Evaluating NAFTA:

The Employment Effects of Trade Shocks from Mexico in the United States

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ABSTRACT

Using data from 1980 to 2000, I analyze the effect of NAFTA on employment in the United States. First, I estimate a long first difference model using the reduction in U.S-Mexico tariffs and increased imports from Mexico as the explanatory variables. I then estimate a difference of differences model and look for the effect of trade shocks from Mexico at different levels of skill intensity and of capital to labor ratios across industries. The tariff-based difference of differences estimation shows that the employment effect varies greatly by skill intensity and ratio of capital to labor.

Approved: _____

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Presented to the Department of Economics
in partial fulfillment of the requirements
for a Bachelor of Science degree with Honors

University of Oregon
Eugene, Oregon
June 9, 2017

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1. Introduction

As the United States continues to globalize and deindustrialize, free trade agreements such as the North American Free Trade Agreement, or NAFTA for short, have come under attack. NAFTA was signed by the governments of Canada, Mexico, and the United States in 1993 and came into force January 1, 1994. NAFTA had numerous provisions with the principal one being the steady elimination of all U.S.-Mexico tariffs over a 10-year period. The U.S. president at the time, Bill Clinton, pledged that NAFTA would generate jobs. Now, more than 20 years later, the new U.S. president is also promising jobs, not because of the establishment of NAFTA, but because of its elimination. In fact, during the presidential election Donald Trump used the promise of withdrawing from NAFTA as a central rallying point.

Promising more jobs is nothing new for politicians on the right or left—nonetheless, what was the true effect of NAFTA? More specifically, how did NAFTA affect employment in the United States? This paper attempts to answer that question. NAFTA had many labor market effects, but I strictly focus on employment as much of the literature focuses on other effects like trade and wages. I attempt to analyze job displacement, the driving force behind effects like depressed wage growth as discovered by Hakobyan and McLaren (2016), and job creation, the often-overlooked aspect of international trade. I also look at how these effects vary by the level of skill intensity and by the ratio of capital to labor across industries. Using data from 1980 to 2000 and a long difference as well as difference-of-differences specifications, I argue that the trade shocks from Mexico on average led to a moderate decrease in U.S. employment. Additionally, I argue that the effects differ significantly for industries at various levels of skill intensity and of capital to labor ratios. These results are consistent with the international trade theory such as the Ricardian model or the Heckscher-Ohlin model, which assume a country

specializes in the goods or industries in which it has the lowest opportunity cost or comparative advantage.

2. The North American Free Trade Agreement (NAFTA)

To illustrate the size and importance of NAFTA for each of 4the three signatory countries, I use data from the Organization for Economic Co-operation and Development (OECD). The data set includes gross domestic product (GDP), imports, exports, and total trade in goods (sum of imports and exports) from 1990 to 2015 between the United States, Canada, and Mexico.

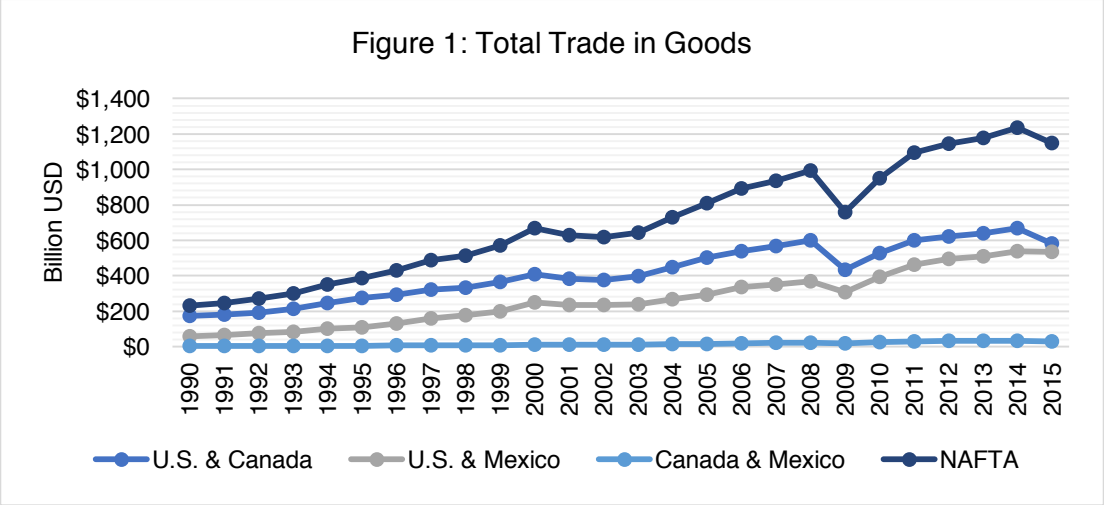


Figure 1 shows total trade (imports plus exports) in goods for each country pair in NAFTA and for NAFTA altogether. In 1990, before the agreement, trade between the United States, Canada, and Mexico totaled $232 billion. By 2000, trade between NAFTA countries increased to $668 billion. Trade between NAFTA countries increased until 2008 and the Great Recession—nonetheless, by 2010 it totaled $949 billion. And in 2011, it surpassed a trillion dollars. Furthermore, of country pairs within NAFTA, bilateral trade between the U.S. and Canada is the

largest, but trade between the U.S. and Mexico is closing the gap. In 2015, trade between the U.S. and Canada was $583 billion while trade between the U.S. and Mexico was $535 billion.

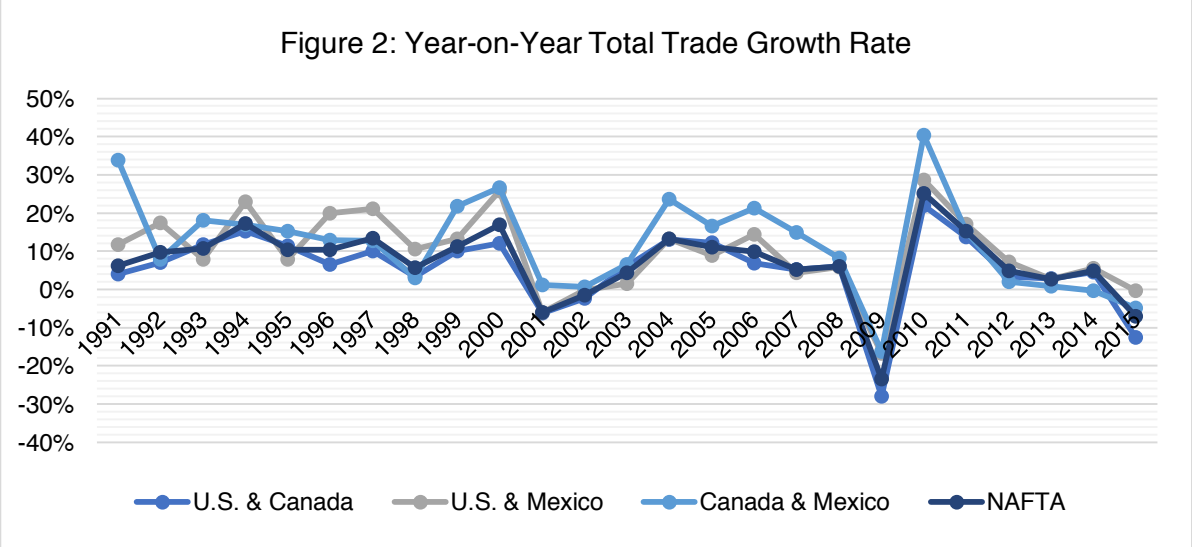


Figure 2 shows the year-on-year growth rate for total trade within NAFTA. From 1991 to 2000, the year-to-year rates for each NAFTA country pair fluctuate around 10% and 20%. From 2000-2001 and 2001-2002, the rates drop to and below zero. They drop below zero from 2008-2009 during the Great Recession, but rebound to a rate above 20% in 2009-2010. But since 2010-2011, rates steadily decreased. And in 2014-2015, trade between NAFTA countries was decreasing at 7.1%. For the U.S. and Mexico, the rate was -0.41%, the least negative rate of all NAFTA country pairs.

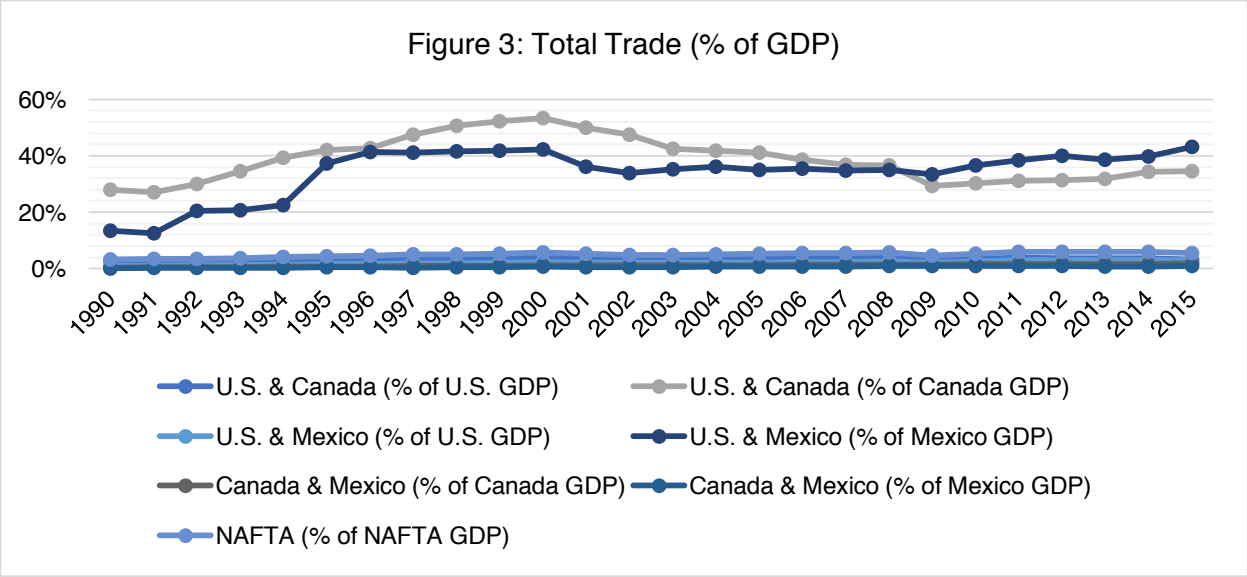
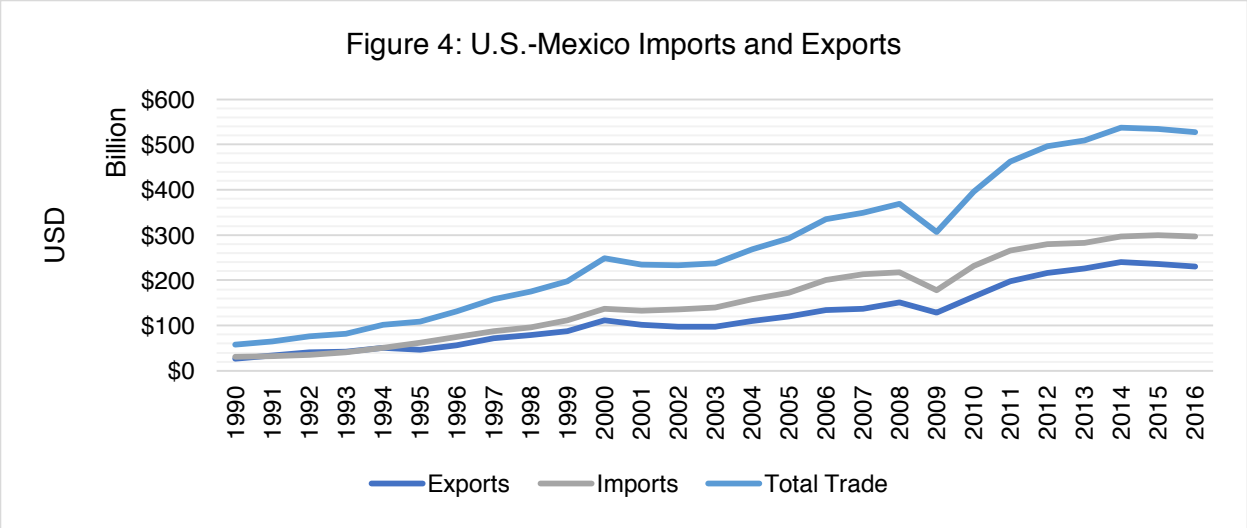
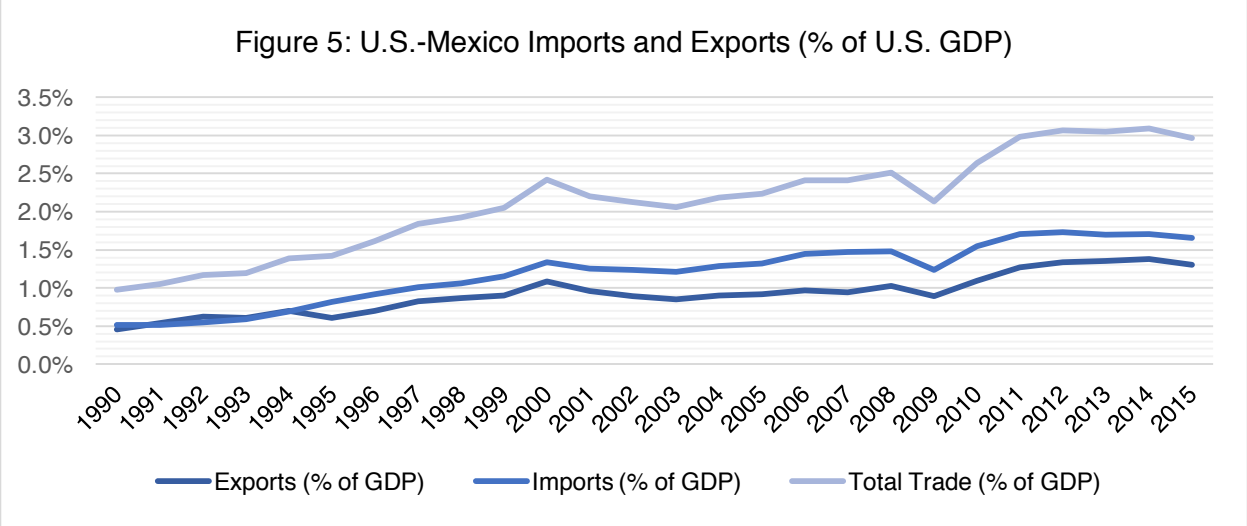


Figure 3 shows trade as a percentage of GDP. For the United States in 2015, trade with Mexico and Canada composed 3% and 3.2% of its GDP, respectively, and was around that percentage since 1990. For Mexico and Canada, trade with the U.S. composes a much larger share of their GDP. In 1990, trade with the U.S. composed 13.6% of Mexico's GDP. From 1994-1995, after the signing of the agreement, that percentage jumped from 22.6% to 37.3%. And in 2015, that percentage was up to 43.3%. For Canada, trade with the U.S. composed 27.9% of its GDP in 1990. That percentage reached its peak in 2000 at a staggering 53.4%. In other words, trade with the U.S. composed more than half of Canada's GDP. In 2015, it was down to 34.6%. Overall, trade made up 5.5% of the combined GDP between the U.S., Canada, and Mexico in 2015.

Trade between the U.S. and Mexico is currently at its largest point since the agreement came into force. As a result, it is important to understand the trend in U.S. imports from Mexico and U.S. exports to Mexico. Figure 4 shows that from 1990 to 1994 the value of imports and exports mainly moved together.



However, after 1994, the value of imports began to exceed the value of exports. This split continued to increase and in 2016, exports to Mexico were $231 billion, whereas imports from Mexico were $297 billion, a $66 billion trade deficit. Figure 5 shows those values as a percentage of U.S. GDP. In 1994, imports and exports made up around half a percent of U.S. GDP. Since 2011, trade with Mexico makes up near 3% of U.S. GDP.



It is also important to understand the composition of imports and exports, or what share of imports and exports are intermediate goods as opposed to final goods. I use U.N. COMTRADE data, which includes annual imported and exported goods between the U.S. and

Mexico classified by Broad Economic Categories (BEC). Table 1 shows the value of U.S. imports from Mexico separated into intermediate and final goods.

Table 1: U.S. Imports from Mexico in Intermediate vs. Final Goods

Year	Intermediate Goods	Final Goods	Total Imports	Intermediate Goods	Final Goods
1998	$60,000,448,294.00	$22,594,190,340.00	$82,594,638,634.00	72.64%	27.36%
1999	$71,884,784,821.00	$23,751,632,054.00	$95,636,416,875.00	75.16%	24.84%
2000	$88,749,819,269.00	$26,217,342,310.00	$114,967,161,579.00	77.20%	22.80%
2001	$85,956,004,602.00	$26,004,450,333.00	$111,960,454,935.00	76.77%	23.23%
2002	$89,609,807,855.00	$26,521,711,681.00	$116,131,519,536.00	77.16%	22.84%
2003	$94,144,992,979.00	$26,754,636,812.00	$120,899,629,791.00	77.87%	22.13%
2004	$107,943,975,960.00	$30,425,007,100.00	$138,368,983,060.00	78.01%	21.99%
2005	$118,906,964,845.00	$33,547,750,279.00	$152,454,715,124.00	77.99%	22.01%
2006	$136,713,777,117.00	$39,474,356,808.00	$176,188,133,925.00	77.60%	22.40%
2007	$144,698,848,925.00	$43,703,834,222.00	$188,402,683,147.00	76.80%	23.20%
2008	$148,884,239,592.00	$42,882,090,163.00	$191,766,329,755.00	77.64%	22.36%
2009	$119,535,554,439.00	$38,946,720,695.00	$158,482,275,134.00	75.43%	24.57%
2010	$163,828,319,075.00	$42,969,102,541.00	$206,797,421,616.00	79.22%	20.78%
2011	$193,309,815,042.00	$45,350,170,696.00	$238,659,985,738.00	81.00%	19.00%
2012	$204,858,584,675.00	$47,708,067,656.00	$252,566,652,331.00	81.11%	18.89%
2013	$204,550,665,092.00	$48,218,786,487.00	$252,769,451,579.00	80.92%	19.08%
2014	$215,133,777,943.00	$49,508,757,086.00	$264,642,535,029.00	81.29%	18.71%
2015	$212,926,809,435.00	$52,355,481,963.00	$265,282,291,398.00	80.26%	19.74%
2016	$210,824,350,734.00	$52,861,128,351.00	$263,685,479,085.00	79.95%	20.05%

In 1998, total imports were $83 billion, of which $60 billion were intermediate goods and $23 billion were final goods. Intermediate goods formed 73% of imports, whereas final goods formed 23%. As imports from Mexico increased so did the difference between intermediate and final goods. By 2016, intermediate goods valued $211 billion and formed 80%. Final goods valued $53 billion and formed 20%. This composition is significant because it is evidence of the interconnectedness of the U.S.-Mexico supply chain. 80% of the goods arriving from Mexico are used as inputs in the manufacturing of other goods.

Moreover, imports from Mexico can be separated beyond intermediate and final goods. Appendix Table 1 shows what commodities constitute intermediate goods and their values from 1998 to 2016. The three largest categories within imported intermediate goods are capital goods (except transport equipment), parts and accessories of transport equipment, and industrial

supplies. The composition of intermediate goods is evidence of Mexico's manufacturing boom and its connection with manufacturing in the United States.

Table 2: U.S. Exports to Mexico in Intermediate vs. Final Goods

Year	Intermediate Goods	Final Goods	Total Goods	Intermediate Goods	Final Goods
1998	$63,693,334,773.00	$9,083,822,616.00	$72,777,157,389.00	87.52%	12.48%
1999	$70,110,489,831.00	$10,018,994,306.00	$80,129,484,137.00	87.50%	12.50%
2000	$89,838,255,707.00	$11,748,452,608.00	$101,586,708,315.00	88.44%	11.56%
2001	$81,478,142,480.00	$11,146,885,178.00	$92,625,027,658.00	87.97%	12.03%
2002	$79,149,754,345.00	$10,278,232,295.00	$89,427,986,640.00	88.51%	11.49%
2003	$80,106,641,868.00	$10,168,627,091.00	$90,275,268,959.00	88.74%	11.26%
2004	$91,538,888,524.00	$10,389,384,879.00	$101,928,273,403.00	89.81%	10.19%
2005	$97,763,904,141.00	$11,288,233,970.00	$109,052,138,111.00	89.65%	10.35%
2006	$109,470,507,331.00	$13,136,247,447.00	$122,606,754,778.00	89.29%	10.71%
2007	$110,620,620,852.00	$13,407,513,236.00	$124,028,134,088.00	89.19%	10.81%
2008	$121,149,372,441.00	$14,249,571,759.00	$135,398,944,200.00	89.48%	10.52%
2009	$105,022,131,488.00	$13,408,792,865.00	$118,430,924,353.00	88.68%	11.32%
2010	$131,114,962,344.00	$15,268,576,193.00	$146,383,538,537.00	89.57%	10.43%
2011	$155,151,805,061.00	$16,692,554,288.00	$171,844,359,349.00	90.29%	9.71%
2012	$170,106,664,086.00	$17,563,515,062.00	$187,670,179,148.00	90.64%	9.36%
2013	$179,728,578,233.00	$18,493,298,560.00	$198,221,876,793.00	90.67%	9.33%
2014	$192,887,442,600.00	$20,449,573,985.00	$213,337,016,585.00	90.41%	9.59%
2015	$191,118,362,792.00	$20,559,829,309.00	$211,678,192,101.00	90.29%	9.71%
2016	$186,094,732,676.00	$19,785,522,633.00	$205,880,255,309.00	90.39%	9.61%

Table 2 shows the value of U.S. exports to Mexico separated into intermediate and final goods. In 1998, $64 billion of the $73 billion exports to Mexico were intermediate goods, a staggering 88%. In 2016, exports almost tripled to $205 billion, of which intermediate goods composed 90%, a value of $186 billion. So not only are products imported from Mexico mainly intermediate goods, but so are products exported to Mexico. Therefore, the U.S. is producing products that are components of Mexican products, which in time, become components of U.S. products. Further, the three largest categories within exported intermediate goods are industrial supplies, parts and accessories of capital goods (except transport equipment), and transport equipment, as seen in Appendix Table 2. Thereby, the U.S. and Mexico are sending industrial supplies back and forth. The U.S. sends Mexico parts and accessories of capital goods, and in turn, Mexico sends the U.S. capital goods. Furthermore, Mexico sends the U.S. parts and

accessories of transport equipment and in turn, the U.S. sends Mexico transport equipment. This flow of goods illustrates the complex and dynamic network of manufacturing between the U.S. and Mexico. It is suggestive of the rise of international supply chains in today's globalized world.

3. Literature Review

The economic literature on the labor market effects of NAFTA is somewhat small. Early empirical research in international trade has focused on import competition. For instance, Revenga (1992) studies the effect of changes in import prices on employment and wages. Following NAFTA, research work has focused on the consequences of the agreement for Mexico. An example is Chiquiar (2008), who looks at the effect of NAFTA on wages and skill premiums. Among the more recent research regarding NAFTA is a paper by Hakobyan and McLaren (2016). Using U.S. Census data from 1990 to 2000, they analyze the effect of NAFTA on wages in the United States. They focus on identifying industries and localities with U.S. workers who experience lower wage growth. Making use of the reduction in U.S. tariffs on imports from Mexico, they estimate a model that controls for the rate of tariff reduction and a worker's industry and geography. They note that much research on the effects of NAFTA focuses on trade, which is why they focus on income distribution. They find that localities with high, but rapidly falling tariffs experience slower wage growth than localities with low tariffs initially. The impact of NAFTA on most workers is small, but for a minority of workers, specifically workers who didn't graduate high school, they find the effects were large and negative. Their results highlight the two different worlds for college-educated and non-college educated workers. They discover that a reduction in both local tariffs and industry tariffs result in

a significant decrease in wages for blue-collar workers. Furthermore, they find that these wage decreases apply to workers both inside and outside the industries that compete with imports from Mexico. Hakobyan and McLaren argue that this result is evidence of the lack of mobility across industry and geography experienced by blue-collar workers. Therefore, workers in non-import-competing industries also experience slower wage growth because they are now competing with unemployed workers from import-competing industries. Their results hold true whether using the reduction in tariffs or the increase in imports as the explanatory variable. This paper takes a closer look at the labor market displacement of NAFTA, which could be driving the slower wage growth.

One reason for the shortage of empirical studies about NAFTA could be that a great deal of attention has been paid to examining the effects of imports from China. For example, Autor, Dorn, and Hanson (2013) investigate the impact of increased exposure to Chinese imports on labor markets in the United States. Using data from 1990 to 2007, they estimate changes in employment, earnings, and transfer payments due to changes in exposure to import competition from China. They use export-supply and import-demand shocks from China to explain wages and employment in manufacturing and non-manufacturing in the United States. To help with endogeneity, they instrument for Chinese imports to the United States by using other high-income countries. They find that increased imports prompt a decrease in wages both inside and outside of manufacturing. They also find that increasing imports lead to higher unemployment and additional transfer payments in areas hosting industries that compete with Chinese imports. Their results highlight the distributional ramifications of trade also emphasized by Hakobyan and McLaren (2016).

Autor, Dorn, and Hanson argue that Chinese import competition leads to a one-quarter total decline in U.S. manufacturing employment. This enormous effect is meaningful because many manufacturing workers who lost their job from increased import competition from China may unknowingly blame NAFTA. And, on the other hand, workers who found a job from increased exports to Mexico may not attribute it to NAFTA. An article in *The Los Angeles Times* highlights how personal and varied opinions are towards NAFTA whether one saw a gain or loss in employment. It is important to note that Mexican imports are inherently different than Chinese imports. Mexico is more involved within U.S. manufacturing than China as seen by the larger share of trade in intermediate goods. A study by the Peterson Institute for International Economics illustrates the U.S.-Mexico manufacturing connectivity. They find that, "for every 100 jobs U.S. manufacturers created in Mexican manufacturing, they added nearly 250 jobs at their larger U.S. home operations" (2014). And like Hakobyan and McLaren, they discover decreased wages in certain localities, but not on average. Broadly, they find that NAFTA prompted growth in employment, productivity, and purchasing power.

In addition to disentangling the effects of increased imports from Mexico versus China, it is important to separate the effects between Mexico and Canada. Trefler (2004) analyzes the effects of the Canada-United States Free Trade Agreement, which was superseded by NAFTA. The results highlight the clash between the short-run adjustment costs and long-run efficiency gains of trade. Using a difference-of-differences estimation, he finds that the trade agreement led to notable declines in employment, particularly in import competing industries. He also finds that labor productivity rose in those industries. However, he doesn't apply his econometric strategy to the United States and Mexico, which this paper will test.

Other literature includes the Brookings Institution who examines what U.S. metropolitan areas are most export oriented. They find that exports construct the highest share of GDP in metro areas with concentrations in energy and manufacturing like Columbus, Indiana. Their findings are significant because although trade is viewed as an international issue, its consequences are highly localized. *The Economist* summarizes the sentiment regarding NAFTA, stating that "estimates suggest that the deal left Americans as a whole a bit better off. But the gains have proved too small, and too unevenly distributed, to spare it continued criticism" (2017). Other empirical research includes Robertson (2004), who discovers that in Mexico after NAFTA the price of skill-intensive goods fell as well as the wages of skilled workers. Burfisher, Robinson, and Thierfelder (2001) is another study that finds that NAFTA forecasts were essentially right and the trade agreement led to large positive gains for Mexico and small positive gains for the United States.

4. Methodology

To identify the specific labor market effect of the elimination of U.S.-Mexico tariffs, one requires an econometric model that accounts for the multitude of variables that affect employment in the United States. Specifying such a complex model may be challenging given the required amount of information about labor market determinants. An alternative approach is to use a long double-differencing model like in Trefler (2006), and use the reduction in U.S.-Mexico tariffs from NAFTA rather than the reduction in U.S.-Canada tariffs from the Canada-U.S. Free Trade Agreement. The main benefits of a double-differencing model are the elimination of time-invariant factors that affect employment like geography or natural resources, as well as the removal of macroeconomic factors that affect local labor markets in the same

manner over time. On January 1, 1994, NAFTA mandated the elimination of all U.S.-Mexico tariffs over a 10-year period. I have data from 1980, 1990, and 2000 and hence I define the long difference 1980-1990 as the pre-NAFTA period (i.e., control period) and the long difference 1990-2000 as the NAFTA period (i.e., treatment period).

I begin by taking the natural log of the variables for employment and for U.S. imports from Mexico. A logarithmic transformation is appropriate because I'll be estimating percent changes in both the dependent and independent variables. I then take the first difference of both variables and the variable for the average U.S. import tariff. To be precise, let *c* index commuting zones, let *i* index industries, and let *t* index a 10-year period. Then, the first difference variables are defined as follows:

$$\Delta lnEmployment_{cit} = \begin{cases} lnEmployment_{c,i,1990} - lnEmployment_{c,i,1980} & \text{for } t = 0 \\ lnEmployment_{c,i,2000} - lnEmployment_{c,i,1990} & \text{for } t = 1 \end{cases}$$

$$\Delta Tariff_{it} = \begin{cases} Tariff_{i,1990} - Tariff_{i,1980} & \text{for } t = 0 \\ Tariff_{i,2000} - Tariff_{i,1990} & \text{for } t = 1 \end{cases}$$

$$\Delta lnImports_{it} = \begin{cases} lnImports_{i,1990} - lnImports_{i,1980} & \text{for } t = 0 \\ lnImports_{i,2000} - lnImports_{i,1990} & \text{for } t = 1 \end{cases}$$

This constructs the 10-year change in U.S. employment, in the average U.S. import tariff on Mexico, and in the U.S. imports from Mexico, respectively, for two periods: 1980-1990 where $t = 0$, and 1990-2000 where $t = 1$. $\Delta Tariff_{i1}$ measures the reduction in tariffs authorized by NAFTA. My first regression uses $\Delta\text{Tariff}_{\text{it}}$ as a measure of the trade shock from Mexico associated with the signing of NAFTA. Using the 10-year change in the average U.S. import tariff makes sense because that was the major provision of NAFTA. Moreover, since tariffs were reduced gradually after 1994, by allowing for a long-time horizon ensures that our tariff change variable captures the full effect of trade liberalization.

The baseline model regresses the 10-year change in U.S. employment in a given industry on the 10-year change in the average U.S. import tariff on Mexico in that industry:

$$\Delta lnEmployment_{cit} = \beta \Delta Tariff_{it} + D_t + e_{cit} \quad (1.1)$$

where D_t is a dummy variable for time (with $t = 0$ if the period is 1980-1990 and $t = 1$ if the period is 1990-2000). The role of the time dummy variable is to account for any macroeconomic shocks that affect decadal employment changes uniformly across industries and commuting zones.

The coefficient of interest is β. It measures the percent change in $Employment_{cit}$ given a $100*\beta$ percent change in $Tariff_{it}$. This is a log-level regression and therefore the interpretation requires the following transformation:

$$\% \, \Delta \, Employment_{cit} = 100 * (e^{\beta} - 1)$$

Economic theories of international trade suggest that β should have a positive sign because a fall in U.S.-Mexico tariffs would increase Mexican imports into the U.S. and consequently reduce the demand of goods produced in the United States, which would negatively affect employment. But if Mexican imports are components of U.S. production then access to cheaper inputs would help firms lower their costs, produce more output, and increase their demand for labor. This paper tests which of these effects dominates.

One limitation of equation (1.1) is that it does not control for differences in industry characteristics and in labor market trends that are industry-specific. This issue leads me to:

$$\Delta lnEmployment_{cit} = \beta \Delta Tariff_{it} + D_t + \theta_i + e_{cit} \quad (1.2)$$

where θ_i denote industry fixed effects, which control for unobserved differences across industries that don't vary over time. By adding these fixed effects, the regression model also accounts for endogeneity. For example, the comparative advantage of an industry is likely

correlated with both the tariff and employment level in that industry. That said, endogeneity may still be a problem. For instance, equation (1.2) does not control for differences across localities. It could be the case that commuting zones closer to the border with Mexico are exposed to different trade and labor market trends than more inland commuting zones. I control for geographical trends by adding commuting zone dummies:

$$\Delta lnEmployment_{cit} = \beta \Delta Tariff_{it} + D_t + \theta_i + D_c + e_{cit} \quad (1.3)$$

where D_c denotes the dummy variables for the 722 commuting zones. Because the computing demand for a regression model like the one in equation (1.3) is substantial, I also experiment with state dummies (instead of commuting zone dummies), which are added to equation (1.2):

$$\Delta lnEmployment_{sit} = \beta \Delta Tariff_{it} + D_t + \theta_i + D_s + e_{cit} \quad (1.4)$$

By comparing the coefficient of interest from estimating the models (1.3) and (1.4), one can gauge whether the sparser specification using state dummies instead of commuting zone dummies produces approximately the same coefficients at a statistically significant level.

It may be the case that the effect of a tariff change on local employment is non-linear. That is, a fall in tariff of, say, 2 percentage points has a different impact on employment if this change happens from a tariff level of 20 percent to 18 percent, as opposed to going from 2 percent to zero tariffs. Perhaps this is because moving to completely free trade entails additional benefits besides the mere drop in tariff. To test for this hypothesis, I control for the differences between the reduction in U.S. import tariffs from 1980-1990 and 1990-2000 by adding an interaction term. I interact D_t with ΔTariff_{it} to yield:

$$\Delta lnEmployment_{cit} = \beta_1 \Delta Tariff_{it} + D_t + \theta_i + D_c + \beta_2 D_t * \Delta Tariff_{it} + e_{cit} \quad (1.5)$$

And:

$$\Delta lnEmployment_{sit} = \beta_1 \Delta Tariff_{it} + D_t + \theta_i + D_s + \beta_2 D_t * \Delta Tariff_{it} + e_{cit} \quad (1.6)$$

Equation (1.5) uses commuting zone dummies, while equation (1.6) uses state dummies. Again, comparing results across the two models allows me to see whether state dummies as an alternative to commuting zone dummies produces approximately the same coefficients at a statistically significant level. The interpretation of β_1 and β_2 follows the formula from before, except that the coefficients must be added together beforehand.

An alternative to using $\Delta Tariff_{it}$ as a measure of the trade shock from Mexico would be to use the change in total U.S. imports from Mexico, i.e., $\Delta lnImports_{it}$. Using this alternative trade cost measure, I can estimate the following regression model:

$$\Delta lnEmployment_{cit} = \delta \Delta lnImports_{it} + D_t + e_{cit} \quad (2.1)$$

Equation (2.1) is the same as the baseline model for $\Delta Tariff_{it}$ from equation (1.1), but uses $\Delta lnImports_{it}$ as the explanatory variable of interest. δ is the coefficient of interest and measures the percent change in $Employment_{cit}$ given a δ percent change Imports_{it}. This is a log-log regression so no further coefficient transformation is needed.

One problem with this equation is that ordinary least squares (OLS) assumes that the independent variable, $\Delta lnImports_{it}$, is uncorrelated with the error term. Most likely, this is not the case. There is probably one or more other factors positively correlated with both $\Delta lnImports_{it}$ and $\Delta \ln Employment_{cit}$, for example technological advantage or non-tariff barriers (import quotas). Therefore, I instrument $\Delta lnImports_{it}$ with the $\Delta Tariff_{it}$. A Hausman test reveals that there is a significant difference between the coefficients from the OLS and two-stage least squares (2SLS) estimation methods. For that reason, in all the regression models that employ $\Delta lnImports_{it}$ as the explanatory variable, I use the average U.S. import tariff to instrument for U.S. imports from Mexico. Like previous models, I add industry fixed effects to equation (2.1) to control for all the time-invariant industry characteristics:

$$\Delta \ln Employment_{cit} = \delta \Delta \ln \text{Imports}_{it} + D_t + \theta_i + e_{cit} \quad (2.2)$$

Then I add state dummies denoted by D_s:

$$\Delta ln Employment_{cit} = \delta \Delta ln Imports_{it} + D_t + \theta_i + D_s + e_{cit} \quad (2.3)$$

Lastly, I add an interaction between the time dummy and the 10-year change in tariffs to allow for different effects between 1980-1990 and 1990-2000:

$$\Delta \ln Employment_{cit} = \delta_1 \Delta \ln \text{Imports}_{it} + D_t + \theta_i + D_s + \delta_2 D_t * \Delta \ln Imports_{it} + e_{cit} \quad (2.4)$$

Following Trefler (2006), I also use a difference-of-differences specification. I subtract from the period where $t = 1$ the period where $t = 0$. Then I apply this second difference to both the 10-year change in U.S. employment and the 10-year change in the U.S. import tariff:

$$(\Delta ln Employment_{ci1} - \Delta ln Employment_{ci0}) = \gamma(\Delta T_{i1} - \Delta T_{i0}) + e_{cit} \quad (3.1)$$

The double differences method helps control for the many problems that arrive from using panel data such as autocorrelation and omitted variable bias. Now, γ is the coefficient of interest. The interpretation of γ is the following:

$$\%\Delta Employment_{cit} = 100 * (e^{\gamma} - 1)$$

In addition to estimating equation (3.1), I also estimate an extended model that adds an interaction term between the skill intensity of a sector and the double difference of the 10-year change in the U.S. import tariff, as well as an interaction term between the capital to labor ratio of a sector and the double difference of the 10-year change in the U.S. import tariff:

$$(\Delta ln Employment_{ci1} - \Delta ln Employment_{ci0}) = \quad (3.2)$$

$$= \gamma_1(\Delta Tariff_{i1} - \Delta Tariff_{i0}) + \gamma_2 Skill_i * (\Delta Tariff_{i1} - \Delta Tariff_{i0})$$

$$+ \gamma_3 \left(\frac{K}{L}_i\right) * (\Delta Tariff_{i1} - \Delta Tariff_{i0}) + e_{cit}$$

This specification allows the employment effect of the change in tariff to vary by the skill intensity of an industry (measured by the fraction of non-production workers by industry) and by

the capital to labor ratio of an industry. The reason for including these interaction terms is that international trade theory suggests that countries should specialize in the good or industry they have comparative advantage in (with comparative advantage defined as the lowest opportunity cost). Applying this theory to NAFTA, the U.S. should have a comparative advantage in industries with high skill intensity and a high capital to labor ratio while the opposite should be true for Mexico. Therefore, the U.S. should see an increase in employment after NAFTA for industries with high skill intensities and/or high capital to labor ratios.

Like equation (3.1), I also apply the double-differences method to my model with the 10-year change in U.S. imports from Mexico:

$$(\Delta lnEmployment_{ci1} - \Delta lnEmployment_{ci0}) = \theta(\Delta Imports_{i1} - \Delta Imports_{i0}) + e_{cit} \quad (3.3)$$

θ is now the coefficient of interest. This is a log-log regression model so the interpretation of θ is that a percent change in $Employment_{cit}$ results in a θ percent change in $\Delta mports_{it}$. Then like equation (3.2) I interact the double difference of the 10-year change in U.S. imports from Mexico with the skill intensity and the capital to labor ratio of an industry, revealing:

$$(\Delta lnEmployment_{ci1} - \Delta lnEmployment_{ci0}) = \quad (3.4)$$
$$= \theta_1(\Delta Imports_{i1} - \Delta Imports_{i0}) + \theta_2 Skill_i * (\Delta Imports_{i1} - \Delta Imports_{i0})$$
$$+ \ \theta_3 \left(\frac{K}{L}_i\right) * (\Delta Imports_{i1} - \Delta Imports_{i0}) + e_{cit}$$

The coefficients on the interaction terms in equation (3.2) and (3.4) are of the most interest because they permit an estimation of the employment effect of NAFTA-induced trade shocks at different levels of skill intensity and capital to labor ratios across industries.

5. Data

To estimate the effects of NAFTA in the United States, one would want information on the tariffs imposed by the United States on Mexican goods, on the total volume of imports from Mexico, and on employment in the United States before and after 1994. One would also want that information to vary by industry and locality. The data from Autor, Dorn, and Hanson (2013) provide that information. The data covers the years 1980, 1990, 2000 and includes employment information for 722 Commuting Zones (CZs). CZs are like counties, but categorize the relationship between geography and employment more advantageously by reflecting local economies rather than political boundaries, which counties do. The employment information is also reported separately by 407 sectors organized by 4-digit Standard Industrial Classification (SIC). Additionally, I use U.S. tariff and trade data from Feenstra, Romalis, and Schott (2002), which was also used by Hakobyan and McLaren (2013). The data is also available by 4-digit SIC and covers the same decadal years. The U.S. tariff data applies to imports from Mexico and is measured in percentage points. The trade data are available from COMTRADE and is measured in millions of U.S. dollars. The data include U.S. imports and exports to and from Mexico, Canada, China, and the rest of the world. The information on industry characteristics such as fraction of non-production workers and capital to labor ratio is available from the NBER-CES Manufacturing Industry database. Unfortunately, as the data sample covers the period 1980-2000, it will only capture a six-year period after NAFTA. This is important to keep in mind when interpreting results.

Table 3: Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
By 4-digit SIC				
U.S. import tariff in 1980 (%)	6.54	6.12	0	32.49
U.S. import tariff in 1990 (%)	2.74	4.83	0	23.21
U.S. import tariff in 2000 (%)	0.29	1.04	0	10.09
Change in U.S. import tariff from 1980 to 1990	-3.80	3.38	-15.88	6.27
Change in U.S. import tariff from 1990 to 2000	-2.45	4.48	-23.21	0.44
U.S. imports from Mexico in 1980 (million USD)	10.11	30.91	0	416.93

U.S. imports from Mexico in 1990 (million USD)	52.06	191.47	0	2448.05
U.S. imports from Mexico in 2000 (million USD)	279.97	1256.37	0	20987.28
Change in U.S. imports from Mexico from 1980 to 1990 (%)	414.92			
Change in U.S. imports from Mexico from 1990 to 2000 (%)	437.79			
Skill level (Fraction of non-production workers)	0.29	0.12	0.04	0.82
Capital to labor ratio	80.78	88.17	5.67	728.61

Table 3 reports the summary statistics. In 1980, the average U.S.-Mexico import tariff was 6.54 percent. In 1990, it was 2.74 percent. And in 2000, it was 0.29 percent. Accordingly, from 1980-1990, the average change in U.S. import tariffs on Mexican goods was -3.8 percentage points. And from 1990-2000, the average change was -2.45 percentage points. The fact that the change was more negative from 1980-1990 than 1990-2000 is important because it shows that trade between the U.S. and Mexico was being liberalized before NAFTA entered in effect. Table 3 also shows the average amount of U.S. imports from Mexico across the 407 industries. In 1980, it was $10.11 million. In 1990, it was $52.06 million. And in 2000, it was $279.97 million. Therefore, from 1980-1990 there was 414.92 percent increase in imports and from 1990-2000 there was 437.79 increase. Interestingly, imports rose more during 1990-2000 than 1980-1990 despite the larger tariff decrease during 1980-1990. Additionally, the average fraction of non-production workers is 0.29 and the average capital to labor ratio is 80.78.

Table 4: Largest Change in U.S.-Mexico Import Tariff from 1980-1990

Rank	Description	SIC4	Change in U.S. import tariff from 1980 to 1990
1	AUTOMOTIVE AND APPAREL TRIMMINGS	2396	-15.88
2	HOSIERY, NEC	2252	-15.21
3	SOYBEAN OIL MILLS	2075	-15.16
4	COSTUME JEWELRY	3961	-14.37
5	VITREOUS CHINA TABLE AND KITCHENWARE	3262	-13.31
6	LEAD PENCILS AND ART GOODS	3952	-13.18
7	PENS AND MECHANICAL PENCILS	3951	-13.12
8	WOMEN'S, JUNIOR'S, AND MISSES' DRESSES	2335	-13.10
9	OPTICAL INSTRUMENTS AND LENSES	3827	-13.00
10	ANALYTICAL INSTRUMENTS	3826	-12.97
11	CUTLERY	3421	-12.04
12	CARBON PAPER AND INKED RIBBONS	3955	-11.85
13	SURGICAL AND MEDICAL INSTRUMENTS	3841	-11.79
14	RUBBER AND PLASTICS FOOTWEAR	3021	-10.99
15	FASTENERS, BUTTONS, NEEDLES, AND PINS	3965	-10.11

16	ROBES AND DRESSING GOWNS	2384	-9.99
17	LACE AND WARP KNIT FABRIC MILLS	2258	-9.99
18	WEFT KNIT FABRIC MILLS	2257	-9.86
19	MACHINE TOOL ACCESSORIES	3545	-9.74
20	OPHTHALMIC GOODS	3851	-9.61

Table 4 shows the industries from 1980-1990 that saw the largest change in U.S. import tariff. The changes range from a -9.61 percentage point change in ophthalmic goods to a -15.88 percentage point change in automotive and apparel trimmings.

Table 5: Largest Change in U.S.-Mexico Import Tariff from 1980-1990

Rank	Description	SIC4	Change in U.S. import tariff from 1990 to 2000
1	BROADWOVEN FABRIC MILLS, WOOL	2231	-23.21
2	WOMEN'S AND MISSES' BLOUSES AND SHIRTS	2331	-21.65
3	KNIT OUTERWEAR MILLS	2253	-21.22
4	MEN'S AND BOY'S UNDERWEAR AND NIGHTWEAR	2322	-20.41
5	BRAS, GIRDLES, AND ALLIED GARMENTS	2342	-20.15
6	MEN'S AND BOY'S FURNISHINGS	2321	-19.79
7	WOMEN'S AND MISSES' OUTERWEAR, NEC	2339	-19.45
8	MEN'S AND BOY'S SUITS AND COATS	2311	-19.45
9	GIRL'S AND CHILDREN'S OUTERWEAR, NEC	2369	-19.31
10	MEN'S AND BOY'S CLOTHING, NEC	2329	-18.95
11	FROZEN FRUITS AND VEGETABLES	2037	-18.54
12	MEN'S AND BOY'S TROUSERS AND SLACKS	2325	-18.45
13	WOMEN'S AND MISSES' SUITS AND COATS	2337	-18.38
14	WOMEN'S AND CHILDREN'S UNDERWEAR	2341	-17.37
15	HOSIERY, NEC	2252	-16.16
16	ICE CREAM AND FROZEN DESERTS	2024	-15.36
17	FABRIC DRESS AND WORK GLOVES	2381	-15.09
18	WEFT KNIT FABRIC MILLS	2257	-14.58
19	LACE AND WARP KNIT FABRIC MILLS	2258	-13.96
20	WOMEN'S, JUNIOR'S, AND MISSES' DRESSES	2335	-13.07

Table 5 shows the largest change in U.S. import tariffs for industries from 1990-2000. The changes range from -13.07 percentage points to -23.21 percentage points. It is important to note that although the average change in the import tariff was more negative from 1980-1990 than 1990-2000, for the industries with the largest change in tariffs, the changes were more negative in 1990-2000. This would make sense as NAFTA would reduce all tariffs eventually to zero.

It is also important to note that the industries that saw the largest drop in tariffs do not coincide with the industries that saw the largest increase in U.S. imports from Mexico.

Table 6: Largest Change in U.S. Imports from Mexico from 1980-1990

Rank	Description	SIC4	Change in U.S. imports from Mexico in 1980-1990 (million USD)
1	MOTOR VEHICLES AND CAR BODIES	3711	$2,445.75
2	HOUSEHOLD AUDIO AND VIDEO EQUIPMENT	3651	$1,807.70
3	MOTOR VEHICLE PARTS AND ACCESSORIES	3714	$1,315.29
4	ENGINE ELECTRICAL EQUIPMENT	3694	$1,179.86
5	FURNITURE AND FIXTURES, NEC	2599	$537.20
6	FABRICATED TEXTILE PRODUCTS, NEC	2399	$478.49
7	PRINTED CIRCUIT BOARDS	3672	$470.16
8	CURRENT-CARRYING WIRING DEVICES	3643	$407.93
9	ELECTRONIC COMPUTERS	3571	$375.45
10	NONFERROUS WIREDRAWING AND INSULATING	3357	$330.21
11	BLAST FURNACES AND STEEL MILLS	3312	$255.13
12	MOTORS AND GENERATORS	3621	$228.82
13	FROZEN FRUITS AND VEGETABLES	2037	$224.67
14	NONCURRENT-CARRYING WIRING DEVICES	3644	$216.02
15	SEMICONDUCTORS AND RELATED DEVICES	3674	$208.13
16	ELECTRONIC COMPONENTS, NEC	3679	$193.67
17	GIRL'S AND CHILDREN'S OUTERWEAR, NEC	2369	$173.36
18	ELECTRIC HOUSEWARES AND FANS	3634	$157.50
19	VALVES AND PIPE FITTINGS, NEC	3494	$147.82
20	ELECTRONIC COILS AND TRANSFORMERS	3677	$146.18

For example, Table 6 shows the industries that saw the largest increase in U.S. imports from Mexico between 1980-1990. Motor vehicles and car bodies experienced the largest increase in imports of over $2.4 billion. Additionally, household audio and video equipment, motor vehicle parts and accessories, and engine electrical equipment all experience over a $1 billion increase.

Table 7: Largest Change in U.S. Imports from Mexico from 1990-2000

Rank	Description	SIC4	Change in U.S. imports from Mexico in 1990-2000 (million USD)
1	MOTOR VEHICLES AND CAR BODIES	3711	$18,539.22
2	HOUSEHOLD AUDIO AND VIDEO EQUIPMENT	3651	$5,888.13
3	MOTOR VEHICLE PARTS AND ACCESSORIES	3714	$5,109.79
4	RADIO AND T.V. COMMUNICATIONS EQUIPMENT	3663	$4,679.03
5	ELECTRONIC COMPUTERS	3571	$3,525.19
6	ENGINE ELECTRICAL EQUIPMENT	3694	$3,327.01
7	ELECTRONIC COMPONENTS, NEC	3679	$3,221.52
8	COMPUTER PERIPHERAL EQUIPMENT, NEC	3577	$2,601.62
9	TELEPHONE AND TELEGRAPH APPARATUS	3661	$2,193.20
10	MEN'S AND BOY'S TROUSERS AND SLACKS	2325	$2,001.73
11	MOTORS AND GENERATORS	3621	$1,594.89

12	FABRICATED METAL PRODUCTS, NEC	3499	$1,485.62
13	RELAYS AND INDUSTRIAL CONTROLS	3625	$1,335.27
14	WOMEN'S AND MISSES' SUITS AND COATS	2337	$1,313.71
15	NONFERROUS WIREDRAWING AND INSULATING	3357	$1,188.29
16	MEN'S AND BOY'S FURNISHINGS	2321	$1,175.72
17	FURNITURE AND FIXTURES, NEC	2599	$1,129.39
18	PROCESS CONTROL INSTRUMENTS	3823	$1,097.69
19	SEMICONDUCTORS AND RELATED DEVICES	3674	$1,070.48
20	REFRIGERATION AND HEATING EQUIPMENT	3585	$1,017.56

Table 7 shows the same information from 1990-2000. Once more, motor vehicles and car bodies experienced the largest expansion in imports of $18.5 billion. Household audio and video equipment experience a $5.9 billion expansion and motor vehicle parts and accessories experienced a $5.1 billion expansion. Of the 20 industries that experienced the largest growth in imports, they all experienced growth of over $1 billion.

6. Results

6.1 Tariff-based Estimations

Table 8: OLS Tariff-based Estimations

Dependent variable: First Difference of the Log of U.S. Employment, 1980-2000

	(1)	(2)	(3)	(4)	(5)	(6)
10-year Change in U.S. Import Tariff	0.033***	0.016**	0.016**	0.016**	-0.017*	-0.017*
	[0.002]	[0.007]	[0.007]	[0.007]	[0.009]	[0.009]
Time Dummy	0.005	0.025	0.017	0.020	0.173***	0.175***
	[0.012]	[0.032]	[0.032]	[0.032]	[0.043]	[0.043]
Time Dummy x 10-year Change in U.S. Import Tariff					0.050***	0.049***
					[0.011]	[0.011]
Industry Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
State Dummies	No	No	No	Yes	No	Yes
Commuting Zone Dummies	No	No	Yes	No	Yes	No
Observations	94,633	94,633	94,633	94,633	94,633	94,633
R-squared	0.005	0.001	0.015	0.004	0.016	0.006
100*(e^β-1)	3.36	1.61	1.61	1.61	3.36	3.25

Notes: Robust standard errors are in brackets. *** p<0.01, ** p<0.05, * p<0.1. Column (1) corresponds to equation (1), column (2) corresponds to equation (1.2), and so forth. For equations (1.1) to (1.4), β is only the coefficient on the 10-year change in U.S. import tariff. For equations (1.5) to (1.6), β is the sum of coefficients from the 10-year change in U.S. import tariff and the interaction term.

Table 8 shows the results from estimating the regression models in equations (1.1) to (1.6). Across all columns, the coefficient of interest has the expected sign and is statistically significant. Column (1) shows that a 1 percentage-point decrease in the average U.S. import tariff on goods from Mexico decreases U.S. employment by 3.36 percent. This number is calculated according to the formula previously mentioned in the methodology. That formula can also be seen in the last row of Table 8. Note that the average tariff decrease from 1980 to 1990 was 3.8 percentage points and from 1990 to 2000 was 2.45 percentage points. Therefore, a 3.8 percentage-point decrease in tariffs would decrease employment by 12.77 percent. A 2.45 percentage-point decrease in tariffs would decrease employment by 8.23 percent. Introducing industry fixed effects into the specification reduces the effect on employment to 1.61 percent for a 1 percentage-point decrease in the tariff. Adding commuting zone dummies or state dummies does not affect the coefficient on the 10-year change in the U.S. import tariff. Adding an interaction term between the time dummy and the 10-year change in the U.S. import tariff does adjust the coefficient. In column (6), the preferred model, the sign on the coefficient for the 10-year change in the U.S. import tariff switches, signaling that the effect is different from 1980-1990 and 1990-2000. During the NAFTA period, from 1990-2000, a 1 percentage-point decrease in the average U.S. import tariff decreased employment by 3.25 percent. Applying the average tariff decrease observed in the data from 1990-2000 to the model would decrease employment over the same period by 7.96 percent. These decreases are for total employment in an average sector and commuting zone and they are remarkably high. The coefficient on the 10-year change in the U.S. import tariff in column (6) is significant at the 10-percent level. The coefficient on the interaction term is significant as well—nonetheless, the staggering percentages signal that the coefficients may be an overestimate. The coefficients are likely overcompensating for one or

more omitted variables like non-tariff barriers to trade (NTBs) such as import quotas. Import quotas would be both correlated with U.S.-Mexico tariffs (NAFTA required the elimination of both tariffs and NTBs) and they'd also effect U.S. employment, fulfilling the conditions for omitted variable bias. Comparing these results with the model using the 10-year change in the U.S. imports would help reveal any discrepancies.

6.2 Import-based Estimations

Table 9: 2SLS Import-based Estimations
Dependent variable: First Difference of the Log of U.S. Employment, 1980-2000

	(1)	(2)	(3)	(4)	(5)
10-year Change in Log of U.S. Imports from Mexico	0.003	-0.832***	-1.040***	-1.034***	-1.640***
	[0.003]	[0.055]	[0.210]	[0.210]	[0.420]
Time Dummy	0.035***	0.190***	0.126***	0.121***	-2.377***
	[0.012]	[0.019]	[0.024]	[0.024]	[0.761]
Time Dummy x 10-year Change in U.S. Imports from Mexico					1.586***
					[0.495]
Industry Fixed Effects	No	No	Yes	Yes	Yes
State Dummies	No	No	No	Yes	Yes
Observations	86,658	86,658	86,658	86,658	86,658
R-squared	0.000	0.000	0.000	0.009	0.001
Sum of Coefficients	0.00	-0.83	-1.04	-1.03	-0.05
2SLS First Stage Estimates					
		-0.042***	-0.016***	-0.16***	0.109***
		[0.002]	[0.002]	[0.002]	[0.004]
R-squared		0.009	0.000	0.009	0.007

Notes: Robust standard errors are in brackets. *** p<0.01, ** p<0.05, * p<0.1. Column (1) is estimated with OLS. The Hausman test obtains a test statistic of 266.01 and p-value of 0.000.

Table 9 reports the results from estimating equations (2.1) to (2.5), where the first column reports the OLS estimates from the baseline regression model, while columns 2 to 5 report the 2SLS results which account for endogeneity. All 2SLS coefficients for the variable of interest have the correct sign and are statistically significant. Column (2) indicates that a 1 percent increase in U.S imports from Mexico results in a .83 percent decrease in employment. Column (3) shows that including industry fixed effects in fact increases the coefficient on the 10-year change in the log of U.S. imports from Mexico to -1.040 and therefore a 1 percent increase in

U.S. imports from Mexico results in a 1.04 percent decrease in employment. Column (4), which includes state dummies, reports a similar coefficient on the 10-year change in the log of U.S. imports from Mexico of -1.034. But column (5), which includes an interaction term between the time dummy and the 10-year change in U.S. imports from Mexico changes the coefficient to -1.640. Additionally, the sign on the interaction term is positive. That being the case, in my preferred imports model, a 1 percent increase in U.S. imports from Mexico lead to a 0.05 percent decrease in employment.[1] The magnitude of these coefficients is much smaller than those of the preferred tariff model. It could be that the tariff model is omitting variables, which are biasing my estimates upwards. It also could be that using an instrumental variable is helping solve some of the endogeneity problem. Moreover, it may be important to use the average increase in Mexican imports rather than using a 1 percent increase and see if the results differ. From 1990-2000, the average increase in Mexican imports was 414.92 percent. Thus, in the preferred model, from 1990-2000 given the average increase in Mexican imports, we'd expect a 21.89 percent decrease in employment. This effect is even larger than the effect found by the tariff-based estimations and requires more analysis.

6.3. Double-difference Estimations

Table 10: OLS and 2SLS Double-Difference Estimations

Dependent variable: Double Difference of the Log of U.S. Employment, 1980-2000

	(1)	(2)	(3)	(4)
Double Difference of 10-year Change U.S. Import Tariff	0.022***	0.113***		
	[0.003]	[0.014]		
Skill Intensity x Double Difference of 10-year Change U.S. Import Tariff		-0.188***		
		[0.030]		
K/L Ratio x Double Difference of 10-year Change U.S. Import Tariff		-0.013***		
		[0.004]		
Double Difference of 10-year Change in Log of U.S. Imports from Mexico			-1.293***	-1.259***
			[0.324]	[0.170]

[1]This number is produced by adding the coefficients on the 10-year Change in Log of U.S. Imports from Mexico and the interaction term: $\delta_1 + \delta_2 = -1.64 + 1.586 = -0.054$.

Skill Intensity x Double Difference of 10-year Change in Log of U.S. Imports from Mexico				-1.358***
				[0.343]
K/L Ratio x Double Difference of 10-year Change in Log of U.S. Imports from Mexico				0.446***
				[0.080]
R-squared	0.002	0.004	0.000	0.000
Observations	38,687	38,687	34,817	34,817
2SLS First Stage Estimates				
			-0.017***	-0.324
			[0.004]	[0.014]
R-squared			0.001	0.000

Notes: Robust standard errors are in brackets. *** p<0.01, ** p<0.05, * p<0.1. (1) and (2) are estimated with OLS. (3) and (4) are estimated with 2SLS.

Table 10 shows the estimates for the effects of the tariff and import double-difference models. Column (1) shows that the coefficient on the double-difference of the 10-year change in the U.S. import tariff is 0.022 and significant at the 1 percent level. Column (2) shows the coefficients for when I include the interaction of the double difference of the 10-year change in the U.S. import tariff with skill intensity and with the capital to labor ratio, respectively. Using the average skill intensity and average capital to labor ratio observed in my sample, a 1 percent decrease in the U.S. tariff leads to a 0.68 percent decrease in employment.[2] This result is much more modest than the result for the single difference tariff model.

Table 11: Employment by Skill Intensity (Fraction of Non-Production Workers)

	(1) Level	(2) Percentage of U.S. Employment	(3) Percent Change in Employment from a 1% Tariff Decrease	(4) Percent Change in Employment from the Average Tariff Decrease during NAFTA Period
Bottom 1%	381615	1.10%	-4.35%	-10.66%
Bottom 5%	2689794	7.75%	-3.68%	-9.02%
Bottom 10%	4241660	12.22%	-3.23%	-7.91%
Bottom 25%	8157924	23.51%	-2.34%	-8.07%
Top 25%	10915479	31.45%	0.56%	1.37%
Top 10%	6406178	18.46%	2.60%	6.37%
Top 5%	3841099	11.07%	3.64%	8.92%
Top 1%	1505245	4.34%	6.48%	15.88%

[2] This number is calculated by adding γ_1 to $\gamma_2$multiplied by the average skill intensity, and γ_3 multiplied by the average capital to labor ratio:$0.1130 \pm 0.1880 * 0.2878 \pm 0.0130 * 4.0093 = 0.0068$. I then plug that number into my formula from the methodology yielding: $= 100 * 1e^{0.0068} - 1) = 0.6805$.

Table 11 shows what a 1 percent decrease in the U.S. import tariff would be for industries with varying levels of skill intensity. This is important to look at because international trade theory suggests that countries specialize in the good or industry they have comparative advantage in after trade liberalization. Regarding NAFTA, the U.S. should see an increase in industries at the top levels of skill intensity because they have comparative advantage relative to Mexico. Looking at table 11, industries with the bottom 1 percent of skill intensity experienced a 4.35 percent decrease in employment, whereas industries with the top 1 percent of skill intensity experience 6.48 percent increase in employment. The positive increase in employment is consistent with trade theories that predict an expansion in industries with comparative advantage. Table 11 shows these percent increases and decreases for industries with the top and bottom 1, 5, 10, and 25 percent skill intensities, respectively. Column (2) in table 16 indicates what percentage of U.S. employment those industries make. For example, industries in the bottom 25 percent of skill intensity compose 23.51 percent of U.S. employment while industries in the top 25 percent of skill intensity compose 31.45 percent of U.S. employment.

Applying the average change in the U.S.-Mexico import tariff during the NAFTA period as an alternative to a 1 percent decrease enlarges the magnitudes. Column 4 shows that an industry at the bottom 1 percent of skill intensity experienced a 10.66 percent decrease in employment during the NAFTA period. Whereas an industry at the top 1 percent of skill intensity experienced a 15.88 percent increase in employment during the NAFTA period. An industry at the bottom 25 percent of skill intensity underwent an 8.07 percent decrease while an industry at the top 25 percent underwent a 1.37 percent increase. Applying the average change in the U.S.-Mexico import tariff during the NAFTA period, the average skill intensity, and the average capital to labor ratio results in a 1.67 percent decrease in employment, a moderate

decrease. Again, the growth in employment for industries with a high skill intensity is in line with the international trade theory according to which a country specializes in the industry it has comparative advantage in.

Table 12: Employment by Capital to Labor Ratio

	(1) Level	(2) Percentage of U.S. Employment	(3) Percent Change in Employment from a 1% Tariff Decrease	(4) Percent Change in Employment from the Average Tariff Decrease during NAFTA Period
Bottom 1%	169344	0.49%	-3.30%	-8.09%
Bottom 5%	1367604	3.94%	-2.62%	-6.42%
Bottom 10%	2893470	8.34%	-2.10%	-5.15%
Bottom 25%	7550001	21.75%	-1.31%	-3.21%
Top 25%	8911189	25.68%	0.05%	0.12%
Top 10%	2492196	7.18%	1.47%	3.60%
Top 5%	1578716	4.55%	1.47%	3.60%
Top 1%	205212	0.59%	2.09%	5.12%

This display of percentile information is also applied to the capital to labor ratios observed across industries. Table 12 shows that the industries within the bottom 1 percent of capital to labor ratios represent 0.49 percent of employment (column 2) and witnessed a 3.3 percent decrease in employment (column 3). On the other hand, industries within the top 1 percent of capital to labor ratios amount to 0.59 percent of employment and witness a 2.09 percent increase in employment. Capital to labor ratios follow the same trend as the skill intensity, which is that industries in the top levels of skill or capital to labor ratio underwent an increase in employment, whereas industries in the bottom levels of skill or of capital to labor ratios underwent a decrease in employment. Applying the average change in the U.S.-Mexico import tariff observed during the NAFTA period (a 2.45 percent decrease) results in increased magnitudes again. For instance, industries within the bottom 5 percent of capital to labor ratios amount to 3.94 percent of employment and experience a 6.42 percent decrease in employment over the NAFTA period. Industries within the top 5 percent of capital to labor ratios make up

4.55 percent of employment and experienced a 3.6 percent increase. Overall, the effects of adjusting for the capital to labor ratio are smaller than the effects for adjusting the skill intensity.

Columns (3) and (4) of table 10 also show the coefficients for the double difference model using the 10-year change in the log of U.S. imports from Mexico. Column (3) shows that the coefficient on the double difference of the log of U.S. imports from Mexico is -1.293 and significant at the 1 percent level. Column (4), which includes an interaction term with skill intensity and capital to labor ratio reveals approximately the same coefficient on the double difference of the log of U.S. imports from Mexico. What is interesting is that the sign on the coefficient on the capital to labor ratio interaction term is negative. And applying the average level of skill intensity and capital to labor ratio shows that a 1 percent increase in Mexican imports leads to a .14 percent increase in employment. This result suggests that overall, an increase in imports from NAFTA lead to an increase in employment. This result differs from my previous models and would be worth taking a deeper look at.

Since the results from column (4) require more analysis into the sign and magnitude of the estimated coefficients, caution must be used in drawing any statistical interference. Nevertheless, for the sake of completeness, I have calculated how a 1 percent increase in imports from Mexico would affect industries at different levels of skill intensity and ratios of capital to labor. Appendix table 3 shows that industries at the bottom 1, 5, 10, 25 percent of skill intensity, respectively, and at the top 25 percent, all experienced minor, but positive employment growth from a 1 percent Mexican import increase. This is opposite of the trend shown by the tariff double-difference model and what international trade theory suggests. However, when holding the skill intensity at the average level and adjusting the capital to labor ratio, the trend returns. Appendix table 4 shows that industries within the bottom half of capital to labor ratios

experienced decreased employment from 1 percent increase in imports from Mexico. And industries in the top half of capital to labor ratios experienced increased employment from a 1 percent increase in imports from Mexico. All in all, the findings from the import double-differences require a further look.

7. Discussion

In 2000, six years after NAFTA came into force, U.S. imports from Mexico totaled $114 billion. 77 percent of those goods were intermediary such as capital goods, industrial supplies, and parts and accessories of transport equipment. And every year since 2000, intermediate goods have made up at least 75 percent of Mexican imports. Likewise, since 1998, intermediate goods have made up more than 80 percent of U.S. exports to Mexico. And in 2016, intermediate goods accounted for 90 percent of U.S. exports to Mexico. These numbers emphasize the interconnected supply chain between the U.S. and Mexico. Additionally, they help make sense of the results. One of the main findings of this paper is that the employment effects vary by skill level and capital to labor ratio across industries. Industries with low levels of skill and/or low ratios of capital to labor experience a fall in employment, whereas industries with high levels of skill and/or high ratios of capital to labor experience a rise in employment. This pattern is consistent with the Ricardian model and the Heckscher-Ohlin model of international trade. The U.S. has a comparative advantage in goods and industries that require higher skill levels and higher ratios of capital to labor and therefore specializes in those areas. Moreover, adjusting the skill level as opposed to the capital to labor ratio appears to have a more significant effect on employment. The decline in employment in industries with low levels of skill and low ratios of

capital to labor would help explain the wage reductions found by Hakobyan and McLaren (2016).

The fact that industries with a low fraction of production workers saw increased employment, whereas industries with a high fraction of production workers saw decreased employment spotlights the divisive effect of trade. Naturally, U.S. workers who lost their job because of NAFTA blame the trade agreement, and consequently their political ideology may favor politicians that promise to renegotiate or terminate the trade deal. At the same time, many workers gained a job because of NAFTA, but these jobs are not as easily identifiable and they are also not as useful for populist politicians. Nonetheless, this demonstrates the need for policies that mitigate the impact of globalization and free trade.

The results also stress the need for further analysis. The estimation with the double-difference of the 10-year change in U.S. imports from Mexico yielded results that were not consistent with the other models or with the trade theories. Additionally, adding the U.S.-Mexico export tariff would be beneficial as it would capture the effect of U.S. exports to Mexico, another important aspect of NAFTA especially considering the percent of goods that are intermediate. Also, adding some measure of NTBs would help capture the complete impact of NAFTA. Finally, controlling for the effect of automation and imports from China would add to the robustness of the models as well.

8. Conclusion

From 1990 to 2000, U.S. imports from Mexico grew by 437 percent. Currently, trade between the U.S. and Mexico is at its largest point since NAFTA came into force. This paper examines the employment effect of trade shocks induced by NAFTA using a difference of

differences estimation as in Trefler (2006). Trade shocks are measured by U.S. imports from Mexico and the fall in the U.S.-Mexico import tariff. The findings for the tariff-based estimations show that the average tariff decease from 1990-2000 reduced employment over the same period by 7.96 percent. Clearly, these estimations are very high and there is likely some omitted variable bias occurring, which is overestimating the size of the coefficients. The imports-based estimations were also dealing with some sort of omitted variable bias.

For the double-difference tariff-based estimations, the average decrease in the U.S.-Mexico tariff during the NAFTA period lead to a 1.67 percent decrease in employment for the average skill level and capital to labor ratio. This result was consistent with previous studies. But the main finding is that the skill intensity and the ratio of capital to labor within a sector seem to be significant measures of whether an industry experienced a gain or loss in employment. Industries with high levels of skill intensity saw increased employment, whereas industries with low levels of skill intensity saw decreased employment (with skill level defined as the fraction of non-productions workers). This pattern was also true for ratios of capital to labor, but at a smaller magnitude. This result is in line with international trade theory that after trade liberalization – in this case NAFTA – countries specialize in the industries they have comparative advantage in. The results from the imports-based double difference model showed the opposite trend and require further examination.

Nevertheless, jobs are only one factor of NAFTA and going forth, the econometric models could be applied to additional factors such as U.S. wages, non-labor income, productivity, and purchasing power. Furthermore, it would be interesting to look at how the employment results vary by gender, race, and education.

REFERENCES

Autor, David H., David Dorn, and Gordon H. Hanson, "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review* (2013).

Burfisher, Mary, Sherman Robinson, Karen Thierfelder, "The Impact of NAFTA on the United States," *Journal of Economic Perspectives* (2001).

Chiquiar, Daniel, "Globalization, regional wage differentials and the Stolper-Samuelson Theorem: Evidence from Mexico," *Journal of International Economics* (2008).

Feenstra, Robert C., John Romalis, Peter K. Schott, "U.S. Imports, Exports, and Tariff Data, 1989-2001," *NBER Working Paper Series* (2002).

Hakobyan, Shushanik and John McLaren, "Looking for Local Labor Market Effects of NAFTA," *Review of Economics and Statistics* (2016).

"In Defense of NAFTA," *The Economist* (2017), http://www.economist.com/news/finance-and-economics/21716033-nafta-has-been-disappointment-its-benefits-are-underappreciated-defence.

Kitroeff, Natalie, "Despite fears, Mexico's manufacturing boom is lifting U.S. workers," *Los Angeles Times*, August 21, 2016.

"NAFTA 20 Years Later," *Peterson Institute for International Economics* (2014), https://piie.com/publications/piie-briefings/nafta-20-years-later.

Robertson, Raymond, "Relative Prices and Wage Inequality: Evidence from Mexico," *Journal of International Economics* (2004).

Revenga, Ana L., "Exporting Jobs?: The Impact of Import Competition on Employment and Wages in U.S. Manufacturing," *The Quarterly Journal of Economics* (1992).

Trefler, Daniel, "The Long and Short of the Canada-U.S. Free Trade Agreement," *Canadian Institute for Advanced Research and National Bureau of Economic Research* (2006).

"US Metros Most Exposed to a Trump Trade Shock," *The Brookings Institution* (2017), https://www.brookings.edu/blog/the-avenue/2017/01/27/u-s-metros-most-dependent-on-trade/.

Appendix

Appendix Table 1:

Year	Commodity Code	Commodity	Intermediate Goods (USD)
1998	41	Capital goods (except transport equipment)	$15,199,740,003.00
1998	22	Industrial supplies nes, processed	$12,024,456,080.00
1998	53	Parts and accessories of transport equipment	$11,921,967,668.00
1998	42	Parts and accessories of capital goods (except transport equipment)	$9,876,246,599.00
1998	31	Fuels and lubricants, primary	$5,217,012,756.00
1998	521	Transport equipment, other, industrial	$4,206,501,636.00
1998	111	Food and beverages, primary, mainly for industry	$721,878,376.00
1998	21	Industrial supplies nes, primary	$713,276,931.00
1998	121	Food and beverages, processed, mainly for industry	$108,981,460.00
1998	322	Fuels and lubricants, processed (other than motor spirit)	$10,386,785.00
1998		Sum	$60,000,448,294.00
1999	41	Capital goods (except transport equipment)	$18,788,207,392.00
1999	53	Parts and accessories of transport equipment	$13,512,145,137.00
1999	22	Industrial supplies nes, processed	$13,226,943,893.00
1999	42	Parts and accessories of capital goods (except transport equipment)	$11,709,037,124.00
1999	31	Fuels and lubricants, primary	$6,977,649,100.00
1999	521	Transport equipment, other, industrial	$6,175,963,788.00
1999	111	Food and beverages, primary, mainly for industry	$745,285,933.00
1999	21	Industrial supplies nes, primary	$620,222,977.00
1999	121	Food and beverages, processed, mainly for industry	$124,677,430.00
1999	322	Fuels and lubricants, processed (other than motor spirit)	$4,652,047.00
1999		Sum	$71,884,784,821.00
2000	41	Capital goods (except transport equipment)	$24,248,600,634.00
2000	22	Industrial supplies nes, processed	$15,089,118,752.00
2000	53	Parts and accessories of transport equipment	$14,954,073,972.00
2000	42	Parts and accessories of capital goods (except transport equipment)	$14,599,495,483.00
2000	31	Fuels and lubricants, primary	$12,308,363,124.00
2000	521	Transport equipment, other, industrial	$5,961,380,403.00
2000	111	Food and beverages, primary, mainly for industry	$873,757,865.00
2000	21	Industrial supplies nes, primary	$620,159,111.00
2000	121	Food and beverages, processed, mainly for industry	$85,627,487.00
2000	322	Fuels and lubricants, processed (other than motor spirit)	$9,242,438.00
2000		Sum	$88,749,819,269.00
2001	41	Capital goods (except transport equipment)	$24,849,022,292.00
2001	22	Industrial supplies nes, processed	$14,875,143,666.00
2001	53	Parts and accessories of transport equipment	$14,309,554,274.00
2001	42	Parts and accessories of capital goods (except transport equipment)	$13,451,513,412.00
2001	31	Fuels and lubricants, primary	$9,741,169,203.00
2001	521	Transport equipment, other, industrial	$7,427,320,397.00
2001	111	Food and beverages, primary, mainly for industry	$591,798,785.00
2001	21	Industrial supplies nes, primary	$553,510,012.00
2001	121	Food and beverages, processed, mainly for industry	$141,496,558.00
2001	322	Fuels and lubricants, processed (other than motor spirit)	$15,476,003.00
2001		Sum	$85,956,004,602.00
2002	41	Capital goods (except transport equipment)	$24,487,348,016.00
2002	22	Industrial supplies nes, processed	$16,373,021,055.00
2002	53	Parts and accessories of transport equipment	$15,536,910,100.00
2002	42	Parts and accessories of capital goods (except transport equipment)	$12,732,150,797.00

2002	31	Fuels and lubricants, primary	$11,775,332,438.00
2002	521	Transport equipment, other, industrial	$7,520,527,175.00
2002	21	Industrial supplies nes, primary	$534,020,258.00
2002	111	Food and beverages, primary, mainly for industry	$471,040,035.00
2002	121	Food and beverages, processed, mainly for industry	$165,804,933.00
2002	322	Fuels and lubricants, processed (other than motor spirit)	$13,653,048.00
2002		Sum	$89,609,807,855.00
2003	41	Capital goods (except transport equipment)	$23,853,427,392.00
2003	22	Industrial supplies nes, processed	$17,099,902,779.00
2003	53	Parts and accessories of transport equipment	$15,951,746,929.00
2003	31	Fuels and lubricants, primary	$14,877,292,605.00
2003	42	Parts and accessories of capital goods (except transport equipment)	$13,094,972,388.00
2003	521	Transport equipment, other, industrial	$7,869,038,330.00
2003	111	Food and beverages, primary, mainly for industry	$613,893,036.00
2003	21	Industrial supplies nes, primary	$608,642,959.00
2003	121	Food and beverages, processed, mainly for industry	$149,088,795.00
2003	322	Fuels and lubricants, processed (other than motor spirit)	$26,987,766.00
2003		Sum	$94,144,992,979.00
2004	41	Capital goods (except transport equipment)	$25,748,274,477.00
2004	22	Industrial supplies nes, processed	$20,587,955,218.00
2004	31	Fuels and lubricants, primary	$18,591,029,434.00
2004	53	Parts and accessories of transport equipment	$17,984,284,655.00
2004	42	Parts and accessories of capital goods (except transport equipment)	$15,016,442,512.00
2004	521	Transport equipment, other, industrial	$8,268,275,611.00
2004	21	Industrial supplies nes, primary	$854,207,078.00
2004	111	Food and beverages, primary, mainly for industry	$690,323,882.00
2004	121	Food and beverages, processed, mainly for industry	$178,857,234.00
2004	322	Fuels and lubricants, processed (other than motor spirit)	$24,325,859.00
2004		Sum	$107,943,975,960.00
2005	41	Capital goods (except transport equipment)	$25,418,224,814.00
2005	31	Fuels and lubricants, primary	$23,933,627,955.00
2005	22	Industrial supplies nes, processed	$23,638,890,692.00
2005	53	Parts and accessories of transport equipment	$19,972,011,268.00
2005	42	Parts and accessories of capital goods (except transport equipment)	$15,867,551,975.00
2005	521	Transport equipment, other, industrial	$8,043,135,684.00
2005	21	Industrial supplies nes, primary	$1,042,208,801.00
2005	111	Food and beverages, primary, mainly for industry	$678,313,338.00
2005	121	Food and beverages, processed, mainly for industry	$248,606,563.00
2005	322	Fuels and lubricants, processed (other than motor spirit)	$64,393,755.00
2005		Sum	$118,906,964,845.00
2006	31	Fuels and lubricants, primary	$31,059,522,713.00
2006	41	Capital goods (except transport equipment)	$28,367,758,244.00
2006	22	Industrial supplies nes, processed	$26,673,172,395.00
2006	53	Parts and accessories of transport equipment	$21,478,352,485.00
2006	42	Parts and accessories of capital goods (except transport equipment)	$17,157,235,247.00
2006	521	Transport equipment, other, industrial	$9,689,582,240.00
2006	21	Industrial supplies nes, primary	$1,130,547,310.00
2006	111	Food and beverages, primary, mainly for industry	$742,804,002.00
2006	121	Food and beverages, processed, mainly for industry	$299,786,022.00
2006	322	Fuels and lubricants, processed (other than motor spirit)	$115,016,459.00
2006		Sum	$136,713,777,117.00
2007	41	Capital goods (except transport equipment)	$32,151,665,132.00
2007	31	Fuels and lubricants, primary	$30,944,877,521.00
2007	22	Industrial supplies nes, processed	$27,830,107,626.00

2007	53	Parts and accessories of transport equipment	$23,250,596,840.00
2007	42	Parts and accessories of capital goods (except transport equipment)	$17,779,126,455.00
2007	521	Transport equipment, other, industrial	$10,109,949,223.00
2007	21	Industrial supplies nes, primary	$1,252,524,163.00
2007	111	Food and beverages, primary, mainly for industry	$713,032,368.00
2007	322	Fuels and lubricants, processed (other than motor spirit)	$393,031,721.00
2007	121	Food and beverages, processed, mainly for industry	$273,937,876.00
2007		Sum	$144,698,848,925.00
2008	31	Fuels and lubricants, primary	$37,630,696,241.00
2008	41	Capital goods (except transport equipment)	$33,462,624,221.00
2008	22	Industrial supplies nes, processed	$27,955,447,515.00
2008	53	Parts and accessories of transport equipment	$21,211,464,727.00
2008	42	Parts and accessories of capital goods (except transport equipment)	$17,228,506,939.00
2008	521	Transport equipment, other, industrial	$8,557,906,865.00
2008	21	Industrial supplies nes, primary	$1,514,164,291.00
2008	111	Food and beverages, primary, mainly for industry	$574,707,105.00
2008	121	Food and beverages, processed, mainly for industry	$436,263,404.00
2008	322	Fuels and lubricants, processed (other than motor spirit)	$312,458,284.00
2008		Sum	$148,884,239,592.00
2009	41	Capital goods (except transport equipment)	$33,597,993,245.00
2009	22	Industrial supplies nes, processed	$22,654,639,869.00
2009	31	Fuels and lubricants, primary	$22,466,161,327.00
2009	53	Parts and accessories of transport equipment	$16,211,671,050.00
2009	42	Parts and accessories of capital goods (except transport equipment)	$13,538,455,624.00
2009	521	Transport equipment, other, industrial	$8,783,691,777.00
2009	21	Industrial supplies nes, primary	$1,011,969,722.00
2009	111	Food and beverages, primary, mainly for industry	$635,752,954.00
2009	121	Food and beverages, processed, mainly for industry	$467,073,473.00
2009	322	Fuels and lubricants, processed (other than motor spirit)	$168,145,398.00
2009		Sum	$119,535,554,439.00
2010	41	Capital goods (except transport equipment)	$46,091,025,450.00
2010	31	Fuels and lubricants, primary	$30,015,549,799.00
2010	22	Industrial supplies nes, processed	$29,997,050,232.00
2010	53	Parts and accessories of transport equipment	$24,821,717,278.00
2010	42	Parts and accessories of capital goods (except transport equipment)	$16,467,689,196.00
2010	521	Transport equipment, other, industrial	$13,632,120,193.00
2010	21	Industrial supplies nes, primary	$1,371,011,383.00
2010	111	Food and beverages, primary, mainly for industry	$763,243,723.00
2010	121	Food and beverages, processed, mainly for industry	$492,440,474.00
2010	322	Fuels and lubricants, processed (other than motor spirit)	$176,471,347.00
2010		Sum	$163,828,319,075.00
2011	41	Capital goods (except transport equipment)	$48,001,088,200.00
2011	31	Fuels and lubricants, primary	$40,009,441,651.00
2011	22	Industrial supplies nes, processed	$36,931,307,461.00
2011	53	Parts and accessories of transport equipment	$30,356,758,499.00
2011	42	Parts and accessories of capital goods (except transport equipment)	$18,130,809,667.00
2011	521	Transport equipment, other, industrial	$16,196,066,380.00
2011	21	Industrial supplies nes, primary	$1,781,235,188.00
2011	111	Food and beverages, primary, mainly for industry	$1,106,474,395.00
2011	121	Food and beverages, processed, mainly for industry	$712,173,520.00
2011	322	Fuels and lubricants, processed (other than motor spirit)	$84,460,081.00
2011		Sum	$193,309,815,042.00
2012	41	Capital goods (except transport equipment)	$51,402,197,339.00
2012	22	Industrial supplies nes, processed	$38,991,665,298.00

2012	31	Fuels and lubricants, primary	$37,568,394,172.00
2012	53	Parts and accessories of transport equipment	$34,828,164,361.00
2012	42	Parts and accessories of capital goods (except transport equipment)	$19,781,159,452.00
2012	521	Transport equipment, other, industrial	$18,947,484,268.00
2012	21	Industrial supplies nes, primary	$1,563,996,389.00
2012	111	Food and beverages, primary, mainly for industry	$1,199,577,997.00
2012	121	Food and beverages, processed, mainly for industry	$478,834,549.00
2012	322	Fuels and lubricants, processed (other than motor spirit)	$97,110,850.00
2012		Sum	$204,858,584,675.00
2013	41	Capital goods (except transport equipment)	$51,761,441,434.00
2013	53	Parts and accessories of transport equipment	$37,368,120,629.00
2013	22	Industrial supplies nes, processed	$37,278,531,285.00
2013	31	Fuels and lubricants, primary	$32,279,727,502.00
2013	521	Transport equipment, other, industrial	$21,332,463,627.00
2013	42	Parts and accessories of capital goods (except transport equipment)	$21,195,483,062.00
2013	21	Industrial supplies nes, primary	$1,586,853,298.00
2013	111	Food and beverages, primary, mainly for industry	$861,095,954.00
2013	121	Food and beverages, processed, mainly for industry	$818,897,572.00
2013	322	Fuels and lubricants, processed (other than motor spirit)	$68,050,729.00
2013		Sum	$204,550,665,092.00
2014	41	Capital goods (except transport equipment)	$53,266,484,682.00
2014	53	Parts and accessories of transport equipment	$41,171,639,145.00
2014	22	Industrial supplies nes, processed	$39,346,913,399.00
2014	31	Fuels and lubricants, primary	$28,157,681,966.00
2014	521	Transport equipment, other, industrial	$26,973,915,687.00
2014	42	Parts and accessories of capital goods (except transport equipment)	$22,529,125,285.00
2014	21	Industrial supplies nes, primary	$1,951,271,846.00
2014	111	Food and beverages, primary, mainly for industry	$1,042,826,063.00
2014	121	Food and beverages, processed, mainly for industry	$615,266,895.00
2014	322	Fuels and lubricants, processed (other than motor spirit)	$78,652,975.00
2014		Sum	$215,133,777,943.00
2015	41	Capital goods (except transport equipment)	$60,657,664,732.00
2015	53	Parts and accessories of transport equipment	$44,492,087,016.00
2015	22	Industrial supplies nes, processed	$39,249,651,091.00
2015	521	Transport equipment, other, industrial	$29,103,559,949.00
2015	42	Parts and accessories of capital goods (except transport equipment)	$23,050,905,684.00
2015	31	Fuels and lubricants, primary	$12,811,825,808.00
2015	21	Industrial supplies nes, primary	$1,570,432,851.00
2015	111	Food and beverages, primary, mainly for industry	$1,137,318,696.00
2015	121	Food and beverages, processed, mainly for industry	$798,175,883.00
2015	322	Fuels and lubricants, processed (other than motor spirit)	$55,187,725.00
2015		Sum	$212,926,809,435.00
2016	41	Capital goods (except transport equipment)	$63,200,523,849.00
2016	53	Parts and accessories of transport equipment	$46,009,766,123.00
2016	22	Industrial supplies nes, processed	$39,825,734,661.00
2016	521	Transport equipment, other, industrial	$28,046,607,950.00
2016	42	Parts and accessories of capital goods (except transport equipment)	$22,963,951,448.00
2016	31	Fuels and lubricants, primary	$7,797,574,930.00
2016	21	Industrial supplies nes, primary	$1,402,867,829.00
2016	111	Food and beverages, primary, mainly for industry	$775,387,540.00
2016	121	Food and beverages, processed, mainly for industry	$751,945,682.00
2016	322	Fuels and lubricants, processed (other than motor spirit)	$49,990,722.00
2016		Sum	$210,824,350,734.00

Appendix Table 2:

Year	Commodity Code	Commodity	Intermediate Goods (USD)
1998	22	Industrial supplies nes, processed	$21,274,588,826.00
1998	42	Parts and accessories of capital goods (except transport equipment)	$16,091,362,085.00
1998	521	Transport equipment, other, industrial	$10,743,536,083.00
1998	53	Parts and accessories of transport equipment	$9,278,014,669.00
1998	21	Industrial supplies nes, primary	$2,314,164,552.00
1998	111	Food and beverages, primary, mainly for industry	$1,656,908,719.00
1998	41	Capital goods (except transport equipment)	$1,544,099,203.00
1998	121	Food and beverages, processed, mainly for industry	$451,775,637.00
1998	322	Fuels and lubricants, processed (other than motor spirit)	$272,558,056.00
1998	31	Fuels and lubricants, primary	$66,326,943.00
1998		Sum	$63,693,334,773.00
1999	22	Industrial supplies nes, processed	$23,546,983,346.00
1999	42	Parts and accessories of capital goods (except transport equipment)	$19,177,979,290.00
1999	521	Transport equipment, other, industrial	$12,313,437,485.00
1999	53	Parts and accessories of transport equipment	$9,146,648,476.00
1999	21	Industrial supplies nes, primary	$1,828,392,223.00
1999	41	Capital goods (except transport equipment)	$1,622,412,642.00
1999	111	Food and beverages, primary, mainly for industry	$1,534,653,100.00
1999	121	Food and beverages, processed, mainly for industry	$519,038,905.00
1999	322	Fuels and lubricants, processed (other than motor spirit)	$348,000,532.00
1999	31	Fuels and lubricants, primary	$72,943,832.00
1999		Sum	$70,110,489,831.00
2000	22	Industrial supplies nes, processed	$29,498,628,312.00
2000	42	Parts and accessories of capital goods (except transport equipment)	$24,898,990,130.00
2000	521	Transport equipment, other, industrial	$15,667,710,412.00
2000	53	Parts and accessories of transport equipment	$12,453,774,322.00
2000	21	Industrial supplies nes, primary	$2,185,856,316.00
2000	41	Capital goods (except transport equipment)	$2,137,971,625.00
2000	111	Food and beverages, primary, mainly for industry	$1,731,815,300.00
2000	322	Fuels and lubricants, processed (other than motor spirit)	$713,202,423.00
2000	121	Food and beverages, processed, mainly for industry	$493,262,187.00
2000	31	Fuels and lubricants, primary	$57,044,680.00
2000		Sum	$89,838,255,707.00
2001	22	Industrial supplies nes, processed	$26,577,157,091.00
2001	42	Parts and accessories of capital goods (except transport equipment)	$21,505,322,819.00
2001	521	Transport equipment, other, industrial	$14,045,530,692.00
2001	53	Parts and accessories of transport equipment	$11,746,805,250.00
2001	41	Capital goods (except transport equipment)	$2,463,472,639.00
2001	21	Industrial supplies nes, primary	$2,201,487,163.00
2001	111	Food and beverages, primary, mainly for industry	$1,864,502,706.00
2001	322	Fuels and lubricants, processed (other than motor spirit)	$559,446,530.00
2001	121	Food and beverages, processed, mainly for industry	$452,422,988.00
2001	31	Fuels and lubricants, primary	$61,994,602.00
2001		Sum	$81,478,142,480.00
2002	22	Industrial supplies nes, processed	$26,361,391,388.00
2002	42	Parts and accessories of capital goods (except transport equipment)	$21,093,982,793.00
2002	521	Transport equipment, other, industrial	$12,308,513,840.00
2002	53	Parts and accessories of transport equipment	$11,231,838,511.00
2002	41	Capital goods (except transport equipment)	$2,415,020,763.00
2002	21	Industrial supplies nes, primary	$2,362,573,287.00
2002	111	Food and beverages, primary, mainly for industry	$1,974,826,543.00

2002	322	Fuels and lubricants, processed (other than motor spirit)	$888,826,048.00
2002	121	Food and beverages, processed, mainly for industry	$460,475,269.00
2002	31	Fuels and lubricants, primary	$52,305,903.00
2002		Sum	$79,149,754,345.00
2003	22	Industrial supplies nes, processed	$27,452,824,118.00
2003	42	Parts and accessories of capital goods (except transport equipment)	$22,312,339,435.00
2003	521	Transport equipment, other, industrial	$11,694,016,756.00
2003	53	Parts and accessories of transport equipment	$10,316,657,960.00
2003	41	Capital goods (except transport equipment)	$2,800,827,618.00
2003	21	Industrial supplies nes, primary	$2,425,025,552.00
2003	111	Food and beverages, primary, mainly for industry	$2,006,294,516.00
2003	121	Food and beverages, processed, mainly for industry	$524,800,504.00
2003	322	Fuels and lubricants, processed (other than motor spirit)	$507,075,830.00
2003	31	Fuels and lubricants, primary	$66,779,579.00
2003		Sum	$80,106,641,868.00
2004	22	Industrial supplies nes, processed	$32,367,756,488.00
2004	42	Parts and accessories of capital goods (except transport equipment)	$24,025,428,700.00
2004	521	Transport equipment, other, industrial	$14,671,534,341.00
2004	53	Parts and accessories of transport equipment	$11,401,674,889.00
2004	41	Capital goods (except transport equipment)	$2,924,613,974.00
2004	21	Industrial supplies nes, primary	$2,807,458,093.00
2004	111	Food and beverages, primary, mainly for industry	$2,030,025,922.00
2004	121	Food and beverages, processed, mainly for industry	$718,345,639.00
2004	322	Fuels and lubricants, processed (other than motor spirit)	$509,668,670.00
2004	31	Fuels and lubricants, primary	$82,381,808.00
2004		Sum	$91,538,888,524.00
2005	22	Industrial supplies nes, processed	$36,331,074,204.00
2005	42	Parts and accessories of capital goods (except transport equipment)	$24,206,637,134.00
2005	521	Transport equipment, other, industrial	$15,122,803,510.00
2005	53	Parts and accessories of transport equipment	$11,970,432,726.00
2005	41	Capital goods (except transport equipment)	$3,509,477,732.00
2005	21	Industrial supplies nes, primary	$2,963,564,313.00
2005	111	Food and beverages, primary, mainly for industry	$1,959,111,677.00
2005	121	Food and beverages, processed, mainly for industry	$1,012,894,413.00
2005	322	Fuels and lubricants, processed (other than motor spirit)	$607,826,211.00
2005	31	Fuels and lubricants, primary	$80,082,221.00
2005		Sum	$97,763,904,141.00
2006	22	Industrial supplies nes, processed	$41,347,490,623.00
2006	42	Parts and accessories of capital goods (except transport equipment)	$25,719,448,730.00
2006	521	Transport equipment, other, industrial	$16,846,993,088.00
2006	53	Parts and accessories of transport equipment	$13,550,649,730.00
2006	41	Capital goods (except transport equipment)	$4,166,477,258.00
2006	21	Industrial supplies nes, primary	$4,062,647,452.00
2006	111	Food and beverages, primary, mainly for industry	$2,041,484,462.00
2006	121	Food and beverages, processed, mainly for industry	$952,627,349.00
2006	322	Fuels and lubricants, processed (other than motor spirit)	$710,824,971.00
2006	31	Fuels and lubricants, primary	$71,863,668.00
2006		Sum	$109,470,507,331.00
2007	22	Industrial supplies nes, processed	$42,398,192,250.00
2007	42	Parts and accessories of capital goods (except transport equipment)	$23,483,361,448.00
2007	521	Transport equipment, other, industrial	$16,178,119,210.00
2007	53	Parts and accessories of transport equipment	$14,582,213,173.00
2007	21	Industrial supplies nes, primary	$4,550,749,863.00
2007	41	Capital goods (except transport equipment)	$4,128,332,403.00

2007	111	Food and beverages, primary, mainly for industry	$2,622,285,907.00
2007	121	Food and beverages, processed, mainly for industry	$1,475,178,081.00
2007	322	Fuels and lubricants, processed (other than motor spirit)	$889,151,132.00
2007	31	Fuels and lubricants, primary	$313,037,385.00
2007		Sum	$110,620,620,852.00
2008	22	Industrial supplies nes, processed	$45,699,938,075.00
2008	42	Parts and accessories of capital goods (except transport equipment)	$24,215,244,457.00
2008	521	Transport equipment, other, industrial	$18,501,217,590.00
2008	53	Parts and accessories of transport equipment	$14,905,005,474.00
2008	21	Industrial supplies nes, primary	$6,167,415,737.00
2008	41	Capital goods (except transport equipment)	$4,429,533,675.00
2008	111	Food and beverages, primary, mainly for industry	$3,807,012,357.00
2008	121	Food and beverages, processed, mainly for industry	$1,828,538,444.00
2008	322	Fuels and lubricants, processed (other than motor spirit)	$980,776,706.00
2008	31	Fuels and lubricants, primary	$614,689,926.00
2008		Sum	$121,149,372,441.00
2009	22	Industrial supplies nes, processed	$38,331,721,508.00
2009	42	Parts and accessories of capital goods (except transport equipment)	$22,700,834,421.00
2009	521	Transport equipment, other, industrial	$18,063,829,291.00
2009	53	Parts and accessories of transport equipment	$12,493,139,854.00
2009	41	Capital goods (except transport equipment)	$4,055,311,434.00
2009	21	Industrial supplies nes, primary	$3,923,608,462.00
2009	111	Food and beverages, primary, mainly for industry	$2,770,940,034.00
2009	121	Food and beverages, processed, mainly for industry	$1,481,913,244.00
2009	322	Fuels and lubricants, processed (other than motor spirit)	$740,600,269.00
2009	31	Fuels and lubricants, primary	$460,232,971.00
2009		Sum	$105,022,131,488.00
2010	22	Industrial supplies nes, processed	$46,826,804,037.00
2010	42	Parts and accessories of capital goods (except transport equipment)	$29,194,549,367.00
2010	521	Transport equipment, other, industrial	$20,877,708,482.00
2010	53	Parts and accessories of transport equipment	$17,542,955,979.00
2010	21	Industrial supplies nes, primary	$4,767,135,254.00
2010	41	Capital goods (except transport equipment)	$4,663,174,010.00
2010	111	Food and beverages, primary, mainly for industry	$3,038,511,861.00
2010	121	Food and beverages, processed, mainly for industry	$1,831,673,087.00
2010	31	Fuels and lubricants, primary	$1,226,962,373.00
2010	322	Fuels and lubricants, processed (other than motor spirit)	$1,145,487,894.00
2010		Sum	$131,114,962,344.00
2011	22	Industrial supplies nes, processed	$54,081,782,764.00
2011	42	Parts and accessories of capital goods (except transport equipment)	$32,064,885,894.00
2011	521	Transport equipment, other, industrial	$24,533,436,520.00
2011	53	Parts and accessories of transport equipment	$22,169,436,708.00
2011	21	Industrial supplies nes, primary	$7,180,218,854.00
2011	41	Capital goods (except transport equipment)	$5,449,446,596.00
2011	111	Food and beverages, primary, mainly for industry	$3,877,769,239.00
2011	121	Food and beverages, processed, mainly for industry	$2,351,773,764.00
2011	31	Fuels and lubricants, primary	$2,081,381,646.00
2011	322	Fuels and lubricants, processed (other than motor spirit)	$1,361,673,076.00
2011		Sum	$155,151,805,061.00
2012	22	Industrial supplies nes, processed	$59,531,184,230.00
2012	42	Parts and accessories of capital goods (except transport equipment)	$35,345,850,138.00
2012	521	Transport equipment, other, industrial	$27,588,360,733.00
2012	53	Parts and accessories of transport equipment	$25,134,247,035.00
2012	21	Industrial supplies nes, primary	$6,837,743,043.00

2012	41	Capital goods (except transport equipment)	$5,843,999,256.00
2012	111	Food and beverages, primary, mainly for industry	$3,933,045,271.00
2012	121	Food and beverages, processed, mainly for industry	$2,718,680,015.00
2012	31	Fuels and lubricants, primary	$1,977,789,449.00
2012	322	Fuels and lubricants, processed (other than motor spirit)	$1,195,764,916.00
2012		Sum	$170,106,664,086.00
2013	22	Industrial supplies nes, processed	$62,105,443,042.00
2013	42	Parts and accessories of capital goods (except transport equipment)	$38,744,247,060.00
2013	521	Transport equipment, other, industrial	$29,054,361,566.00
2013	53	Parts and accessories of transport equipment	$26,713,450,428.00
2013	21	Industrial supplies nes, primary	$6,705,906,378.00
2013	41	Capital goods (except transport equipment)	$6,610,848,700.00
2013	111	Food and beverages, primary, mainly for industry	$3,275,902,075.00
2013	31	Fuels and lubricants, primary	$2,607,433,307.00
2013	121	Food and beverages, processed, mainly for industry	$2,600,297,779.00
2013	322	Fuels and lubricants, processed (other than motor spirit)	$1,310,687,898.00
2013		Sum	$179,728,578,233.00
2014	22	Industrial supplies nes, processed	$65,732,939,200.00
2014	42	Parts and accessories of capital goods (except transport equipment)	$41,277,799,170.00
2014	521	Transport equipment, other, industrial	$30,657,508,024.00
2014	53	Parts and accessories of transport equipment	$29,287,882,289.00
2014	21	Industrial supplies nes, primary	$8,059,705,250.00
2014	41	Capital goods (except transport equipment)	$7,421,545,983.00
2014	31	Fuels and lubricants, primary	$3,249,722,272.00
2014	111	Food and beverages, primary, mainly for industry	$3,237,775,328.00
2014	121	Food and beverages, processed, mainly for industry	$2,369,312,382.00
2014	322	Fuels and lubricants, processed (other than motor spirit)	$1,593,252,702.00
2014		Sum	$192,887,442,600.00
2015	22	Industrial supplies nes, processed	$63,700,369,156.00
2015	42	Parts and accessories of capital goods (except transport equipment)	$42,009,572,077.00
2015	521	Transport equipment, other, industrial	$31,965,862,405.00
2015	53	Parts and accessories of transport equipment	$30,434,543,452.00
2015	21	Industrial supplies nes, primary	$8,176,695,850.00
2015	41	Capital goods (except transport equipment)	$6,707,066,940.00
2015	111	Food and beverages, primary, mainly for industry	$2,631,380,417.00
2015	31	Fuels and lubricants, primary	$2,439,021,031.00
2015	121	Food and beverages, processed, mainly for industry	$1,985,583,981.00
2015	322	Fuels and lubricants, processed (other than motor spirit)	$1,068,267,483.00
2015		Sum	$191,118,362,792.00
2016	22	Industrial supplies nes, processed	$61,582,775,971.00
2016	42	Parts and accessories of capital goods (except transport equipment)	$42,041,451,731.00
2016	521	Transport equipment, other, industrial	$31,129,368,129.00
2016	53	Parts and accessories of transport equipment	$28,585,337,549.00
2016	21	Industrial supplies nes, primary	$7,710,024,596.00
2016	41	Capital goods (except transport equipment)	$6,454,515,567.00
2016	111	Food and beverages, primary, mainly for industry	$2,715,621,105.00
2016	31	Fuels and lubricants, primary	$2,192,881,079.00
2016	121	Food and beverages, processed, mainly for industry	$2,021,556,927.00
2016	322	Fuels and lubricants, processed (other than motor spirit)	$1,661,200,022.00
2016		Sum	$186,094,732,676.00

Appendix Table 3: Employment by Skill Intensity (Fraction of Non-Production Workers)

	Level	Percentage	Percent Change in Employment from a 1% Import Increase
Bottom 1%	381615	1.10%	0.40%
Bottom 5%	2689794	7.75%	0.35%
Bottom 10%	4241660	12.22%	0.32%
Bottom 25%	8157924	23.51%	0.26%
Top 25%	10915479	31.45%	0.05%
Top 10%	6406178	18.46%	-0.10%
Top 5%	3841099	11.07%	-0.17%
Top 1%	1505245	4.34%	-0.36%

Appendix Table 4: Employment by Capital to Labor Ratio

	Level	Percentage	Percent Change in Employment from a 1% Import Increase
Bottom 1%	169344	0.49%	-0.74%
Bottom 5%	1367604	3.94%	-0.52%
Bottom 10%	28934670	8.34%	-0.34%
Bottom 25%	7550001	21.75%	-0.07%
Top 25%	8911189	25.68%	0.35%
Top 10%	2492196	7.18%	0.87%
Top 5%	1578716	4.55%	0.87%
Top 1%	205212	0.59%	1.08%