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Abstract

This paper reviews a series of econometric studies of the impact of the North American Free Trade Agreement on the economies of Mexico, Canada, and the United States. It highlights eleven papers from the last decade that vary in the economic outcomes analyzed (trade flows, wages, employment, productivity, investment, and income in one or more of the countries) and in the statistical methodologies and types of data that are utilized.

1. Introduction

The North American Free Trade Agreement (NAFTA) was enacted in January 1994. The agreement lowered tariff and investment barriers between Canada, Mexico, and the United States over a fifteen-year period.² Given the differences in the countries' level of economic development and the differences in their wages and relative factor endowments, there were concerns that the trade liberalization would have significant distributional effects within the three countries, creating winners and losers, and that it would have disproportionately large effects on Mexico than on the two larger countries.

The policy debates that preceded the ratification of NAFTA often cited model-based predictions of the economic effects that the agreement would have. These analyses consisted mostly of simulations based on computable general equilibrium models, rather than econometric analysis, since there was no historical record of effects at the time. Several years later, after the agreement went into force and

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² Many of the tariff reductions between Canada and the United States were initiated by the earlier Canadian-United States Free Trade Agreement (CUSFTA).

economic data started to reflect some of the effects of the agreement, an econometric literature emerged to complement the simulation models.³ This literature has grown significantly over the past decade, and now there is a large body of evidence – but no consensus – about the economic effects of NAFTA on the three countries.

In a 1999 working paper titled “Trade Creation and Trade Diversion under NAFTA,” Anne Krueger presents an analysis of the changes in the trade flows of the three countries during the first few years of NAFTA.⁴ This seminal paper is often cited in the econometric literature that has followed. Krueger identifies several empirical challenges to disentangling the effects of NAFTA from other major events that affected the Mexican economy, including Mexico’s unilateral trade liberalization in the 1980s and its exchange rate crisis in 1994 and 1995. Her study documents the growth in trade flows through 1998 and calculates the shifts in the countries’ shares of trade during these early years. She finds that there was a four percentage point increase in the share of Mexico in total U.S. imports between 1992 and 1998; however, at the industry-level there was little correlation between the share gains and the magnitude of NAFTA tariff preferences, and the increase in Mexico’s share of the imports of non-NAFTA countries was almost as large as the increase in Mexico’s share of U.S. imports, which suggests that the expansion of Mexican exports may have been driven more by the devaluation of the peso than by the NAFTA tariff reductions. She concludes the paper by estimating a gravity model of the countries’ bilateral non-oil exports. Her econometric estimates indicate that NAFTA was “not seriously trade-diverting.” However, she cautions that a longer time series is needed to draw conclusions about the effects of NAFTA.

Mary Burfisher, Sherman Robinson, and Karen Thierfelder provide an overview of the early empirical literature on the effects of NAFTA in a 2001 article titled “The Impact of NAFTA on the

³ USITC (1997) includes an early attempt to econometrically estimate the effects in the first three years of NAFTA.

⁴ Krueger (2000) is an abbreviated presentation of the analysis in Krueger (1999).

United States.” Like Krueger, the authors warn that it is difficult to separate the effects of NAFTA from the effects of Mexico’s exchange rate crisis. Based on their review of the literature, they conclude that NAFTA had only small economic effects on Canada and the United States but larger effects on Mexico. They find little evidence that NAFTA affected aggregate employment in the three countries. They also discuss the significant structural adjustments in the NAFTA countries in specific industries – the agriculture, autos, and textiles industries – as a result of the agreement’s rules of origin.

Since 2001, there has been a significant expansion in the econometric literature on the economic effects of NAFTA. Our review provides a brief overview of many of the key studies. The studies that we review vary in the types of economic outcomes analyzed. These include changes in trade flows, wages, employment, productivity, investment, and income that affected Mexico, Canada, and the United States. The studies vary in the econometric techniques and types of data that they utilize. Our review highlights the eleven studies listed in table 1, but it also identifies several other relevant studies in footnotes. All of the studies that we review use econometric analysis. Most have been published in academic economic journals or have been widely circulated as working papers.

TABLE 1: Eleven Highlighted Econometric Studies

Authors and Year	Findings	Methods
Easterly et al (2003)	There is evidence of converging income levels in Mexico and the United States since NAFTA, with the exception of 1995.	Several econometric models, including time series analysis and cross-industry regressions
Esquivel et al (2003)	NAFTA did not contribute to the rising skill gap in Mexican wages between 1994 and 2000. It is attributable instead to technological improvements in Mexico.	Econometric model of wages using industry-level data
Fukao et al (2003)	The reduction in tariffs on Mexican and Canadian goods resulted in diversion of U.S. imports from non-NAFTA countries to NAFTA countries for several products, most notably apparel and textiles.	Econometric model using HTS two-digit trade shares, wages, and tariff rates.
Trefler (2004)	CUSFTA increased the productivity of Canadian manufacturing firms by approximately 14%.	Econometric model using Canadian industry-level and firm-level data
Estevedoreal et al (2005)	NAFTA deterred foreign direct investment in Mexican industries that had restrictive rather than flexible rules of origin.	Econometric model of the effects on FDI in Mexican manufacturing industries
Lederman et al (2006)	NAFTA increased Mexico's GDP per capita by approximately 4%. The rules of origin had significant effects on the textiles and apparel industries in Mexico and the U.S. NAFTA increased wage growth in the Mexican states most involved in trade and FDI.	Several econometric models using a diverse set of Mexican economic data
Romalis (2007)	NAFTA tariffs reductions had a large effect on U.S. trade volumes but little effect on prices or welfare in the three countries.	Econometric models of import supply and demand elasticities using tariff rates and six-digit trade data
McLaren and Hakobyan (2010)	There has been smaller wage growth in local U.S. labor markets that had industries more vulnerable to NAFTA tariff reductions.	Micro-econometric model of wages and local average and industry average tariff reductions
Lileeva and Trefler (2010)	CUSFTA had a significant positive effect on the investment and productivity of Canadian manufacturers.	Econometric model using data from individual Canadian firms
Caliendo and Parro (2012)	NAFTA tariff reductions resulted in a 10% increase in Mexican total trade and a 1% increase in U.S. total trade. They resulted in a 1.30% increase in Mexican real wages and a 0.17% increase in U.S. real wages.	Simulation based on a structural general equilibrium model of trade with linkages between sectors and econometric estimates of trade elasticities
De Hoyos and Iacovone (2013)	NAFTA increased the productivity of Mexican manufacturers by increasing competition and lowering tariffs on imported intermediate goods.	Econometric difference-in-difference model using data for individual Mexican firms

The rest of this review is organized into five sections. Section 2 focuses on studies that quantify the impacts of NAFTA on the Mexican economy. Sections 3 and 4 focus on studies that quantify the impacts of NAFTA on the Canadian and American economies, respectively. Section 5 discusses papers that use econometric models to estimate the effects of NAFTA on all three countries. Section 6 offers concluding remarks.

2. Effects on Mexican Productivity, Wages, Incomes, and Investments

Economists expected that NAFTA would have disproportionately larger effects on the Mexican economy, given its relative size and heavy reliance on trade with the United States, even prior to the agreement. So it is not surprising that much of the econometric literature has focused on the Mexican economy.

William Easterly, Nobert Fiess, and Daniel Lederman examine whether the trade liberalization has led to convergence in the income levels of the NAFTA countries in a 2003 article titled “NAFTA and Convergence in North America: High Expectations, Big Events, and Little Time.” The authors report a time series analysis of the gap between the income levels in Mexico and the United States.⁵ They find that Mexico’s convergence toward U.S. income levels has increased since NAFTA, but that Mexico’s growth in income over this period has been similar to the growth rates of a reference group of Latin American countries that did not receive NAFTA preferences. They analyze whether changes in Mexico’s institutions can explain the limited income convergence. They find some improvement in these institutions since NAFTA was enacted, but again not more than the improvements in other Latin American countries during the period. They also estimate the rate of convergence of U.S. and Mexican productivity in twenty-eight manufacturing industries. They find substantially faster convergence since

⁵ More recently, Vasquez Galan and Oladipo (2009) use multivariate time series models to examine whether the growth in Mexico’s exports since NAFTA can explain the pattern in Mexico’s output growth. They report that exports were a good predictor of total output in Mexico (technically that exports Granger caused output in Mexico), after NAFTA entered into force. In contrast, they estimate that inbound foreign direct investment had only a negligible effect on output growth.

NAFTA. Finally, they examine whether NAFTA reduced the difference in incomes across Mexican states, and conclude that it has not.

In a 2005 book titled *Lessons from NAFTA*, Daniel Lederman, William Maloney, and Luis Serven present evidence of income convergence and then estimate the effects of NAFTA on several measures of the Mexican economy. The authors estimate that NAFTA increased Mexican GDP per capita by about four percent, and that the NAFTA rules of origin had a significant impact, especially in the textiles and apparel industries in Mexico. They estimate that NAFTA increased the synchronization of macroeconomic conditions in Mexico and the United States. Like Krueger, they conclude that NAFTA did not cause significant trade diversion. The authors find that aggregate FDI flows to Mexico have increased since NAFTA, but not significantly more than the increase in comparable Latin American countries. Finally, they find higher levels and growth of wages in the Mexican states that exported more and received more FDI.

Gerardo Esquivel and Antonio Rodriguez-Lopez examine the effects of NAFTA on Mexican wages in a 2003 article titled “Technology, Trade, and Wage Inequality in Mexico before and after NAFTA.”⁶ Their econometric analysis uses product price regressions and a “mandated wage” approach derived from the Stolper-Samuelson theorem to separate the contributions of technological change and the trade liberalization to the observed changes in the wages of skilled and unskilled workers in Mexican manufacturing industries. The authors find that the trade liberalization cannot explain the increase in the

⁶ Hanson (2003) also examines the evolution of Mexican wages. His study includes an econometric analysis of wage data from the 1990 and 2000 Mexican Census. Hanson investigates the hypothesis that NAFTA increased investor confidence, which lead to increased capital inflows, increased demand for skilled workers, and increased relative wages. He finds an increase in the relative wage of skilled workers and an increase in the relative wages in the Mexican states that are most exposed to globalization. He uses distance to the nearest border crossing, the state’s share of manufacturing in state GDP, the state’s share of net FDI, the state’s share of national maquiladora employment, and the state’s import share as measures of the states’ exposure to globalization.

skill gap in Mexican wages between 1994 and 2000. They attribute the increase entirely to changes in technology.⁷

Rafael De Hoyos and Leonardo Iacovone examine the link between NAFTA and productivity levels in Mexican manufacturing in a 2013 article titled “Economic Performance under NAFTA: A Firm-Level Analysis of the Trade-Productivity Linkages.”⁸ The authors examine firm-level data for the period 1993-2002.⁹ They classify each Mexican firm in their sample as an exporter only, importer of intermediates only, integrated (both), or non-integrated (neither). They link the changes in productivity to industry-level tariff reductions, and then they use a difference-in-difference approach to infer the effects of NAFTA from period-to-period changes in productivity. They conclude that NAFTA stimulated productivity improvements by increasing import competition and increasing access to imported intermediate inputs. However, they only find a weak relationship between exports and productivity growth. They conclude that it is difficult to disentangle the effects of trade liberalization from other macroeconomic policies, most notably the peso devaluation.

Antoni Esteveordal, José Ernesto López Córdova and Kati Suominen examine how NAFTA rules of origin (ROOs) have affected foreign direct investment (FDI) in their 2006 article titled “How Do Rules of Origin Affect Investment Flows? Some Hypotheses and the Case of Mexico.” Their econometric model estimates the effect of product-specific ROOs on FDI in 122 Mexican manufacturing

⁷ Baylis, Garduno-Rivera, and Piras (2012) also estimate the distributional effects of NAFTA in different regions and industries in Mexico, but they find larger effects of trade liberalization. They estimate spatial panel econometric models of the effects of NAFTA on CPI-deflated measures of gross value added. They conclude that NAFTA caused already-wealthy regions near the border to grow significantly but that densely-populated areas did not grow as fast as they did before NAFTA. They find that regions that were less developed in terms of education and infrastructure experienced increased growth.

⁸ Verhoogen (2008) also presents a microeconomic analysis of the impact on trade in Mexican manufacturing plants. He focuses on quality upgrading of labor and wage inequality. However, he is quantifying the effects of the peso devaluation rather than the effects of NAFTA.

⁹ They measure the productivity of the firm as value-added per unit of hourly labor input.

industries between 1994 and 2000.¹⁰ They find that FDI flowed predominantly to industries with flexible NAFTA rules, and that restrictive rules deterred FDI in Mexico.

3. Effects on Canadian Producers

There are several studies that find that the Canadian economy has been significantly affected by the trade liberalization that began with the CUSFTA and was expanded by NAFTA. The studies do not try to quantify the separate, incremental effects of NAFTA, because the effects of Canada's integration with the United States generally overwhelms the effects of adding Mexico, given the relative size of the markets and common border between the United States and Canada.

An excellent example of this literature is a 2004 article by Daniel Trefler titled "The Long and Short of the Canadian-U.S. Free Trade Agreement." Trefler estimates several econometric models of the effects of the CUSFTA on the employment and productivity of Canadian manufacturing firms, using a combination of industry and firm-level data and detailed tariff rates for the period 1980-1996.¹¹ Trefler's difference-in-difference estimation technique uses political economy characteristics of the industries in 1980 as instrumental variables for the changes in their tariff rates. He models changes in employment (total, production workers, non-production workers, skill upgrading), labor productivity, trade diversion and creation, import prices, earnings, and earnings inequality. Trefler finds that the plants that were most affected by the tariff reductions experienced employment losses of twelve percent on average. He also finds that the effects on labor productivity were high at the industry level but insignificant at the plant level, suggesting that the productivity increase came mostly from the exit of less efficient firms and the expansion of more efficient firms. He provides some evidence that the trade liberalization was welfare-improving overall, though it had negative effects on many Canadian production workers.

¹⁰ The authors developed a detailed index for classifying NAFTA's product-specific ROOs.

¹¹ Melitz and Trefler (2012) provide a summary of this firm-level econometric study, as well as the related article Lileeva and Trefler (2010).

In a related 2010 article titled “Improved Access to Foreign Markets Raises Plant-Level Productivity... For Some Plants,” Alla Lileeva and Daniel Trefler provide additional analysis of the effects of these tariff reductions on the productivity and product innovations of the Canadian firms, as well as the firms’ adoption of advanced manufacturing technologies, using plant-level data from the period 1984-1996. Lileeva and Trefler find complementarities between the firms’ exporting and investment decisions, and they find very heterogeneous responses to the trade liberalization. They estimate that the tariff reductions resulted in a total increase in Canadian manufacturing labor productivity of approximately fourteen percent, including within-plant effects.

4. Effects on Labor Markets and Imports in the United States

Several of the econometric studies investigate whether NAFTA had a significant impact on labor markets in the United States. John McLaren and Shushanik Hakobyan examine how NAFTA affected wages in local labor markets in the United States in their 2010 working paper titled “Looking for Local Labor Market Effects of NAFTA.” The paper is an econometric analysis of the effects of NAFTA reductions in U.S. tariffs on imports from Mexico, and ultimately on the wages of U.S. workers in local labor markets within the United States. The authors use worker-level data from the U.S. Census in 1990 and 2000 to estimate each industry’s vulnerability to Mexican imports and the share of each location’s employment in vulnerable industries. To measure local vulnerability, they calculate an average of the tariff changes weighted by local employment in each industry and measures of Mexican revealed comparative advantage in the industry. They distinguish the effects of tariff reductions that already occurred by 2000 from tariff reductions that were anticipated after 2000. They find lower wage growth for blue-collar workers and some evidence of anticipation effects (wages go up as labor supply falls in anticipation of a drop in demand after 2000).¹²

¹² In a 2011 article titled “Trade Liberalization, Unemployment, and Adjustment: Evidence from NAFTA Using State Level Data,” John Francis and Yuqing Zheng build an econometric model of supply and demand in the U.S. labor market and examine the effects of NAFTA on unemployment across the states. They use national and state-level data for the period 1977-2007. Their model allows for the lagged effects of the tariff reductions on unemployment growth. They estimate that NAFTA reduced yearly unemployment growth by 4.4 percent. They

In a 2003 article titled “An Econometric Analysis of Trade Diversion under NAFTA,” Kyoji Fukao, Toshihiro Okubo, and Robert Stern address the issue of trade diversion in the U.S. market. The authors build several OLS fixed effects models to quantify the impact tariff rates on U.S. import shares. They find fifteen product groups in which there was statistically significant trade diversion as a result of tariff reductions on imports from Mexico and Canada; the most obvious diversion was in U.S. imports of apparel and textiles. They find less evidence of trade diversion for autos and machinery, and the authors conclude that FDI inflows – rather than tariff reductions– were probably the key drivers of the shifts in import shares.

5. Models of All Three NAFTA Countries

John Romalis uses tariff and trade data to estimate an econometric model of the effect of the NAFTA tariff reductions on trade volumes and prices, and then he uses the model to calculate the welfare effects of the agreement in a 2007 article titled “NAFTA’s and CUSFTA’s Impact on International Trade.”¹³ His model is based on a panel data set of U.S. imports at the six-digit level for the period 1989-2000. Romalis estimates demand elasticities by regressing delivered values of imports on relative tariffs and a set of dummies using a difference-in-difference estimation technique. He controls for unobserved cost terms by modeling the demand for imports in the United States relative to the demand for imports in the European Union.

Romalis notes that there was a striking increase in Mexican exports to the United States over the time period, but that it is difficult to disentangle the effects of NAFTA from the effects of earlier Mexican trade liberalization and the 1994-1995 peso devaluation. He finds that “NAFTA had a substantial impact

conclude that there was an immediate effect of NAFTA in 1994 but that the impact on U.S. labor markets continued for at least seven years.

¹³ He uses a static structural model of trade to identify import supply and demand elasticities. The inverse supply elasticities are identified by regressing observed imports prices (average unit values excluding duties) on observed trade quantities, using tariffs as instrumental variables, to estimate an industry-specific constant inverse supply elasticity in foreign production.

on international trade volumes, but a modest effect on prices and welfare. NAFTA increased North American output and prices in many highly protected sectors by driving out imports from non-member countries.” He calculates small welfare effects: the small increases in the real value of output of NAFTA members are mostly offset by the decline in tariff revenues due to trade diversion. He finds that the effects on trade volumes are more substantial than the effects on welfare or prices.

In a 2012 working paper titled “Estimates of the Trade and Welfare Effects of NAFTA,” Lorenzo Caliendo and Fernando Parro use a stochastic Ricardian model with inter-sectoral linkages to estimate the trade and welfare effects of tariff reductions between 1993 and 2005. The authors estimate sector-level trade elasticities and then use the elasticities to calculate trade and flow and real wage effects of the NAFTA tariff reductions. They find that it is important to take into account intermediate goods in production and input-output linkages when estimating the trade effects of NAFTA. They estimate that NAFTA tariff reductions lead to a ten to eleven percent increase in Mexico’s imports and exports, a four percent increase in Canada’s imports and exports, and a one percent increase in U.S. imports and exports.¹⁴ They estimate that NAFTA tariff reductions (all other provisions ignored) increased real wages by 1.30 percent in Mexico, by 0.96 percent in Canada, and by 0.17 percent in the United States.

6. Concluding Remarks

This review is an introduction to the large and growing econometric literature on the economic effects of NAFTA. The methodologies and dataset are quite diverse, and each of the econometric studies focuses on a different set of economic effects. Together they provide useful estimates that can be refined still further as additional datasets and modeling techniques are developed.

We have not reviewed the many important studies that use computable general equilibrium simulations rather than econometric estimation. We expect to review this complementary literature in a companion working paper.

¹⁴ They find that 93 percent of Mexico’s, 58 percent of Canada’s and 55 percent of the United States’ trade effects due to tariff reductions can be attributed to NAFTA’s tariff reductions.

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