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Repealing NAFTA: The impact on international trade with focus on Mexico

Bachelor thesis

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Abstract

The North American Free Trade Agreement came into force in 1994 after long and emotive discussions. When Donald Trump became the US president in 2016, its future became uncertain, which motivates this paper to attempt to quantify the impact of its repeal. To do that, it uses a standard GTAP general equilibrium model and models an increase of intra-NAFTA tariffs to the derived MFN rates. It finds that NAFTA repeal would notably reduce intra-NAFTA trade and have a modest but negative impact on countries' welfare. NAFTA repeal is estimated to decrease Canadian GDP by 0.48%, US GDP by 0.39% and Mexican GDP by 0.06%. It would severely damage US-Mexico value chains and increase income inequality in Mexico by hurting unskilled workers more. Additional simulations are performed to control for variation in sectoral MFN rates and to observe the sensitivity of results to the choice of closure. The only positive of NAFTA repeal is that it might mitigate regional economic disparities in Mexico by damaging sectors concentrating their production near the US-Mexico border.

Abstrakt

Severoamerická dohoda o volném obchodu (NAFTA) nabyla účinnosti v roce 1994 po dlouhých a emotivních diskuzích. Po zvolení Donalda Trumpa prezidentem USA v roce 2016 je její budoucnost nejistá, což motivovalo vznik této práce, která kvanfitikuje důsledky jejího případného zrušení. K tomuto účelu bude použit model všeobecné rovnováhy GTAP a bude modelován nárůst celních sazeb mezi členy NAFTA na odvozenou úroveň MFN. Zrušení NAFTA by mělo výrazný dopad na obchod mezi členskými státy a mírný ale negativní dopad na jejich bohatství. Odhadovaný pokles kanadského HDP je 0.48%, amerického HDP 0.39% a HDP Mexika 0.06%. Byly by vážně poškozeny hodnotové řetězce mezi USA a Mexikem a byla by zvýšena příjmová nerovnost v Mexiku, protože nekvalifikovaní pracovníci by byli zasaženi více. Další simulace byly provedeny s cílem vzít v potaz odchylky v odvětvových sazbách MFN a sledovat citlivost výsledků na volbu uzavření modelu. Jediným pozitivem zrušení NAFTA je, že by mohlo zmírnit regionální ekonomické rozdíly v Mexiku tím, že poškodí odvětví, která soustředí svoji výrobu v blízkosti hranic USA s Mexikem.

Keywords

international trade, international economics, free trade agreements, trade policy, NAFTA, Mexico, computable general equilibrium, GTAP

Klíčová slova

mezinarodní obchod, mezinarodní ekonomie, smlouvy o volném obchodu, obchodní politika, NAFTA, Mexiko, všeobecná rovnováha, GTAP

Declaration of Authorship

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Prague, 7 May 2018

Signature

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Bachelor Thesis Proposal

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Proposed topic	Repealing NAFTA: The impact on international trade with focus on Mexico

Motivation

Three days after his inauguration as the 45th President of the United States, Donald Trump fulfilled his campaign promise and officially withdrew from the Trans-Pacific Partnership (TPP) trade agreement. President Trump's stance on trade and immigration policy raises new questions on the future of international trade.

This thesis will focus on the North American Free Trade Agreement (NAFTA), a pact established in 1994 eliminating tariff and non-tariff barriers of international trade among its three member countries: Canada, the United States and Mexico. More specifically, the thesis will aim to analyze the theoretical impact of repealing the agreement today, 23 years after its entry into force, using a computable general equilibrium model along with the most recent data. The simulation will assume that tariff rates between Canada, the United States and Mexico would increase (more precisely non-decrease) to the Most Favoured Nation tariff rate. Previous studies analyzing the impact of NAFTA have concluded that the agreement had a significant effect on trade volumes within member countries, but only a small impact on their real wages and welfare. (Romalis, 2007; Caliendo & Parro, 2014).

With the ratification of NAFTA, Mexico became the first developing country to establish a free trade agreement with developed countries. It has since experienced growth in terms of GDP and wage levels, but also a significant increase in income inequality and in regional wage differences favoring regions near the Mexico-US border. The contribution of NAFTA to these trends will be estimated using the above-mentioned model and compared with the conclusions of the existing literature.

Research questions

- How would repealing NAFTA impact international trade flows, wealth of countries involved and other key factors?
- Did the agreement contribute to the growing inequality among skilled/unskilled workers and among regions in Mexico, and if yes, could its repeal actually help in addressing these issues?

Methodology

To model the impact of repealing NAFTA I will use the GTAP Model, a computable general equilibrium model which is part of the Global Trade Analysis Project. The latest version 6.2a will be used along with the RunGTAP interface. The general equilibrium is estimated using GEMPACK, an economic modeling software suitable for solving large systems of equations.

Contribution

Over the years, many researches have been estimating the effects of NAFTA on various aspects of member states' economies. The aim of this thesis will be to complement the existing literature by using the most recent model and data, and by looking at the issue from a different perspective. In the conclusion, I will compare the results with other studies in this area and discuss potential differences. By describing the characteristics of and the theory behind the GTAP Model, this thesis can also serve as a comprehensible introduction for students interested in using this model for policy analysis on other issues.

Outline

1. Introduction
2. Methods used

3. Literature review

4. Policy change

5. Results

6. Conclusion

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Contents

1 Introduction

The *North American Free Trade Agreement* (NAFTA) is an international agreement on the elimination of tariff and the reduction of non-tariff trade barriers between three countries: Canada, the United States of America and Mexico. NAFTA entered into force in January 1994, but its implementation has been gradual, in phases. For example, according to a study by the US International Trade Commission (Brookhart and Wallace, 1993), approximately 31% of 1990 US exports to Mexico would be duty-free immediately, 17.4% within 5 years after the implementation, 31.8% within 10 years, and 1.4% within 15 years. 17.9% of US exports had already been duty-free under the *most favored nation* (MFN) rates before the agreement. The reduction of non-tariff barriers mainly consisted of harmonization of standards, for example, transportations or telecommunications standards (Giermanski, 1994). NAFTA was also accompanied by reforms of agricultural policy, especially in Mexico (more on this topic in Chapter 3). Duty-free access of goods depends on the fulfillment of *rules of origin*, meaning that a large part of the value of the good must originate from a NAFTA country (Easterly et al., 2003).

In the United States, NAFTA's establishment was preceded by political and academic debates on the benefits and costs of the agreement. Proponents of NAFTA argued that the agreement would lead to higher efficiency and gains from specialization, while opponents warned of increased unemployment as a result of cheap imports and companies moving their production to Mexico. The fact that there is still no public consensus on whether international trade agreements are beneficial or not became apparent after the 2016 US presidential election. Just three days after his inauguration as the 45th President of the United States, Donald Trump fulfilled his campaign promise and withdrew from the *Trans-Pacific Partnership* trade agreement. President Trump's stance on trade and immigration policy raises new questions on the future of international trade and NAFTA, which Mr

Trump called ”the worst trade deal ever”.[1] While the impact of NAFTA has been analyzed extensively by economists, there is to date very limited academic literature on the impact of repealing the agreement, perhaps because it has not been a relevant policy question until recently. Moreover, NAFTA repeal would be unprecedented – other events that restored trade barriers such as African decolonisation or the breakup of the *Council for Mutual Economic Assistance* in Eastern Europe are incomparable because they were accompanied by regime changes.

In this thesis, I will use a *computable general equilibrium* (CGE) model to quantify the effect of such policy change on international trade and on the welfare of member countries. While all three NAFTA countries will be subject to this analysis (together with the rest of the world), the case of Mexico will be examined in more depth. Since NAFTA adoption, Mexico has experienced growth in terms of real GDP and wage levels, but also a significant increase in income inequality and in regional wage differences favoring regions near the Mexico-US border. The potential impact of canceling NAFTA to these trends will be observed using the above-mentioned model and compared with the conclusions of the existing literature.

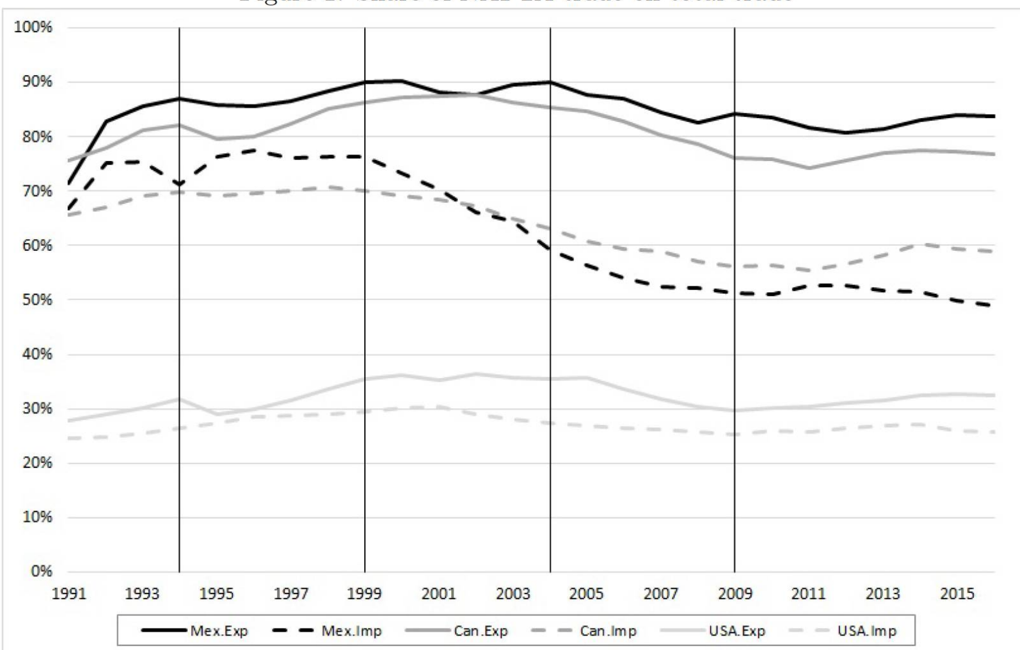
The rest of this thesis is organized as follows: In the remainder of Chapter 1 I perform a preliminary analysis of NAFTA countries' trade flows before and after the adoption of the agreement. Chapter 2 introduces the *computable general equilibrium* model that will be used to evaluate the impact of repealing NAFTA. After describing this technique in general, I will proceed to the specific model which I use, the *Global Trade Analysis Project* (GTAP) model. Chapter 3 reviews the economic literature evaluating the agreement. In Chapter 4 I formulate the specification of the model and the policy change and in Chapter 5 discuss the results. Chapter 6 concludes.

[1] Donald Trump has repeated this claim many times during the presidential campaign as well as after it. Examples can be found on the YouTube website after searching for ”Trump NAFTA”. Bernie Sanders, a democratic candidate for the US president, also criticized NAFTA, calling the trade deal ”devastating”.

1.1 Preliminary analysis

In this subsection, I will describe how economies of United States, Canada and Mexico have evolved since NAFTA adoption in terms of their trade interconnection and their economic openness in general.

Figure 1: Share of NAFTA trade on total trade



Source: UN Comtrade database, World Integrated Trade Solution (WITS) user interface. Vertical lines represent years important for NAFTA: its entry into force in 1994 and years 1999, 2004 and 2009, which marked the end of three main phase-out periods of the agreement.

Figure 1 shows the evolution of each member country's merchandise exports and imports to the remaining two NAFTA members, expressed as a share of that country's total merchandise exports and imports respectively. [2]

For all three countries, the share of NAFTA trade was increasing even before the agreement was adopted in 1994. For United States and Canada, this is likely a consequence of *CUSFTA*, the Canada-United States Free Trade Agreement, which was signed in 1988. Mexico has experienced increasing shares of NAFTA trade before 1994, which might be a consequence of expectations of NAFTA (the negotiations began in 1990 and the agreement

[2]Trade in services is not included in figure 1 as these data were not available for this time period for all three countries.

was signed in 1992) and of Mexican unilateral trade liberalization, which took place in 1985-1988 (Kose et al., 2004). Moreover, the implementation of NAFTA coincided with multilateral trade liberalization that resulted from the Uruguay Round of GATT talks (Cline, 1995).

Burfisher et al. (2001) attribute the decrease in US NAFTA exports in 1995 to the Mexican peso crisis, during which the Mexican currency lost nearly half of its value in early 1995 due to speculative attacks on the pegged currency system. Critics of NAFTA argued that the agreement triggered this crisis, but Burfisher et al. (2001) note that it was accepted among economists that peso was overvalued long before NAFTA entered into force in 1994. With the exception of year 1995, export shares of all three NAFTA countries have continued to grow steadily and in 2000, 90.3% of Mexican exports were destined for the USA and Canada and 87.3% of goods exported from Canada ended up either in the United States or in Mexico.

Both Mexico and Canada experienced a strong decline in the share of NAFTA imports after 2000. A closer examination of UN Comtrade data reveals that this decline can be mostly attributed to the surge of Chinese imports: While the share of Canadian imports from other NAFTA countries decreased by 12.6 percentage points between 2000 and 2010 (from 69.0 to 56.4 percent), the share of Chinese imports increased in the same time period by 7.9 percentage points (from 3.2 to 11.1 percent). In Mexico the drop was even sharper - the share of NAFTA imports decreased by 22.3 percentage points and the Chinese share of imports increased by 13.5 percentage points, from 1.6 percent share in 2000 to 15.1 percent in 2010.

Figure 1 also reveals that United States have historically been considerably less dependent on their neighbors, at least in terms of trade. Currently, Canada and Mexico are only the United States' third and fourth largest trading partners respectively, after the European Union and China. Interestingly, the share of NAFTA exports from the US exceeds the share of imports in all years of the examined time period. While the US merchandise trade balance with Canada and Mexico is negative in absolute values, as Mr

Trump frequently reminds his audience, this figure shows that trade deficits with these countries are by no means outliers in the context of the whole world (notwithstanding that trade deficits are not necessarily a negative phenomenon (Krugman, 1996)).

Table 1: Economic openness of NAFTA counties

Year	1990	1995	2000	2005	2010	2015
CAN	50.0	69.1	82.9	69.7	60.1	65.5
MEX	33.6	46.3	52.4	54.0	60.8	71.2
USA	19.8	22.4	25.0	25.5	28.2	27.9

Source: OECD *National Accounts at a Glance* database.
Sum of country's exports and imports, expressed
as a percentage of GDP.

Table 1 shows the overall economic openness of each NAFTA country, computed by summing up the value of exports and imports of goods and services and expressing them as a percentage of the country's Gross Domestic Product for the given year. The gradual growth of this value for Mexico and the United States illustrates the effect that globalisation and offshoring had on national economies. It should be noted, however, that economic openness of the United States is significantly lower in terms of GDP compared to both Canada and Mexico. This, together with the low share of NAFTA trade on total trade apparent from figure 1, suggests that the impact of NAFTA repeal would be lower for the US than for the other two member countries because a much smaller part of the economy would be directly affected by the policy change.

Canada's trade-to-GDP ratio has been notably more volatile than that of Mexico and the United States. It has increased by almost 30 percentage points from 1990 to 2000, when the value of imports to and exports from Canada equaled 82.9% of Canada's GDP, and has since then declined to reach values similar to those of Mexico. A report from Statistics Canada (Gellatly, 2017) attributes the growth in the 1990s to the "deepening of trade ties" between Canada and United States, a consequence of firms adjusting to

CUSFTA and NAFTA. The subsequent decline was, according to the report, driven by declining exports of the automotive sector, which was only partly offset by growth in the energy sector.

Overall, the adoption of CUSFTA and NAFTA has been followed by increased trade flows among member countries in the 1990s, both in absolute terms and in comparison to other trade partners. After 2000, the effect is less clear due to strong influence of Asian imports and other factors that affect international trade flows. An overview of the existing literature in Chapter 3 will provide a more detailed analysis.

2 Methods used

2.1 Computable General Equilibrium models

Computable General Equilibrium models (also referred to as Applied General Equilibrium models) have an ambitious goal of describing the whole economy by defining agents and letting them interact. To do that, they use data on the various linkages within the economy, which normally take the form of an *Input-Output table*.[3] Another key step is to define agents that operate in that economy and their behavior in the form of utility or production functions. This requires specifying functional forms that determine agents' behavior (for example a *Cobb-Douglas* function or a *Constant Elasticity of Substitution* (CES) function), and then parameters of that function. The key elasticity parameters of these functions are, in most cases, obtained from econometric regressions and the rest of the parameters is set in order to be consistent with the Input-Output data, a process called *calibration*. Central to this step, and to the whole model, is the microeconomic assumption that consumers maximize utility and producers maximize profits subject to budget and technology constraints respectively. In other words, CGE models assume that the observed I-O data are an equilibrating outcome of agents' interactions.

[3]Some models use a *Social Accounting Matrix* (SAM) instead of the I-O table, which is similar to the I-O table but includes more institutional detail (Reinert and Francois, 1997).

After a national economy has been defined, the rest of the world needs to be accounted for as well. This can be done by modeling each country (or region) separately, or by adopting a *small country assumption*, where the examined economy has no power over world prices. Then, the modeler needs to specify variables that will be treated as exogenous, i.e. determined outside the model. Government expenditures, population parameters or tariff rates are examples of variables often chosen as exogenous (Robinson, 1989). Finally, an economic shock is defined by adjusting one or more exogenous variables, for example, a reduction in tariffs and/or a change in world prices, and a new equilibrium is computed.

In the following sections, I will describe each part of the process in more detail. For the purpose of illustration, I will use a classic model of the Mexican economy from two international economists, Patrick J Kehoe and Timothy Kehoe (Kehoe and Kehoe, 1994). While newer models use more detailed data and much more sophisticated functional specifications, the essential logic of these models remains the same.

Figure 2: Input-Output table for Mexico 1989

		Expenditures							
		Intermediate Inputs			Final Demands				
Receipts		Primaries	Manufactures	Services	Private Consumption	Investment	Government Consumption	Exports	Total Demand
Intermediate Inputs	Primaries	1	4	0	2	0	0	1	8
	Manufactures	1	8	2	11	8	1	4	35
	Services	1	5	5	21	2	2	2	38
	Imports	0	3	1	1	2	0	1	8
Components of the Value Added	Wages & Salaries	1	4	7	—	—	1	—	13
	Other Factor Payments	4	10	19	—	—	0	—	33
	Indirect Taxes & Tariffs	0	1	4	—	—	0	—	5
Total Production		8	35	38	35	12	4	8	140

Source: Kehoe and Kehoe (1994) from data of Instituto National de Estadística, Geografía e Informatica. Data are in 10 Trillion 1989 Mexican Pesos

2.1.1 Input-Output table

As mentioned above, a key data input for a CGE model is an Input-Output table. It has been developed by Wassily Leontief and used, for example, as a tool for central planning in socialist economies (Leontief, 1986). I-O tables describe the interdependencies in an economy and allow for the decomposition of a nation's GDP by industry, its use and the source of its value. The level of detail in the decomposition by industry depends on the purpose of the Input-Output table and on data availability. For example, Kehoe and Kehoe (1994) disaggregate the Mexican GDP info four sectors (primaries, manufactures, services and imports/exports), but for a detailed analysis a significantly larger disaggregation is desirable.

Rows of an Input-Output table describe the total demand for the output of an industry. Each good or service is either used as an *intermediate input* for the production of other goods or services, or it is purchased by a final consumer. A common approach, adopted also by Kehoe and Kehoe (1994), is to disaggregate this *final demand* into private consumption, investment, government consumption and exports.

In contrast, columns of an Input-Output table describe the source of the value of the goods and services produced by each industry. One source are the *intermediate inputs*, inputs used during the production a good or a service, and the second source are the *components of the value added.* These typically comprise of wages to employees, payments for the use of capital and land, and indirect taxes and tariffs.

An Input-Output table, such as the one constructed by Kehoe and Kehoe (1994) and shown in figure 2, can be used to estimate the impact of a change in private demand, government expenditure or demand from the rest of the world. If one assumes that the proportions of intermediate inputs and components of the value added on total production are constant, then this effect can be calculated by solving a set of linear equations and a new, "after-change" Input-Output table is obtained (Kehoe and Kehoe, 1994).

Such analysis based only on an Input-Output table has several serious drawbacks: It does not take into account the responsiveness of supply and demand to relative prices or possible changes in the composition and levels of demand due to changes in income. Moreover, the resulting I-O table may contain unrealistic "extreme" imbalances, for example, in the balance of trade. Building a CGE model, defining consumers and producers in the economy and functions that determine their behavior, can address these issues (Reinert and Francois, 1997).

2.1.2 Identification of agents

Kehoe and Kehoe (1994) aggregate all consumers and the government and define a single representative consumer, who maximizes utility over six goods produced in the economy - for simplicity, they consider investment, government consumption and imports as goods just like, for example, primaries. The rest of the world is treated not as a separate foreign agent (as will be the case in the GTAP model), but as a sector that takes exports as inputs and produces imports as outputs.

Utility maximization is subject to a budget constraint, which in this case is the sum of after-tax wages, factor payments and tax revenue. The simplest form of the utility function is the Cobb-Douglas utility function, here transformed to a logarithmic form:

$$u(c_1, c_2, c_3, c_4, c_5, c_6) = \sum_i \theta_i \log(c_i). \tag{1}$$

While the decision about the form of the utility function is made by the author of the model, the parameters (in this case only θ_i) must be *calibrated* to be in accordance with the observed data. The calibration of equation 1 is straightforward thanks to the property of Cobb-Douglas function that the share of expenditures on good i is constant for all positive prices and income. θ_i is therefore obtained by taking the observed expenditures of the representative consumer on good i and dividing it by observed total expenditures of that consumer. Data in the Input-Output table in figure 2 are reported in monetary units rather than in some kind of natural units. Therefore, one may calibrate prices of goods p_i to be equal to one, as well as the wage rate w and the capital rental rate r. For example, the last column of the I-O table shows that 8 "units" of primaries goods were produced in Mexico in 1989, each unit being worth 10 trillion pesos.

The assumption that a consumer always spends a fixed part of his income on each good is very strong and one might propose an alternative utility function, for example, a Constant Elasticity of Substitution function:

$$u(c_1, c_2, c_3, c_4, c_5, c_6) = \big(\sum_i \theta_i c_i^{(\sigma-1)/\sigma}\big)^{\sigma/(\sigma-1)}. \tag{2}$$

In this case, one needs to first define σ, the *elasticity of substitution*, which measures the change in relative demand as a response to a change in relative prices. σ is usually obtained from econometric literature and the subsequent calibration of θ_i is performed similarly as in equation 1 - by "working backward from the solution to the utility-maximization problem" (Kehoe and Kehoe, 1994).

Production functions in the model of Kehoe and Kehoe (1994) assume that the proportions of intermediate goods needed for production are fixed, which means there is no possibility of substitution between intermediate inputs. That does not apply to components of value added, capital and labor, which are governed by a standard Cobb-Douglas production function. As a result, production functions in the Mexican model take the following form:

$$y_j = min(x_{1j}/a_{1j}, x_{2j}/a_{2j}...., x_{6j}/a_{6j}, \beta_j k_j^{\alpha_j} l_j^{1-\alpha_j}). \tag{3}$$

In addition to profit maximization and cost minimization subject to technological constraints, this model assumes perfect competition, i.e. zero after-tax profit of producers. Parameters of these equations can therefore be calibrated from the Input-Output data, just like in the case of consumers.

2.1.3 Closure and simulation

By defining a representative consumer and producers in an economy and defining and calibrating the functions that drive their behavior, a base level *equilibrium* is described. In this equilibrium, consumers maximize their utility subject to the budget constraint, producers minimize costs and earn zero after-tax profit, supply equals demand for each good and for each factor, and the tax revenue equals total tax receipts. Now, one may define a (policy) shock, for example, a tax increase, compute the new equilibrium and observe how agents respond to this change.

Most CGE models are *comparative static* models, meaning that they represent not how the economy changes through time, but present differences between different states of the economy - without and with the shock (Corong et al., 2017). [4]

Generally, defining one single shock in a CGE model is not sufficient for a new equilibrium to be computed and one must specify more variables that will be treated as exogenous (typically held fixed) in a process called *closure*. One aspect of closure is the definition of *numeraire*, a unit in terms of which all values will be expressed (Kehoe and Kehoe, 1994). Authors of the Mexican model propose normalizing prices so that

$$\sum_i \theta_i p_i = 1, \tag{4}$$

where θ_i are parameters of the Cobb-Douglass utility function and therefore shares of expenditures to each sector on final expenditures. If this condition holds before as well as after the policy shock, changes in the wage rate w reflect changes in the *real* wage rate.

An interesting measure to report after a policy experiment is the change in consumer welfare, called *equivalent variation.* It measures the change in income, in the base scenario and under original prices, that the regional household would need to achieve the new level of utility after the policy change.

[4] Dynamic versions of CGE models exist, which take into account the gradual effects of a policy change. A disadvantage of these models is that they require additional assumptions on how economies adjust to a change (see e.g. Reinert and Francois (1997)).

2.2 Global Trade Analysis Project

The Global Trade Analysis Project is a framework for global policy analysis. It was established in 1992 by Thomas Hertel, aiming to "lower the cost of entry for those seeking to conduct quantitative analyses of international economic issues in an economywide framework" (Hertel, 1997). It continues to be used for the analysis of the impact of proposed trade policies such as the TPP (for example, by Burfisher et al. (2014) or Kawasaki (2014)). GTAP consist of two key components:

- A multiregion, multisector computable general equilibrium model – the GTAP Model, currently in its 7th version.
- A database, which serves as an input to the model. This database is global: It describes every part of the world, most often on a country-level and, when local data are not easily available, on a regional level. This database is regularly updated by a network of researchers.

Calibration and computation of the new equilibrium is done using a *GEMPACK* software, which is suitable for solving large systems of equations. A *RunGTAP* user interface was created to make shock definition and results viewing clearer. The documentation to the version 7 of the GTAP Model was published in the *Journal of Global Economic Analysis* (Corong et al., 2017) and key features of the model are described in the following subsection.

2.2.1 GTAP Model

Similarly to the model of Kehoe and Kehoe, all factor payments in a region – wages, payments for capital and land – and revenue from indirect taxes are received by one representative *regional household*. This aggregated income is allocated in levels. On the top level, the regional household maximizes utility over three categories: private consumption, public expenditure and saving. Each of these categories have their own *sub-utility* functions subject to maximization except for saving, which is a treated as a unitary good. The government sub-utility function has a Constant Elasticity of Substitution form. By default, it is a Cobb-Douglas function.

In contrast, private expenditures are modeled much more carefully because of their importance for trade policy analysis. The functional form is based on the *Constant Differences of Elasticities* (CDE) expenditure function formulated by Giora Hanoch. This functional form is a generalization of the CES function and allows for more parameters to be included in the model. While the CES function for n goods, such as the one presented in equation 2, contains n distribution parameters θ_i and only one elasticity of substitution σ, the CDE form has n substitution parameters and n expansion parameters, in addition to the n distribution parameters (Hanoch, 1975). Substitution parameters explain how demand for each good reacts to a change in relative prices. Expansion parameters relate to the responsiveness of demand for each good to income, which makes private consumption preferences non-homothetic.

Expenditures for each good are further decomposed into demand for domestic and imported goods by a CES sub-utility function. This is named *Armington specification* as it has been formulated by Paul Armington. It has been commonly used by CGE modelers, for example, by Romalis (2007), whose work is reviewed in Chapter 3. This specification has important consequences for international trade because it allows for substitutability between domestic and imported goods of the same sector, and between goods from different source countries. Consumer preferences therefore explain frequent empirical cases when a country both imports and exports goods of the same product category (Armington, 1969). At the same time, the home bias in consumption is explained by parameters of the CES function (Shikher, 2012). The sourcing of imports by region of origin is, for each good, done collectively for the whole region (and therefore includes also import demand for intermediate inputs and investment), and is driven by another CES preference function.

The production function of each activity is based on a sequence of "nested" functions, just like the regional utility function described in the previous paragraphs. On the top level, output from an activity is determined by a CES function combining intermediate inputs and sources of value added. The elasticity of substitution on this level is by default 0, which makes it a *Leontief production function* with fixed proportions of value added and intermediate inputs. These two components are further disaggregated into their components using CES functions. If the elasticity of substitution is set to 0 for intermediate inputs and 1 for the components of value added, the resulting production function will very closely resemble the one used by Kehoe and Kehoe in their model of the Mexican economy and shown in this paper in equation 3. On the third and final level, demand for intermediate inputs is decomposed into domestic and imported goods.

In its standard version, the GTAP model distinguishes between five factors of production: natural resources, land, skilled labor, unskilled labor and capital. Labor and capital are treated as perfectly mobile and with fixed aggregate quantity. As a result, a policy change cannot lead to a change in unemployment or economic activity, or to migration of labor to other regions, and the standard model should therefore be viewed as predicting rather the medium- and long-term effects of a policy change. Furthermore, the fact that the quantity of capital is constant in each region means that it is not sensitive to the level of investment. As a result, investment's main effect is that it increases the demand for output that is used for this purpose. Natural resources are considered sector-specific and land is a "sluggish endowment" and its supply is subject to a transformation frontier, in contrast to labor and capital, which are perfectly elastic.

The level of global investment is determined by the savings equal investment identity. Neither macroeconomic policies nor monetary phenomena, which are generally considered as main determinants of investment are accounted for because the main focus of the model is on trade policy and its effect on global production and trade (Hertel, 1997). The allocation of investment into regions, however, does depend on changes in the return on investment. The level of this sensitivity is determined by an elasticity parameter *RORFLEX* and the expected return on investment depends on variables such as the rate of depreciation or price of capital goods. Alternatively, investment allocation may be based on initial shares of regions on total investment. Yet another option is fixing the current account, which fixes also the difference between savings and investment, since the following identity must hold:

$$S - I \equiv X - M. \tag{5}$$

The structure of investment expenditures within a region is based on a Leontief utility function and therefore held constant.

The determination of how investment is allocated is a fundamental part of the *macroeconomic* closure. *Microeconomic* exogenous variables include the population parameter, quantities of all factors of production and all tax and tariff rates. Numeraire is set by default to the global index of factor remuneration.

The global closure of this model is *neoclassical* as global investment adjusts to accommodate changes in savings (Hertel et al., 1997). For comparison, I list other macroeconomic closures that may be used in CGE models, as formulated in Dewatripont and Michel (1987). In these types of closures, investment is fixed and there is another source of adjustment:

- The *Keynesian* closure relaxes the assumption of full employment by making employment level endogenous.
- The *Kaldorian* closure allows wage levels to be below the marginal labor productivity.
- In the *Johansen* closure, full employment is not defined explicitly but realized as a residual adjustment of private consumption.

2.2.2 GTAP Data Base

The latest release of the GTAP Data Base, version 9, includes data for 140 regions, 57 sectors and 8 factors of production, valued in current US dollars

(Aguiar et al., 2016). It also includes elasticity parameters – one elasticity of substitution parameter when CES function is applicable and n substitution and n expansion parameters for the private expenditure function, where a CDE functional form is used. These parameters are necessary for the calibration of the remaining distribution parameters of each function based on the Input-Output data. The base year of this database is 2011, meaning that the precise question the model will answer is "What would happen (in the medium-run) if NAFTA was repealed in 2011". This fact of course decreases the reliability of the result, but the advantages of the GTAP Data Base (that it is global, detailed and fully compatible with the GTAP Model) outweigh this drawback, in my opinion.

Marcoeconomic data, such as GDP aggregates and population, are taken from the World Development Indicators (WDI), a database of the World Bank. If data for a certain country were not available in this database, they were taken from other sources, for example, from the UN Statistics Division.

Input-Output data are provided by researches from around the world, who typically source them from national statistical or government agencies. After being received, an I-O table is checked by GTAP researches, who determine whether the data quality and structure is appropriate. They check various aspects of the table, for example, whether the balance condition holds, whether it includes sufficient amount of detail or whether the data don't imply unrealistically high or low tax rates. After this check the table is adjusted in several ways. The main adjustment is that the table is *scaled* to fit the national accounts data from the WDI database. Of the 140 regions in the GTAP Data Base, 120 represent individual countries, which together represent 92% of the world's population and 98% of its GDP. For the remaining regions, an Input-Output table is constructed as a linear combination of selected other I-O tables, scaled to fit the region's (in extreme cases also estimated) GDP. In addition to national data, the database also includes information about transport costs, which are taken primarily from the Foreign Trade Statistics of the United States Bureau of Census.

Behavioral parameters are obtained from econometric literature. For example, the two Armington elasticities, which relate to the substitution between imported and domestic goods and between imports from different regions, are taken from (Hertel et al., 2007). These elasticities are commodity-specific, but neither region-specific nor agent-specific. Their values typically range between 2 and 4.5 for the domestic/import substitution, and between 5 and 8 for the substitution between imports from different regions. An implication of this is that agents are more willing to substitute between imports from different regions than between domestic and imported goods.

3 Literature review

The North American Free Trade Agreement has been a source of great interest among the academic community - Fox et al. (2015) fittingly describe it as a ”large-scale historical experiment”. I will review mainly those papers that use a computable general equilibrium model to analyze the impact of NAFTA on trade flows and general welfare. I will also mention econometric and other papers that have the same purpose and summarize the conclusions of the reviewed papers. In the second subsection, I will analyze papers that focus on certain aspects of the Mexican economy and the impact of NAFTA on them. In summary, most of the authors mentioned in this review would likely agree that NAFTA had significantly increased international trade among its members, but had only a modest effect on welfare. There is no consensus, however, on whether that modest effect has been positive or negative. In Mexico, NAFTA has accelerated the shift in production towards regions near the Mexico-US border. It will therefore be interesting to observe which sectors would be hurt the most by NAFTA repeal and whether it would decrease Mexico’s level of income inequality, which is currently among the highest in the world (Cingano, 2014).

3.1 NAFTA's impact on trade and welfare

Romalis (2007) applies both econometrics and CGE modeling when estimating the impact of NAFTA on international trade. He constructs a general equilibrium model with perfect competition, industry-specific factors of production and an Armington approach to the consumer utility function. From this model, he derives two equations which are then used for a a difference-in-difference-based econometric estimation of key parameters of the model – supply and demand elasticities – based on consumption patterns in NAFTA and non-NAFTA countries. Romalis' estimates of the demand elasticity range between 6.2 and 10.9, suggesting that consumers are fairly sensitive to the relative change in prices of products differentiated only by the country of origin. The supply elasticity is estimated using the Instrumental Variable estimation and its values are much lower, between 0.45 and 0.24. With these estimates of elasticities and with data on trade and tariffs, Romalis applies the above-mentioned model to estimate the effect of NAFTA on trade levels and welfare. He finds that NAFTA had significantly increased trade flows among member countries, namely between USA and Mexico (a 27.5% increase in bilateral trade), but the increase in the value of output has been fully offset by decreased tariff revenue. Romalis claims that this is in part because the largest tariff reduction took place in industries in which NAFTA members were not low-cost producers and that NAFTA might have "actually increased North American output and prices in many highly protected sectors by driving out imports from nonmember countries" (Romalis, 2007). The author then supports the claim that NAFTA has been a source of trade diversion by an econometric estimation. On the other hand, he also admits that the welfare effect has been underestimated because potential sources of welfare gains, such as increasing returns of scale or productivity increases, are not included in his model.

An interesting study on the ability of CGE models to predict the effects of NAFTA has been conducted by Kehoe (2005), who systematically tracked real trade and welfare data and compared them to predictions computed before the Agreement entered into force. He found very little correlation between the predictions of the CGE models and actual data, especially in trade flows and the variation of these flows across industries. The main reason identified by Kehoe is that failed to predict increases in trade in sectors with little or no previous trade.

Fox, Shikher, and Tsigas (2015) build on the work of Kehoe (2005) and re-create the predictions using pre-NAFTA data along with the latest CGE models, GTAP being one of them.[5] They focus on the changes of intra-NAFTA trade relative to total trade of each member country, which is a clever way of accounting for other events that have affected international trade flows, for example, the Mexican peso crisis in 1994. By comparing their predictions with actual trade data for 2009, the authors find that modern models are much more accurate in predicting relative trade flow changes than the ones used before NAFTA entered into force. For example, while the actual increase in intra-NAFTA trade relative to total trade of all NAFTA countries has been 24.8%, the increase predicted by the latest version of GTAP has been 28.7%. On the other hand, the other model used in this paper, a version of the Eaton and Kortum model, was better in predicting the industry-level bilateral trade flows than GTAP. This model was described in a separate paper (Shikher, 2012), which is summarized later in this chapter. Interestingly, none of the model was able to predict at all the trade flows between Mexico and Canada. Authors suggest that this is because CGE models are unable to predict trade changes between countries where there is little trade in the base point: "The pre-NAFTA trade between those countries was very small and post-NAFTA changes, in percentage terms, were big." (Fox et al., 2015) Authors also note that even after NAFTA, the Canada-Mexico trade accounts for about 1% of total NAFTA trade. So, even though these new models predict better than the old ones, the main weakness suggested by Kehoe appears to still be present. On the other

[5] The other two models used by Fox et al. are a version of the Eaton and Kortum model, which the authors call the HPPC (Heterogeneous Producers, Perfect Competition) model, and the Brown-Deardorff-Stern model.

hand, this limitation should not be relevant to the policy analysis in this paper because it does not say anything about what happens in little-traded industries when tariffs increase. Our results for Canada-Mexico trade should nevertheless be interpreted with this limitation in mind.

Baldwin and Krugman (1989) highlight another possible limitation of the GTAP Model. They describe the phenomenon of *hysteresis in trade*, when a temporary shock can have permanent effects on international trade. For example, the strong US Dollar in the 1980s has led to increased activity of foreign firms, who invested massively in the US market and pushed domestic companies out of business. Consequently, the return of the exchange rate to its normal levels did not reverse this effect because foreign firms still found it profitable to continue their operations in the US, once the initial investment has been made (and was now a sunk cost). Repealing NAFTA might in fact make the agreement a "temporary shock with permanent consequences", like the dollar appreciation mentioned by Baldwin and Krugman (1989) and it is possible that the already invested US capital in Mexico (see section 3.2 of this paper) would be affected only marginally.[6] The limitation of GTAP therefore is that it doesn't take trade hysteresis into account. If it predicted large changes in capital endowment in any sector in any country, then these predictions would have to be viewed with suspicion and questioned.

Kehoe, Pujolas, and Rossbach (2017) review the development of GGE models used for trade policy analysis. Especially relevant for this paper is authors' evaluation of the GTAP model, done for several bilateral trade agreements, for example, between US and Chile or between China and New Zealand. The methodology is similar as in Fox et al. (2015) and the results at the industry-level are highly unsatisfactory. However, the results improve rapidly after authors implement their method (the Least Traded Products method) to account for the inability of the model to predict large increases in industries with little previous trade. This suggests that GTAP should

[6]Not only could there be the sunk cost effect as during the dollar appreciation, but firms might also consider NAFTA repeal temporary and might expect the agreement to be renegotiated in the future, e.g. once Donald Trump is not the US President.

still be suitable for the analysis of canceling NAFTA, where this issue is not present.

Authors of the next two papers I review create their own versions of a CGE model built by Jonathan Eaton and Samuel Kortum. It is therefore worth looking in detail at this model published in *Econometrica* journal and titled "Technology, Geography, and Trade" (Eaton and Kortum, 2002). They title their model "Ricardian" because it shares its main characteristic with David Ricardo's classic model of gains from trade through comparative advantage. That main characteristic and a key difference between this model and, for example, GTAP is the Ricardian assumption that agents consider goods of same category but different origin as identical, and trade is therefore driven by comparative advantage.[7] In the Eaton and Kortum model, there is a continuum of goods, i.e. an infinite number of goods denoted $j, j \in (0,1)$, with the cost of inputs constant across goods within a country. Technology, however, is not the same across goods, but it is a realization of a country-specific random variable, drawn independently for each good j. The cumulative distribution function of this random variable contains a country-specific technology parameter, which determines absolute advantage, and a common variance parameter, which determines comparative advantage (low variance means less heterogeneity in efficiency across goods within a region). The price of a certain good offered from one country to another can therefore be also expressed as a realization on a random variable, in addition depending on input costs and a distance parameter. Finally, a probability that country i offers the lowest price to country n is expressed, and *"Since there are a continuum of goods, this probability is also the fraction of goods that country n buys from country i"* (Eaton and Kortum, 2002). The implication of this specification is that trade costs are the drivers of the home bias and the composition of imports, as opposed to the "love of variety" in the Armington specification (Kehoe et al., 2017). The model is completed ("closed") by decomposing inputs into labor and intermediates and modeling how these

[7] In contrast, GTAP applies the Armington specification, where consumer and firm preferences drive international trade – see section 2.2.1.

relate to each other and to trade flows.

The Heterogeneous Producers, Perfect Competition (HPPC) model from Shikher (2012) shares many features with neoclassical CGE models such as GTAP: It assumes multiple industries, perfect competition, constant returns to scale. The HPPC model, however, does not rely on the Armington specification determining trade flows, it instead adopts the Eaton-Kortum framework. The author adopts it at the industry level, assuming a continuum of goods *within each industry*, in contrast to the country level approach of Eaton and Kortum (2002). To test this model, he estimates the impact of NAFTA on 1989 data and compares the results with actual data and with a Brown-Deardorff-Stern model, which uses an Armington specification and which the author considers a representative example of current CGE models. While the HPPC model performs well, the BDS model underpredicts the magnitude of intra-NAFTA trade flows and even the correlation between predicted and actual changes on the industry-level is close to zero. The underprediction is due to low values of Armington elasticities, which determine the substitutability of imports from different countries. After increasing their value to 8, the prediction of the magnitude of trade flow changes improves rapidly. Failure of the BDS model to predict variance is to some extent caused by an incorrect assumptions on the elimination of non-trade barriers in Mexican food and textile industries, i.e. it is not the fault of the model, but of the policy change specification. After omitting trade flows in these two industries, the correlation between the estimates of trade changes in the remaining sectors and actual data rises from 0.12 to 0.44.

Caliendo and Parro (2015) also build on the Ricardian model from Eaton and Kortum (2002), in a similar way as Shikher (2012). The difference between these two models is that the HPPC model has more factors of production and different parameters (in fact, Shicker openly admits that his model "predates" the previous version of the model of Caliendo and Parro). This model includes 31 countries and 40 sectors and authors use data from

1993 to calibrate the model and to evaluate the trade and welfare effects of NAFTA. They find that the removal of trade barriers significantly increased intra-bloc trade, the most for Mexico (by 118%) and the least for Canada (by 11%). NAFTA has also increased sectoral specialization in Mexico: While in 1993 exports of electrical machinery represented one fifth of total export shares, after the policy shock the share increased to one third. The effect on welfare has also been the strongest in Mexico, whose real wages increased the most due to NAFTA. The welfare effect on United States and Canada has been very small, for Canada even negative (a welfare loss of 0.06%). Real wages, however, have increased in all three countries due to NAFTA, according to the authors' model.

De Janvry et al. (1997) use an econometric model to disentangle the effect of NAFTA on international trade from macroeconomic shocks and other effects. They construct a model predicting US exports to and imports from Mexico based on parameters such as income, population or the real exchange rate. They build the model on data from 1973 to 1990, compute the fitted values for 1994 and 1995 and attribute the difference between the predicted and true values to NAFTA. Authors find that NAFTA greatly helped to mitigate the negative effect that the peso crisis in 1995 would otherwise have had on US-Mexico trade.

In their article titled "The impact of NAFTA on the United States", Burfisher, Robinson, and Thierfelder (2001) evaluate the concerns that the agreement would harm the US labor markets and lead to increased migration of unskilled workers from Mexico to the United States. Three sectors, the authors note, were "especially contentious" during the NAFTA debates: agriculture, the automotive industry and textiles.

Prior to NAFTA, agriculture has been heavily regulated and subsidized in Mexico - corn and grain farmers faced a guaranteed price and imports of these commodities were restricted. Sudden liberalization of these sectors would cause their collapse and the resulting unemployment of Mexican workers could lead to a surge in migration to the United States. Two measures had been taken to avoid this scenario: Sensitive crops were liberalized only after a 15-year transition period, and Mexico undertook a policy reform, replacing the guaranteed price system with income subsidies. The United States and Canada also revised their agricultural policies, leading together with NAFTA to a faster growth in agricultural trade within NAFTA countries than with the rest of the world.

Like agriculture, the auto industry has also been heavily protected in Mexico prior NAFTA. There were requirements for domestic content, limits on imports of new cars and a prohibition on importing used ones. All of these were to be eliminated as part of NAFTA for cars that had at least 65% North American content. Proponents of NAFTA therefore argued that US auto workers would not be hurt by NAFTA because potential job losses would be offset by the opening of the Mexican market. According to Burfisher et al., they were right. Employment in the auto industry grew, as did hourly wages and investment in new manufacturing plants in the United States. The automotive industry also experienced a strong increase in intra-industry trade, meaning that auto parts are manufactured in Mexico and then assembled in the US and vice versa, leading to increased efficiency and competitiveness of North American car producers.

North America has also seen an increase in trade in textiles and apparel after NAFTA, but these sectors are not very relevant for the discussion about NAFTA repeal due to surging imports from China and other countries.

3.2 Papers focusing on Mexico

The Heckscher-Ohlin model of international trade states that a country will export goods intensive in factors of production in which the country is abundant. This has a direct effect on the distribution of income: "Owners of a country's abundant factors gain from trade, but owners of a country's scarce factors lose" (Krugman et al., 2012). Applying this simple model to Mexico, a relatively unskilled-labor abundant country, and the skilled-labor abundant United States, NAFTA should *decrease* income inequality in Mexico by disproportionately benefiting the low-wage unskilled workers. In reality, many other variables affect the impact of trade liberalization on wage inequality (for example, countries' endowment of other factors of production or FDI) and it is therefore desirable to look at existing studies on NAFTA and Mexico.

Esquivel and Rodrıguez-López (2003) observe the evolution of the wage ratio between production and non-production workers (a proxy for skilled/ unskilled labor wage ratio) in 49 sectors of Mexico's manufacturing industry. They find that while this ratio has increased notably in most sectors between 1988 and 1994, between 1994 and 2000 (i.e. after NAFTA) the increase has been very minor. Overall, the wage gap increased by 27% between 1988 and 2000. Further, authors try to separate the effects of trade liberalization, which should favor the low-skilled workers, and "worldwide skill-biased technological change". The main assumption of their "mandated wage" approach is that in a price-taking economy changes in productivity have no effect on prices and are under a zero-profit condition reflected only in wage levels. Trade liberalization, on the other hand, influences wage levels solely through price changes. Authors construct corresponding functions and apply econometrics to estimate the key parameters. Their conclusion is that unilateral trade liberalization before NAFTA would have reduced the wage gap, but was offset by the large negative impact of skill-biased technological change. After 1994, the trade effect was nil, according to the authors, and the slight increase in the wage gap has also been driven by technological progress.

Hanson (2003) also examines the impact of liberalization of trade and investment on Mexican wages. To do that, he obtains random samples from the 1990 and 2000 Mexico census. Contrary to Esquivel and Rodrıguez-López (2003), he concludes that trade liberalization has in fact increased wage inequality because it has been accompanied with large inflows of FDI, which further raised the demand for skilled workers. Moreover, unilateral trade liberalization and NAFTA contributed to increasing *regional* disparities in Mexico as northern regions close to the United States benefited much more.

An IMF working paper (Kose et al., 2004) reviews a number of surveys and finds that NAFTA has positively contributed to GDP growth, which was driven mainly by investment and exports. It also mentions increased competitive pressures as a result of trade liberalization and highlights the importance of structural reforms. As for wage and regional inequalities, authors mention the rapid growth of the *Maquiladora* sector as a source of increasing wage differences between regions. These companies are located near the US border and manufacture mainly auto parts, apparel and electronics. They import inputs from the United States, process them and re-export them back to the US.

Baylis, Garduño-Rivera, and Piras (2012) collect data at the municipal level to observe the distributional effects of NAFTA. They construct several econometric models and find that the distance of a municipality from the US-Mexico border had a higher impact in 2003 than in 1980 on the growth of Gross Value Added in that municipality. In line with the predictions of the Heckscher-Olin model but contrary to (Hanson, 2003), authors find that regions with high rates of low-skilled workers benefited more from NAFTA.

4 Policy change

Modeling a policy change such as the repeal of NAFTA in GTAP consists of several steps that need to be taken before GEMPACK software computes the new after-shock equilibrium. One must first aggregate the GTAP Data Base, then define the policy shock and choose a closure. I will describe my approach to each of these steps in this chapter.

Only tariff rates will be assumed to change as a consequence of NAFTA repeal – non-tariff barriers will be assumed to remain constant. While the establishment of NAFTA had reduced many non-tariff barriers by harmonizing standards or by speeding up agricultural reforms, these benefits are unlikely to be affected if NAFTA was canceled. As for costs associated with customs clearances, these will also be assumed to remain constant because they were not eliminated by NAFTA – traded goods still need to be checked for their content and for whether they comply with the agreement's rules of origin.

One might also argue that the policy will affect other exogenous variables in the model such as endowment of labor due to migration or factor productivity in some industries. Determining the direction and the size of such change, however, would to some extent have to be arbitrary and it would decrease the transparency of the experiment.

4.1 Data aggregation

As mentioned in section 2.2.2, the GTAP Data Base contains information on 140 regions, 57 sectors and 8 factors of production. Using a model with all these regions, sectors and factors for policy analysis would be extremely computationally intensive and it would make the results difficult to coherently interpret. GTAP therefore provides an aggregation software *GTAPAgg*, which allows users to define aggregation that will be most suitable for their intended use.

In the regional aggregation, Canada, Mexico and the United States were kept disaggregated, and the rest of the world has been aggregated into four distinct regions so that the direction of potential trade diversion can be observed. One region is the European Union, which is an important trading partner of all three countries, as is the East Asia region, which includes countries such as China, Japan or South Korea. Third region in this aggregation is Latin America which includes economies of Central and South America. This region was included because of its proximity to Mexico (and the rest of NAFTA members) which, in line with the gravity theory of trade (Bergstrand, 1985), should play a role in the determination of trade diversion as a consequence of NAFTA repeal. The remaining 81 countries/regions were aggregated to a Rest of the World region. In total, there are 7 regions in the aggregation created for this thesis:

- Canada
- USA
- Mexico
- Latin America
- EU
- East Asia
- Rest of the World

In the sectoral aggregation, I focused on identifying sectors that were affected by NAFTA the most. Burfisher et al. (2001) name three industries "especially contentious" during the NAFTA debate: automotive industry, agriculture and textiles. Kose et al. (2004) describe Maquiladoras, manufacturing plants near the US-Mexico border that produce electronics, auto parts and apparel. The aggregation for this thesis is based on the preset aggregation, which creates 10 sectors out of the original 57 and was further disaggregated where desirable. *Textiles and Apparel* already formed one sector in the preset aggregation, so there was no need to adjust it. Similarly, the agriculture sector was already well represented by *Grains and Crops* sector, which comprises of rice, cereal grains or sugar, and *Livestock and Meat Products* sector including animals, milk or wool. Products of the automotive industry were by default part of the preset *Light Manufacturing* sector, and were therefore excluded from this sector and treated separately. Similarly, *Electronic Equipment* (computers, radios or telephones) was separated from the *Heavy Manufacturing* sector. The desirability of separate treatment of these two sectors is supported by trade data in the GTAP Data Base: nearly 20% of Mexican imports to the US fall into the *Motor Vehicles and Parts* category and 16.5% into the *Electronic Equipment* sector. After accounting for key sectors identified in the literature, the rest of the sectoral aggregation was obtained from the preset aggregation, resulting in the total of 12 sectors – 9 goods sectors and 3 sectors of services:

- Grains and Crops
- Livestock and Meat Products
- Mining and Extraction
- Processed Food
- Textiles and Clothing
- Light Manufacturing
- Heavy Manufacturing
- Motor Vehicles and Parts
- Electronic Equipment
- Utilities and Construction *(services)*
- Transport and Communication *(services)*
- Other Services

When it comes to factors of production, GTAP distinguishes between capital, land, natural resources and five categories of labor. These five categories are by default aggregated into skilled and unskilled labor. I chose not to disaggregate labor further, because the division into skilled and unskilled labor is suitable for observing the impact of canceling NAFTA on income inequality. The five resulting factors of production therefore are:

- Land
- Capital
- Natural Resources
- Skilled Labor
- Unskilled Labor

4.2 Target tariff rates

Canceling NAFTA will increase tariffs. Without a free trade agreement, USA, Mexico and Canada will trade under their *Most Favored Nation* (MFN) rates, which are applicable to products from countries without any special treatment. Unfortunately, these cannot be applied precisely in our model and therefore have to be derived. Even if a fully disaggregated GTAP Data Base was used, 57 sectors are still much less than 12748 unique tariff lines in the United States' tariff schedule, as published by the United States International Trade Commission.[8] As a result, the import tariff rate implied by GTAP differs for importer countries that face the MFN treatment due to different structure of imports *within* each sector. To determine United States' *target* tariff rates, i.e. rates to which US import tariffs will be adjusted, I used the following procedure:

1. From the UN Comtrade database I obtained a list of 50 largest importers to the United States and excluded countries with which the US has an FTA.

2. I disaggregated the GTAP data base and obtained tariff rates for each of the remaining importers and for each of the 57 *old* sectors.

3. I computed an average tariff rate for each sector, omitting entries with the value of 0 to account for cases when a country exports nothing from a certain sector to the US.[9] If there was no non-zero tariff in a sector then this suggests that that sector has already been fully liberalized and its target rate has therefore been set to zero.

4. After obtaining a target tariff for old sectors, the rate for the 12 *new* sectors for Mexico and Canada was calculated as an average of the old sectors, weighted by the share of imports of the old sector on total imports of the new sector from Mexico and Canada respectively.

The procedure was repeated for Canada and Mexico, resulting in 72

[8] Moreover, there is a difference between sectoral aggregation and a commodity-based tariff schedule.

[9] For example, if the tariff entries were 3, 0, 0 and 5, then the resulting average was 4.

unique target tariff rates that will be assumed to take place after NAFTA. This process was chosen in order to mitigate the impact of different import structure within sectors by obtaining a "representative" target tariff for each of the 57 old sectors and further by using country-specific weights when averaging these rates to new sectors. The decision to work with the largest import partners was made with the same goal – to decrease the likelihood that the GTAP tariff rate for a certain country will be determined by just one or few products being exported from that country to the US, which is most likely not the case of Canada and Mexico.

Table 2 presents the resulting 72 target tariff rates, along with the value of current imports that will be affected by the tariff change in parentheses. The table reveals that the most traded industries, Light Manufacturing, Heavy Manufacturing, Electronics and Motor Vehicles will face a relatively modest tariff increase with one important exemption, US exports to Mexico. Mexican MFN tariffs on manufactures, especially on cars and car parts, are relatively high and repealing NAFTA would make US-Mexico value chains and Maquiladoras notably less profitable.

Tariff rates in the three service sectors are zero before as well as after the modeled policy change because barriers to trade in services are almost exclusively non-tariff. Service sectors are included in table 2 just to inform the reader about the size of intra-NAFTA trade in these sectors.

Interestingly, tariff values for some sectors between NAFTA members are not zero in the GTAP Data Base. The implied tariff rates in GTAP may include also ad valorem equivalents of other trade barriers, which suggests that NAFTA did not fully liberalize certain sectors. The disaggregated database reveals that Canada still severely restricts imports of dairy products, which have an implied tariff rate of over 170% for USA and Mexico, and similar values for other regions. Mexico and USA also appear to regulate trade in dairy products, although the implied tax rates are much lower. Tariff rates for other products are zero with few rare exceptions, which in most cases fall to the *Livestock and Meat Products* or *Processed Food* category. Fortu-

Table 2: Derived post-NAFTA tariff rates and the value of imports affected

Destination	USA		Canada		Mexico	
Source	Can	Mex	USA	Mex	Can	USA
GrainsCrops	2.10 (4.77)	2.73 (11.27)	1.30 (5.97)	1.56 (1.02)	11.97 (1.53)	12.08 (9.75)
MeatLstk	1.57 (4.11)	1.90 (1.15)	47.42 (2.99)	22.59 (0.01)	16.64 (0.32)	17.88 (4.45)
Extraction	0.10 (65.38)	0.11 (28.22)	0.3 (7.28)	0.22 (0.51)	2.36 (0.10)	1.53 (3.4)
ProcFood	3.58 (14.68)	5.57 (9.63)	13.87 (12.49)	10.35 (0.24)	15.46 (0.29)	17.86 (7.12)
TextWapp	7.08 (2.26)	8.32 (6.07)	9.11 (3.01)	10.96 (0.22)	18.01 (0.06)	16.53 (4.51)
LightMnfc	0.67 (36.91)	1.10 (17.01)	2.18 (29.63)	3.06 (1.32)	9.01 (0.83)	8.33 (17.02)
HeavyMnfc	1.24 (103.34)	1.05 (89.69)	0.75 (114.47)	0.43 (4.04)	5.41 (2.60)	4.92 (100.72)
Electr	0.31 (4.75)	0.31 (44.46)	0.24 (6.52)	0.24 (2.44)	1.31 (0.67)	1.31 (8.90)
MotorVeh	0.82 (54.25)	0.82 (53.51)	3.55 (47.29)	3.55 (5.31)	13.25 (1.49)	13.25 (22.02)
Util_Cons	0 (3.08)	0 (0.08)	0 (0.63)	0 (0)	0 (0)	0 (0.06)
TransComm	0 (6.33)	0 (5.03)	0 (7.33)	0 (0.06)	0 (0.02)	0 (2.43)
OthServices	0 (16.6)	0 (3.11)	0 (20.95)	0 (0.05)	0 (0.10)	0 (5.25)

Source: Own calculations based on the disaggregated GTAP Data Base. Tariff rates are expressed in percentage points, value of imports is in parentheses and expressed in billions of 2011 US dollars.

nately, these anomalies are not an issue for the analysis because all target rates calculated above are higher than base rates and the simulation will therefore increase tariffs in all sectors.

4.3 Closure

The choice of most *microeconomic* variables that will be treated as exogenous is straightforward and derives from the logic of the model. All the behavioral parameters of production and utility functions are kept constant, as well as parameters allowing for technological change. Exogenous is also the level of factor endowment in each region, tax rates and tariff rates, which will be adjusted.

Macroeconomic closure means deciding on how investment will be allocated. In this simulation, I will use a standard GTAP closure where the allocation of investment is sensitive to rates of return, as described in section 2.2.1. Later, I will adopt two alternative macroeconomic closures and observe the sensitivity of results to the choice of closure. The default numeraire, i.e. the global index of factor remuneration, is used.

5 Results

The core of this chapter are tables 6, 7 and 8 which describe the sectoral impact of potential NAFTA repeal on each NAFTA member. A very similar form of presentation of results was adopted by Hertel, Ianchovichina, and McDonald (1997), who used GTAP to estimate the impact of the Uruguay Round on South Korea.[10] First, however, an overall assessment of the "post-NAFTA" equilibrium, as predicted by GTAP, will be made.

I mentioned in the literature review that it should first be checked whether predictions of sectoral changes in capital endowment are compatible with the potential effect of trade hysteresis. I conclude that they are since the change is in most cases lower than 3%.[11] There is one outlier, however, and that

[10] The text is part of the textbook "Applied methods for trade policy analysis: A handbook" (Reinert and Francois, 1997).

[11] A full table is provided in the Appendix – table 12.

is the textile industry in Mexico, which is predicted to experience an 11% outflow of capital. I consider this prediction realistic as well because the decline could be achieved merely by halting or decreasing new investment to this industry and letting the existing capital depreciate. [12]

5.1 Overall impact

5.1.1 Trade

Table 3: Changes in trade flows after NAFTA repeal

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU	Total
RoW	-0.1	0	0.3	-0.4	11.6	0	0	0
EAsia	-0.3	-0.2	1.8	-0.6	12.7	-0.2	-0.2	-0.1
Canada	2.7	2.5	0	-3.3	-21	2.6	2.9	-1.5
USA	2.4	2.4	-4.6	0	-20.1	2.4	2.4	-0.7
Mexico	1.3	1	-8	-6.1	0	0	0.6	-4.6
LatAm	-0.5	-0.4	0	-0.4	19.1	-0.4	-0.4	-0.1
EU	-0.1	-0.1	0.4	-0.4	14.7	0	-0.1	0
Total	0.1	0.2	-2.4	-1.4	-6.5	0.4	0.1	-0.2

Values are in percentage changes of base year values, rows denote the source country and columns the destination country. For example, a value of 0.3 in the first row and third column means that exports from Rest of the World to Canada increased by 0.3 percent in the post-NAFTA equilibrium

Table 3 presents percentage changes in trade flows between all regions of the model. It is immediately apparent that Mexico took the biggest hit in terms of trade flows. Imports from the country's main trading partner, the United States, are estimated to decrease by one fifth in the medium term after NAFTA repeal. Imports from Canada decreased at a similar rate, but the decline in absolute quantity is 22 times lower than in the case of the United States given that Canada and Mexico trade relatively little. It should be noted that one unit of a good produced by a certain sector is

[12] For example, we can assume that useful life of capital in textiles is less than 50 years and that the medium-term horizon of GTAP predictions is 5 years.

worth one million 2011 US Dollars in the GTAP Data Base. As a result, change in the quantity produced, consumed or traded means change of the output's value in terms of millions of 2011 US Dollars.[13]

Mexican consumers and producers seeked to replace now-expensive US imports with imports from other regions, but the drop has been offset only to some extent: Total imports to Mexico declined by 6.5%. Mexican exports have been hit as well, dropping by 8% to the US and by 4.6% overall. In this case, trade diversion of Mexican products to other regions appears to be negligible.

The United States and Canada have also experienced a drop in their economic openness. Canadian exports to and imports from the US decreased by 3.3% and 4.6% respectively. Canadian exporters managed to find other markets for their products outside the North American continent and exports there rose by about 2.5%. Imports to Canada from other countries, however, did not rise notably with the only exception being the East Asia region.

Looking at how US trade with non-NAFTA regions is predicted to evolve, one might get the impression that repealing NAFTA would in fact help achieve Donald Trump's goal of strengthening exports and decreasing imports. The crucial flaw of this interpretation is the 20% decline of exports to Mexico due to large MFN tariff rates of Mexico on manufactures, especially the estimated 13.25% MFN rate on cars and car parts (see table 2). Expressed in 2011 US Dollars, this means a 35 billion USD decrease.

Trade within and between non-NAFTA regions in the model will be affected marginally. The value in the final row and column of table 3 provides an estimate on how global trade will be affected by NAFTA repeal. It is estimated to decrease by 0.2%, which translates to 44 billion USD.

5.1.2 Welfare

GTAP model offers several measures on which the impact on welfare can be observed. Four of them are shown in table 4: Total and per capita Equivalent Variation, and changes in the value and quantity of GDP.

[13] Table 15 in the Appendix shows trade changes expressed in millions of 2011 US Dollars.

Table 4: Overall welfare effects of NAFTA repeal

Measure	EV	EV PC	QGDP	VGDP
RoW	2604	0.66	0	0.15
EAsia	5399	3.42	0.01	0.20
Canada	-1709	-49.82	-0.05	-0.48
USA	-11050	-35.46	0	-0.39
Mexico	-645	-5.40	-0.11	-0.06
LatAm	1723	3.57	0.01	0.28
EU	3571	7.50	0	0.17

The Equivalent Variation is in millions of 2011 USD, its per capita counterpart in units of USD. Quantity and Value of GDP are expressed as percentage changes.

Equivalent Variation denotes the amount of US Dollars that would need to be given to (or taken away from) each region in the pre-shock state of the world to achieve the after-shock level of utility. The medium-term cost of NAFTA repeal would be the highest for Canadian citizens, each of whom would be, on average, 50 US Dollars per year poorer without NAFTA.

The difference between the change in quantity and value of Gross Domestic Product is subtle but important. As mentioned above, one unit of any sector's production is worth 1 million 2011 USD Dollars. As a result, the quantity indicator of GDP does not take into account the change in relative prices, unlike the value indicator. Value of the Canadian GDP would again decrease the most, although not very much, by 0.48%. The United States would lose slightly less, 0.39%. *Assuming that Mexico would be able to redistribute the loss evenly*, the cost of NAFTA repeal would be the lowest by some margin for the poorest member of the agreement – a GDP drop of only 0.09%.

Since this assumption usually does not hold, in table 5 I present changes in the real returns to factors of production of the model. Those results are not favorable for Mexico – labor force takes the strongest hit of all regions, with real wages of unskilled labor dropping by 1.3%. Not only would NAFTA repeal hurt Mexican workers, it would lead to an increase in income inequality by hurting the unskilled workers disproportionately more. American labor force would be hurt the least, according to the model, and NAFTA repeal would actually benefit holders of land and natural resources in all three NAFTA countries.

Table 5: Percentage changes in real factor income

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU
Land	0.07	-0.14	0.99	0.05	5.89	0.04	0.08
UnSkLab	0.03	0.03	-0.50	-0.15	-1.30	0.06	0.03
SkLab	0.01	0.03	-0.39	-0.11	-0.97	0.03	0.01
Capital	0.01	0.02	-0.43	-0.12	-1.22	0.04	0.02
NatRes	-0.15	-0.31	2.01	1.45	2.36	-0.81	-0.23

Results for Mexico suggest that its production has shifted towards industries more intensive in the use of land and natural resources. This hypothesis will be evaluated in the following section.

5.2 Mexico

The predicted effect of NAFTA repeal on Mexican production is shown in table 6, which will be reproduced also for the United States and Canada. First column of the table shows how the quantity (i.e. the value in base year dollars) of output has evolved in each sector of our simulation. The top entry of the table is the percentage change, the bottom entry in parentheses is the change in millions of 2011 (base year) USD. Other columns of the table show the determinants of that change: Second column shows the change in domestic sales and 6 remaining columns the evolution of exports from Mexico to each region. Note that by summing up the bottom entries of the second to last column in a certain row, one obtains the overall change in output, as shown in the bottom entry of the first column. The table includes a lot of entries but it is, in my opinion, a comprehensive representation of the impact of the modeled policy shock on the domestic economy and on international trade.

Table 6: Mexican output, domestic sales and exports after NAFTA repeal

Mexico	qo	qds	ROW	EAS	CAN	USA	LAM	EU
GrainsCrops	1.33 (426)	6.87 (1508)	-2.66 (-10)	-2.7 (-10)	-7.28 (-54)	-12.42 (-989)	-2.31 (-7)	-2.61 (-11)
MeatLstk	3.76 (1201)	4.97 (1493)	-9.44 (-17)	-9.81 (-46)	-71.34 (-3)	-19.61 (-211)	-9.03 (-5)	-9.64 (-9)
Extraction	0.52 (462)	0.17 (90)	2.31 (35)	1.78 (73)	-1.61 (-7)	0.62 (168)	2.07 (16)	2.37 (87)
ProcFood	-0.37 (-449)	1.32 (1443)	-1.11 (-4)	-1.2 (-4)	-12.15 (-27)	-21 (-1837)	-0.93 (-12)	-1.14 (-7)
TextWapp	-11.91 (-2546)	2.56 (373)	-6.13 (-5)	-6.05 (-5)	-53.7 (-113)	-47.95 (-2753)	-5.94 (-35)	-6.37 (-9)
LightMnfc	1.08 (852)	4.16 (2423)	0.04 (0)	-0.07 (0)	-17.23 (-212)	-8.65 (-1365)	0.24 (4)	0.09 (1)
HeavyMnfc	0.43 (1269)	3.42 (6172)	1.11 (49)	1.18 (53)	-1.76 (-68)	-5.98 (-5128)	0.93 (113)	1.15 (78)
Electr	1.46 (998)	2.19 (295)	4.42 (63)	4.46 (75)	0.59 (14)	0.64 (278)	4.35 (161)	4.63 (112)
MotorVeh	-3.01 (-3281)	5.38 (2058)	-4.7 (-67)	-4.44 (-71)	-13.28 (-673)	-7.92 (-4033)	-3.82 (-269)	-4.67 (-227)
Util_Cons	-1.94 (-3689)	-1.97 (-3717)	2.43 (9)	2.51 (3)	0.48 (0)	0.56 (0)	2.8 (1)	2.53 (15)
TransComm	-0.05 (-204)	-0.13 (-484)	3.43 (60)	3.51 (37)	1.84 (1)	2.44 (123)	3.68 (9)	3.46 (44)
OthServices	0.39 (2185)	0.34 (1864)	4 (68)	4 (66)	2.25 (1)	3.1 (96)	4.28 (11)	4.1 (77)

Values in the top entry are a percentage change, values in the bottom entry are that change in millions of 2011 USD. Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model.

It appears from the table that sectors that concentrate their production near the Mexico-US border took the largest hit. Three sectors associated with Maquiladoras by Kose et al. (2004) (textiles, electronics and cars/car parts) decreased their total value of output by 4.8 billion USD in base year prices. The sector that took the biggest hit was the *Textiles and Clothing* sector, where output declined by 11.91 % and exports to the US fell by almost a half. Output of the automotive sector also fell notably as the increase in domestic demand did not offset the drop in exports. That, however, was not the case in other manufacturing industries – *Light Manufacturing*, *Heavy Manufacturing* and *Electronic Equipment* sectors all experienced a slight rise in the base year value of their output as domestic demand rose more than exports fell. Apart from these sectors, Mexican production has also shifted towards agriculture, represented in the model by the first two sectors.

It might seem confusing that domestic demand increased in almost every sector despite the overall GDP slightly declining as we saw in table 4. The explanation is not present in this table but it is present in table 3, more specifically in its fifth row which shows the percentage changes in imports to Mexico. It is apparent that Mexican consumers and firms began to substitute US and Canadian imports not only with imports from other regions, but also with their own production, mitigating the impact of tariff increases in Canada and USA on their output.

I mentioned in the previous section that it appears that production has shifted towards sectors that use high proportion of land and natural resources for their production. Land is only used in the two agriculture industries – *Grains and Crops and Livestock* and *Meat Products* – and natural resources are an input only to *Mining and Extraction*. Production in all three sectors has indeed increased, increasing the demand for these factors and consequently also their price. It may raise some eyebrows that output of the *Mining and Extraction* industry increased while the endowment of natural resources, which should essentially also be the output, remained constant. The increase is nevertheless very small, only 0.1%, and one may argue that this increase in efficiency is possible with additional labor and capital. Developers of GTAP took this into account because they set the elasticity of substitution between primary factors in this sector to just 0.2.

Changes in the demand for other factors of production (i.e. capital, skilled labor and unskilled labor) very much follow the path of changes in output.[14]

[14] A reader interested in changes in factor demand (which equal to the change in the actual use of these

GTAP does not employ a fixed proportion production function, in which case the correlation would be one, but the room for substitution between factors is nevertheless limited due to relatively low values of substitution elasticities.[15]

5.3 United States

Unlike Mexico, the United States of America did not experience a very significant substitution of imported goods for those produced domestically in the new equilibrium. The second row of table 7 reveals that there is no sector in which domestic sales would increase by more than one percent, compared to eight such sectors in Mexico. The view changes when these values are considered in absolute terms, which is due to the different size of the Mexican and US economy. Top entries of the first column of the same table also do not reveal any large changes in the US production, the "shake up" has been much larger in Mexico than in the US, in relative terms.

Nevertheless, some sectors have been hurt. The biggest decline in production in both absolute and relative terms is predicted in the auto sector. The base year value of the output in this sector would decline by 7.5 billion USD. Marginal increases in domestic sales and in exports to non-NAFTA regions could not offset the 7.3% decline of exports to Canada and 32.4% decline of exports to Mexico. These findings confirm the hypothesis from section 4.2 that companies like Chrysler, Ford or General Motors would be the least happy with NAFTA repeal.

Each of the three remaining manufacturing sectors experienced an increase in production, with their total output rising by just over 11 billion USD. The largest decrease in exports to Mexico was in the textile industry, which again supports the conclusion that NAFTA repeal would severely damage value chains between Mexico and the United States associated with Maquiladora production plants.

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factors) may look at tables 12, 13 and 14 in the appendix and perhaps compare them with changes in output reported in tables 6, 7 and 8.

[15] These values typically range from 1.1 to 1.4 and the lowest value (0.2) is in the above-mentioned mining sector.

Table 7: US output, domestic sales and exports after NAFTA repeal

USA	qo	qds	ROW	EAS	CAN	MEX	LAM	EU
GrainsCrops	0.17 (413)	0.52 (845)	2.05 (423)	1.57 (541)	-2.37 (-110)	-18.1 (-1547)	2.11 (126)	2.35 (135)
MeatLstk	-0.71 (-2553)	-0.17 (-590)	3.5 (142)	3.01 (295)	-32.67 (-921)	-37.61 (-1569)	3.67 (56)	3.78 (35)
Extraction	0.21 (844)	0.28 (1032)	1.53 (74)	1.34 (98)	-3.06 (-194)	-10.41 (-311)	1.27 (25)	1.55 (120)
ProcFood	-0.15 (-1052)	0.13 (792)	1.81 (201)	1.74 (205)	-1.67 (-192)	-36.05 (-2307)	1.98 (127)	1.95 (121)
TextWapp	-0.57 (-1680)	0.57 (1563)	3.05 (80)	3.12 (85)	-42.43 (-1196)	-58.15 (-2440)	3.11 (149)	3.1 (80)
LightMnfc	0.04 (642)	0.17 (2481)	3.32 (1538)	3.18 (1201)	-8.94 (-2476)	-29.16 (-4576)	3.45 (537)	3.45 (1935)
HeavyMnfc	0.14 (4901)	0.31 (8455)	2.41 (3946)	2.5 (3450)	-2.65 (-2872)	-15.68 (-14946)	2.24 (2222)	2.49 (4647)
Electr	0.98 (5498)	0.74 (3441)	3.26 (827)	3.3 (956)	-0.54 (-34)	-6.43 (-561)	3.18 (253)	3.44 (616)
MotorVeh	-1.22 (-7527)	0.3 (1491)	2 (440)	2.27 (233)	-7.27 (-3278)	-32.34 (-6820)	2.76 (150)	2.2 (256)
Util_Cons	-0.28 (-6710)	-0.29 (-6963)	2.36 (111)	2.44 (61)	0.41 (3)	0.48 (0)	2.74 (6)	2.46 (72)
TransComm	0.01 (466)	-0.03 (-1515)	1.92 (481)	1.99 (443)	0.34 (25)	0.13 (3)	2.16 (80)	1.94 (937)
OthServices	0.04 (4548)	-0.01 (-866)	1.87 (1559)	1.87 (1012)	0.15 (31)	-0.49 (-26)	2.14 (217)	1.96 (2620)

Values in the top entry are a percentage change, values in the bottom entry are that change in millions of 2011 USD. Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model.

5.4 Canada

Impact of NAFTA repeal on Canada is determined by US-Canada trade, since Mexico-Canada trade is still relatively small. Trade between the United States and Canada has not been analyzed in detail in this thesis, but it is still important to look at sectoral changes in Canada to get the full picture of the estimation made in this paper.

Exports to the US were affected the most in *Heavy Manufacturing*, *Motor*

Table 8: Canadian output, domestic sales and exports after NAFTA repeal

Canada	qo	qds	ROW	EAS	USA	MEX	LAM	EU
GrainsCrops	0 (0)	1.32 (173)	2.65 (136)	2.26 (105)	-5.65 (-224)	-19.66 (-278)	2.71 (38)	2.92 (51)
MeatLstk	1.97 (982)	2.81 (1181)	1.75 (16)	1.26 (29)	-7.69 (-297)	15.35 (46)	1.93 (3)	1.95 (4)
Extraction	0.33 (542)	-0.35 (-284)	1.94 (46)	1.85 (190)	0.7 (434)	-18.07 (-16)	1.9 (24)	2.29 (148)
ProcFood	-0.23 (-219)	0.3 (230)	2.22 (24)	2.11 (48)	-3.72 (-498)	-22.44 (-59)	2.32 (10)	2.4 (26)
TextWapp	-2.87 (-496)	2.3 (334)	2.55 (4)	2.64 (5)	-38.08 (-813)	-62.46 (-32)	2.64 (2)	2.59 (5)
LightMnfc	0.66 (1291)	1.15 (1593)	3.62 (179)	3.38 (280)	-2.34 (-796)	-33.99 (-265)	3.79 (57)	3.88 (244)
HeavyMnfc	-0.99 (-3771)	0.41 (937)	2.71 (348)	2.79 (248)	-5.76 (-5627)	-18.47 (-455)	2.5 (121)	2.83 (656)
Electr	1.12 (263)	0.86 (131)	4.43 (37)	4.47 (27)	0.67 (31)	-5.34 (-35)	4.36 (14)	4.63 (57)
MotorVeh	-1.99 (-1989)	2.27 (987)	-1.27 (-13)	-1.04 (-7)	-4.69 (-2448)	-34.51 (-497)	-0.51 (-3)	-1.18 (-7)
Util_Cons	-0.74 (-2386)	-0.78 (-2463)	3.06 (17)	3.14 (8)	1.17 (36)	1.17 (0)	3.44 (3)	3.16 (13)
TransComm	0.08 (456)	-0.02 (-103)	2.81 (131)	2.89 (116)	1.83 (116)	1.01 (0)	3.06 (20)	2.84 (153)
OthServices	0.18 (2249)	0.09 (1045)	2.87 (314)	2.87 (153)	1.98 (329)	0.49 (1)	3.15 (42)	2.96 (365)

Values in the top entry are a percentage change, values in the bottom entry are that change in millions of 2011 USD. Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model.

Vehicles and Parts (in absolute terms) and *Textiles and Clothing* (in relative terms). These three sectors were also affected the most overall, in terms of output. The automotive sector is the only sector in Canada in which exports to non-NAFTA regions fell, resulting in total output decline of 2 percent, or nearly 2 billion USD. Exports to non-NAFTA regions rose in Canada's largest sector, *Heavy Manufacturing*, but that did not offset the 5.8% decline in exports to the United States and the resulting drop in output's value was nearly 3.8 billion USD.

Textiles and Clothing industry's exports to the United States fell by almost 40% and its total output by 2.87%. Further, GTAP predicts that exports to Mexico in this industry would fall by 62.46%, which is interesting with respect to the discussion in the literature review. There, Kehoe (2005) and Fox et al. (2015) argue that models like GTAP are unable to predict large increases in trade in sectors with little previous trade following trade liberalization. I do not object their claim but it is apparent that GTAP can predict large *decreases* in these little-traded industries when tariffs are modeled to increase.

5.5 Scenario analysis

5.5.1 Different target tariff rates

The target level of tariffs after NAFTA repeal had to be estimated in this model because of the limited number of sectors and because the structure of imports within a sector differs across regions (see section 4.2). For that reason, it is desirable to observe how results of the model vary when different target tariff changes are assumed. In one scenario, I will work with target tariffs that are 20% higher than those estimated in section 4.2 and shown in table 2 and in the second scenario the target tariff rates will be 20% lower. The decision to adjust target tariff rates by a certain amount of *percent* rather than *percentage points* was made with respect to the observed variance in MFN rates of NAFTA countries in the GTAP model, which was higher when the resulting average of non-zero values was relatively high and lower when the average was low (step 2 of the procedure used to obtain target tariff rates described in section 4.2).

The simulation which I performed using target tariff rates from section 4.2 will be referred to as the *original* scenario/simulation, the one with target tariffs 20% higher will be called *bad case* (BCS) and the remaining one *good case* scenario (GCS).[16] Results of these alternative simulations are

[16]It should be noted that one target tariff rate in the good case scenario (the Canadian tariff on imports

summarized in table 9, which shows how factor income and welfare evolves under the two scenarios. Tables that show the impact on international trade and output in Mexico, USA and Canada are available in the Appendix – tables 16, 17, 18 and 19 respectively. The results reveal that the choice of designations has been appropriate: The predicted negative effect of NAFTA repeal on income, welfare and trade is mitigated when lower target tariffs are used and amplified in the bad case scenario. For example:

- The per capita Equivalent Variation for USA is -35.46 USD in the original scenario, -42.74 USD in the BCS and -28.41 USD in the GCS (see tables 4 and 9).
- The value of Mexican GDP decreased by 0.06% in the original scenario, by 0.14% in the BCS and by 0.01% in the GCS (see tables 4 and 9).
- Real wages of skilled and unskilled workers in Mexico decreased by 0.97% and 1.30% respectively in the original scenario, by 1.16% and 1.52% respectively in the BCS and by 0.78% and 1.07% respectively in the GCS (see tables 5 and 9).
- Exports from United States to Mexico decreased by 20.1% in the original scenario, by 23.5% in the bad case scenario and by 16.4% in the good case scenario (see tables 3 and 16).
- Exports from Mexico to the United States decreased by 6.1% in the original scenario, by 7.1% in the BCS and by 5.1% in the GCS (see tables 3 and 16).
- Total imports to Mexico decreased by 6.5% in the original scenario, by 7.5% in the BCS and by 5.3% in the GCS (see tables 3 and 16).
- Mexican auto exports to the US declined by 7.92% in the original scenario, by 9.15% in the BCS and by 6.57% in the GCS. Domestic sales of

of the *Processed food* sector from the US) was lower than the rate implied by the GTAP Data Base. As mentioned in section 4.2, in rare cases base year rates between NAFTA countries are not zero, and this was one of them. I decided to keep this tariff rate unchanged in the GCS because NAFTA repeal would definitely not decrease any tariffs.

the automotive industry in Mexico rose by 5.38% in the original scenario, by 6.24% in the BCS and by 4.46% in the GCS. Total output of this industry in Mexico declined by 3.01% in the original scenario, by 3.45% in the BCS and by 2.51% in the GCS (see tables 6 and 17).

Table 9: Changes in factor income and welfare under different scenarios

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU
Land	0.04 (0.1)	-0.12 (-0.15)	0.47 (1.36)	0.12 (-0.01)	4.7 (7.04)	0.01 (0.07)	0.04 (0.13)
UnSkLab	0.02 (0.03)	0.03 (0.04)	-0.38 (-0.64)	-0.12 (-0.18)	-1.07 (-1.52)	0.04 (0.07)	0.02 (0.04)
SkLab	0 (0.01)	0.02 (0.03)	-0.29 (-0.51)	-0.09 (-0.13)	-0.78 (-1.16)	0.03 (0.04)	0.01 (0.02)
Capital	0.01 (0.01)	0.02 (0.03)	-0.32 (-0.56)	-0.09 (-0.14)	-0.99 (-1.44)	0.03 (0.05)	0.02 (0.02)
NatRes	-0.12 (-0.18)	-0.25 (-0.36)	1.62 (2.32)	1.16 (1.76)	1.83 (2.93)	-0.64 (-0.98)	-0.18 (-0.27)
EV	2084 (3142)	4382 (6400)	-1179 (-2287)	-8852 (-13318)	-203 (-1207)	1364 (2093)	2864 (4287)
EV PC	0.53 (0.8)	2.77 (4.05)	-34.38 (-66.67)	-28.41 (-42.74)	-1.7 (-10.11)	2.83 (4.34)	6.02 (9.01)
QGDP	0 (0)	0.01 (0.01)	-0.03 (-0.07)	0 (-0.01)	-0.06 (-0.15)	0.01 (0.01)	0 (0)
VGDP	0.12 (0.18)	0.16 (0.24)	-0.39 (-0.56)	-0.32 (-0.47)	-0.01 (-0.14)	0.22 (0.34)	0.14 (0.2)

First five rows denote percentage changes in real income of factors of production. The Equivalent Variation is in millions of 2011 USD, its per capita counterpart in units of USD. Quantity and Value of GDP are expressed as percentage changes. Top entry values denote changes when 20% lower target tariffs are used (the good case scenario), bottom entry in parentheses is the result when 20% higher target tariffs are used (the bad case scenario). For corresponding values of the original scenario look at tables 5 and 4.

Sensitivity analysis such as the Monte Carlo simulation would be even more appropriate for this model. It would take into account cases when tariff increases follow a *good case* scenario in one industry and a *bad case* in another, and the resulting substitution effects. It was, however, not performed in this thesis due to technical constraints. The scenario analysis performed in this section nevertheless produces intervals in which the impact of NAFTA repeal is likely to be, should it be realized in the near future.

5.5.2 Different macroeconomic closures

In this section, I perform two additional simulations with the GTAP model that differ only in the choice of macroeconomic closure, more specifically in the determination of how global investment (determined by the level of total savings) is allocated into regions. The main simulation, results of which were described in previous sections, adopted a variable portfolio assumption where global investment allocation is sensitive to expected rates of return in regions. The second model will assume a fixed portfolio, meaning that shares of regional investment on total investment do not change. Third closure explicitly fixes the difference between exports and imports, i.e. the current account, which is identically equal to the difference between savings and investment. As a result, the level of regional investment changes by the same amount as regional savings do. Target tariff rates are taken from the original scenario. A similar analysis has been performed by Hertel et al. (1997), from who I again adopt the form of the presentation of results.

The reason I perform this comparison is precisely the effect that investment allocation has on the current account. The issue of trade deficits is frequently discussed but its connection to savings and investment is too often being neglected. It is therefore interesting to observe how the current account and other key variables are sensitive to the choice of investment determination. While the fixed current account assumption may seem too unrealistic, the fixed portfolio assumption is appealingly simple and transparent.

Table 10 compares results of the three closures. The two alternative closures with fixed portfolio and fixed trade balance produce very similar results. As Hertel et al. (1997) note, this is because our simulation did not lead to very large changes in regional income. As a result, regional savings also changed little and so did the level of global savings which equals to the level of global investment. Under the fixed portfolio assumption, regional investment did not change much either and that is why we observe only small changes in the current account under this type of closure.

Table 10: Sensitivity of results to the choice of closure – selected macro variables

	Closure type	Standard	Fixed trade bal.	Fixed portfolio
Mexico	Export volume	-4.64%	-5.81%	-5.93%
	Trade bal. change	5361.86	0	-579.72
	Terms of trade	0.19%	0.39%	0.41%
	EV	-644.85	52.55	140.79
USA	Export volume	-0.67%	-1.30%	-1.28%
	Trade bal. change	16655.22	0	612.96
	Terms of trade	-0.41%	-0.3%	-0.3%
	EV	-11049.81	-7788.76	-7941.81
Canada	Export volume	-1.45%	-2.04%	-2.13%
	Trade bal. change	3757.85	0	-503.04
	Terms of trade	-0.2%	-0.11%	-0.1%
	EV	-1708.69	-1031.38	-912.92

Trade balance change is in millions of USD, as well as the Equivalent Variation. The remaining two variables are percentage changes.

In contrast, under the standard closure there is an outflow of investment from NAFTA countries due to decreases in their respective rates of return, as shown in table 11. That increases the left-hand side of the identity $S - I \equiv X - M$, and so the right-hand side needs to adjust as well. This leads to a decrease in export prices and/or an increase in import prices, which translates to the worsening of terms of trade compared to other closure types (see table 10). Terms of trade changes tend to dominate the welfare effect in models like GTAP (Hertel et al., 1997), and so we see that Equivalent Variation improves when we use an alternative closure. In Mexico, it even changes sign from negative to positive. This in per capita terms means that a Mexican citizen would be, on average, by an equivalent of 0.44 or

1.17 USD per year (depending on which of the two alternative closures is adopted) better off if NAFTA was repealed.

Table 11: Changes in the current rate of return (RORC)

Region	RestofWorld	EastAsia	Canada	USA	Mexico	LatinAmer	EU
RORC	0.03	0.05	-0.91	-0.42	-2	0.11	0.04

Values are percentage changes in the level of the rate of return (not percentage point changes).

6 Conclusion

In this paper, I estimated the potential impact of canceling a large and frequently discussed free trade agreement, the *North American Free Trade Agreement*. I used a standard version of the Global Trade Analysis Project computable general equilibrium model, a respected model used for estimating medium term effects of trade (and other) policies. The latest version of the accompanying GTAP Data Base was used as a data input. If NAFTA was repealed, tariff rates between Canada, Mexico and the United States would rise to the *Most Favored Nation* levels, which were derived for each sector using detailed trade data of the GTAP Data Base. Two other simulations that assumed MFN levels to be 20% higher and lower than original estimates were carried out to take into account the variance of sectoral MFN rates in GTAP due to different import structures within sectors.

Finding positives in repealing NAFTA is extremely difficult. In fact, under each of these three simulations, all the different welfare measures imply that canceling NAFTA would not be beneficial for any of the three countries involved. Canadian citizens would, on average, lose an equivalent of 34 to 66 USD per year and their real GDP would decline by 0.39% to 0.56%, depending on the choice of MFN rates. Impact on the United States would be slightly lower (GDP drop between 0.32% and 0.47%) and Mexican GDP would be affected the least (a decline between 0.01% and 0.14%). However, in terms of wages, it would be the Mexican workers who would get the biggest hit – real wage of skilled workers is estimated to decline by 0.97% and wages of unskilled workers by 1.3% in the original scenario. So, not only would income of Mexican workers decline the most, NAFTA repeal would hurt the unskilled workers disproportionately more, further amplifying the already high level of income inequality in Mexico.

The magnitude of the effect of NAFTA repeal on trade would be notably higher. It would severely harm especially the US-Mexico value chains that thrived after the agreement's entry into force in 1994 and concentrate near the US-Mexico border. US exports to Mexico of textiles, automobiles and electronics, sectors most associated with these value chains, would drop by 58%, 32% and 6% respectively in the original scenario. For Mexican exports to the US these changes are -48%, -8% and +0.6% respectively. From this point of view, NAFTA repeal could help fight the increasing regional disparities in Mexico, as its production would shift towards more traditional sectors such as agriculture. While trade relationships of NAFTA members with regions outside North America would generally improve (a phenomenon called trade diversion), these increases would not offset the decline in intra-NAFTA trade and the economic openness of all three countries would decline.

For further research I suggest replicating the experiment with a different model (for example with the HPPC model mentioned in chapter 3, which uses a different specification of international trade) and comparing the results.

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Table 12: Percentage changes in the demand for capital across regions and sectors

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU
GrainsCrops	0.01	-0.07	0.05	0.19	1.89	-0.01	0.01
MeatLstk	0.05	-0.02	2.04	-0.73	4.42	0.04	0.04
Extraction	-0.03	-0.07	0.49	0.31	0.71	-0.17	-0.05
ProcFood	0.03	0.02	-0.23	-0.17	-0.38	0.02	0.03
TextWapp	0.23	0.15	-2.87	-0.59	-11.92	0.02	0.11
LightMnfc	-0.02	-0.07	0.66	0.02	1.07	-0.07	-0.02
HeavyMnfc	0.01	0	-0.99	0.12	0.41	-0.15	-0.01
Electr	-0.12	-0.35	1.11	0.96	1.45	-0.22	-0.08
MotorVeh	0.18	0.45	-1.99	-1.24	-3.02	0.59	0.36
Util_Cons	0.11	0.15	-0.78	-0.30	-1.96	0.26	0.16
TransComm	-0.01	-0.02	0.06	-0.01	-0.06	0	-0.06
OthServices	-0.03	0	0.19	0.03	0.47	0	-0.02

Table 13: Percentage changes in the demand for skilled labor across regions and sectors

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU
GrainsCrops	0.02	-0.07	0.03	0.19	1.81	-0.01	0.01
MeatLstk	0.05	-0.02	2.02	-0.73	4.29	0.04	0.05
Extraction	-0.03	-0.07	0.48	0.31	0.66	-0.17	-0.05
ProcFood	0.04	0.02	-0.28	-0.17	-0.66	0.02	0.04
TextWapp	0.24	0.15	-2.92	-0.60	-12.20	0.02	0.12
LightMnfc	-0.02	-0.07	0.61	0.01	0.75	-0.07	-0.02
HeavyMnfc	0.02	-0.01	-1.05	0.11	0.09	-0.15	-0.01
Electr	-0.11	-0.35	1.06	0.95	1.13	-0.22	-0.07
MotorVeh	0.19	0.45	-2.04	-1.24	-3.32	0.60	0.36
Util_Cons	0.12	0.14	-0.84	-0.31	-2.30	0.27	0.17
TransComm	0	-0.02	-0.01	-0.02	-0.47	0.01	-0.05
OthServices	-0.02	0	0.14	0.03	0.16	0	-0.01

Table 14: Percentage changes in the demand for unskilled labor across regions and sectors

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU
GrainsCrops	0.01	-0.07	0.07	0.20	1.91	-0.02	0.01
MeatLstk	0.04	-0.02	2.07	-0.71	4.46	0.03	0.04
Extraction	-0.04	-0.07	0.50	0.32	0.73	-0.17	-0.05
ProcFood	0.02	0.01	-0.16	-0.13	-0.29	0	0.02
TextWapp	0.21	0.14	-2.78	-0.55	-11.83	-0.01	0.10
LightMnfc	-0.04	-0.08	0.75	0.06	1.17	-0.10	-0.04
HeavyMnfc	-0.01	-0.01	-0.91	0.17	0.51	-0.17	-0.02
Electr	-0.13	-0.35	1.20	1	1.55	-0.24	-0.09
MotorVeh	0.16	0.45	-1.90	-1.19	-2.92	0.57	0.34
Util_Cons	0.09	0.14	-0.69	-0.25	-1.86	0.24	0.15
TransComm	-0.04	-0.03	0.17	0.05	0.07	-0.02	-0.07
OthServices	-0.04	0	0.28	0.08	0.57	-0.03	-0.03

Table 15: Change in trade flows after NAFTA repeal

	RoW	EAsia	Canada	USA	Mexico	LatAm	EU	Total
RoW	-925	-293	130	-2370	2351	-45	-518	-1670
EAsia	-2912	-2708	1048	-4568	6961	-286	-1625	-4091
Canada	1240	1200	0	-9758	-1591	330	1714	-6864
USA	9820	8580	-11213	0	-35098	3949	11574	-12387
Mexico	182	171	-1141	-15651	0	-12	151	-16300
LatAm	-722	-654	2	-714	2393	-681	-696	-1071
EU	-1957	-331	253	-2204	5243	-50	-3021	-2068
Total	4726	5965	-10921	-35266	-19740	3205	7580	-44451

Values are expressed in milions of 2011 US Dollars.

Table 16: Changes in trade flows under different scenarios

Region	RoW	EAsia	Canada	USA	Mexico	LatAm	EU	Total
RoW	0 (-0.1)	0 (0)	0 (0.6)	-0.3 (-0.5)	9.4 (13.9)	0 (-0.1)	0 (0)	0 (0)
EAsia	-0.2 (-0.3)	-0.2 (-0.3)	1.5 (2.3)	-0.5 (-0.8)	10.2 (15.1)	-0.1 (-0.2)	-0.2 (-0.3)	-0.1 (-0.1)
Canada	2.2 (3.2)	2.1 (2.9)	0 (0)	-2.5 (-4)	-16.7 (-25.1)	2.1 (3)	2.3 (3.4)	-1.1 (-1.8)
USA	1.9 (2.9)	1.9 (2.9)	-3.5 (-5.8)	0 (0)	-16.4 (-23.5)	1.9 (2.9)	1.9 (2.9)	-0.5 (-0.8)
Mexico	1 (1.7)	0.8 (1.3)	-6.5 (-9.3)	-5.1 (-7.1)	0 (0)	-0.1 (0.1)	0.4 (0.9)	-3.9 (-5.3)
LatAm	-0.4 (-0.6)	-0.3 (-0.5)	-0.2 (0.5)	-0.3 (-0.5)	15.3 (22.8)	-0.3 (-0.5)	-0.4 (-0.5)	-0.1 (-0.2)
EU	-0.1 (-0.2)	-0.1 (-0.1)	0.2 (0.7)	-0.4 (-0.5)	11.8 (17.4)	0 (0)	-0.1 (-0.1)	0 (0)
Total	0.1 (0.1)	0.1 (0.2)	-1.9 (-3)	-1.1 (-1.6)	-5.3 (-7.5)	0.3 (0.5)	0.1 (0.1)	-0.2 (-0.3)

Values are in percentage changes of base year values, rows denote the source country and columns the destination country. Top entry values denote changes when 20% lower target tariffs are used (the good case scenario), bottom entry in parentheses is the result when 20% higher target tariffs are used (the bad case scenario). For example, values of 0 and (0.6) in the first row and third column mean that exports from Rest of the World to Canada increased by 0 percent in the post-NAFTA equilibrium under the good case scenario and by 0.6 percent under the bad case scenario. For corresponding values of the original scenario look at table 3.

Table 17: Mexican output, domestic sales and exports under different scenarios

Mexico	qo	qds	ROW	EAS	CAN	USA	LAM	EU
GrainsCrops	1.05 (1.59)	5.53 (8.17)	-2.16 (-3.1)	-2.17 (-3.18)	-5.85 (-8.6)	-10.05 (-14.7)	-1.87 (-2.68)	-2.12 (-3.04)
MeatLstk	3.09 (4.38)	4.1 (5.77)	-7.87 (-10.8)	-8.18 (-11.2)	-69.24 (-74.0)	-16.4 (-22.6)	-7.54 (-10.3)	-8.02 (-11.1)
Extraction	0.41 (0.63)	0.13 (0.23)	1.86 (2.75)	1.43 (2.12)	-1.29 (-1.96)	0.5 (0.74)	1.67 (2.47)	1.91 (2.83)
ProcFood	-0.29 (-0.46)	1.1 (1.52)	-0.94 (-1.22)	-1.01 (-1.32)	-5.01 (-16.2)	-17.33 (-24.4)	-0.8 (-0.99)	-0.96 (-1.25)
TextWapp	-10.23 (-13.3)	2.2 (2.87)	-5.44 (-6.62)	-5.36 (-6.52)	-46.4 (-59.7)	-41.2 (-53.8)	-5.27 (-6.4)	-5.65 (-6.87)
LightMnfc	0.86 (1.3)	3.38 (4.89)	-0.09 (0.25)	-0.17 (0.1)	-14.16 (-20.1)	-7.1 (-10.1)	0.08 (0.49)	-0.05 (0.31)
HeavyMnfc	0.32 (0.54)	2.75 (4.07)	0.84 (1.43)	0.89 (1.5)	-1.47 (-2.02)	-4.87 (-7.05)	0.69 (1.2)	0.86 (1.47)
Electr	1.13 (1.8)	1.74 (2.65)	3.48 (5.39)	3.51 (5.44)	0.44 (0.78)	0.47 (0.83)	3.43 (5.32)	3.65 (5.65)
MotorVeh	-2.51 (-3.45)	4.46 (6.24)	-4.01 (-5.27)	-3.8 (-4.98)	-10.95 (-15.5)	-6.57 (-9.15)	-3.28 (-4.26)	-3.99 (-5.23)
Util_Cons	-1.57 (-2.3)	-1.59 (-2.33)	1.91 (2.98)	1.98 (3.07)	0.36 (0.64)	0.42 (0.73)	2.21 (3.43)	1.99 (3.1)
TransComm	-0.04 (-0.08)	-0.1 (-0.17)	2.72 (4.17)	2.78 (4.25)	1.44 (2.28)	1.93 (2.97)	2.91 (4.47)	2.74 (4.19)
OthServices	0.34 (0.43)	0.3 (0.37)	3.16 (4.86)	3.17 (4.86)	1.77 (2.76)	2.45 (3.77)	3.39 (5.21)	3.24 (4.98)

Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model. Top entry values denote changes when 20% lower target tariffs are used (the good case scenario), bottom entry in parentheses is the result when 20% higher target tariffs are used (the bad case scenario). For corresponding changes in the original simulation look at top entries of table 6.

Table 18: US output, domestic sales and exports under different scenarios

USA	qo	qds	ROW	EAS	CAN	MEX	LAM	EU
GrainsCrops	0.14 (0.2)	0.44 (0.58)	1.59 (2.53)	1.21 (1.92)	-1.9 (-2.77)	-14.52 (-21.55)	1.63 (2.6)	1.82 (2.89)
MeatLstk	-0.45 (-0.92)	-0.11 (-0.24)	2.73 (4.29)	2.32 (3.69)	-12.7 (-48.57)	-31.87 (-42.96)	2.86 (4.5)	2.97 (4.6)
Extraction	0.17 (0.25)	0.22 (0.33)	1.23 (1.81)	1.08 (1.59)	-2.45 (-3.69)	-8.37 (-12.45)	1.03 (1.5)	1.25 (1.84)
ProcFood	-0.11 (-0.27)	0.1 (0.15)	1.45 (2.18)	1.39 (2.09)	0.12 (-8.03)	-29.65 (-41.82)	1.58 (2.39)	1.56 (2.35)
TextWapp	-0.53 (-0.58)	0.45 (0.69)	2.44 (3.69)	2.49 (3.76)	-35.77 (-48.33)	-50.04 (-64.76)	2.49 (3.75)	2.47 (3.75)
LightMnfc	0.03 (0.06)	0.14 (0.21)	2.66 (4)	2.55 (3.82)	-7.2 (-10.62)	-23.7 (-34.29)	2.76 (4.16)	2.76 (4.15)
HeavyMnfc	0.11 (0.18)	0.25 (0.37)	1.94 (2.9)	2.01 (3.01)	-2.13 (-3.16)	-12.66 (-18.62)	1.8 (2.7)	2 (3)
Electr	0.78 (1.17)	0.59 (0.88)	2.61 (3.92)	2.64 (3.96)	-0.41 (-0.64)	-5.18 (-7.64)	2.55 (3.83)	2.75 (4.14)
MotorVeh	-1 (-1.42)	0.24 (0.35)	1.6 (2.41)	1.82 (2.73)	-5.83 (-8.69)	-26.7 (-37.59)	2.22 (3.31)	1.76 (2.65)
Util_Cons	-0.22 (-0.33)	-0.23 (-0.35)	1.9 (2.84)	1.96 (2.93)	0.34 (0.51)	0.4 (0.57)	2.19 (3.3)	1.97 (2.96)
TransComm	0.01 (0.01)	-0.03 (-0.04)	1.54 (2.31)	1.6 (2.39)	0.27 (0.45)	0.14 (0.11)	1.73 (2.6)	1.55 (2.33)
OthServices	0.03 (0.04)	-0.01 (-0.01)	1.5 (2.25)	1.5 (2.25)	0.13 (0.2)	-0.36 (-0.62)	1.72 (2.59)	1.57 (2.36)

Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model. Top entry values denote changes when 20% lower target tariffs are used (the good case scenario), bottom entry in parentheses is the result when 20% higher target tariffs are used (the bad case scenario). For corresponding changes in the original simulation look at top entries of table 7.

Table 19: Canadian output, domestic sales and exports under different scenarios

Canada	qo	qds	ROW	EAS	USA	MEX	LAM	EU
GrainsCrops	0.04 (-0.02)	1.06 (1.64)	2.22 (3.07)	1.92 (2.57)	-4.43 (-6.9)	-16.2 (-23.02)	2.26 (3.14)	2.44 (3.39)
MeatLstk	0.98 (2.71)	1.25 (4.03)	2.67 (1.05)	2.25 (0.48)	-5.2 (-9.98)	26.35 (5.31)	2.79 (1.29)	2.92 (1.22)
Extraction	0.26 (0.39)	-0.28 (-0.43)	1.56 (2.32)	1.49 (2.22)	0.56 (0.84)	-14.78 (-21.21)	1.52 (2.27)	1.84 (2.75)
ProcFood	0 (-0.2)	0.15 (0.83)	1.98 (2.15)	1.89 (2.02)	-1.29 (-6.37)	-15.97 (-28.65)	2.04 (2.29)	2.14 (2.32)
TextWapp	-2.44 (-3.25)	1.9 (2.65)	1.98 (3.08)	2.06 (3.18)	-32.02 (-43.56)	-54.59 (-68.97)	2.06 (3.18)	2.01 (3.13)
LightMnfc	0.53 (0.77)	0.93 (1.35)	2.89 (4.29)	2.7 (4)	-1.88 (-2.87)	-28.34 (-39.28)	3.02 (4.49)	3.09 (4.6)
HeavyMnfc	-0.8 (-1.21)	0.33 (0.47)	2.17 (3.2)	2.24 (3.29)	-4.64 (-6.93)	-15.08 (-21.78)	2 (2.95)	2.27 (3.34)
Electr	0.89 (1.29)	0.69 (1)	3.53 (5.25)	3.57 (5.3)	0.53 (0.71)	-4.31 (-6.43)	3.47 (5.16)	3.69 (5.49)
MotorVeh	-1.6 (-2.4)	1.84 (2.67)	-1.04 (-1.53)	-0.85 (-1.26)	-3.75 (-5.66)	-28.6 (-39.99)	-0.41 (-0.64)	-0.97 (-1.43)
Util_Cons	-0.59 (-0.89)	-0.62 (-0.93)	2.44 (3.63)	2.51 (3.72)	0.93 (1.37)	0.93 (1.34)	2.73 (4.09)	2.52 (3.75)
TransComm	0.07 (0.09)	-0.01 (-0.03)	2.27 (3.3)	2.33 (3.38)	1.48 (2.11)	0.87 (1.08)	2.46 (3.6)	2.29 (3.32)
OthServices	0.15 (0.22)	0.07 (0.1)	2.29 (3.4)	2.29 (3.4)	1.57 (2.33)	0.41 (0.51)	2.51 (3.75)	2.36 (3.52)

Qo stands for quantity of output, qds for quantity of domestic sales. The remaining columns show the change in exports to each region of the model. Top entry values denote changes when 20% lower target tariffs are used (the good case scenario), bottom entry in parentheses is the result when 20% higher target tariffs are used (the bad case scenario). For corresponding changes in the original simulation look at top entries of table 8.