemented, net effects are not likely to be high. This is in fact validated by literature (see above) and the simulation exercises carried out below. It is often claimed that, while overall effects on the U.S. may not be significant in terms of employment and wages, sectoral effects may nevertheless be strong. For example, one study estimates that the labour displacements in the U.S. because of trade deficits of the U.S. with its NAFTA partners between 1993 and 2004 amounted to about one million jobs.[11] However this study did not focus on the tariff margins under NAFTA. More recent econometric studies that have examined the economic effects of NAFTA have found that sectoral effects may be significant in certain protected products, such as footwear, textiles and plastics. They found that wage growth in these sectors may have reduced by 16 per cent as a result of the tariff reductions following NAFTA between 1990 and 2000.[12] The study also showed that certain locations such as Georgia, North Carolina, South Carolina and Indiana witnessed an 8 per cent reduction in wage growth between 1990 and 2000 as a result of NAFTA tariff reductions.[13]

[9] Source: J. de la Cruz & D. Riker (2014, June 6). The impact of NAFTA on US labour markets. Presentation by United States International Trade Commisions.
[10] Ibid.
[11] Scott, R.E., Callas, C & Campbell, B. (2006, September 28). *Revisiting NAFTA: Still not working for North American worker*s. Economic Policy Institute Briefing paper 173. Retrieved from
[12] McLaren, J. & Hakobyan, S. (2010), *Looking for local labour market effects of NAFTA*. NBER working Paper no 16535. Retrieved from http://www.nber.org/papers/w16535.pdf
[13] Ibid.

Other studies have shown different results. For example, one study has shown that between 1994 and 2007, tariff reduction under NAFTA may have reduced annual unemployment by as much as 4.4 per cent.[14] Another study has shown that, while there may have been some labour market impact of imports from Mexico, it is very difficult to disaggregate these effects from those originating from Chinese imports.[15] A detailed sectorally disaggregated employment impact of NAFTA, however, shows fairly insignificant effects in a recent study in 2014. This study, as explained above, has simulated a situation where NAFTA tariffs are brought back to MFN levels.[16]

Table 1. Effects on U.S. Employment by Sector[17]

GTAP Sector	Change in Sector's Employment of Skilled Workers (%)	Change in Sector's Employment of Unskilled Workers (%)
Textiles	+0.104	+0.112
Apparel	-0.308	-0.305
Leather	+0.048	+0.054
Chemicals, Rubber, and Plastics	+0.073	+0.079
Non-Metallic Mineral Products	-0.044	-0.038
Iron and Steel	+0.183	+0.192
Non-Ferrous Metal Products	+0.359	+0.370
Electronic Products	-0.013	-0.007
Other Machinery	+0.187%	+0.195%
Motor Vehicles	+0.006	+0.012
Other Transportation Equipment	+0.106	+0.114

Simulations carried out for this paper are in line with the expectations from literature. The overall effects of increasing NAFTA tariffs by 20 per cent using a CGE model (shown in Table 2) is the highest for the U.S. (For a full description of the model see Annex 1.) However, the percentage changes are likely to be the highest for Canada, followed by Mexico. In no case is the overall effect very high. However, in selected sectors, as shown below, the effects will be higher.

Table 2. Effects of Renegotiating NAFTA on GDP (in millions of US dollars)[18]

GDP	% change	Before	After	Change
USA	-0.02	1,5533,786	15,530,335	-3,451
Canada	-0.16	1,778,628.75	1,775,780.88	-2,847.88
Mexico	-0.05	1,170,083.25	1,169,497	-586.25

In terms of employment, the effects are somewhat similar, with Canada showing the highest decline in employment followed by Mexico and then the U.S. As the U.S. is a much larger economy, the absolute numbers of people displaced may be different. Canada's loss is the highest, showing the high level of dependence on the U.S. economy. Obviously, Mexico suffers more than the U.S., but not as much as

[14] Francis, J. & Jeng, Y. (2010). Trade liberalization, unemployment and adjustment: Evidence from NAFTA using state level data. Applied Eocnomics, 43(11). doi: 10.1080/00036840903194212
[15] Autor, D. H., Dorn, D., & Hanson, G.H. (2013, October). The China Syndrome: Local labor market effects of import competition in the United States, *American Economic Review, 103* (6), 2121–68.
[16] Cruz & Riker, 2014, op.cit
[17] Source: Cruz and Riker, 2014, op.cit
[18] Where the source of table data is not specified, the results are from the GTAP simulations carried out for this paper.

Canada, probably reflecting the fact that Mexico's export basket and destinations are more diversified than those of Canada. In fact, some of the investment displaced from Mexico may actually go to Canada instead of the U.S., as wages in Canada are lower than those of the U.S. In any case, neither the effects on employment, nor on wages is large enough for any of the economies. In terms of absolute numbers of unskilled labour, about 31,000 people will be displaced in Mexico, followed by 17,000 in the U.S. and about 13,000 in Canada. The picture changes somewhat for skilled labour, where Canadian and U.S. losses would be around 17,000, whereas losses for Mexico would be around 10,000 people. These numbers are quite insignificant in comparison to displacements that occur because of technological change.

Table 3. Change in Employment and Wages from 20 per cent tariff rise in NAFTA (%)

Type of Employment	USA	Canada	Mexico
UnSkLab	-0.03	-0.21	-0.1
SkLab	-0.02	-0.17	-0.07
Wages of Unsk lab	-0.11	-0.66	-0.30
Wages of sk lab	-0.11	-0.62	-0.27

The welfare declines are highest in the U.S. economy, on account of its large size. However, these figures are small for all the economies considered here. Considering that U.S. GDP stands at over USD 16 trillion, a loss of about USD 5 billion cannot be considered to be important for any policy change that it may decide to make.

Table 4. Changes in Welfare from Renegotiating NAFTA (in millions of US dollars)

USA	-5140.31
Canada	-3970.92
Mexico	-747.71

Most economists agree that, while the overall effects of a 20 per cent tariff hike may not be very high for the NAFTA region as a whole, some sectors will be affected. In keeping with this finding in empirical literature, this paper has focussed on a few sectors where there is little economic or empirical literature.[19] It thus hopes to add to the body of knowledge on the effects of renegotiating NAFTA. This paper has also focused on the effects on Canada and Mexico because, as shown above, the exposure of these two countries to the U.S. markets is very high and that of the U.S. to these markets is relatively small.

[19] For a comprehensive literature review on the economic effects of NAFTA see J. E. Cruz, D. Riker & B. Vorhees, (2013, November 26). *Econometric estimates of the effects of NAFTA: A review of literature*. No 2013-12A. USITC, Office of Economics.

II. Effects of Increasing Tariffs by 20 per cent on the Energy Sector

The NAFTA region has a highly integrated and interdependent energy market, especially for oil, natural gas and electricity. This integration has created economies of scale, attracted private investment, lowered capital costs and reduced energy costs for consumers. Energy system integration has encouraged energy self-sufficiency in the NAFTA region, and it is expected that by 2020 production will outpace consumption.[20] NAFTA, as it stands today, exempted trade in energy from its provisions. Since then, Mexico has undergone substantial sectoral openings, while energy and electricity trade has increased in North Americas. Modelling a tariff shock for energy not only provides insight into different upstream and downstream effects, but points to the merits of exploring an energy chapter in a new NAFTA.

As Figure 2 shows, most forms of energy flow from north to south. Mexico and Canada export most of their crude oil to the U.S. and accounted for nearly 50 per cent of total U.S. imports by 2015.[21] Canada is a major producer of heavy crude oil, which is suited to the mid-west refineries in the U.S. The U.S. is a net importer of natural gas from Canada and a net exporter to Mexico. As pipeline infrastructure between the U.S. and Mexico has improved, exports from U.S. to Mexico has increased. The U.S. is also a net supplier of liquefied natural gas (LNG) to Mexico. The seamless border between United States and Canada allows electricity grid managers to trade freely to improve electricity reliability and efficiency. Currently, there are more than 30 active major transmission connections (69 kilovolts or greater) between the two countries.[22]

While Canada is an overall net exporter of energy to the United States, small amounts are also exported by the U.S. to Canada. Mexico imports a small amount of electricity from California and Texas. Mexico's recent energy reforms present a huge opportunity for integrating the market for electricity and natural gas further in the NAFTA region. Mexico's growth in its domestic electricity market has largely been met through new natural gas-fired plants, driving the increase in U.S. natural gas exports to Mexico.

In this scenario of extremely flexible trade between the three countries, what would happen if the NAFTA rates increase by 20 per cent? As shown in Table 5 below, the output effects are not high. All countries have invested heavily in interconnected infrastructure, and hence tariffs may not be the only consideration in trade in energy by the NAFTA countries. More investment is planned in the energy sector over the next few years in the NAFTA region. Hence, it is unlikely that trade or output would change much in the near future. The maximum output effects are seen in Canada, as it has been the largest exporter of energy in the NAFTA region.

[20] American Petroleum Institute. (2017). *North American Energy*. Retrieved from http://www.api.org/~/media/Files/Policy/Trade/North-American-Energy-Onepager.pdf
[21] Ibid.
[22] Ibid.

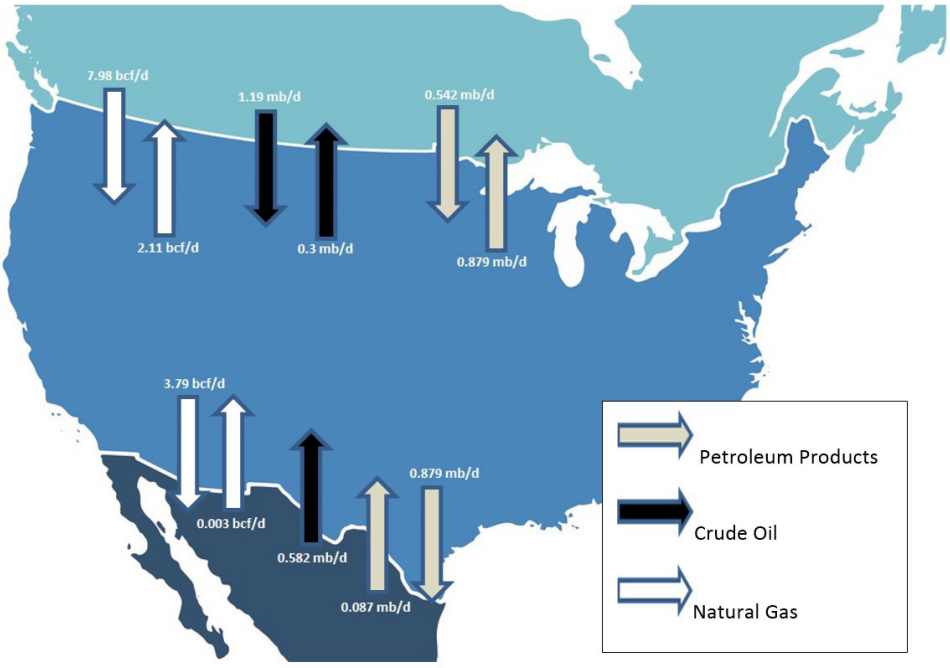

Figure 2. North America Energy Flows by Commodity[23]

Table 5. Effects on Output of Energy if NAFTA Rates Increased by 20 Per Cent (per cent changes)

Product	USA	Canada	Mexico
Electricity: Transmission and Distribution	-0.104	-0.334	-1.079
Nuclear base load	-0.055	-1.11	-0.484
Coal base load	0.035	-1.162	-0.946
Gas base load	0.073	-0.065	-1.602
Wind base load	-0.016	-1.032	0.022
Hydro base load	-1.11	-0.418	0.521
Oil base load	0.008	-0.029	-1.354
Other base load	0.065	-0.953	-0.596
Gas peak load	-0.048	-0.805	-0.065
Hydro peak load	-0.372	-0.858	-0.404
Oil peak load	-0.095	-0.888	-1.111
Solar peak load	-0.022	-0.898	-0.491

The highest decline in output will be in Canada because, as shown in the figure above, its exports to the U.S. far exceed its imports. However as shown by the table above coal, gas and oil outputs in the U.S. increase marginally perhaps to meet domestic demand for energy. There is a slight decline in the production of gas peak load in the U.S., as Mexico is its major market, especially because of the recent improvements in the infrastructure for selling piped gas from the U.S. to Mexico. Even output of renewable energy is expected to decline marginally showing that trade in the region in renewable energy

[23] Source: http://energytomorrow.org/blog/2017/03/07/north-american-energy-fosters-growth-sec

is important, especially for hydroelectricity. In fact, trade between the U.S. and Canada for hydropower and equipment began as early as 1901. In terms of dollars, the total loss to Canada aggregates to around USD 490 million, while the U.S. and Mexico gain by USD 346 million and 128 million, respectively. On the question of emissions, the three NAFTA countries exhibit significant differences. Emissions in Canada reduce by roughly 0.5 per cent whereas the U.S. and Mexico see a reduction of roughly 0.01 and 0.26 per cent respectively.[24]

Table 6. Aggregate Effects on Trade in the Electricity Sector

Country	Output	Imports	Exports
Canada	- 0.64	- 2.18	- 1.31
USA	- 0.20	- 1.70	- 1.04
Mexico	- 0.16	- 0.97	- 0.22

While these figures may appear small, more than 10 per cent of NAFTA trade is in energy products, and there are more than 100 cross-border energy infrastructure projects in place between the three economies.[25] Around 20 per cent of Canada's exports to the U.S. are in energy and electricity. This implies that the indirect and direct effects of a 20 per cent increase in NAFTA tariffs could be high. For the first time since the 1940s the U.S. is likely to be an energy exporter, Canada is among the top-five energy producers and Mexico's reforms have attracted private investment, putting it on the path to self-sufficiency. Hence the NAFTA region has become a key player in the world energy market.

Table 7. Employment Effects for Unskilled labour in the Electricity Sector (in per cent)

Product	USA	Canada	Mexico
Electricity: Transmission and Distribution	-0.104	-0.334	-1.079
Nuclear base load	-0.055	-1.11	-0.484
Coal base load	0.035	-1.162	-0.946
Gas base load	0.073	-0.065	-1.602
Wind base load	-0.016	-1.032	0.022
Hydro base load	-1.11	-0.418	0.521
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Hydro peak load	-0.372	-0.858	-0.404
Oil peak load	-0.095	-0.888	-1.111
Solar peak load	-0.022	-0.898	-0.491

However, when it comes to absolute numbers in terms of employment, the U.S. and Mexico would lose much more than Canada. U.S. would lose nearly 600,000 jobs in the energy sector versus 120,000 in Canada and 260,000 in Mexico. In the gas sector too, the U.S. would lose over 100,000 jobs versus 26,000 in Mexico and 10,000 in Canada.

[24] GTAP exercise carried out for this paper.
[25] https://www.americanchemistry.com/Media/PressReleasesTranscripts/RelatedPDF/Joint-Statement-by-ACC-CIAC-and-ANIQ-on-NAFTA.pdf

So if tariffs, while important, are not a significant challenge to energy integration in the NAFTA region, what are the main non-tariff barriers? First and foremost are the infrastructural challenges. For geographical reasons, there are two significant bilateral centres of trade: one between the U.S. and Canada and the other between the U.S. and Mexico. There is little energy trade between Canada and Mexico. While the transmission lines between Canada and the U.S. are well integrated for electricity, those between Mexico and U.S. are less so. The region as a whole would become surplus producers of oil and gas, but there are no piped networks to convey the surplus to common ports or ports with a large handling capacity. Most of the pipelines flow north to south and not east to west or vice versa. In addition to the challenge of getting crude oil to ports, the ports themselves will require massive investments. In addition, the region as a whole would need to look for markets in Europe and China. Further gas surplus may need to be converted to LNG for export, or truck fleets may need to use gas and this may need infrastructural investments. In addition, there is the issue of infrastructure security, both physical and cybersecurity. The energy sector is particularly vulnerable to threats from terrorist, to generation and refining facilities, as well as pipeline theft. In addition, the severe weather in North America requires constant attention to shared infrastructural facilities.[26]

Paucity of human capital is emerging as an important challenge in this sector. Developing regional schemes for both university and technical qualifications, and facilitating internship arrangements across the North American region would be of great importance.[27]

Table 8. Employment Effects on Skilled Labour (in per cent terms)

Product	USA	Canada	Mexico
Electricity: Transmission and Distribution	-0.104	-0.334	-1.079
Nuclear base load	-0.055	-1.11	-0.484
Coal base load	0.035	-1.162	-0.946
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Hydro base load	-1.11	-0.418	0.521
Oil base load	0.008	-0.029	-1.354
Other base load	0.065	-0.953	-0.596
Gas peak load	-0.048	-0.805	-0.065
Hydro peak load	-0.372	-0.858	-0.404
Oil peak load	-0.095	-0.888	-1.111
Solar peak load	-0.022	-0.898	-0.491

As can be seen in Table 8, there is a loss of skills in all countries. The sectors for each country differ, the highest is in hydro in the U.S., in nuclear in Canada and in the oil and gas sector in Mexico. This indicates the trade dependence in the respective sectors in the three countries and also the investment trends. For example, Canadian investment in the hydro sector in the U.S., U.S. investment in the nuclear sector in Canada, and U.S. investment in the oil and gas in Mexico have all lead to the development of skills. As this investment was mostly for cross border trade, renegotiation of NAFTA would have a chilling effect on such investment.

[26] Wood, D. (2014). *Integrating North American energy markets: A call for action*. Wilson Centre, Mexico Institute. Retrieved from https://www.wilsoncenter.org/sites/default/files/Integrating%20North%20America's%20Energy%20Markets.pdf

[27] Ibid.

The energy outlook in North America is fundamentally different today than when NAFTA was first negotiated. Mexico has carried out major reforms by opening its state-owned electricity utility firm to competition, spurring investment and increased efficiencies. Technological advancements have lowered prices and brought the region to complete energy independence and even energy surplus. A truly integrated market could boost the competitiveness of the region as a whole as low energy prices would give the region a strategic comparative advantage. Thus, renegotiations in NAFTA should not increase tariff rates in this sector, but to the contrary include provisions that tackle non-tariff barriers in this sector. This would move North America to an integrated market with the most efficient and least expensive energy in the world. Thus even if NAFTA is renegotiated, there is likely to be a carve-out for the energy sector. In this case, renegotiations should include issues such as regulatory convergence, standards, infrastructural projects and other issues that will facilitate and improve the conditions of trade in this sector.

III. Steel, Cement and Auto Sector

NAFTA led to an integration of the supply chains in the automobile industry and its parts between the U.S., Canada and Mexico. This in turn generated a demand for steel.[28] The rules of origin (ROO) for motor vehicles in NAFTA required 62.5 per cent regional value content for a vehicle to be eligible for duty free treatment.[29] Thus in 2014, 87 per cent of total U.S. exports of steel products went to Canada or Mexico.

Table 9. Tariffs on Steel Mill Products by Trade Agreement and Partner Country or Group[30]

Trade agreement and partner country group	Ad valorem equivalent range before agreement	Ad valorem equivalent range during implementation	Ad valorem equivalent range after implementation
NAFTA	**1993**	**1995**	**2004**
U.S. tariffs on Canadian and Mexican goods	0.40–10.6	0.20-8.6	0
Canadian tariffs on U.S. goods	0.04–6.20	0.04–1.2	0
Mexican tariffs on U.S. goods	5.0–15	2.0–12.5	0
Uruguay Round	**1994**	**1995**	**2005**
U.S. tariffs on URA partners' goods	0.40–12.5	0.20–11.2	0
URA partners' tariffs on U.S. goods	0.19–12.5	0.49–11.3	0

Despite the parity of tariffs between NAFTA and the Uruguay Round tariff reductions, steel exports from the U.S. only increased to the NAFTA region. This is because there is a global oversupply of steel, and China has become an important player in the market. Depressed prices globally as well as non-tariff barriers such as widespread use of anti-dumping and safeguard measures have inhibited global trade. Small changes in domestic demand in China for steel imply huge exports from China, thus leading to a slump in global markets. On the other hand, NAFTA provides ideal conditions and ideal rules for the export of U.S. steel to Canada and Mexico. There are also small volumes of steel exports from Canada and Mexico to the U.S. and each other, but 70 per cent of the U.S. exports of steel go to the NAFTA region.

[28] USITC hearing transcript, November 17, 2015, 160–162 (testimony of Kevin Dempsey, AISI).
[29] NAFTA, Chapter 4, Article 403, Paragraph 5; SMA, written submission to the USITC, November 4, 2015, 5.
[30] Source: USITC DataWeb/USDOC (December 30, 2015); UNCTAD TRAINS (via the World Integrated Trade Solution (WITS)) (accessed October 20, 2015) as shown in USITC, 2016, Investigation number 332-355, p. 190.

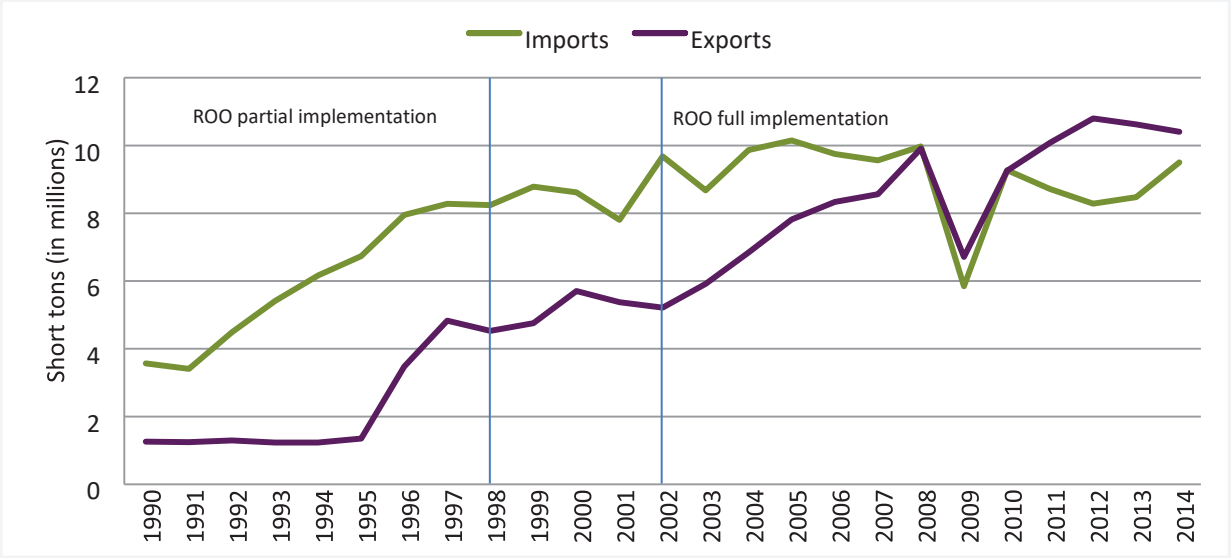

Figure 3. U.S. Steel Mill Products Trade with NAFTA (Canada and Mexico), 1990–2014[31]

Note: Imports are imports for consumption and exports are domestic exports. Steel mill products include the following HS numbers: 7206.10–7301.10, 7302.10–7302.90, and 7304.10–7306.90.

Since January 2015, due to substantial overcapacity globally, the NAFTA region has also suffered. Employment in the steel industry in the U.S. declined by 14,500 workers. Multiple U.S. steel plants like AK Steel Ashland Works (Kentucky), U.S. Steel Granite City Works (Illinois) and pipe/tube mills in Texas, Ohio and Alabama were shut down after January 2015. Two major Canadian steel producers, Essar Steel Algoma and U.S. Steel Canada, have had to declare bankruptcy. In Mexico, too, there has been a 10 per cent decline in employment since 2015 and capacity utilization was below 70 per cent in 2015–16.[32]

The important question is what happens if NAFTA tariffs increase by 20 per cent for the steel industry in North America. As can be seen above, tariffs should have little impact. However a change in the ROO in the auto sector, as well as NTBs, would impact the NAFTA region if NAFTA were to be renegotiated. Further the interlinkages between the steel, auto and appliances industry are likely to have effects on all parameters in the NAFTA region. It is therefore necessary to examine trade, output and employment effects in the steel industry along with the effects on the auto industry, because, as said earlier, 70 per cent of North American steel is destined for the auto industry. To get an integrated picture, as explained above, a CGE model using a GTAP database was used. The picture in terms of output that emerged in the key sectors is shown below. The most affected country in terms of decline in output appears to be Canada. However in terms of reduction of output, given the huge base of production of the U.S., steel output would fall by about 16,000 metric tons in both countries.[33] In Mexico, the fall is expected to be a little higher. However as shown below, the employment multiplier is different for all countries, and, hence, each country would experience different levels of employment.

[31] Source: USITC DataWeb/USDOC (accessed May 5, 2016); NAFTA, Chapter 4, Article 403, Paragraph 5. Corresponds to appendix table I.19,
[32] Power point presentation, 2016, *Recent Developments in the NAFTA Steel Industry*, OECD Steel Committee Meeting, Paris, September 9, 2016
[33] Ibid.

Table 10. Output Effects of Increasing NAFTA Tariffs by 20 Per Cent (in per cent terms)

Output	Canada	USA	Mexico
Cement	-1.25	-0.10	-0.38
Steel	-1.67	-0.15	-0.97
Auto	-0.93	-0.08	-0.44

In the auto sector, the U.S. produced roughly 12 million small vehicles in 2016, followed by Mexico's 4 million and Canada's 2 million. This would translate to a reduction of roughly 18,600 vehicles in Canada, 9,600 in the U.S. and 17,600 in Mexico. This trend can be explained by the fact that both Canada and Mexico's domestic sales of vehicles is less 20 per cent of its total production. For Canada, it is even lower at around 12 per cent. Both these countries export most of their small vehicles to U.S., as this was facilitated by NAFTA.[34] However the picture changes completely when it comes to automobile parts, as the U.S. is the major exporter to Canada and Mexico. The imported content from the U.S. of vehicles exported to the U.S. are roughly 25 per cent and 40 per cent for Canada and Mexico respectively.[35] Thus, if retaliatory tariffs were imposed on these goods, the U.S. would be a net loser with significant losses of output in a number of sectors ranging from plastic products, semiconductors and other electronic components, electrical equipment and components, general purpose machinery, and computer equipment. All these products are used in the auto sector. In principle, both Mexico and Canada could import auto parts from China and India if the ROO were lifted.

Table 11. Import Effects of Increasing Tariffs by 20 Per Cent (in per cent terms)

Imports	Canada	USA	Mexico
Cement	-3.99	-1.39	-4.34
Steel	-3.29	-1.10	-3.37
Auto	-2.96	-0.87	-3.44

Again it is interesting to see that imports to the U.S. from Mexico and Canada decline by smaller percentages than that of Canada and Mexico. In the case of Mexico, the decline is much higher than either Canada or the U.S. Moreover, U.S. imports are much higher in magnitude than those of Canada and Mexico. Hence, small changes in percentages would result in large changes in volumes. For both Mexico and Canada, a large portion of imports are inputs for export to the U.S., hence when exports fall so will imports. Cement and steel are important inputs to shale gas and oil production in the NAFTA region. Hence the markets for cement, steel and energy are integrated.

Table 12. Exports Effects of Increasing NAFTA Tariffs by 20 Per Cent (in per cent terms)

Exports	Canada	USA	Mexico
Cement	-5.24	-2.42	-3.15
Steel	-6.28	-1.81	-4.36
Auto	-2.87	-1.31	-0.84

[34] Centre for Automotive Research (CAR). (2017, January). *NAFTA briefing: Trade benefits to the automotive industry and potential consequences of withdrawal from the agreement.* Retrieved from http://www.cargroup.org/wp-content/uploads/2017/01/nafta_briefing_january_2017_public_version-final.pdf

[35] Ibid.

For all products listed here, Canada shows a much higher decline in exports than either the U.S. or Mexico. Interestingly, the decline in U.S. exports is higher than its decline in imports, reflecting the integrated supply chain in the region. Thus, eliminating NAFTA tariffs is unlikely to improve the trade balance of the United States, as its exports are likely to decline more than its imports. A decline in Canada's exports indicates that NAFTA conditions such as ROO were advantageous to its exports. For steel, Canada exported mostly to Mexico and, as the increase in tariffs in Mexico would imply an erosion of NAFTA benefits, these declines in exports are understandable. In fact, Mexico's Cemex is the largest producer of cement in North America, but as it has subsidiaries in the U.S., its exports are not affected as much as Canada. Canada's domestic cement market is already crumbling under the weight of regulations on climate change. Losing U.S. markets will be a further blow to the industry. Currently, Canada is the largest exporter of cement to North America, hence the loss in exports is significant. U.S. on the other hand is a net importer of cement.[36] Given the large exports of small cars from Mexico to the U.S., the small decline in exports upon NAFTA renegotiation is a little surprising. However, Mexico has emerged as a hub for small cars, with investment from global players such as Japan and Germany. Hence its exports outside the NAFTA region has grown and is expected to be over 60 per cent by 2018.[37] Thus, the impact of renegotiating NAFTA will not be as high on Mexico as it would have been at the turn of this decade. It is also unlikely that Mexican investments would relocate to the U.S. as the U.S. has near full capacity utilization in the small car sector.[38] As Canada is more dependent on the U.S. for its small car exports, the reduction in its exports are higher, as shown here.

Employment follows the same trend as output. Post-NAFTA renegotiation, prices in these sectors also change. In keeping with output changes, the highest effects are on Canada followed by Mexico. The lowest percentage employment changes are observed in the U.S. However, in absolute numbers, the U.S. would displace 1.2 million unskilled workers in the cement sector, Mexico 0.7 million and Canada's decline would be about 93,000 workers. In the auto sector, roughly 63,000 people would be unemployed in Canada, 0.7 million in the U.S. and 0.5 million in Mexico. In the steel sector, roughly 30,000 people would become redundant in Canada versus 0.5 million in the U.S. and 0.7 million in Mexico. Thus, while relatively speaking Canada is worse off from NAFTA renegotiation, in terms of actual output, trade and employment in the U.S. and Mexico would suffer greater losses. As far as skilled workers are concerned, in absolute numbers both Canada and the Mexico lose 0.1 million workers, whereas the U.S. loses roughly 0.8 million skilled workers in the cement industry. In the steel industry too, the same story is repeated. Canada loses 45,000, Mexico 35,000, whereas the U.S. loses 0.2 million skilled workers in the steel industry. As far as the auto industry is concerned U.S. loses (0.3 million) thrice the number of skilled workers in comparison to Canada (0.1 million) and Mexico (0.1 million), though far lower than either steel or cement.

In the cement and auto sectors there are minor price decreases, whereas in the steel sector there is a slight price increase in all three countries. These changes indicate that cheaper imports of cement from China and India would replace trade in cement in the NAFTA region. In the case of steel trade, logistic cost appears to be high, thus costs may rise marginally. For autos, again cheaper imports from the rest of the world would depress prices. Thus the price effects of renegotiating NAFTA are not expected to be significant.

[36] Ad Lighthart, Intercem Shipping Americas, Cement Distribution Consultants. (2016, June 13). *North American cement trade flows: A detailed overview of export sources, shipping methods, import facilities and domestic distribution*. Retrieved from https://cementdistribution.com/wp-content/uploads/2016/10/north_american_cement_trade_flows.pdf

[37] CAR, 2017, op.cit

[38] Op.cit

Advanced manufacturing in many areas of the U.S. depend on intermediate imports from Canada and Mexico. Michigan's auto industry imports 61 per cent of its total intermediate imports from Canada and Mexico.[39] These include products such as motor vehicle seats, ignitions, wires and other parts. Apart from Michigan, Ohio and Indiana also import nearly USD 3 billion and USD 2 billion worth of auto parts respectively from Canada. In the southern belt, Texas imports nearly USD 6 billion worth of auto parts from Mexico; Tennessee imports USD 2 billion and Kentucky USD 1.6 billion from Canada.[40]

While the auto industry is the most integrated in the NAFTA region, an aerospace supply chain is emerging too.[41]

Table 13. Employment and Price Effects of Renegotiating NAFTA (in per cent terms)

Sector	Type of employment/prices	Canada	USA	Mexico
Cement	Unskilled	-2.14	-0.13	-0.1
Cement	Skilled	-2.19	-0.14	-0.14
Cement	Prices	-0.17	-0.05	0.06
Steel	Unskilled	-7.44	-1.7	-2.7
Steel	Skilled	-7.49	-1.4	-2.49
Steel	Prices	0.42	0.08	0.38
Auto	Unskilled	-0.14	-0.06	-0.11
Auto	Skilled	-0.08	-0.07	-0.07
Auto	Prices	-0.13	-0.04	-0.08

The employment multipliers in the auto sector appear to be the lowest in all three countries, but is far lower in Canada in the skilled employment sector than in U.S. This indicates that the assembly of cars in Canada is relatively more capital intensive than the U.S. complaints about U.S. and Canadian auto jobs leaving for Mexico may be less justified, as mechanization and global slowdown in the auto industry in the NAFTA era may be more responsible for job losses. Today there are fewer automotive industry jobs than there were when NAFTA was negotiated three decades ago. As Mexico is already becoming a hub for small cars, employment effects may be small as there may simply be a trade diversion to other markets in Latin America and even Asia.

The only sector that sees larger employment decline in all three countries is the steel sector. This is because intra-NAFTA trade in steel accounts for over 70 per cent of the steel production and an equal amount is destined for the auto industry. Hence, steel would be the most affected industry in terms of output and employment, as its linkages with other industries is very high. Again, this is a relatively labour-intensive industry, and hence its employment multiplier tends to be almost as high as cement. A slight rise in prices is only observed in this industry for reasons listed above. Overall, the effects on employment in the first two sectors would be felt more strongly than in the auto sector, which appears to be a contentious sector in NAFTA. While these results may appear counter-intuitive, the auto sector is so well

39 Parilla, J. (2017, March 30). How US states rely on NAFTA supply chain. Retrieved from https://www.brookings.edu/blog/the-avenue/2017/03/30/how-u-s-states-rely-on-the-nafta-supply-chain/

40 Ibid.

41 Ibid. "Washington—led by the Seattle-Tacoma area—imports more than $1 billion annually from Canadian aerospace suppliers. Kansas—where aerospace manufacturing anchors the Wichita metro economy—receives at least $700 million annually in North American-sourced aircraft component parts. Arizona imports nearly $300 million worth of turbojets and turbopropellers from Mexico to supply its aerospace manufacturing base. In 2016, U.S. aerospace exports totaled nearly $147 billion overall."

integrated in the NAFTA region that tariff changes by themselves may be less important than changes in ROO. However, given the overproduction of steel in the global economy, even small changes in tariffs will give an edge to players outside the NAFTA region. In the case of cement, the consumption growth centres are outside the NAFTA region, except for the U.S., where domestic consumption far outpaces production. Hence, the North American industry, which is already experiencing a slowdown, is expected to experience further losses, especially in Canada and Mexico. Thus CGE is able to provide us with a comprehensive picture of not only NAFTA but also the effects of the changes in the global economy once NAFTA is renegotiated.

IV. Competiveness Issues Related to Carbon Prices in Canada and Mexico

Carbon pricing is expected to affect competitiveness negatively, but it is projected to be limited to some industries.[42] However, trade competitiveness depends on several other factors, such as exchange rates, labour costs, taxation and the rate of technological innovation, hence to isolate the effects of carbon taxes is not an easy task.[43] Industries that are not emissions-intensive and not trade-exposed (non-EITE), such as services, some light manufacturing industries, construction, wholesale retail trade, pulp and paper are likely to remain competitive.[44] Some may actually experience slight gains such as electricity generation, office machinery and equipment.[45] However, EITE industries such as industrial non-ferrous smelting, natural gas, refined oil, crude oil and gas are expected to face significant competitiveness impacts.[46]

Most of Canada's economic output is from industries where energy costs are less than 2 per cent, and those with greater than 5 per cent account for only 12 per cent of its GDP.[47] Exports such as coal, natural gas and other mineral mining likely to be negatively affected by carbon pricing will be outweighed by gains in sectors such as agriculture and metal smelting. Among imports with a BTA, coal, natural gas and other mineral mining are expected to be negatively affected, while other industries may be unaffected.[48] However, these effects may be of limited duration, as it is likely that other NAFTA countries would impose retaliatory taxes of other kinds should Canada impose carbon taxes at the border.

Competitiveness Effects on Ontario Industries

As shown below in Figure 4, in Ontario, EITE industries contribute 15 per cent to the province's economy.[49] With a CAD 40/tonne CO_2 emissions carbon pricing, the overall output is expected to decline by 0.22 per cent.[50] However, a large number of sectors such as services, construction, agriculture and forestry, food, other manufacturing, pulp and paper, fabricated metal products, electronics, vehicles and parts, hydro and nuclear, and renewable energy are expected to grow. Hydro and nuclear and renewable electricity are likely to grow by 12 per cent and 58 per cent respectively. Most significant decreases in productivity are expected in fossil electricity, cement and lime, and petroleum.[51]

[42] Sustainable Prosperity. *The competitiveness of a trading nation.* (Sustainable Prosperity, 2011). Retrieved from http://sustainableprosperity.ca/article1041

[43] Sawyer, D. (2013). *Sustainable prosperity | Carbon exposed or carbon advantaged? Thinking about competitiveness in carbon-constrained markets.* (2013). Retrieved from http://www.sustainableprosperity.ca/dl949&display

[44] Ibid.

[45] Ibid.

[46] Ibid.

[47] Sustainable Prosperity. (2013). *Sustainable Prosperity Submission. Consultation on Greenhouse Gas Emissions Reductions Program Design 2013.* Retrieved from http://www.sustainableprosperity.ca/dl984&display

[48] Ibid.

[49] Sawyer, D., (2013), op.cit

[50] Rivers, N. (2010). Impacts of climate policy on the competitiveness of Canadian industry: How big and how to mitigate? *Energy Econ. 32*, 1092–1104.

[51] Ibid.

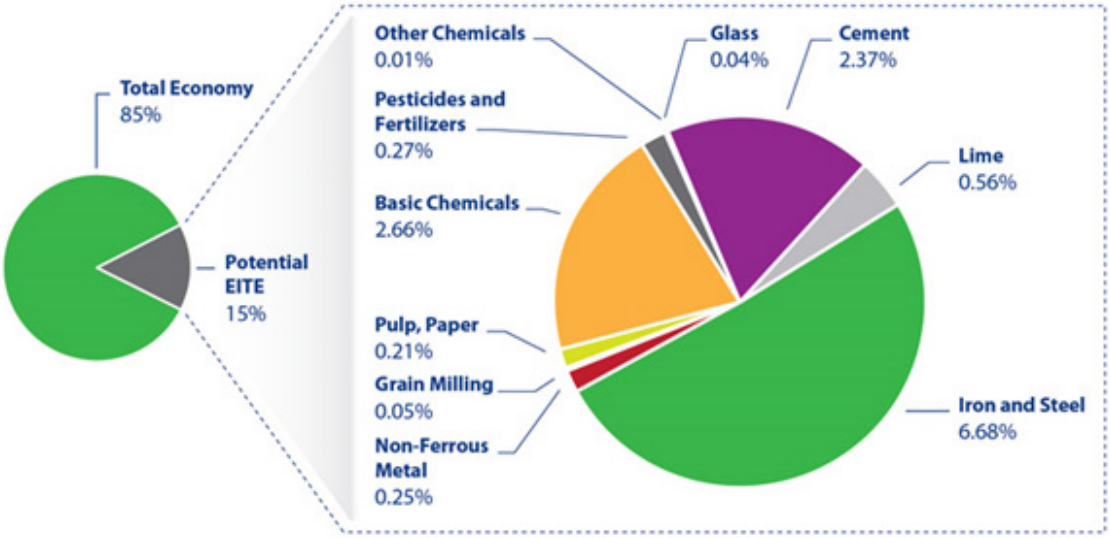

Figure 4. EITE industries in Ontario's Economy[52]

Impact of Carbon Pricing on Different Ontario Sectors' Ability to Compete in North America

With carbon pricing, 88 per cent of goods traded sector would have an improved ability to compete in North America. These sectors include food, mining, chemicals, vehicles and parts, electronics, pulp and paper and electricity. The sectors that would have a decreased ability to compete are cement and lime, petroleum products and metals.[53]

Competiveness Effects on Mexico

A study from Mexico has examined the effects of emission cuts of 40 per cent in 2030 and 50 per cent in 2050, as compared with the baseline of 2000 levels. This requires carbon tax to reach USD 100 in 2030 and USD 700 in 2050. But the study found that these emission levels could only be achieved with very high economic costs, where GDP dropped by approximately 8 per cent after 2040 in comparison with the reference scenario.[54]

The model used to show these changes was a CGE model, which used an updated sectorial and aggregated national accounts data. The model was calibrated for 24 commodities—including three energy sources—and 32 sectors, with an explicit distinction between 11 energy sectors and seven transport sectors. Electricity production was disaggregated into nine technologies: hydro, geothermal, wind, solar, biomass, nuclear, coal-based, oil-based and gas-based. The level of the carbon tax was endogenously computed to meet national emissions reduction targets, as stated in the Mexican Climate Change Law.

[52] Sustainable Prosperity. (2013, January). *Carbon exposed or carbon advantaged? Thinking about competitiveness in carbon-constrained markets.* Policy brief. Retrieved from http://www.sustainableprosperity.ca/sites/default/files/publications/files/Carbon%20Exposed%20or%20Carbon%20Advantaged.pdf

[53] Sawyer, D., 2013, op.cit

[54] Cortés et al., (n.d.). *Transiting to a low-carbon economy in Mexico: An application of the ThreeME model.* Retrieved from http://climate.blue/download/Final%20Report_Mexico_ThreeMe(3).pdf

This scenario changes if carbon taxes are implemented in a revenue-neutral way. For instance, with a full redistribution of carbon tax revenues among consumers (through reducing household income taxes) and producers (through compensating for social security payroll taxes), economic consequences do not appear to be quite so severe. There are beneficial effects on GDP and carbon emissions. With respect to the no-redistribution scenario, gains on the latter feature are slightly lower (72 per cent versus 75 per cent decrease in emissions, respectively) because of rebound effects: increased economic activity from redistribution leads to enhanced production and consumption, which ultimately drive energy use.

Sensitivity tests showed that CO_2 emissions reduction is low when the elasticity of substitution between capital and energy is constant (in absence of endogenous energy efficiency) and when the elasticity of substitution across types of commodities is low. Moreover, the economic gains from the tax crucially depend on the inflationary pressure resulting from the taxation policy (and therefore on the wage setting process) and on the responsiveness of Mexico's economy to foreign competition. Thus in the NAFTA region, setting a BTA would positively impact some sectors and negatively impact others.

GTAP Simulation Exercise

Given this background of carbon pricing and BTAs, the simulations for this paper included a 20 per cent tax on imports from the U.S. and a subsidy of 20 per cent on Canadian and Mexican exports. While a range of sectors was examined, this paper will focus on a few EITE and a few non-EITE sectors only. As far as the overall GDP effects are concerned, both Canada and the U.S. see some reductions, and Mexico very little. This indicates the integrated supply chain between Canada and U.S. for most EITE sectors and the significance of two-way trade in energy as shown in Figure 2. Further, steel and cement constitute roughly half the total output in the EITE sector in Ontario, as shown in Figure 5. As was shown earlier, increasing tariff rates by 20 per cent would have a significant impact on the output of these two industries in Canada, which in turn is dependent to a large extent on its exports to the U.S. As inputs to these two industries come from the U.S., a 20 per cent subsidy will be outweighed by the fact that the duty on these products cannot be deducted in the case of a BTA. Further, an increase in tariffs on imports of intermediate products will make exports less competitive.

However in welfare terms, it is interesting to see that of the U.S. decreasing by much more than Canada. Mexico actually would experience an improvement in its welfare. It is likely that producer welfare would reduce in the U.S. as exports from the U.S. decrease. As Mexico mostly imports EITE products from the U.S., its welfare is likely to rise with a BTA.

Table 14. GDP Effects of a BTA

GDP	% change	Change in millions of USD	Welfare in millions of USD
USA	-0.01	-2213	-5363
Canada	-0.07	-1258.88	-650
Mexico	-0.01	-59.25	942

The sectoral effects are most widely felt in the electricity transmission and distribution sector, though the effects are small. Here, the highest effects are felt on Mexico in overall terms. This is because, as explained in Section 2, Mexico is highly dependent on U.S. imports of shale gas for its generation of electricity. Thus, as imports become more expensive, its own output is likely to fall.

Table 15. Output Effects of BTA in Per Cent Terms

	USA	Canada	Mexico
Electricity: Transmission and Distribution	-0.085	-0.47	-1.12
Nuclear base load	-0.067	-0.752	-0.159
Coal base load	0.067	-1.23	-1.014
Gas base load	0.158	-0.086	-1.652
Wind base load	-0.042	-0.711	0.114
Hydro base load	-1.147	-0.674	0.336
Oil base load	-0.018	-0.047	-1.166
Other base load	0.143	-1.073	-0.493
Gas peak load	-0.028	-0.88	-0.083
Hydro peak load	-0.366	-1.069	-0.392
Oil peak load	-0.022	-0.923	-1.157
Solar peak load	-0.068	-0.467	-0.566

This is especially true for its gas and oil-based electricity as these are imported from the U.S. For the U.S. specifically, the output of hydro is likely to fall as its exports to Canada decline. For Canada too there is a slight decline in coal and other base load as well as peak loads, as these are imported from the U.S. Employment follows the decline in output with higher decline in both skilled and unskilled employment in Mexico, followed by the U.S. But all declines are marginal as is the output decline.

Paradoxically, output and employment in the steel and cement sectors fall by far higher percentages in Canada and Mexico than that in the U.S. This shows the high dependence of these two economies on imported inputs from the U.S. In the case of Mexico, the largest firm in North America is Cemex, which produces cement in the U.S. for domestic consumption. Thus output in the U.S. does not fall, but that in Mexico and Canada does. As Canada exports most of its cement to the U.S. and Canada, and the industry is already suffering because of environmental law BTA would not help this industry.

Table 16. Effects of BTA on Output (in per cent changes)

Product	USA	Canada	Mexico
Paddy rice	0.073	0.389	0.085
Wheat	0.032	0.809	0.144
Cereal grains nec	-0.007	0.338	0.072
Vegetables, fruit, nuts	0.018	0.394	0.035
Oil seeds	0.045	0.642	0.058
Sugar cane, sugar beet	-0.014	-0.083	0.083
Plant-based fibers	0.097	-0.062	0.142
Crops nec	0.076	0.426	0.084
Cattle,sheep,goats,horses	-0.026	0.349	0.05
Animal products nec	-0.011	0.509	0.082
Raw milk	-0.019	0.094	0.107
Wool	0.273	0.039	0.494
Fresh vegetables and fruit	-0.019	0.469	0.164
Fish	0.003	0.13	0.047
coal	0.032	0.164	-0.057
Oil	0.013	0.173	0.044
Gas	-0.002	0.155	-0.019
Minerals nec	0.001	0.099	-0.302
Meat: cattle,sheep,goats,horse	-0.024	0.302	0.121
Meat products nec	-0.013	1.004	0.128
Vegetable oils and fats	0.03	0.827	0.1
Dairy products	-0.016	0.093	0.111
Processed rice	0.041	0.032	0.054
Sugar	-0.013	0.317	0.134
Food products nec	-0.024	0.332	0.088
Beverages and tobacco products	-0.028	0.081	0.076
Textiles	0.044	0.838	0.382
Wearing apparel	0.034	0.571	0.233
Leather products	0.136	0.915	0.201
Wood products	-0.074	0.647	0.22
Paper products, publishing	-0.02	0.493	0.087
Petroleum, coal products	-0.006	-0.277	-0.137
cement	0.16	-2.923	-1.023
Mineral products nec	-0.027	-0.159	0.064
Steel	1.084	-13.031	-6.46
Metals nec	0.038	1.487	0.522
Metal products	-0.099	0.105	0.241
Auto	-0.098	0.602	0.203
Transport equipment nec	0.051	1.688	0.232

Product	USA	Canada	Mexico
Electronic equipment	0.068	1.245	0.669
Machinery and equipment nec	-0.002	1.177	0.381
Manufactures nec	0.039	0.284	0.251
Electricity	-0.123	-0.699	-0.613
Gas manufacture, distribution	0.036	-0.235	-0.673
Water	-0.005	-0.06	-0.127
Construction	-0.082	-0.387	-0.08
Trade	-0.023	-0.082	0.009
Transport nec	0.015	-0.09	0.052
Sea transport	0.013	0.333	0.01
Air transport	0.01	0.265	0.092
Communication	-0.016	0.089	0.087
Financial services nec	-0.012	0.079	0.072
Insurance	-0.015	0.29	0.14
Business services nec	0.002	0.085	0.01
Recreation and other services	-0.027	0.186	0.091
PubAdmin/Defence/Health/Educat	-0.029	0.015	0.104
Dwellings	-0.023	0.069	0.129

As a result of the BTA, the U.S. sees a fall in its output in several agricultural products, such as sugar and sugarcane, milk and dairy products, cereals, meat and cattle, fresh vegetables and fruits. While the decline is not significant for any product, as shown above, it adds up to over USD 2 billion in output terms and over USD 5 billion in welfare terms. The big losses for Canada are in the steel sector where its output declines by some 13 per cent; for Mexico, it declines by 6.5 per cent. These losses will probably occur because of higher import prices of inputs and steel rods, which are finished for final use in Canada and Mexico. The U.S. would increase its output marginally perhaps for domestic use in appliance sectors and the auto sector. The auto sector registers minor losses in the U.S. and gains in Canada and Mexico. Another surprise is the small losses in output in a number of service sectors in the U.S., with slight gains in Canada and Mexico. This is probably because these services are embedded in the products exported by the U.S. to the NAFTA countries. When import declines because of BTA, so do these services, as they are substituted by domestic services in Canada and Mexico.

Employment follows output trends with minor losses in several agriculture products for the U.S., and large losses for Canada and Mexico in the steel and the cement sectors. The price effect of these changes is important. Land and natural resources will become more expensive by small margins of 1 to 2 per cent in Canada and the U.S., whereas Mexico sees a small fall in the price of natural resources. Capital becomes marginally cheaper in all three countries reflecting the lowered demand for it. However, none of these changes is significant. Prices of almost all traded products fall in all three countries but the fall is marginal. As expected, the fall is more significant in Canada and Mexico, as their trade dependence and integration with the U.S. economy are far more significant than that of the U.S. with them. Overall, a BTA would be beneficial in a broader sense for Mexico, would hurt the U.S. the most, but would not leave Canada unaffected.

Table 17. Employment and Wage Effects of BTA (in per cent terms)

Employment and Wages	USA	Canada	Mexico
UnSkLab	-0.014	-0.108	-0.028
Wages of unSklab	-0.052	-0.416	-0.126
SkLab	-0.015	-0.079	0.014
Wages of sklab	-0.054	-0.416	-0.126

Overall employment follows the trend of output effects, but the effects on Canada are relatively higher here. Given that wages in Canada are lower than in the U.S., this effect will be even stronger, though all in all the effects are marginal at best. The effects on Mexico are far lower, pointing to lower trade volumes between Mexico and the U.S. in EITE products. These overall results show that Mexico may be better off than Canada with a BTA, but the U.S. will be the worst affected in terms of competitiveness as comparator countries, especially Canada, will experience higher wage decline making it even more competitive.

Thus border adjustments of carbon taxes have to be carefully thought out because of the integrated nature of the supply chains between the NAFTA countries, especially for EITE products. It is possible that losses in terms of output and employment would be highest in the U.S., and gains for Mexico would be the most, but Canadian economy and employment is also likely to register losses from a BTA.

Conclusions

The paper shows that NAFTA not only increased trade in North America by over 500 per cent in the last 20 years, but that it also built an integrated supply chain for several products in the region. The increased dependence on energy trade amongst the NAFTA countries, as well as the near energy sufficiency, would make North America very competitive in several manufacturing industries in the next decade. Moreover, investment by all the NAFTA partners is the highest among each other. Hence, increasing tariffs or BTAs are policies that have to be examined carefully before implementing them.

This paper has simulated two scenarios. In the first, tariffs across the board were increased by 20 per cent across the NAFTA region. In some cases, this tariff level may be higher than MFN tariffs and in some products less than MFN tariffs. However, in general, for sensitive products such as auto parts and automobiles and steel, it is less than the tariffs being discussed in the U.S. today to bring down its trade deficit.[55] In the case of energy, it is unlikely that such high tariffs would be implemented, but on the other hand Mexico and Canada have warned about a BTA, which would entail a tariff higher than 20 per cent under most calculations.[56]

The second scenario examined in this paper is that of a carbon tax of 20 per cent, which is adjusted at the border by Canada and Mexico on U.S. imports. This translates to an export subsidy of 20 per cent in the case of Canada and Mexico on EITE goods, and a tariff of 20 per cent on similar U.S. goods.[57] As USD is the vehicular currency for trade in North America, it is assumed that there is no exchange rate adjustment and the full extent of the carbon tax is adjusted at the border.

The simulations from the first scenario show that, in an economy-wide sense, Canada will be relatively worst off followed by Mexico and the U.S. However, in absolute terms, the U.S. will lose the most, about USD 3.4 billion in GDP, and USD 5 billion in welfare terms followed by Canada and Mexico. Comparing the losses from increases in NAFTA tariffs with potential gains from NAFTA, the losses appear even more insignificant. Some estimates show that the gains to the U.S. from NAFTA currently stand at USD 127 billion, for Mexico at USD 170 billion and for Canada at about USD 50 billion annually.[58] Each country would suffer about 5 per cent welfare losses, with the lowest welfare loss for Mexico. Thus the gains expected by the U.S. from renegotiating NAFTA are not forthcoming in an economy-wide sense. To the contrary minor losses are expected.

In overall employment terms about 31,000 unskilled workers will be displaced in Mexico followed by 17,000 in the U.S. and 13,000 in Canada. In terms of skilled workers, both the U.S. and Canada would lose roughly 17,000 skilled workers followed by about 10,000 in Mexico. These changes cannot be considered significant by any standards. Manufacturing employment because of mechanization has displaced far more people than trade deals like NAFTA. For example in the U.S., the value added from manufacturing has remained constant at around 12 per cent between 1950 and 2015, but the share of employment in the manufacturing sector has fallen from roughly 31 per cent of the total employment

[55] Ohara, M. (2017, January). Is NAFTA really the culprit behind the US Steel Industry's woes? Retrieved from http://marketrealist.com/2017/01/is-nafta-really-the-culprit-behind-the-us-steel-industrys-woes/

[56] Gale, W. G. (2017, February 7). A quick guide to Border Adjustments Tax. Retrieved from https://www.brookings.edu/opinions/a-quick-guide-to-the-border-adjustments-tax/ ; Hufbauer, G. C. & Lu, A. (2017, January). Border Tax Adjustments: Assessing risks and rewards, Peterson Institute for International Economics. PB 17-3. Retrieved from https://piie.com/publications/policy-briefs/border-tax-adjustments-assessing-risks-and-rewards

[57] Haufbauer and Zhiyao, 2017, op.cit

[58] Scotiabank, Feb 10, 2017, op.cit

to less than 7 per cent in the same period.[59] It is estimated that nearly 5 million jobs were created in North America because of NAFTA.[60] A 20 per cent increase in tariffs across the board would displace a little more than 100,000 workers all over North America. This would amount to 2 per cent of the total employment created by NAFTA and would not be important in any discussion on renegotiating NAFTA.

However, the picture changes completely when it comes to sectoral effects. This paper has focused on four sectors: energy, steel, cement and the auto sector. While GTAP results for a wide range of sectors including agricultural sectors were available and have been reflected in the paper, the focus has been on these four sectors as these are the most traded and integrated in the NAFTA region. Canada, which is by far the largest trader in the North American region, will lose roughly half a billion dollars in terms of output, while U.S. and Mexico would gain an equal amount together as their domestic production would increase. Trade losses would also be most severe for Canada though U.S. would also lose exports to Mexico in the gas sector. However, when it comes to absolute numbers in terms of employment, it is the U.S. and Mexico that would lose much more than Canada. U.S. would lose nearly 600,000 jobs in the energy sector versus 120,000 in Canada and 260,000 in Mexico. In the gas sector too, the U.S. would lose over 100,000 jobs versus 26,000 in Mexico and 10,000 in Canada. Thus job losses in the U.S. would be much higher on account of the larger size of the economy and the huge number of people who are employed in transmission and distribution of electricity. Thus, while energy may be imported from Canada in the border states, it is nevertheless transmission and distribution that is employment intensive.

The trends for steel, cement and auto follow the same path as that of energy. In relative terms, Canada, followed by Mexico, is worse off than the U.S., though in absolute terms it is the U.S. that suffers the largest employment losses. While output losses in the steel sector are not high in all three countries, it is the trade losses and employment losses that are significant. For instance nearly 460,000 people would be displaced in the steel industry in the U.S., followed by 240,000 in Mexico and nearly 75,000 in Canada. Similarly in the cement industry nearly 2 million people will be displaced in the U.S., followed by over 200,000 in Canada and Mexico each. In the auto industry some 800,000 people will be displaced in Mexico, followed by 750,000 in the U.S. and nearly 150,000 in Canada.

Thus overall, while the output and trade effects may not be significant, the employment effects are quite severe. The price effects of some forms of energy will also be felt in the U.S. making it less competitive. Thus NAFTA's energy trade and its future self-sufficiency in cheap energy will further enhance its competitiveness in the next decade. While energy prices in Europe and the rest of the world are rising, cheaper energy will help to shore up its competitiveness, which it is fast losing to East Asia. In fact, NAFTA, through its free trade rules and ROO, has made Canada and the U.S. competitive for trade between each other. Tariff hikes are likely to bring several firms in these countries to the brink of bankruptcy. This paper has used a comparative static model where the assumptions do not allow for technological changes, exchange rate fluctuations, price changes, etc. that are exogenous to the model. If those changes were included, all these effects of tariff hikes would be much more severe.

Coming to a BTA, the largest overall gains are for Mexico, followed by Canada and the U.S. However, as only EITE industries are likely to be affected, the overall changes are smaller than in the case of an overall tariff hike of 20 per cent. However, both countries that would make border adjustments (Canada and Mexico) would lose in terms of output and employment, though not as much as the U.S. As trade

[59] Soctiabank, Feb 10, 2017, op.cit

[60] Wilson, C. (2011). Working together: Economic Ties between US and Mexico. Retrieved from https://www.wilsoncenter.org/publication/working-together-economic-ties-between-the-united-states-and-mexico

between Canada and the U.S. in EITE products is much higher than that between Mexico and the U.S., the loss for Canada would be half as much as that of U.S., while Mexico's would be a quarter as much. Thus, while a BTA would not compensate Canada and Mexico fully for the output, employment, GDP and welfare losses consequent to a tariff hike under NAFTA, it would go at least halfway towards doing so. In the end, whether it is a tariff hike or a BTA, all three NAFTA countries will suffer. The greatest losses, however, will be borne by the U.S., as is shown by recent studies and opinion pieces outlined above.

Annex 1

Global Trade Analysis Project (GTAP) model is a publicly available multi-sectoral, multi-regional Computable General Equilibrium (CGE) model. This has several standard features of a global CGE model such as Constant Elasticity of Substitution (CES) nests for production and trade, a flexible Constant Difference Elasticity (CDE) functional form for consumption, Cobb-Douglas utility function for the aggregate regional household, perfect competition, constant returns to scale, conversion of all global savings into all global investment and Armington assumption to capture product heterogeneity between domestic products and imports as well as amongst imports from different sources. This model is documented at length in Hertel (1997).

We turn now to a discussion of key components of the GTAP model. We define the sets SECT of sectors (indexed by k) and REG of regions (indexed by r in most cases and if the region is the source of exports/imports but by s if the region is destination of exports/imports).

a. International Trade

The change in imports of each region from each of the others is determined by three factors: (i) substitution among different sources, based on the differential between import prices from specific sources and the sum of import-augmented technical change and aggregate import prices *pimkk,s*[61], multiplied by the elasticity of substitution of imports between the sources $\sigma M,k$, which is the Armington elasticity for the sector as in GTAP Data Base, (ii) import-augmenting technical change, amskk,r,s, that lowers the effective price of a good in the destination market, and (iii) the import penetration as captured by change in composite imports of subsector commodity *k, qimkk,s*:

For all sectors k in SECT, regions r and s in REG:

$$xskk,r,s = -amskk,r,s + qimkk,s - \sigma M,k * [pmskk,r,s - amskk,r,s - pimkk,s] \quad \ldots\ldots\ldots\ldots (1a)$$

Global transport margins are treated in the same manner as in the standard GTAP model, with the quantity of international trade, transport and insurance services required as a fixed proportion of the volume of goods shipped. Technical change in this sector is represented with the variable *atmfsdkk,r,s* obtained by adding up the changes at different levels, which are directly translated from the aggregate changes in the corresponding variables. Trade and transport services are provided at a common price, *pt*, which represents a Cobb-Douglas aggregation of trade and transport services exports from all regions in the model. Deducting the rate of technical progress from this price change gives the percentage change in the commodity and route-specific transport margin, *ptranskk,r,s*. The price linkages in the model also include export taxes *txskk,r,s*, export fob prices *pfobkk,r,s*, and import *cif* prices *pcifkk,r,s*. Changes in import tariff and export taxes are the policy variables here.

Given the importance of tariffs in the context of our current paper, we now turn our attention to the channel in which tariffs affect prices, which in turn affect quantities as shown in equation (1a). In this model, we have the per cent change in power of tariffs; power of tariff is defined as (1+rate of tariff). In level terms, as we know, price including tariff is (1+rate of tariff) times the price before tariff. Now per cent change terms work similar to logarithms, and therefore a product in level terms would be a sum in

[61] The substitution effect for a particular flow (*k,r,s*) increases in divergence of import tariff for good k from regions *r* to *s*, from the weighted-average tariff of *s*. Since higher weight means lower divergence, this effect decreases in import-shares of region *r* in the total imports by region *s* of the good *k*.

per cent change terms. Therefore, per cent change in market price of imports after including tariffs is the sum per cent change in CIF prices excluding tariffs and per cent change in power of tariffs (*tmskk,r,s*).

pmskk,r,s = tmskk,r,s + pcifkk,r,s ..... (1b)

b. Domestic Consumption

There are three broad categories of consumption of products and services manufactured in a country: private households, government and firms. In addition, each of these categories of agents also consumes imports that are aggregated across exporters, based on the descriptions in section (a) above. For private households, GTAP assumes CDE (Constant Difference Elasticity) functional form, which is flexible enough to have Linearized Expenditure Systems (LES) and Constant Elasticity of Substitution (CES) as special cases. For government to consume different products and for firms to consume different intermediate inputs, the functional form is CES. There is also a CES nest between domestic and imported products for each of these agents.

c. Domestic Production

Production function in GTAP involves three levels of nests: (1) There is a Leontief function on the topmost part of production system, wherein intermediate inputs as a composite single input and primary factors as another composite single input are complements. (2) Within the intermediate inputs, there is a CES function. (3) Within the primary factor inputs, there is a CES function. With the exception of land and natural resources, which can move only within agricultural and extraction sectors respectively, other factors are mobile across sectors. GTAP-E model, which focuses on energy and environmental aspects, modifies the system above to introduce substitution between energy sectors and capital input, while further introducing substitution (CES) between different types of energy sources to capture channels of emissions reduction.

d. Links between Production, Consumption and International Trade:

The sub-modules explained above are linked with each other. The percentage change in sector-level domestic consumption, *qdmkk,s* , with corresponding price change *pmkk,s*, substitutes for imported subsector goods, *qimkk,s*, with corresponding price change *pimkk,s*. The CES elasticity between these two variables is *σD,k*, and this substitution takes place based on their respective price differentials from the sector-level domestic prices pdkk,s, as illustrated by equations (2) and (3):

For all *k* in SECT and *s* in REG:

qimk(k,s) = qdk(k,s) – σD(k) * [pimk(k,s) - pdk(k,s)] ***..... (2)***

qdmk(k,s) = qdk(k,s) - σD(k) * [pmk(k,s) - pdk(k,s)] ***..... (3)***

Domestic market and import price changes are aggregated to domestic price changes by weighting according to their respective shares. *VDKk,r* is the total value of domestic consumption of goods corresponding to the sub-sector *k* in the region *r,VDMKk,r* is the value of domestic consumption of goods produced by the domestic sector *k* in the region *r* and *VIMKk,s* is the value of imports of goods produced by the sub-sector k to the region *s*.

For all k in *SECT* and s in REG:

pdkk,s =αDk,s *pmkk,s +αMk,s *pimkk,s ..... (4)

where: αDk,s =VDMKk,s /VDKk,s and αMk,s = VIMKk,s /VDKk,s

Finally, the total changes in supply and demand are equalized to ensure equilibrium, by equating the percentage change in total output *qokk,r* with the share-weighted sum of exports and domestic consumption for all sectors *k* in SECT and regions r in REG. When the slack variable *tradslackkk,r,* is exogenized, this equilibrium condition determines the change in market prices, pmkk,r (output, *qokk,r* , is determined by Equation (5).

For all *k* in *SECT* and *r* in REG:

qokk,r= βDk,r*qdmkk,r +ΣsβMk,r,s*qxskk,r,s + tradslackkk,r ..... (5)

Additionally, for this paper, we employ a newly developed special version of GTAP model, named GTAP-POWER model. This is documented in Peters (2016). In this model, there is a substitution between capital and energy products as a composite commodity; there is a multi-level nesting system among different energy products, including both renewable and non-renewable energy. This accounts for substitution among these sources in response to either carbon taxes for cutting emissions or to any other economic and technological policy changes in the economy.

Further to these changes, we made another modification to this model, which enriches the labour supply specification; in the standard GTAP model, we can only assume a horizontal or vertical labour supply curve, whereas in our model, we have defined a labour supply curve for different countries using the estimated labour supply elasticities. This lets us capture a more realistic labour supply situation.

Data Sources

The data source for this paper is GTAP-POWER dataset documented by Peters (2016). This has been developed based on the World Bank dataset on different energy sources, as well as International Energy Agency (IEA) energy balances dataset, on top of the standard GTAP Data Base, which is documented in Narayanan et al (2015). The base year for this dataset is 2011.

Scenarios

We have two scenarios modelled herein:

1. A 20 per cent point increase in the tariffs between the NAFTA countries, for renewable energy sectors, steel, cement and construction.

2. 20 per cent border tax in the U.S., which means a 20 per cent increase in tariffs for imports by the U.S. from Canada and Mexico with a 20 per cent subsidy on exports from the U.S., for renewable energy sectors, steel, cement and construction.

e. Prices, Wages and Employment

In the GTAP model, as in all other CGE models, all of the initial data is in millions of U.S. dollars; there is no break-up between prices and quantities. CES nests have the ability to decompose the effects into relative changes in prices and quantities. As we see in the sections above, there are equations tracing the movements of prices, and they are added up from disaggregated to aggregated price changes using initial value shares. Market prices adjust to make sure that the supply and demand are equal in value terms.

In this way, we are able to keep track of the per cent changes in prices. Wages are modelled as prices of labour and therefore they follow the same treatment as other prices. There is also aggregate consumer price index in the model, which can help mimic inflation; if wages are deflated using this index, we can obtain real wages as well. Employment in the model is a function of labour demand created by production changes in different sectors, as well as labour supply, which is a function of aggregate real wages in the economy, defined by labour supply elasticities in the model, as explained before.

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Narayanan, G., Badri, A. A. & McDougall, R. (Eds.) (2015). *Global Trade, Assistance, and Production: The GTAP 9 Data Base*. Center for Global Trade Analysis, Purdue University

Peters, J. (2016). The GTAP-Power Data Base: Disaggregating the Electricity Sector in the GTAP Data Base. *Journal of Global Economic Analysis, 1*(1), 209–50.

Annex 2

Border Tax Adjustment

A border adjustment makes sense for a domestic consumption tax like a value-added tax (VAT), since exports are not consumed domestically, but imported goods and services are. This makes the border adjustment a policy that levels the playing field so that all goods consumed in a country face the same tax rate regardless of where they are produced. All NAFTA countries have the equivalent of a VAT, which is already border adjusted. The carbon tax proposed by Canada and Mexico would be in addition to a VAT, which would essentially imply an export subsidy for the two NAFTA countries and an import tax for the U.S.

The border adjustment for a cash flow tax would also be implicit—the tax would exclude exports from tax and would not allow deductions for the cost of imported goods. By ignoring foreign transactions, the cash flow tax with border adjustment also removes the incentive for firms to relocate profits or move profitable activities outside of the country. It would also, in principle, prevent dirty industry relocation within the NAFTA region, as may have happened earlier in Mexico.

However, the border adjustment is probably not WTO-compatible. The WTO requires that imports and domestically produced goods be treated the same. But carbon taxes the whole value of imports while only taxing the part of domestically produced goods that relate to above-normal emissions. WTO issues aside, simple economic theory implies that the exchange rate should rise immediately perhaps by the full extent of the tax, thus negating any punitive effects on the U.S. There are two ways to see this. First, the Canadian dollar and the Mexican peso would appreciate dampening their exports and negating the effects of a tariff increase. The extent to which the appreciation affects exports and imports is a function of their elasticities. A second effect will work through domestic saving and domestic investment, which must, in an accounting sense, equal the difference between exports and imports. If the border adjustment does not affect saving and investment, it cannot change the difference between exports and imports. If the quantities do not change, exchange rates must adjust to the new equilibrium.

If the theory is correct and the exchange rate fully adjusts—i.e., rises by the level of the tax—the border adjustment would have no effect on the trade balance, the level of exports, the level of imports, the domestic price level, or the net profitability of importers and exporters. Also BTAs would affect capital flows, at the very least, because international investors would want to rebalance their portfolios, once their Canadian dollar-denominated investments rose by the extent of its appreciation. Moreover, savings and investment would probably be affected, as it would raise revenue for the government (because imports are greater than exports) over the next few years and so would affect government saving.

In addition, a number of factors make it difficult to estimate the exchange rate effects of border adjustment. Exchange rates can be excessively volatile, especially if the prices of goods and services adjust slowly to new events. The amount of foreign exchange related to trade flows is dwarfed by the amount related to asset purchases and sales. Pre-existing contracts may muddy exchange rate dynamics. Investors may hedge their bets until WTO resolution occurs. Plus, the fact that U.S. exports and imports are almost exclusively invoiced in dollar terms tends to dampen price responses to exchange rates.[62] In any case, achieving complete exchange rate adjustment is dependent on all business tax rates being equal. If there

[62] Gopinath, G. (2015, November 2). *The international price system. Harvard University and NBER.* Retrieved from http://scholar.harvard.edu/files/gopinath/files/paper_083115_01.pdf

are different rates for corporations (for example, 20 per cent) and pass-through entities (for example, 25 per cent), then it is impossible to have a single "full" offsetting exchange rate change.

If the exchange rate does not adjust fully and immediately, though, the effects of the border adjustment could be quite different. Exports would rise, imports would fall, and the trade deficit would fall. Consumer prices would rise, fuelled by higher import costs, and this would hit low-income households disproportionately. Exporters would enjoy larger profits, while importers would be hurt.[63] The short-term revenue yield of the tax would decline (since the tax on imports would bring in less and the subsidy for exports would be more expensive).

What would actually happen to exchange rates? Convincing empirical evidence is difficult to come by. The analysis is difficult, because financial markets can anticipate legislative changes, so that much or most of any adjustment may well have occurred before a border adjustment takes effect. There is suggestive evidence[64] of full exchange rate offset for border-adjustable taxes but it comes from data from smaller countries that initiated smaller border-adjustable taxes than the 20 per cent being considered in the GTAP exercise here.

[63] Furman, J. Russ, K., & Shambaugh, J. (2017, January 12). US tariffs are an arbitrary and regressive tax. Retrieved from http://voxeu.org/article/us-tariffs-are-arbitrary-and-regressive-tax

[64] Freund, C. & Gagnon, J. (2017, February 1). Consumption taxes, real exchange rates, and trade balances. Retrieved from https://piie.com/system/files/documents/gagnon20170201ppt.pdf

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