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The U.S. Employment Impacts of North American Integration After NAFTA: A Partial Equilibrium Approach

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Executive Summary

The key findings of this report indicate that:

(1) The overall pattern of U.S.-Mexico trade and investment began to change radically nearly a decade before NAFTA with Mexico's unilateral trade liberalization. This ushered in a dramatic growth in the two-way trade of manufactured intermediate goods that has continued and matured since the implementation of NAFTA.

The most significant change in the U.S.-Mexico trade relationship over the last few decades has been an explosion of exports and imports since the late 1980's, driven almost entirely by an expansion of Mexican manufactured exports based on the processing of imported intermediate inputs. As a result, a large part of Mexican imports have become predominantly linked to the demand for Mexican exports rather than to fluctuations in Mexican domestic demand. This new import-export dynamic has grown even faster than the recent rapid expansion of Mexican *maquiladora* exports as the strategy of manufacturing for exports is adopted by many other regions, sectors, and types of firms in the Mexican economy. The period since NAFTA has seen a continuation, maturation and even a slight deceleration of this previously initiated shift.

(2) The lowering of tariffs through NAFTA has not had a significant impact on the growth of Mexican exports to the United States. Mexican exports to the U.S. have actually grown faster in those sectors that were not directly liberalized by NAFTA.

U.S. imports from Mexico have clearly increased rapidly since NAFTA – they grew at an average of 6.3 percent per year in the three years prior to NAFTA and at an average of 20 percent in the years since. While the impact of NAFTA tariff liberalization on the level of trade appears to have been positive and statistically significant, NAFTA trade liberalization in itself can only statistically explain a small part of these changes. A larger impact on the level and pattern of trade should be attributed to the collapse and recovery of Mexican growth related to the peso crisis and the ongoing bi-national industrial integration. In fact, an analysis of the pattern of U.S.-Mexico trade since NAFTA indicates that U.S. imports in those commodities liberalized by NAFTA actually rose less rapidly than imports in commodities that were not effected by NAFTA liberalization.[1] This finding corroborates our earlier findings (Hinojosa-Ojeda, et. al., (1996)), as well as those by Shelburne (1998). It can also be shown that the evolving structure of trade is unlikely to have been substantially

[1] Either because they were already liberalized before NAFTA, were liberalized by other means, or have not yet been liberalized.

determined by NAFTA tariff liberalization or any other tariff liberalization, but rather still needs to be explained through other causes.

(3) This report presents a partial equilibrium methodology for estimating direct and indirect U.S. employment impacts related to North American trade since NAFTA implementation. Jobs "put at risk" from imports number about 37,000 per year due to Mexican imports and 57,000 per year due to Canadian imports.

We developed an alternative methodological approach to tracking the potential employment impacts of trade, using partial equilibrium CES (Constant Elasticity of Substitution) aggregation functions at a 4-digit SIC sectoral level to estimate U.S. domestic demand for domestic production, given a particular level of imports. These production estimates are then translated into domestic labor requirements using direct and indirect input-output labor coefficients. By utilizing the econometrically estimated Armington elasticities, these functions attempt to account for the complementarity in production between the United States and a given country in a given sector.

The usefulness of this partial equilibrium model is to isolate the impact of imports and to show that even in the most exaggerated scenario for import impact – with demand and productivity fixed – the potential job impact is relatively small. If we add up these estimates across sectors,[2] we find the totals are not large. Total estimated potential job impact in the United States from 1990 to 1997 due to imports from Mexico would be 299,000, and it would be 458,000 for imports from Canada. That is an average of 37,000 jobs *per year* for Mexican trade and 57,000 *per year* for Canadian trade. Considering that the U.S. economy creates over 200,000 jobs *per month* and causes the separation of about 400,000 workers *per month* from their jobs, the small relative share of potential job impacts from this trade is apparent. Applying more realistic productivity and demand changes experienced since NAFTA significantly reduces the potential U.S. job impacts due to imports.

(4) The NAFTA-TAA program is a relatively better indicator for estimating employment losses due to plants moving to Mexico, but is less reliable as an indicator of employment loss due to import penetration.

The U.S. Department of Labor had certified 238,051 workers for NAFTA-TAA through early July 1999, an average of 3,662 workers per month. The workers certified due to trade impacts from Mexico were 46,826 or 700 per month, while from Canada there were 23,250 workers certified or about 350 per month. The remaining certified workers were from causes not specified or not directly linked to Mexico or Canada

[2] Because they are partial equilibrium estimates, we have no theoretical basis upon which to add them, nor to interpret the magnitude of the sum. But certainly the sum is an overestimate of the true general equilibrium impact.

The NAID-Armington estimate of potential trade impacts is thus between 75 and 90 percent higher than the NAFTA-TAA numbers. Even conceding that our estimate is high, and that some of the certified plant shifting results in imports back to the United States, it is likely that NAFTA-TAA is undercounting trade impacts.

(5) Estimates of employment impacts due to trade have a limited but important role to play in the public discussion of trade.

In general, jobs gain/loss accounting methodologies should <u>not</u> be used to evaluate the relative benefits of trade. In general, changes in aggregate demand created by a changing trade balance and/or trade policy are likely to be counteracted by general macro-economic policy and thus trade policy changes are likely to have only a very insignificant impact on overall employment in the short run and no impact in the long run. What is much more significant as a measure of trade policy is the impact on economies of scale, technological change, new investments, and productivity growth in the liberalized sectors and the ability of the economy as a whole to reap benefits from these productivity increases.

The trade and employment impact methodologies presented here should, however, be central to our understanding of the adjustment costs of the impacts of trade. Accurately identifying employment displacement risks is very important to assist workers and communities take adequate steps to prepare for a positive adjustment. Failure to identify and address adjustment risk will inevitably generate exaggerated political opposition to trade liberalization, in some cases based on ignorance and fear, and in some cases based on the legitimate defense of uncompensated individual costs which are incurred on behalf of the overall societal welfare.

I. Introduction

During the two years preceding the U.S. congressional vote on the North American Free Trade Agreement (NAFTA) in November 1993, a variety of methodological approaches were developed to generate predictions of the employment and income results of accelerated North American economic integration. A lively debate emerged over the most appropriate methodology for measuring the relevant dynamics (trade, capital, and migration flows) and predicting accurately both positive and negative impacts at the national, regional, and sectoral levels. In light of the political importance that the congressional vote on NAFTA took on, this type of data analysis is now crucial for the design of future U.S. trade policy and for the formulation of a regional integration strategy beyond NAFTA.

Since the passage of NAFTA, however, comparatively little research has been devoted to tracking the pattern of North American integration and explaining the significance of the complex trends now observable. This lack of attention is particularly distressing given that a number of related policy issues that are central to the future of U.S. trade policy and North American integration remain unresolved. These issues include North American monetary stability and migration flows, the expansion of regional integration in the Western Hemisphere, and the increase in global trade and investment and its potential impact on U.S. labor markets.[3]

Despite the paucity of ongoing research, there has nevertheless been much speculation in the media about the impact on U.S. employment of NAFTA trade liberalization and Mexico's 1994-95 peso crisis. Unfortunately, the recent round of speculation has been based on estimations that reproduce many of the errors made during the NAFTA debate on both sides of the issue.[4] It should come as no surprise that opinion polls indicate that the public in NAFTA countries is confused about the employment impacts of NAFTA and about which

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3 Moreover, the "NAFTA Implementation Act" of 1993 requires that "[b]y not later than July 1, 1997, the President shall provide to the Congress a comprehensive study on the operation and effects of the Agreement" that includes an assessment of "[t]he net effect of the Agreement on the economy of the United States, including the United States gross national product, employment, balance of trade, and current account balance." Title V, Subtitle B, Section 512, p. 17.

4 Bob Herbert, writing in The New York Times, for example, used an estimate of "one million jobs lost due to NAFTA" without any critical examination of its source (see "NAFTA's Bubble Bursts: Almost a million jobs lost already," The New York Times, September 11, 1995, p. A13). The Los Angeles Times has reported without critical examination the California Trade and Commerce Agency's claim that "NAFTA is clearly benefiting California's economy..."--a claim based solely on export figures without ever mentioning imports (see Los Angeles Times, June 27, 1996).

country has benefited more from the agreement.[5] Most of the recent round of estimates are based, at best, on partial information from one source or another, extrapolated by way of imprecise or faulty methodologies. Rarely have recent estimates clearly presented the data and methodologies that underlie their conclusions.

The lack of careful attention to these developments is particularly unfortunate in light of the new institutions and policies, such as the North American Development Bank (NADBANK) and the NAFTA-Trade Adjustment Assistance (NAFTA-TAA) program, that were developed as part of the agreement to provide an unprecedented level of support for identifiable adjustment needs. NADBANK, for example, through its Community Adjustment and Investment Program (CAIP), seeks to provide investment in U.S. communities that have been adversely affected by trade liberalization under NAFTA. Similarly, the TAA program provides resources for training and relocation of workers that have been dislocated by NAFTA-related trade. The research presented here may help to develop and evaluate criteria for effectively implementing these new institutions.

This paper proceeds with a review of some recent approaches that have been used to estimate changes in the pattern of trade and integration and the potential impact of these changes on employment gains and losses. Following this review, an alternative methodological approach is presented in Section III, which begins with a partial equilibrium methodology based on the converting of econometrically estimated price elasticities of substitution for imports (Armington elasticities) into a measure for determining the domestic output impacts of imports. Direct multipliers are then used to estimate selected employment impacts at a national level. This exercise, the results of which are presented here, is designed to be a first step in an alternative and partial equilibrium methodological approach, leading to a fully dynamic CGE (Computable General Equilibrium) framework, which would allow for all relevant short-and long-term price, production, investment and technology effects.

Section IV of the paper presents the an historical overview of the transformation in pre- and post-NAFTA patterns of trade in manufactured goods between the United States and Mexico. Section V assesses the direct employment impacts of pre- and post-NAFTA patterns of manufactured trade on the U.S. economy, reviewing NAFTA-TAA certifications and utilizing the methodology outlined in Section III.[6] This method is compared with other approaches that are being used to estimate the employment impacts of trade and investment

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[5] See Los Angeles Times, "Mexicans' View of U.S. Positive but Skeptical," September 13, 1996, which reports that a "majority said NAFTA has taken away U.S. jobs, while just 6% said it has generated jobs north of the border." A recent Southwest Voter Research Institute poll of U.S. Latinos found that over 50% support NAFTA and believe it has helped the United States; see the National Latino Voter Opinion Survey (San Antonio: Southwest Voter Research Institute, 1996).

[6] We chose to focus this paper on manufacturing because (1) we lack comparable wage and employment data for other sectors, such as agriculture, and (2) services are for the most part not included in NAFTA-TAA, as there is no "product" produced.

flow since NAFTA and the eligibility of local communities for NAFTA-TAA and NADBANK assistance in the United States.

II. Review of Post-NAFTA Methodological Approaches

II.1. Explaining Post-NAFTA Trade and Investment Trends

Several recent studies have used different methodologies for estimating the effect of NAFTA on trade and investment flows and the impact of these flows on employment and earnings. Some studies have focused on explaining the post-NAFTA pattern of trade, while others offer an empirical accounting of the employment impacts of post-NAFTA trade and investment flows. Some of the early literature, however, should be considered reviews of trends and events, rather than attempts to explain these trends, as was the case for many official publications from governments and international organizations. More recent studies were econometrically based attempts to estimate the potential impact of NAFTA on trade, output and income levels in North America, but did not attempt to estimate the impact on employment either directly or indirectly. A handful of studies have attempted to generate aggregate and sectoral employment impacts. As we shall see below, however, most of these studies contain major methodological problems

A early example of the methodological approaches taken in official reports is an ECLAC document that seeks to "describe and illustrate" the complex issues involved in the implementation of NAFTA-type agreements for a Latin American audience. The purpose of the report, however, is "not an evaluation of NAFTA's impact."[7] The report does review some of the major trade trends among NAFTA countries, particularly the changes in U.S. exports to Mexico in sectors that became duty free under NAFTA. In looking at the twenty-five top U.S. export categories liberalized by NAFTA since 1994, the ECLAC report makes the point that "[t]he dynamism of many exports in NAFTA's first two years has been impressive [compared to 1993], particularly semiconductors, computers, machine tools, medical devices, and aerospace equipment."[8] The report also points out that, according to the U.S. Department of Commerce, in "just about every state exports to Mexico grew faster than to the rest of the world." While these specific results are interesting, proper analysis of the impact of NAFTA should include the effect of tariff liberalization on both imports and exports. It is also necessary to try to differentiate between the impact of NAFTA tariff liberalization and other macroeconomic dynamics.

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7 United Nations Economic Commission for Latin America and the Caribbean (UN ECLAC), "NAFTA Implementation in the United States: The First Two Years," LC/WAS/L.34-June (Washington, DC: UN ECLAC, 1996), p. 3.

8 UN ECLAC (1996), p. 93.

One of the early studies that did take a more analytical approach to the evolution of post-NAFTA trade and investment trends is found in Espinoza and Noyola (1996). The authors hypothesize that "the most important structural effects experienced in the bilateral relation over the last two years are the positive effect of the incentives created by NAFTA."[9] While they accept the notion that shifts in exchange rates have strong impacts on the magnitude of trade flows, they argue that "before 1994, economic agents allocated resources and took strategic decisions both in anticipation of NAFTA and as a result of the unilateral reforms."

The principal argument put forward by Espinoza and Noyola is that the "[p]ure exchange rate effect belies the fact that during 1994 and 1995 there were substantial direct effects on specific sectors which were subject to restrictive non-tariff barriers until 1993." As evidence for this argument, they look at import and export data and review changes in some broad sectors, presenting pre- and post-NAFTA trade trends. Yet, unlike the ECLAC study, they do not try to differentiate among sectors that were actually liberalized by NAFTA and those that were not in making their comparison. Their data review is also much too broad-brush to distinguish between those products that were actually affected by tariff and non-tariff barriers and their liberalization.

In two other studies, de Janvry and Gould use regression methodology in their efforts to estimate the differential impact that NAFTA and the peso crisis have had on patterns of U.S.-Mexican trade.[10] Both studies pursue the same goal through the use of similar techniques: to "disentangle NAFTA from macroeconomic effects,"[11] and to "distinguish NAFTA from the peso crisis."[12] Gould, for example, estimates that "although U.S. exports fell 11% in 1995, in 1996 they are 12% greater than they would have been *without* NAFTA. Imports are nearly 3% greater than they would have been without the trade agreement."[13] De Janvry similarly makes the statement that "[t]he agreement thus helped avoid 52% of the fall in exports to Mexico due to the peso crisis."[14] Though these models help to show that there has been structural change in the trading relationship since the peso crisis of the early 1980s, the attribution to NAFTA is a strong claim, and its verification requires more extensive analysis and a much clearer causal argument.

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9 Enrique Espinoza and Pedro Noyola, "Emerging Patterns of Mexico-U.S. Trade," draft presented at a Working Conference on U.S. Mexico Relations, Washington, DC, The Brookings Institution, July 1996.

10 See Alain de Janvry, "NAFTA and Agriculture: An Assessment," paper prepared for presentation at the Trinational Research Symposium on "NAFTA and Agriculture: Is the Experiment Working?" San Antonio, Texas, November 1-2, 1996; and David M. Gould, "Distinguishing NAFTA from the Peso Critis," Southwest Economy, Federal Reserve Bank of Dallas, No. 5, September/October 1996, pp. 6-10.

11 de Janvry (1996), p. 5

12 Gould (1996), p. 6.

13 Gould (1996), p. 6.

14 de Janvry (1996), p. 5.

More recently, President Clinton transmitted to Congress a mandated "Study on the Operation and Effect of the North American Free Trade Agreement,"[15] which found a consensus among a number of studies concerning the impact of NAFTA on trade and output for the U.S. Economy.[16] The White House/USTR study reports that "[t]hese studies generally conclude that NAFTA in isolation has had a modest effect on the U.S. economy, although the precise measurement of the benefits varies."[17] The USITC (1997) study, which was widely cited as an econometric estimation of the impact of NAFTA, also found that "there was a strong statistical link between the increase in bilateral trade between the United States and Mexico and the implementation of NAFTA."[18] Yet the USITC study indicated that the effects it found "… may also reflect other events that occurred concurrently with NAFTA implementation,"[19] and that it was unable to draw a link between NAFTA and the levels of U.S. exports to and imports from Canada and Mexico. The USITC study states "[i]n 1994, the only year in which NAFTA was in place and the peso devaluation does not confound the estimates, the implied increase in the volume of U.S. exports to Mexico outpaced the increased volume of U.S. imports from Mexico."[20]

With respect to labor market impacts, the USITC reports that its principal finding "is that relatively few U.S. industries show evidence of having been affected (either positively or negatively) by NAFTA in the Agreement's first three years."[21] The ITC did not attempt to make estimates of employment impacts from trade. The earnings equation of the ITC model did find, however, that for a small number of industries, "the coefficient on the NAFTA variable was significant and negative."[22] While the wage effect are likely to be small, the data base used in the model nevertheless spreads these negative effects over "4 million workers employed in these industries."

II.2. Estimating Employment Impacts Under NAFTA

Both the White House/USTR and USITC studies recognize the need for studies to address the linkage between trade effects of NAFTA and employment. Both criticize the flawed yet common approach of associating trade balances with employment effects. Yet both also recognize that few studies undertaken both before and after NAFTA's

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15 This report was required by section 512 of the NAFTA Implementation Act (Public Law 103-182; 107 Stat. 2155; 19 U.S.C. 3462). USTR, "Study on the Operation and Effect of the North American Free Trade Agreement," 1997. See http://www.ustr.gov/reports/naftareport/presltr.pdf.

16 The four studies reviewed include Gould (1996), USITC (1997), DRI/McGraw Hill (1997) and Hinojosa-Ojeda et al, (1996).

17 White House/USTR (1997), p. 1-14.

18 USITC (1997), p. 4-13.

19 USITC (1997), p. 4-1.

20 USITC (1997), p. xxii.

21 USITC (1997), p. 4-14.

22 USITC (1997), p. 4-18.

implementation focused on the sectoral and aggregate employment effects of trade. The White House/USTR makes the point that "[t]he mainstream economic community has not developed any broadly agreed methodology to sort out from the nearly $1 trillion in U.S. annual imports those imports that might displace U.S. production, as well as the degree to which such production is displaced."[23] They go on to recognize that "Hinojosa-Ojeda, et al., (1996) has started preliminary work using Armington elasticities to take into account that estimated job displacement effect of imports are smaller than the job creating effects of exports." Before discussing our methodological approach, however, it is important to review the recent discussion on trade and employment effects and the nature of the problems associated with the flawed, yet currently still used approaches.

Perhaps the most widely cited and replicated of these aggregate trade and employment approaches, and where many of the methodological problems within the current debate began, was the study conducted at the Institute for International Economics (IIE) by Hufbauer and Schott.[24] Hufbauer and Scott took a two-stage approach: first, they projected a growing U.S. aggregate trade surplus with Mexico based on historical average growth rates of GDP and trade for thirty-one developing countries undergoing trade reforms;[25] and, second, they assumed that "U.S. jobs are ... created at the rate of 14,500 jobs per net $1 billion improvement in the U.S. trade balance. Thus about 130,000 additional U.S. jobs are created under a NAFTA scenario" (a $9 billion U.S. trade surplus multiplied by 14,500).[26] The IIE approach was probably the most frequently cited estimate for NAFTA trade and employment gains in press reports during 1992 and 1993, and both the Bush and Clinton administrations regularly cited its prediction that "NAFTA would lock in and expand" a U.S. trade surplus as an argument for passage of the agreement.[27]

However, hindsight has shown that the IIE estimation was based not only on a weak foundation for macroeconomic projection, but also on a multiplier methodology that was highly flawed conceptually and was not rooted in the specific structures of U.S.-Mexican trade. Not surprisingly, the predictive capacity of this approach has now been discredited. For example, the Hufbauer-Schott model implies that, because the first year of NAFTA produced growth of $1.64 billion in the U.S. trade surplus with Mexico, and assuming that U.S. jobs grow at a rate of 14,500 jobs per net $1 billion improvement in the U.S. trade balance, there would have been a net gain of 23,800 in U.S. jobs. Conversely, in 1995, the $17.5 billion negative swing in the U.S. trade surplus with Mexico would have produced a

[23] White House/USTR (1997), p. 1-19.

[24] Gary Clyde Hufbauer and Jeffrey J. Schott, North American Free Trade: Issues and Recommendations (Washington, DC: Institute for International Economics, 1992).

[25] Hufbauer and Schott (1992), p. 51.

[26] Hufbauer and Schott (1992), p. 55-56.

[27] See, for example, United States Trade Representative (USTR), "Overview: The North American Free Trade Agreement," 1992; and USTR, "Administration Statement on the North American Free Trade Agreement," July 1993, p. 7.

net job loss at the same rate--that is, a loss of 254,000 jobs, an obviously exaggerated figure, as discussed below. It is no surprise that the Hufbauer and Schott approach is now widely quoted by NAFTA opponents such as the AFL-CIO[28] and Ross Perot.[29]

In a subsequent book, Hufbauer and Schott revised their methodology slightly.[30] Instead of computing a single, aggregate number by multiplying the projected change in the trade surplus by a "jobs multiplier" per billion dollars, they dis-aggregated their estimates by sector and measured "direct and indirect jobs supported by exports" as the parameter for projecting net employment gains. By doing so, they are able to raise their estimate of the jobs that would be created by the same projected long-term $9 billion increase in U.S. net exports to Mexico from 130,000 to 170,000.

Unfortunately, this approach is also flawed in several important ways. First, Hufbauer and Schott are incorrect in using the Department of Commerce multipliers on direct and indirect jobs when estimating job gains by sector and occupation. Though the direct jobs multiplier is a technical coefficient and we use it in this paper, they mistakenly apply the indirect jobs multiplier as if it referred to jobs <u>in the sector</u> created by exports in the economy as a whole, while it actually refers to indirect jobs <u>in the rest of the economy</u> generated by exports in this sector. The indirect multipliers Hufbauer and Schott claim to be using simply

[28] U.S. Job Loss From NAFTA: During the NAFTA debate in Congress, supporters claimed that 170,000 U.S. jobs would be created by 1995 as a result of the trade agreement. The figure was determined by using the calculation that every billion dollars of net exports creates 20,000 jobs. According to this methodology, the trade surplus with Mexico must reach $8.5 billion by 1995 to produce the 170,000 jobs. It is clear that given the shrinking trade surplus with Mexico ($1.3 billion in 1994), NAFTA will not produce the number of jobs claimed by NAFTA supporters by 1995.
More recently, NAFTA supporters claim that increased exports to Mexico have created more than 100,000 jobs in 1994. They refuse to acknowledge, however, that increased IMPORTS from Mexico are destroying U.S. jobs. Underscoring this reality is the disturbing admission of Julius Katz, former deputy U.S. Trade Representative, who told the Wall St. Journal, "the job numbers are totally phony numbers." AFL-CIO Task Force on Trade (1995), "NAFTAmath: First Year Assessment," (http://www.aflcio.org/issues/docs/ipnaft-5er.html) . See also AFL-CIO Task Force on Trade, "NAFTAmath – Two Years Later," March 1996.

[29] ROSS PEROT: Which industries and workers have had the greatest losses?
PAT CHOATE: This chart shows the industries and workers that have been hurt the most. The 1995 trade numbers, I think, provide the best answer. Overall, we imported 174 billion dollars more goods than we exported last year. Now, according to the U.S. Commerce Department, one billion dollars in trade equals 20,000 jobs. That means that a 174 billion dollar trade deficit equals 3.4 million American jobs lost overseas, and that is just in one year. The 1995 trade deficit pushed the total cumulative trade deficit over one trillion dollars since 1980. That is 20 million U.S. jobs were lost over the past 16 years. This is the largest unilateral transfer of jobs and wealth in the history of the world." Ross Perot for President Infomercial, "Made In The U.S.A...Again" Video Transcript, Saturday, September 14, 1996. (http://www.perot.org/headquarters/speeches/info5.htm).

[30] Gary Clyde Hufbauer and Jeffrey J. Schott, <u>NAFTA: An Assessment</u> (Washington, DC: Institute for International Economics, 1993).

do not exist as statistics published by the U.S. Government.[31] The second, more crucial, problem is the implicit assumption that exports and imports are symmetric in their impact on employment in the economy. In fact, there is no reason to assume that an increase in jobs related to a rise in exports will translate into a similar decline in jobs for a corresponding rise in imports. There are several reasons for believing that the effects in fact would be different:

- Exports and imports are not symmetric. If a product is exported, it is safe to say that no domestic buyer was willing to pay the market price for that product, and, depending on the industry, the additional production may not have taken place had the export opportunity not existed. In any case, one can associate jobs with production that is exported – "jobs supported by exports" in the U.S. Department of Commerce's phraseology. If a product is imported, it is not safe to assume that, in the absence of the import, the same product would have been produced domestically. For example, imports from a given country such as Mexico may compete with products from other developing countries, rather than with domestic production. If imports do not substitute one-for-one for domestic production, and may even be complementary to U.S. production, then the fallacy of looking at net trade balances becomes apparent.

- As Lester Davis has noted, "...full examination of the effect of imports on U.S. jobs requires asking what would have happened to all U.S. jobs if the level of imports was different than under actual conditions. Moreover, inflation, productivity growth, shifts in product composition, and, therefore, changes in the level and composition of jobs supported by exports differs significantly from that related to imports."[32] The Hufbauer-Schott methodology assumes that, in the absence of imports, an equivalent amount of goods would have been produced domestically and would have generated the corresponding jobs. This is not a valid assumption because it neglects the gains from trade and the real savings of producing goods more cheaply elsewhere with resources not available or more productively employed in the United States.

- Trade (exports and imports, foreign and domestic) actually <u>creates</u> jobs indirectly, and nowhere is this more apparent than in the U.S.-Mexican trade relationship. Transportation, communications, finance, insurance, real estate, wholesale and retail trade, and even construction employment continue to expand as an indirect result of increased trade.

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[31] Personal communications from Lester Davis, U.S. Department of Commerce, and Margaret McCarthy, INFORUM, University of Maryland.

[32] Lester A. Davis, "U.S. Jobs Supported By Goods and Services Exports," U.S. Department of Commerce, Economics and Statistics Administration, OMA-1-95, May 1995, p. 20.

Despite the clear shortcoming in the Hufbauer and Schott methodology, this basic approach has continued to be replicated in a variety of recent studies. The Economic Policy Institute (Scott [1999], Rothstein and Scott [1997]), for example, has adopted the Hufbauer and Schott methodology to estimate "jobs losses" as a direct multiple of total imports and net employment impacts as a function of the trade deficit. The one methodological change they introduce is the use of "net export" data (domestic exports less imports not for consumption),[33] which only slightly reduces exports and thus employment levels related to exports. All imports, on the other hand, are assumed to displace domestic employment. As we shall sell below, such a treatment of both imports and exports severely underestimates the impact of cross border production sharing and complementary trade, thus overestimated the employment impacts of trade.

The Congressional Research Service (Bolle [1998a, 1998b]), on the other hand, uses the "DOC model" to define job "gains" as those associated with export growth, but does not use these multiplies to define job "losses". Rather, the CRS has decided to use the U.S. Department of Labor's NAFTA-TAA program certifications as a measure of job "losses". The EPI characterizes such an approach as the "crudest models" whereby "only exports are considered; the offsetting effects of imports is ignored."[34] The CRS approach does, in fact, have a problem of underestimating employment impacts due to imports. As we shall see below, while the NAFTA TAA data might be useful as an estimated of job losses due to very visible plant closures and movement to Mexico or Canada, it is notoriously weak as an estimate of import penetration. Direct and indirect employment displacement due to imports are much less likely to be detected though such a self-reporting government program.

Though the shortcomings of this trade and employment multiplier approach have been noted by a number of economists, this has not prevented critics of NAFTA from using it, especially since the U.S.-Mexican trade balance has swung in Mexico's favor. It should also not be surprising that the few existing methodologies continue to be used (particularly simple ones with minimal new empirical data requirements such as the US DOC multipliers and NAFTA TAA), since the U.S. government has failed historically to estimate the employment impact of imports. The nature of government data-gathering and analysis of the employment impacts of exports and especially imports has been a hotly debated question at various times over the past few decades. One of the most well-respected proponents of accurate measurement of the employment impacts of imports was Walter Salant.[35] His careful review of the various questions involved in measuring employment impacts of imports is an

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33 Rothstein and Scott (1997), p. 4.

34 Rothstein and Scott (1997), p. 4.

35 Walter S. Salant, "The effects of increases in imports on domestic employment: a clarification of concepts," Special Report of the National Commission for Manpower Policy No. 18, 1978; and Walter S. Salant, Employment Effects of United States Import Liberalization (Washington, DC: The Brookings Institution, 1960).

important reminder that this complex analytical question must be tackled and that policies must be devised for adjustment assistance "both on the grounds of equity and efficiency."[36]

II.3. Pre-NAFTA CGE Modeling

Another widely used methodological approach for estimating ex-ante the potential employment impacts of tariff liberalization was computable general equilibrium (CGE) modeling. Many models were developed and a series of reviews of those modeling efforts are available. The principle contribution of CGE models is that they could be used to estimate the long run reallocation of resources, including labor, that could be specifically attributed to policy or macroeconomic shocks, such as the lowering of tariffs among a group of countries or the devaluation of a given currency. CGE modeling is recognized as perhaps the most powerful tool available to estimate and compare the potential full equilibrium impacts of particular policies in a framework that is theoretically grounded as well as empirically based. What also makes the CGE framework especially attractive is that it is flexible enough to incorporate a wide variety of both theoretical assumptions as well as empirically-based parameters.

One of the most important contributions to emerge from this modeling effort is the incorporation of empirically-estimated parameters for this changing structure of specialization and complementarity in the emerging cross-border integration of production. The use of econometrically-derived Armington elasticities (discussed in detail below in Section III) in CGE models during the NAFTA debates had established an implicit critique of the simple multiplier trade-surplus and employment-multiplier framework of Hufbauer and Schott. Armington elasticities measure the degree of empirically-observable impact on domestic prices of changes in import prices, which has been found to vary normally in the range from .02 to 2, thus demonstrating the weakness of the assumption of complete substitutability between imports and domestic production (or an infinite elasticity) which underlies the trade surplus-employment multiplier framework.

Ironically, the use of Armington elasticities in CGE models was criticized by some during the NAFTA debate as introducing "unrealistic" assumptions about the emerging pattern of trade and investment in North American. Stanford (1993, p. 101) for example, states that "[t]he fear of labor is that firms will relocate facilities producing the same variety of a commodity to low-cost locations in Mexico… The Armington assumption prevents such a relocation by assuming that Mexican output – even if produced by a U.S. firm – is actually a different product." However, rather than negating the existence of cross border investment for production, the existence of differing estimated (not assumed) elasticities of substitution, in fact confirms the overriding tendency towards two-way U.S.-Mexico trade, where the

[36] Salant (1978), p. 4.

United States exports intermediate goods for cross-border production.[37] Data presented below will clearly show that this ongoing process of investment for cross-border production is generating cross-border specialization at the detailed sectoral level.

Useful as these CGE models may have been for ex-ante estimations, there are limitations to the usefulness of CGE models for ex-post analysis of empirical trends. It is not that CGE models are an inappropriate methodology for empirical trend analysis. The real limitations lie in the further work that needs to be done at an empirical level to determine the most important detail in sectoral structure that should be modeled. A CGE modeling framework could be very useful for dis-aggregating the effects of different factors in a general equilibrium context, just as a partial equilibrium approach can be useful. A future task will be to develop a more complex dynamic CGE model that actually simulates the impact of annual impacts of imports and exports throughout the total economy and within the context of evolving long-term trends in investment and technological choice that are being influenced by the changing patterns of relative prices. The partial equilibrium framework presented below should be seen as an important first step in that direction, one that clearly identifies the upper bound potential employment impacts of trade before the application and estimation of general equilibrium effects

[37] Ignoring Armington elasticities and not properly calibrating the model with empirically available estimates of parameters is not the answer, for that would clearly overestimate the observed substitutability. Rather what is further required is research such as the NAID Center and others are performing into how specific sectors are being restructured for bi-nationally linked production. What does not appear to be occurring is the scenario which Stanford posits, and which he claims the Armington "approach is unrealistic for evaluating," namely "the possibility of investment diversion by individual firms, which can manufacture their own differentiated variety at any production location" (p. 102).

III. Toward an Alternative Methodological Approach to Tracking the Impact of NAFTA: The NAID-Armington Methodology

III.1. Background

This section presents an alternative methodological approach to tracking the employment impact of post-NAFTA trade. The approach begins with a method for converting econometrically-estimated measures for price impacts of imports (Armington elasticities) into a measure for determining the potential impact of imports on domestic production by sector in a series of partial equilibrium models. Labor requirements multipliers are then used to estimate domestic employment. This exercise is first performed holding all other variables apart from imports constant, then with varying productivity of labor, and finally with increasing U.S. demand. This approach is designed to be a first step in an alternative methodological approach that would proceed to a CGE framework, which would allow for all relevant short and long term price, production, investment, and technology effects.

Trade economists have devised an approach to measure the degree of substitutability (and complementarity) between imports and domestic production. Called "Armington elasticities" – after Paul Armington, who first proposed an approach to analyzing trade based on the premise that products from different countries competing in the same market can be considered imperfect substitutes for each other[38] – they measure the price elasticity of substitution between imports and domestic production, that is, the degree to which lower prices would give imports greater market share. The U.S. International Trade Commission (USITC) has sponsored several efforts to estimate these elasticities, but coverage of the various economic sectors is incomplete and the estimates for a given sector do differ.[39] Nevertheless, these estimates are used by the ITC for "the analysis of trade-related injury (or

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[38] Paul Armington, "A Theory of Demand for Products Distinguished by Place of Production," International Monetary Fund Staff Papers, Vol. XVI, No. 1, March 1969, pp. 159-176; and Paul Armington, "A Geographic Pattern of Trade and the Effects of Price Changes," International Monetary Fund Staff Papers, Vol. XVI, No. 2, 1969, pp. 179-201.

[39] See, for example, Kenneth A. Reinert and David W. Roland-Holst, "Parameter Estimates for U.S. Trade Policy Analysis," U.S. International Trade Commission, January 1990; Kenneth A. Reinert and David W. Roland-Holst, "Armington Elasticities for United States Manufacturing Sectors," Journal of Policy Modeling, Vol. 14, No. 5, 1992; Clinton R. Shiells and Kenneth A. Reinert, "Armington Models and terms-of-trade effects: some econometric evidence for North America," Canadian Journal of Economics, Vol. 26, No. 2, May 1993; Kenneth A. Reinert and Clinton R. Shiells, "Estimated Elasticities of Substitution for Analysis of a North American Free Trade Area," Staff Research Study 19, Office of Economics, U.S. International Trade Commission, undated.

gain) to specific domestic industries and the overall economy as a result of industry-specific trade policy changes" including "subsidies and general duty changes, and [U.S. Tariff] changes that target specific countries."[40] They also are useful as a first step toward correcting previous overestimates of import impact.

What is really needed is a fully developed, multi-period, multi-regional, dynamic computable general equilibrium (CGE) model of trade, capital, and labor flows--one that links all three NAFTA countries while also incorporating political, social, technological, and environmental parameters, as well as dynamic interactions.[41] Such a model would be able to differentiate effectively among:

< Sectors with different Armington elasticities (that is, where imports are more or less substitutable for domestic production). Empirically, these elasticities vary greatly, from goods that are close substitutes to goods that are complementary.

< Sectors with different income elasticities of demand. As income grows over time, it will affect the demand for the output of different goods (both imports and domestic production) in different ways, affecting the level of production, employment, and trade.

< Sectors with different schedules of or degrees of trade liberalization. This would enable more realistic tracking of NAFTA as it is actually phased in.

< Sectors with different investment patterns. Changes in investment flows are an important part of the NAFTA adjustment process. We would expect that domestic job losses from trade impacts would come in some of the same sectors as new investments abroad. Investment data are complementary to trade data, and indeed may give a preview of changes to come in trade flows.

< Changing technologies (endogenous productivity, scale economies), environmental standards, labor dynamics (enforcement, unions, labor markets), industrial organization (monopoly, economies of scale), and regional agglomerations. Quantifying, explaining, and factoring these important changes into the analysis is a daunting but important task in tracking NAFTA.

The approach introduced here is meant to be a partial equilibrium stepping stone to a more precise, dynamic, and general equilibrium analysis. Its main goal is to estimate the

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[40] Francois, Joseph and Keith Hall (1993, May). COMPAS: Commercial Policy Analysis System, Version 1.4, U.S. International Trade Commission. For further description of this methodology see Francois (1992a,b) and Rousslang and Suomela (1985).

[41] For an example of the inclusion of political and social parameters in a CGE framework, see Hinojosa and McCleery (1992); for the incorporation of environmental dynamics in a CGE model, see Madrid and Hinojosa (1997).

impacts of the observed flows of trade on employment levels in the U.S. economy. Simulating the stages of analysis that would be conducted in a complete CGE, a partial equilibrium analysis requires a two-step process. The first step dis-aggregates what would have been the impacts on employment of changing levels of exports and imports from year to year, holding the level of total domestic demand constant. We perform these calculations holding productivity constant and then varying productivity. The second step looks at the change in imports and exports relative to the changing level of domestic demand from year to year in order to estimate how much of the change in trade patterns is due to direct displacement of domestic production or to fluctuations in aggregate demand.

The purpose of developing such a partial model is to address the need for a methodology that is simple to use and understand, yet captures the complexities of bilateral trade flows. With regard to U.S.-Mexican trade, there are two main complexities: First, goods produced in Mexico are in general <u>not</u> perfect substitutes for goods produced in the United States, even within the same industrial category. Thus, increased imports from Mexico do not usually lead to equal reductions in U.S. domestic production and employment. Second, there are in fact significant complementarities between Mexican and U.S. production, illustrated by the example of Mexican exports that contain largely U.S.-made components.[42] Clearly, the re-importation of U.S. products embodied in Mexican goods does not reduce U.S. production and employment.

With respect to exports, this approach includes a number of adjustments to the export-employment multiplier methodology that has been commonly used (and abused). Indirect employment multipliers published by the U.S. Department of Commerce are for <u>total</u> U.S. exports, as there are no estimates of indirect employment effects of exports for <u>individual</u> sectors. It is therefore only possible to use these indirect multipliers at the aggregate level of the whole U.S. economy, not for analyses at a regional or sectoral level.[43] The methodology presented here does allow one to estimate and analyze the impact of trade at the detailed sectoral and regional level of analysis, but at this point only for the direct effects. On the import side, the methodology seeks to determine which imports are actually competitive and

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[42] Even when plants are closed in the United States and relocated to Mexico, and there is therefore a direct displacement of U.S. jobs, the new plants in Mexico usually continue to purchase inputs from the same suppliers and utilize the same distribution networks in the United States. Once this has occurred, any increased production in Mexico requires corresponding increases in production and employment in the United States.

[43] Thus, the recent attempt by the Congressional Research Service to estimate U.S. job gains and losses by state is fundamentally flawed since the way the data is presented by the Department of Commerce does not allow a disaggregation of exactly <u>where</u> the national aggregate jobs gained and lost will be located. See Mary Jane Bolle, "NAFTA: Estimates of Job Effects and Industry Trade Trends After Two Years," <u>CRS Report for Congress</u>, Congressional Research Service, The Library of Congress, September 25, 1996, pp. 1-27.

to what extent they displace U.S. production, and which are more complementary and may even be consistent with increasing U.S. production over time, as income grows.

U.S. Exports to Mexico

There are many transshipments through the United States to Mexico, including most of what Canada exports to Mexico. If one is interested in employment generation in the United States, it is necessary to subtract the volume of transshipments (except to consider the employment in shipping and handling) and focus on domestically produced merchandise. Again, the employment multipliers generated by the Department of Commerce include direct and indirect multipliers. The direct multipliers are straightforward technical coefficients representing average labor:output ratios for each sector. However, the indirect multipliers are for total U.S. exports, as there are no estimates of indirect effects from a particular sector. Note that exports include many intra-firm and intermediate good transfers that ultimately may be returned after a production process in Mexico. Examples include packaging, maquiladora inputs, and agricultural inputs. In agriculture, for example – particularly in the northern Mexican states close to the U.S. border where much of export agriculture is located – many seeds, fertilizers, chemicals, boxes, machinery, and irrigation equipment are brought from the United States and use for the production of exports.

U.S. Imports from Mexico

Import data suffer from the same conceptual problems as export data. If a considerable amount of the value of U.S. imports from Mexico is accounted for by intermediate goods produced in the United States, then increasing imports from Mexico will also increase exports to Mexico, and hence U.S. employment, as they are complementary. We would not necessarily expect to see these complementarities in the same sector of production, since the intermediate goods could be from many sectors. This is another reason why we ultimately wish to consider general equilibrium factors, beyond the partial equilibrium Armington calculations.

Take the frozen vegetable industry as an example. A significant portion of this industry, particularly the broccoli processing industry formerly located in California, has shifted from the United States to Mexico. In Mexico, the broccoli seed is imported, much of it from Japan via the United States. Certain agricultural chemicals are also imported from the United States, as are high-pressure sprayers and some harvesting belts. Virtually all of the freezing equipment in Mexico's twenty processing plants is imported from the United States, Canada, or Europe. Most of the packaging and boxes are imported, then quickly re-exported through Texas. Though total broccoli production in California is less than it would be without the Mexican industry, and the relocation of the processing plants has led to the elimination of thousands of jobs in California, nevertheless some of the intermediate input suppliers for this industry have simply shifted from domestic sales to export sales to Mexico. Higher imports from Mexico in this industry require higher exports to Mexico in other industries. Whether final good production expands in California or Mexico, intermediate good production in the United States will expand. A more narrow focus on U.S.-Mexican trade in frozen vegetables would not reveal these effects.

Another possibility is that there are complementarities within a sector. Cutting costs by importing from Mexico allows a firm to cut total costs and expand sales. To go back to the frozen vegetable example, the shift of broccoli to Mexico has prompted U.S. firms to set up mixing plants in the Midwest because it is still cheaper to produce highly mechanized vegetables (such as corn, peas, or potatoes) in the north-central United States than in Mexico. The cheaper broccoli from Mexico is mixed with various U.S.-grown vegetables to produce products whose overall lower price theoretically should increase demand. Though higher imports of Mexican frozen broccoli displace California production of frozen broccoli, it may increase overall production of frozen vegetables in the United States, because remaining U.S. production is in many ways complementary. In this case, higher imports from Mexico are associated with declines in employment in California (a direct effect) and increases in employment in the Midwest and North-Central regions (an indirect complementarity). In industries where U.S. firms face a great deal of competition in final goods markets from imports, their ability to import part of their product line or intermediate goods may be crucial to their survival; these complementarities may therefore be large.

The methodological approach taken in this paper captures the degree to which different sectors of the U.S. economy are sensitive to imports by comparing their Armington elasticities, and allows us to look at whether imports from Mexico are occurring in sectors that are more or less sensitive to imports. However, it should be kept in mind that this exercise still neglects how trade in one sector affects all of the indirect effects in other sectors, which we must simply combine. While these partial equilibrium estimates are not the final word on NAFTA tracking, they do represent an improvement over some other methodologies currently in use.

These calculations should be considered biased towards overstating job losses due to several factors. On the external side, for example, many U.S. imports from Mexico are direct substitutes for U.S. imports from the rest of the world. It is difficult to determine how much of the Mexican import surge since 1994 represents the displacement of imports from third countries (directly or indirectly through capital investments and transplanting of production into Mexico) as opposed to displacement of U.S. production, but we have conducted a shift-share analysis of the trade data, which is reported in Section V.2.3 below. There is evidence that this is occurring in some sectors with respect to Asia since the peso devaluation. Also, many Mexican exports include large amounts of Asian intermediate exports. Frequently, these are goods produced by Asian multinationals that either have raised “domestic content” to comply with NAFTA or shifted their production base to Mexico as a result of NAFTA. On the internal side, real income growth in the United States in recent years has been brisk, generating increased demand for all goods, domestic and imported. The estimates that hold demand constant thus greatly overstate actual job impacts, but we calculate them to allow a comparison with the results when we include productivity changes and the changes in demand.

III.2. Methodology and Data Manipulation for the NAID-Armington Estimation of Domestic Demand for Domestically Produced Goods and Job gain or loss due to US trade with Mexico

This section presents alternative methodologies for analyzing, in a partial-equilibrium framework, the impact of changes in U.S. import prices from Mexico on domestic production and employment.

Our analysis starts from the assumption that imported and domestically produced goods are imperfect substitutes, an assumption widely used in trade analysis. The analysis follows closely the treatment in de Melo and Robinson (1985).[44] Define the following variables:

Equation	Description
1. $Q = F(M,D)$	Definition of aggregate commodity, Q. M is imports and D is domestic product shipments net of exports.
2. $\varepsilon^{q} \equiv -\dfrac{\partial Q \bullet P}{\partial P \bullet Q}$	Elasticity of demand for aggregate commodity, Q, with respect to a change in its price, P.
3. $P^{m} = \pi^{m} \bullet (1 + t^{m}) \bullet R$	Domestic price of imports equals world price B^{m} times one plus the tariff (t^{m}) times the exchange rate, R.
4. $E^{d,m} \equiv \dfrac{\partial D \bullet P^{m}}{\partial P^{m} \bullet D}$	Cross- elasticity of demand for domestic production, D, with respect to a change in the price of the imported good, P^{m}.

44 de Melo and Tarr (1992), pp. 34-38, also present a summary of this analysis. These studies both focus on the price transmission mechanism, rather than quantity changes. The U.S. International Trade Commission also uses analysis based on an assumption of imperfect substitution in evaluating damage in anti-dumping cases.

Equation 1 defines the aggregation function for imports and domestic goods in a sector. It is often specified as a constant elasticity of substitution (CES) function with a trade substitution elasticity σ[45], where

$$\sigma = \frac{\partial D}{\partial M} \cdot \frac{M}{D}$$

For partial-equilibrium impact analysis, we need not specify a particular functional form, but simply specify a substitution elasticity that holds at the base period.

Equation 2 defines the price elasticity of demand for the aggregate good. It is defined as a positive number. The aggregate price, P, is a function of the prices of both M and D on the domestic market. Equation 3 specifies that the price of the import on the domestic market equals the world price times the exchange rate, plus any tariff. This is a strong assumption, and empirical evidence indicates that such price changes are not fully Atransmitted" to the domestic market in the short run. For example, many Mexican exports to the United States use intermediate inputs imported from the United States. Devaluation of the Mexican exchange rate raise these input costs, and so will not lead to as large a fall in the Mexican export price as would occur if the goods used only Mexican inputs.

Equation 4 defines the cross-elasticity of demand for the domestic good with respect to a change in the price of the imported good. This is the crucial piece of information required to estimate the impact on domestic sectoral production, and hence employment, of a change in the import price. It depends on three variables: (1) the elasticity of substitution, $\sigma = \frac{\partial D}{\partial M} \cdot \frac{M}{D}$; (2) the elasticity of demand for the aggregate good, ε^q; and the share of imports in the value of total domestic demand,

5. $$S^m = \frac{P^m \bullet M}{P \bullet Q} .$$

The relationship is derived in de Melo and Robinson (1985). After a lot of algebra, the equation can be written:

6. $$E^{d,m} = \left(\sigma - \varepsilon^q\right) \bullet S^m$$

Using a hat (^) to denote the rate of growth of a variable, substituting equation 6 into the definition of the cross-price elasticity (equation 4) implies:

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45 The CES treatment was originally specified in Armington (1969), who used this approach to estimate import demand functions. The assumption of imperfect substitutability between imports and domestic goods is often called the Armington assumption.

7. $$\hat{D} = (\sigma - \varepsilon^q) \bullet S^m \bullet \hat{P}^m$$

To see how the application of equation 7 works, consider two special cases. First, assume that the domestic and imported goods have a trade substitution elasticity of zero; *i.e.*, they are perfect complements. For example, assume that, for some reason, we import left shoes from Mexico and produce right shoes in the United States In this case, $\sigma = 0$, and, from equation 7, decreasing the price of the imported good will actually raise the demand for the domestic good (assuming a non-zero elasticity of demand for pairs of shoes).[46] The reason is that the decrease in the price of imported left shoes lowers the cost, and hence price P, of pairs of shoes. The result is increased demand for pairs of shoes (depending on the elasticity of demand ,ε^q), and hence also for domestically produced right shoes. In general, this complementarity effect will operate for any sector in which the elasticity of substitution is lower than the price elasticity of demand for the aggregate good$(i.e, \sigma < \varepsilon^q)$.[47]

At the opposite extreme, assume that the domestic and imported goods are perfect substitutes. In this case, equation 7 collapses: any change in import price will cause the domestic industry to contract or expand dramatically, leading either to its elimination or to its complete dominance. In this case, any increased imports fully displace domestic production.

The assumption of perfect substitutability is inherently implausible and inconsistent with a great deal of empirical evidence.[48] One simply does not observe the price, trade, and production volatility that should characterize sectors in which there is perfect substitutability. Furthermore, even at very fine levels of dis-aggregation, one observes two-way trade (both imports and exports), an observation that is inconsistent with the specialization that should occur if there were perfect substitutability. In sectors such as computer components, for example, there is clearly specialization at the commodity level, but there is also a lot of complementarity with domestically produced goods.

There is now a large body of empirical work estimating trade substitution elasticities for the United States at a various levels of aggregation. The results typically yield substitution elasticities that range from 0.02 to about 2, with most sectors having elasticities clustering between 0.5 and 1.0. Even the high values are far from infinite – the highest elasticity estimated by the USITC at a 3-digit SIC level was 3.5 – indicating that the assumption of imperfect substitutability is both plausible and important. Estimates of the impact of increased imports on domestic production and employment that assume perfect displacement will be widely off the mark.

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46 It will also raise the price of the domestic good, D.

47 de Melo and Robinson (1985) sort out the math and Dervis, de Melo, and Robinson (1982) argue that such cases are not uncommon in developing countries.

48 de Melo and Tarr (1992), pp. 16-17, briefly review this evidence.

Equation 7 is the basic equation we would like to use to estimate the impact of changes in import prices on domestic production. However, this approach requires extensive price and demand elasticity data. The ITC utilizes a variant of this approach in their "COMPAS" model,[49] analyzing selected sectors at a very micro level. Focusing on particular sectors, they are able to collect the price and demand data they need, and to use sensitivity analysis on estimates of elasticities.

In our case, we look at all sectors in a more "broad brush" manner. For so many sectors, we are unable to estimate aggregate demand elasticities and, in any case, do not have the necessary price data. We approach the problem by allowing prices to remain offstage. We do not know the change in prices, but we do observe a change in the value of imports and so can analyze quantity changes.[50] Totally differentiating the Armington import aggregation function, one gets:

8. $$\Delta Q = \frac{\partial Q}{\partial M}\Delta M + \frac{\partial Q}{\partial D}\Delta D$$

Solving this equation for the change in domestic demand yields:

9. $$\Delta D = -\frac{\frac{\partial Q}{\partial M}}{\frac{\partial Q}{\partial D}}\Delta M + \frac{1}{\frac{\partial Q}{\partial D}}\Delta Q$$

In this equation, the change in domestic demand is decomposed into two parts: a "displacement" effect due to a change in imports with no change in Q and a "demand" effect due to a change in demand for the aggregate good, Q. Note that a change in import prices will generally have both a displacement and a demand effect, since it affects the price of the composite good, as shown earlier. The impact of changes in import prices on domestic production depends also on the own-price elasticity of demand for the aggregate good. For consumer goods, these elasticities might well be fairly high, perhaps larger than one. For intermediate goods, however, these demand elasticities are likely to be much lower. Substitution possibilities among intermediate inputs is likely to be low, especially in the short run, and the costs of imported intermediates is likely to be a fairly low share of the total costs of production. Capital goods likely represent an intermediate case.

We do not have time series data after 1992 on changes in consumption of composite goods, however we estimate Q as GDP + Imports – Exports for subsequent years (ignoring

49 Francois and Hall (1993).

50 We assume in the empirical work that import quantities and values are in fixed relation over the period analyzed, which allows us to aggregate and disaggregate in the same units. This is not strictly true, but since trade values do not represent real prices in any case, it is not unreasonable over the short time period considered.

inventories). In an initial scenario, we hold total demand (Q) constant and estimate only the import displacement effect. This approach of assuming that Q is fixed will lead to an upper bound on the estimate of the impact of changes in imports on the demand for the domestic substitute as import prices fall (due to lower protection under NAFTA). In subsequent scenarios, we vary labor productivity and then Q to more accurately represent actual changes.

We compute the displacement effect by specifying a specific form for the Armington import aggregation function, a constant elasticity of substitution (CES) function. :

10. $$Q = A\left(\delta M^{-\rho} + (1-\delta)D^{-\rho}\right)^{-1/\rho}$$

where, as before, Q is the composite good, D is domestic production for domestic consumption, and M is imports. A is a constant depending on choice of units, δ is the share parameter, and ρ is a parameter that depends on the elasticity of substitution σ:

11. $$\rho = \frac{1}{\sigma} - 1$$

Solving the CES function for D (domestic production for domestic consumption) yields:

12. $$D = \left[\frac{\left(Q/A\right)^{-\rho} - \delta_{MX} M_{MX}{}^{-\rho}}{1-\delta_{MX}}\right]^{-\frac{1}{\rho}}$$

This is the equation used to compute the displacement effect from changes in imports. With Q (i.e. D-X+M), A, and {delta} (i.e. the relative value shares of domestic and imported product) held constant, it essentially expresses domestic production for domestic use in the United States as a function of imports (M) and the elasticity of substitution between imports and domestically produced goods (i.e. the Armington elasticities). Changes in M impact D, but this impact is expressed as a function of the empirical experience of substitution between M and D.

III.3. Estimation of Equations

Computing Total Domestic Demand for Domestically Produced Goods (D)

In order to compute U.S. job impacts for nationally aggregated industries (at the 4-digit SIC level) due to trade with a U.S. trading partner, we employed two separate methodologies that require the use of labor:output ratios. The choice of methodology was determined by the trade direction.

- By substituting US imports for a given year from a given trading partner into a Constant Elasticity of Substitution (CES) aggregation function, total domestic production for domestic consumption (D) is obtained. Applying the sectoral employment requirement coefficients (ERCs) to D for each year yields an estimate of the total size of the domestic sectoral labor force after accounting for imports. The difference between the estimates of D for any two consecutive years results in an estimate of the potential job impact in the sector.

- To estimate the job impacts due to U.S. exports, ERCs are multiplied by total exports in any year to yield an export employment estimate by sector. The differences between any two years are the estimated job impacts.

- In both import and export estimates, indirect impacts can only be aggregated, since we do not know what sectors the indirect impacts occur in. As a result, indirect impacts are not reported separately by sector.

Imports

The parameters of the CES function for each sector are computed by using estimated values of the substitution elasticity σ, taken from USITC estimates, and then computing the other parameters from the base data. The share parameters, δ, can be calculated from initial data on value shares under the assumption that the initial data represent a market equilibrium. The relationship is given by:

13. $$\frac{\delta}{1-\delta} = \left(\frac{S^m}{S^d}\right)^{\frac{1}{\sigma}}$$

where, assuming initial prices are one by assumption:

14. $$S^m = \frac{M}{Q}$$

and

15. $$S^d = 1 - S^m$$

Solve the equation for δ:

16. $$\delta = \frac{\left(\frac{S^m}{S^d}\right)^{\frac{1}{\sigma}}}{1+\left(\frac{S^m}{S^d}\right)^{\frac{1}{\sigma}}}$$

We calculate the constant, A, from initial data. Calculate D_0 (domestic consumption) as

$D_0 = Q - M_{WR}$, where *WR* denotes the "world", and A is given by:

17. $$A = \frac{Q}{\left[\delta_{WR} M_{WR}^{-\rho} + \left(1-\delta_{WR}\right) D_0^{-\rho}\right]^{-\frac{1}{\rho}}}$$

There is a separate A for each 4-digit sector.

Substituting into the CES function (equation 12) the variables A, Q, ρ, δ_{MX}, M_{MX} gives the desired domestic production for domestic consumption, D, for a given year with respect to Mexican imports. Three scenarios are estimated for each sector:

- Scenario 1: Q is held constant, ERCs are held constant, M_i varies
- Scenario 2: Q is held constant, ERCs vary, M_i varies
- Scenario 3: Q varies, ERCs vary, M_i varies

These scenarios are estimated first with respect to imports from Mexico and then with respect to Canada.

The Armington elasticity (which varies by sector) is also held constant for all estimated yearly employment impacts, because only one set of estimates for the σ's is provided. The same σ's are used for both Mexico and Canada, since they are actually world elasticities.

By varying imports from only one country, in effect we ignore the possibility that an increase in Mexican imports will cause a decline in imports from other countries, leaving domestic demand unchanged, i.e. we assume that trade diversion is zero. Our measure of displacement thus will tend to <u>overstate</u> the effect of increased imports from a single country (here, Mexico) on domestic sales. Since there is increasing evidence of trade diversion under NAFTA, for instance in garments, this overestimate may be significant in some sectors.

Jobs at Risk

We estimated the number of jobs at risk of direct displacement by Mexican-produced goods, the vector of 4-digit sectors M_{MX}, by computing the change in D between any two years (1990-1998) and multiplying this difference by direct and indirect ERCs, erc_t^i, that we derived from IMPLAN input-output model. We started with 1995 multipliers and varied them forward and backward in time using estimates of changes in sectoral productivity from NBER (National Bureau of Economic Research).

*Jobs at risk of displacement by imports, J*M

$$\text{where } JM_{t+\Delta t}^i = D_t^i \cdot erc_t^i - D_{t+\Delta t}^i \cdot erc_{t+\Delta t}^i$$

for every tradable sector *i*.

Exports

In estimating the number of jobs supported by exports, we multiply the exports for each year considered (1990-1998) by the direct and indirect ERCs, erc_t^i

Jobs supported by exports, JX

$$\text{where } JX_{t+\Delta t}^i = X_t^i \cdot erc_t^i - X_{t+\Delta t}^i \cdot erc_{t+\Delta t}^i$$

for every tradable sector *i*.

III.4. Description of Data Used in Model

Total Domestic Consumption/Demand, (Q)

The baseline 1993 Q is the sum of Final Demand, FD, Total Intermediate Demand, IOUSED, and US Imports from the World. Projections of Q before and after 1993 in the scenarios where it varies are differences from this baseline value that we estimated with Q=GDP+M-X.

Sources:

The data used in estimating the baseline Q come from two sources. The Final Demand, FD, and Total Intermediate Demand, IOUSED, are provided by the US Department of Agriculture's 1993 update to the 1987 Aggregate Social Accounting Matrix. The industry level coding for FD and IOUSED are based on Bureau of Economic Analysis industries used in their input-output matrices (also known as line numbers). US Imports from the World,

M_{WR}, for 1993 are also necessary in estimating Q. These are provided by the US Bureau of Census, Imports of Merchandise Trade.

Transformations:

Since 4-digit SIC is used as the base unit of analysis, and there is a many-to-many (see below for description and example) industry code relationship between BEA and SIC sectors, data from USDA were cross-walked from BEA industries and distributed across SIC codes using a methodology that determined the proportional share of production in an industry according to world import share in the corresponding SIC. A description of this methodology follows:

- A many-to-many code relationship is a problem encountered when data from one database has a record identifier (in our case, BEA industry code) that is different from the identifier in another database (in this case, SIC import sector). In cases such as these it is necessary to use a concordance that maps the relationship between the different identifiers. Sometimes multiple record identifiers map to multiple record identifiers in another database; a many-to-many relationship. The following excerpt describes the many-to-many concordance problem with which we were faced when using M_{WR} from the Census and USDA's values for FD and IOUSED:

USDA Sector	SIC	USDA Sector Description	Census World Imports 1993	USDA Final Demand (FD)	USDA Total Intermediate Demand (IOUSED)
7	0115	Feed grains	63,619,884	4,866,561,845	40,046,624,738
7	0139	Feed grains	322,266,918	4,866,561,845	40,046,624,738
8	0139	Grass seeds	322,266,918	110,272,537	773,155,136
9	0132	Tobacco	987,600,018	-530,188,679	2,711,394,130
10	0171	Fruits	48,500,980	6,580,922,432	2,339,161,426
10	0172	Fruits	271,222,836	6,580,922,432	2,339,161,426
10	0174	Fruits	66,036,062	6,580,922,432	2,339,161,426
10	0175	Fruits	153,842,197	6,580,922,432	2,339,161,426
10	0179	Fruits	2,807,964,527	6,580,922,432	2,339,161,426

14	0139	Miscellaneous crops	322,266,918	61,006,289	682,106,918
15	0139	Oil bearing crops	322,266,918	4,660,691,824	10,516,823,899

Notice that USDA sectors 7 and 10 map to more than one SIC, and SIC 0139 maps to more than one USDA Sector. For this reason we had to apportion data from one database to meaningfully relate that data to the other database. The above example will continue to be used in this discussion.

- FD and IOUSED from USDA SAM constitute the Total Commodity Demand. This value is apportioned by import share among SIC's that crosswalk to a single USDA industry.

USDA Sector	SIC	Census World Imports 1993 by 4-digit SIC	World Import Proportion by USDA Sector	Total Commodity Demand(FD + IOUSED)	Adjusted Total Commodity Demand
A	B	C	D	E	F = D*E
7	0115	63,619,884	16.49%	44,913,184,581	7,406,184,137
7	0139	322,266,918	83.51%	44,913,184,581	37,507,000,443
8	0139	322,266,918	100.00%	883,427,851	883,427,851
9	0132	987,600,018	100.00%	2,181,200,356	2,181,200,356
10	0171	48,500,980	1.45%	8,920,083,491	129,341,211
10	0172	271,222,836	8.10%	8,920,083,491	722,526,763
10	0174	66,036,062	1.97%	8,920,083,491	175,725,645
10	0175	153,842,197	4.60%	8,920,083,491	410,323,841
10	0179	2,807,964,527	83.88%	8,920,083,491	7,482,166,032
14	0139	322,266,918	50.32%	743,113,512	373,934,719
15	0139	322,266,918	48.56%	15,177,516,604	7,370,202,063

- Census World Imports are apportioned by the adjusted Total Commodity Demand share among USDA sectors that crosswalk to a single SIC (i.e. the same approach as before except in reverse).

USDA Sector	SIC	Adjusted Total Commodity Demand	Adjusted Total Commodity Demand Proportion	Census World Imports 1993	Adjusted World Imports 1993
A	B	F	G	C	H = G*C
7	0115	7,406,184,137	100.00%	63,619,884	63,619,884
7	0139	37,507,000,443	81.30%	322,266,918	262,003,005
8	0139	883,427,851	1.91%	322,266,918	6,155,298
9	0132	2,181,200,356	100.00%	987,600,018	987,600,018
10	0171	129,341,211	100.00%	48,500,980	48,500,980
10	0172	722,526,763	100.00%	271,222,836	271,222,836
10	0174	175,725,645	100.00%	66,036,062	66,036,062
10	0175	410,323,841	100.00%	153,842,197	153,842,197
10	0179	7,482,166,032	100.00%	2,807,964,527	2,807,964,527
14	0139	373,934,719	0.81%	322,266,918	2,610,362
15	0139	7,370,202,063	15.98%	322,266,918	51,498,254

- The adjusted World Imports and adjusted Total Commodity Demand combined give Total Consumption/Demand Q, which can be aggregated by 4-digit SIC.

USDA Sector	SIC	Adjusted Total Commodity Demand	Adjusted World Imports 1993	Adjusted Commodity Demand plus Adjusted World Imports (Q)
A	B	F	H	I = F+H
7	0115	7,406,184,137	63,619,884	7,469,804,021
7	0139	37,507,000,443	262,003,005	37,769,003,448
8	0139	883,427,851	6,155,298	889,583,149
9	0132	2,181,200,356	987,600,018	3,168,800,374
10	0171	129,341,211	48,500,980	177,842,191

10	0172	722,526,763	271,222,836	993,749,599
10	0174	175,725,645	66,036,062	241,761,707
10	0175	410,323,841	153,842,197	564,166,038
10	0179	7,482,166,032	2,807,964,527	10,290,130,559
14	0139	373,934,719	2,610,362	376,545,081
15	0139	7,370,202,063	51,498,254	7,421,700,316

- We then aggregated by SIC, e.g. the value of Q for SIC 0139 is $46,456,831,995.

Armington Elasticity, σ

Armington Elasticities are the price elasticities of substitution between domestic and imported goods.

Source:

Data for each Armington Elasticity are provided by the US International Trade Commission (ITC). USITC's elasticity estimates are based on data up to and including 1988. The industry code is based on the BEA industry numbering convention. These were not the Armington elasticities that were estimated by Reinert and Shiells (n.d.) for NAFTA, but were generally higher elasticities related to all U.S. trade with the world that had been estimated earlier. The lower elasticities that were estimated for NAFTA weren't used, because the more generalized estimates from the ITC covered more sectors. In any case, higher elasticities tend to bias upwards the displacement effects of imports, and so in this case overstate the impact of Mexican imports.

Transformation:

- Since there is a many-to-many industry code relationship between BEA and SIC sectors, data from ITC was cross-walked from BEA industries and averaged for a single SIC in cases of multiple ITC industries. For instance, the raw data with the following concordance:

ITC Industry	SIC	ITC Industry Description	Armington Elasticity
4	0271	MISCLIVSTK	0.7

18	0271	FORSTRPROD	0.5

When SIC 0271 is averaged, its Armington Elasticity is given a value of 0.6.

- Thirteen selected 4-digit industries (2082, 2431, 2439, 2514, 2591, 2599, 2721, 2731, 2771, 3011, 3053, 3069, 3543, and 3612) had elasticity values truncated and rounded up to the next tenth digit. This was necessary because the CES equations became highly unstable when used with lower elasticity values.

US Trade with the World and Mexico, M_{WR}, M_{MX} , X_{MX}

M_{WR} is the value of U.S. merchandise imports from the entire world.

M_{MX} is the value of U.S. merchandise imports from Mexico.

X_{MX} is the value of U.S. merchandise exports to Mexico.

Source:

Trade data that NAID used in this model were provided by the Bureau of Census, Merchandise Trade 1990-1998 (history revised data) at an industry level of 10-Digit Harmonized Tariff System (HTS)

Transformations:

- The desired parameters are US Imports from World (1993), US Imports from Mexico and Canada (1990-1998), and US Exports to Mexico and Canada (1990-1998) by 4-digit SIC

- All trade datasets used in the CES model were aggregated from 10-digit HTS to 4-digit SIC using the specific concordance table that was shipped with the detailed trade table.

- All trade datasets used in the CES model are a sum of all customs districts with trade in the specified industry. Thus, the trade figures are an accurate picture of total US trade with a specific partner.

- The import values used in all import datasets are Census-defined Imports for Consumption.

- The export values used in all export datasets are Domestic Exports. Domestic Exports include merchandise grown, produced, or manufactured (including imported merchandise which has been enhanced in value). It excludes Foreign

Exports, which are merchandise that has entered the US and is being re-exported in the same condition as when imported.

Issues encountered with Census trade data:

- The Census Bureau publishes a concordance between the 10 digit Harmonized System trade classifications and 6-8 digit SIC-based product codes that have been aggregated here to the 4 digit level. The relevant parts of it are included with every CD-ROM of trade data distributed. Unfortunately, many of the commodity classifications do not correspond to the process-based SIC output codes used for domestic employment and production analysis.[51] As a result, long lists of SIC-based output codes do not appear in the trade concordance, due in part to the existence of non-traded services. Table A lists some of the problematic concordances we have found.

[51] See Schoepfle (1982:24-25) for a lengthy discussion of this problem as it existed 15 years ago. There appears to have been some improvement in the intervening period, as he reported 105 4-digit SIC-based manufacturing output codes that did not appear in the import codes.

Table A

SIC-based output codes not in trade concordance	SIC based import codes where goods from those industries appear
0251, 0252, 0253	0259
0212	0211
0971	0271
1222	1221
1422	1429
2013	2011
2092	0912, 0913
2038	2099
2052, 2053	2051
2061, 2063	2062
2251	2252
2326	2329
2361	2331
2387	2389
2441	2449
2511, 2512, 2519, 2521, 2531, 2541	2599
2732	2731
2754, 2759	2752
3084	3052
3322, 3324, 3325	3321
3363	3365
3451	3452
3495	3493
3491, 3498	3494
3592	3593
3575	3577
3645, 3646	3648
3716	3711

The problem this creates for analysis is that when one attempts to look at employment, wages, and production on the U.S. side, the data comes by SIC-based output code, including the missing SIC codes noted above. Comparing imports by SIC code with U.S. production by SIC code at a 4-digit level (the level at which Census constructs the concordance) leads to very misleading results, as the import SIC codes noted above include many products that the U.S. production codes do not. Because the imports of frozen fish are in fishing SIC codes, one ends up comparing to fishermen in fishing towns instead of fish processing workers in near-by cities. In our analysis, we did not eliminate these problematic sectors. [52]

[52] It is probably necessary to create a concordance just for this type of analysis, as Schoepfle (1982) did, but this is a task beyond the resources of this project.

- In a number of cases, the trade data series contains imports of zero for one or more years. Since the methodology is based on the computation of D for every year, we eliminated those sectors where D could not be computed in every year considered. The result of eliminating sectors from the analysis due to this problem leaves 308 sectors for Mexico and 334 sectors for Canada. We estimate that the remaining sectors account for 88.8 percent of trade with Mexico and 90.2 percent of trade with Canada over the 1990-1997 period.

IV. Evaluating the Impact of NAFTA on Trade and Investment: the Historical Context

This section presents a tracking of the transformation in pre- and post-NAFTA patterns of trade, a necessary first step for assessing the U.S. employment impacts of pre- and post-NAFTA patterns of trade. In accordance with the alternative methodology outlined above, this section will present an analysis of the pattern of U.S.-Mexican trade, investment, and production ties before and after the implementation of NAFTA. The discussion will set the stage for a subsequent analysis of the employment impacts of these changing ties between the United States and Mexico. The major points to be made here are that:

- U.S.-Mexican trade, investment, and production patterns began shifting dramatically in the late 1980s, years before NAFTA was proposed and implemented. This shift occurred as a part of Mexico's joining the GATT and undertaking unilateral trade liberalization.

- While the impact of NAFTA tariff liberalization on the level and pattern of trade appears to have been slightly positive and statistically significant, NAFTA trade liberalization in itself can only statistically explain a small part of these changes. A larger impact on the level and pattern of trade can be attributed to the collapse and recovery of Mexican growth related to the peso crisis. Mexican exports to the U.S. have actually grown faster in those sectors that were not directly liberalized by NAFTA.

- The major structural changes in the U.S. Mexico pattern of trade consists in the growth of two-way manufactured goods, particularly the growth of intermediate goods. While the major growth and sectoral shift in Mexico-U.S. trade relations began years before NAFTA was implemented, these trends have continued since 1994 but at a slowing pace.

- The impacts of U.S.-Mexico trade changes on the Mexico economy have been much more significant than on the U.S. In a significant shift, Mexican imports are now much more driven by exports to the U.S. than by domestic demand growth. (while domestic demand for domestic consumption in the U.S. is larger in most sectors than is demand for Mexican imports).

- While almost 80% of NAFTA tariff reductions on specific dutiable goods have already occurred, more than half of U.S. imports from Mexico still face some sort of duty. Structural change and adjustments will thus still be ongoing in the U.S., implying the need for ongoing policy response for adjustment and for closing of gaps and address reoccurring imbalances.

- Mexico is still facing major structural problems that must be resolved for the country to succeed under NAFTA. It is in the best interest of the United States that productivity grow in Mexico and that this result in raising Mexican wages. This would both increase demand in Mexico for U.S. consumption exports as well as help Mexico-U.S. industrial complementarities to be based more on best technological practices rather than on low wage competition. It is also clearly in the best interest of the United States that the Mexican economy continue to grow and that its demand for U.S. exports remains strong. Better macroeconomic coordination between the United States and Mexico should seek steady exchange rate relations based on relative productivity and per unit labor cost growth, allowing for lower interest rates and thus help generate sustained Mexican growth and sustained expansion of U.S. exports to Mexico.

IV.1. General Trends in U.S.-Mexico Trade, Investment, and Production Linkages

Particularly in light of the exaggerated expectations that the NAFTA debate generated on both sides of the issue, one of the most important findings from our ongoing tracking of North American integration is the lack of fundamental shift in pre-and post-NAFTA patterns of trade, investment and production. While NAFTA became operational only on January 1, 1994, trade relations within North America had already begun a dramatic transformation in the mid-1980s. Years before NAFTA was contemplated, Mexico underwent a major opening to international trade and investment which ushered in a period of rapid trade growth, large trade and current account deficits, and large capital inflows. The period surrounding the implementation of NAFTA was characterized by an quick acceleration of these previously initiated trends, with a maturation and diminishing acceleration of these trends in recent years.

The most important structural transformation associated with Mexico's post 1986 trade and investment opening was a dramatic shift to a new leading pattern of production based on importing intermediate goods for use in manufactured exports. Driving this production shift was both a series of changes in trade and macro policy, as well as the decision of major producers to shift the orientation of their Mexico operations away from production for the Mexican domestic market and towards the U.S. market. This latter move was prompted in part by a series of Mexican government policies dating back to the 1970s, as well as by strategic decisions by multinational corporations concerning the changing industrial competitive position of Mexico. At the core of this Mexican structural transformation was an ongoing radical redefinition of U.S.-Mexico economic and political relations, including much higher trade levels, more concentration of trade between the two countries, higher capital flows, and much more integrated production. Another significant change was the growth in other foreign firms coming into Mexico in order to produce for the North American market.

The period since the January 1994 implementation of NAFTA has seen a consolidation of Mexico's structural shift that began in the late 1980s, reinforcing these trends at a progressively slower rate. The peso crisis of 1995, whose structural origins both pre-date NAFTA and were not resolved by NAFTA, has had by far the single largest impact on Mexican trade trends in the last 10 years. The crisis and devaluation, however, did not significantly change the pre- and post NAFTA rate of Mexican export growth. The peso crisis also only temporarily set back U.S. exports to Mexico, which recovered by 1996 their pre-NAFTA and pre-crisis levels. Despite the predictions by both pro- and anti-NAFTA advocates to the contrary, total capital flows into Mexico have not increased more in the years after NAFTA, but actually slowed compared to the years preceding NAFTA implementation. Direct Foreign investment has increased, however, relative to a significant decline in portfolio investment. Total foreign investment started rising post 1988, accelerated with the run up to NAFTA, and has now stabilized at a higher level.

IV.2. Dramatic Opening of The Mexican Economy Precedes NAFTA

Mexican imports and exports began to grow rapidly after 1988, at the end of the "lost decade" of relatively slow growth (Table 4.1; Figure 4.1). Mexican exports stagnated for most of the 1980s at about $20 billion a year, with imports lagging further behind. From 1988 to 1996, however, total exports and imports nearly quadrupled. Mexican imports grew particularly faster in the 1990s, outstripping the already rapid growth of exports until the crisis of 1995. During this period of rapid import and export growth both before and after NAFTA, Mexico's trade deficit rose to historic heights. While the crisis of 1995 interrupted the growth of Mexican imports, it did not significantly change the Mexican post-NAFTA rate of export growth (an annual average of 20.7 percent from 1994 to 1996) from the pre-NAFTA export growth rate (an average annual rate of 21.6 percent from 1989 to 1993). Within two years of the crisis, the Mexican imports had fully recovered and surpassed their pre- and post-NAFTA import levels, recovering its double-digit rates of growth. By mid-1996, Mexico had already surpassed the pre-crisis level of imports, an event that was not achieved after the 1982 crisis until five years later.

As table 4.2 shows, the years before NAFTA initiated a historic opening of the Mexican economy represented by a growing share of GDP involved in trade. Imports and exports as a share of GDP rose considerably, rising from around 20 percent before 1985 to over 30 percent in the last few years before NAFTA. Most of this change was due to a huge increase in the share of GDP represented by imports, more than doubling from about 8 percent before 1985 to over 18 percent in the early 1990s. This growth in trade was also accompanied by a dramatic increase in the trade deficit and the current account deficit, reaching a historic high of around 4 percent of GDP in the years before the peso crisis.

Until the crisis of 1995, the trade and current account deficits were financed by rapidly rising capital account surpluses. Figure 4.2 shows the evolution of a widening current account deficit matched by a growing capital account surplus. A large part of the growth in the capital account was sustained by continued growth in foreign investments, allowing the pattern of trade and deficits to be sustainable as long as foreigners were willing to pour new funds into Mexico. Notice that this model was very different from the period preceding the 1982 crisis, when the capital account was sustained by loans and deposits, primarily from large money center banks. Yet the more recent model proved to be as vulnerable as that of the early 1980s to a quick change of expectations on the part of foreign capital holders. As Figure 4.3 indicates, a serious problem was that the recent inflows of foreign investments were concentrated in short-term bonds and stock market holdings, and not in the form of more long-term direct foreign investment in plant and equipment. The collapse of confidence in the relative attractiveness of Mexican financial instruments, particularly the ill-fated, dollar-denominated "teso-bonos", was counteracted only by the willingness of the U.S. Treasury to lead a "rescue package"[53] that provided Mexico an unprecedented amount of direct deposits into the Mexican Central Bank accounts (Figure 4.4).

In contradistinction to the many optimistic as well as critical prognostications that NAFTA would likely lead to a boom in foreign investment in Mexico, alternatively transforming Mexico or "draining" U.S. capital and reducing U.S. jobs, total foreign investments in Mexico have not recovered their pre-NAFTA levels. After peaking in the first two quarters after NAFTA implementation, the flow of new direct foreign investment has settled at levels somewhat higher than the pre-NAFTA recent history (Figure 4.4), but representing a declining share of North American GDP. Despite recovering from dramatic declines during the peso crisis, however, portfolio investments in stocks and bonds continue to lag significantly below levels of the early 1990s. Much higher levels of long term direct investment flows will have to be secured if Mexico is to sustain: (a) sufficient growth in productivity to compensate investors' demands over a relatively short maturity; (b) increase employment and wages to begin closing the gap with the United States; and (c) be able to finance renewed Mexican trade deficits that will accompany renewed growth.

The growth in trade and financial flows was the result of a historic large-scale opening of the Mexican economy in the late 1980s. This opening was initiated by an explicit redefinition by Mexican policy-makers in the mid 1980s of a number of traditionally held trade and macro policies, long before NAFTA was considered even a remote possibility.[54] With respect to trade policy, Mexico undertook a truly dramatic unilateral liberalization of tariff and non-tariff barriers. Table 4.3 displays the various policy shifts the Mexican Government staged in the 1980s and Figure 4.5 displays the resulting change in the mean

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53 See U.S. Department of the Treasury (1995) and GAO (1996).

54 A number of recent studies have extensively reviewed this policy shift, including Pedro Aspe (1993) and Nora Lustig (1992).

tariff rates for Mexican economy. Notice that the unilateral tariff liberalizations that Mexico undertook during the late 1980s represented a steeper decline in protection rates than will be required by NAFTA, both initially and over the entire life of the agreement. Simultaneous to this unilateral trade liberalization, Mexico also made a number of significant changes in policies regulating financial and investment flows that allowed for the financing of the large trade and current account deficits that Mexico would soon be incurring. Rather than initiating a shift in Mexican policy, the decision to pursue NAFTA was seen as a means by which to maintain this growth in trade and continued capital inflows.[55]

This pre-NAFTA, large-scale opening of the Mexican economy represented, in its most important historical and strategic essence, a radical redefinition of Mexico's trade and financial relationship with the United States. The rapid growth in Mexico's overall trade level is driven primarily by an even faster growth in two-way trade between Mexico and the United States. This growth in trade with the United States also dates to the late 1980s, despite the slight U.S. recession during that period (See Table 4.4). Whereas it took about ten years from 1980 to 1990 for U.S-Mexico trade to double to nearly $40 billion, total trade had grown nearly 300 percent by 1996. (See Figure 4.6).

Trade between the United States and Mexico has always highlighted the strong asymmetry in the relations between the two countries. That the United States is much more important to Mexico's economy than Mexico is to the United States is revealed primarily by the fact that the relative shares to total trade are so disproportionate. The United States is overwhelmingly Mexico's principal trading partner, while even though Mexico is the U.S.'s now second most important trading partner, it represents only a fraction of total trade.

Yet the recent pre and post NAFTA growth in trade has indeed moved both countries into greater mutual, if still asymmetrical interdependence. Since U.S.-Mexico trade is growing faster than overall trade for both countries, the result is an increasing concentration of trade between Mexico and the United States as a share of their overall global trade. Imports from Mexico as a share of total U.S. imports has been steadily rising all decade, from 6.1 percent in 1990 to 10.2 percent in 1998. (Figure 4.7a). The Mexican share of total U.S. exports was rising even faster from 1990 to 1994 (from 7.2 percent to 10.1 percent), only to fall back to 7.9 percent in 1995, and jumping up to 11.9 percent in 1998. Manufactured imports from Mexico as a share of total U.S. manufactured imports has been rising at an even faster rate (Fig. 4.8), nearly doubling before NAFTA from 3.2 percent in 1985 to 6.4 in 1993, continuing to grow to 8.3 percent in September of 1995.

The U.S. share of total Mexican imports and exports, meanwhile, has grown faster at a much higher level compared to shares north of the border (Fig. 4.9). The U.S. share of

[55] See Aspe (1993) and Lustig (1992). This was also confirmed to Raul Hinojosa in a long series of interviews he conducted with Jose Cordoba at the Inter-American Development Bank in 1994.

total Mexican imports has grown from 65 percent in 1990, peaking at 76.1 percent in 1996. The U.S. share of total Mexican exports rose even faster, peaking at 85.3 percent in 1994, declining slightly during the Peso crisis, and surging forward to 87% by 1999. The post-NAFTA period has thus seen a continuation of a general pre-NAFTA upward trend of concentration in U.S.-Mexico trade.

The relatively higher concentration with the United States for Mexico's exports (87%) compared to the U.S. share of total Mexican imports (75%) points to a number of interesting characteristics of the pattern of U.S.-Mexico trade which NAFTA will likely augment. On key characteristic is that during periods when Mexico runs a trade deficit, the U.S. share of that deficit has been considerably smaller and shrinking (from 46 percent in 1990 to 27 percent in 1994). Yet, when Mexico moves towards a trade surplus, as was the case after the peso crisis, the U.S. share of Mexico's trade surplus soars to over 150 percent. In other words, during moments of crisis and contraction, Mexico's trade surplus with the United States is significantly higher than Mexico's overall trade surplus. The explanation has to be that Mexico has continued to run trade deficits with other countries, which is poignantly demonstrated in Figure 4.10. While the United States enjoyed roughly the same trade surplus with Mexico as did Asia and the European Union during periods of pre NAFTA growth, during a crisis the U.S. surplus collapses into a deficit for the United States that is greater than Mexico's overall surplus. Asia and Europe, meanwhile, maintain their same level of trade surplus with Mexico.

What is clear from this pattern of trade is that the United States suffered considerably more than other countries around the world during the Mexican period of crisis. Mexico's trade surplus with the United States was significantly higher than Mexico's overall trade surplus, indicating a disproportionately higher negative effect on the trade account with the United States compared to Mexico's other trading partners. The availability of the U.S. market for exports is of vital importance to Mexico during these periods of crisis. Yet what is most significant, however, is that after Mexico's recovery from its Peso crisis and its return to having an overall trade deficit, Mexico continues to have a trade surplus with the U.S.

The explanation of why we observe this dynamic is rooted in the evolving structure of trade and production between the United States and Mexico which also has its origins in two dynamics originating in the pre-NAFTA era.

First, as Mexico began running trade deficits in the late 1980's, this time they were financed primarily by portfolio capital inflows rather than commercial bank loans or Direct Foreign Investment (DFI). Mexico has become a much more open economy than the United States. While making Mexico more competitive in some sectors, this also has made it more dependent on international financial capital markets. U.S. investments were less and less in DFI and more in stock market and bonds, which has made the entire pattern of U.S.-Mexico economic integration more dynamic and, at the same time, more vulnerable.

Second, Mexican exports growth since the late 1980's has been primarily driven by manufacturing exports to the U.S. As we shall see below, it is this growth in exports which is now driving Mexican import growth, which is increasingly concentrated in intermediate goods that are increasingly being used for as inputs for exports. Yet as we shall also see below, it does not appear that non-North American imports for the purpose of exports to the U.S. are growing faster than imports from the U.S. for the same purpose.

IV.3. Dramatic Structural Transformation of Trade Begins before NAFTA

The central dynamic that has driven this pre-NAFTA expansion in Mexican trade is also the central dynamic of the most important transformation that has occurred in U.S.-Mexico trade relations in the last few decades, and which also predates NAFTA by at least five to six years. We are referring to the dramatic increase in Mexican manufacturing exports closely linked with an equally large increase in Mexican intermediate goods imports. As Figure 4.11 shows, the rapid growth of Mexican manufactured exports is matched only by a rapid growth in Mexican intermediate imports.[56]

After the collapse of the Mexican domestic market in 1995, intermediate imports fell slightly but then resumed their growth, parallel to continued growth in Mexican manufactured exports. Consumer and capital goods imports, however, suffered a deeper and more sustained drop. Notice that this was not the case during the 1982 crisis, when intermediate imports collapsed at a faster rate than capital and consumer goods, due to the changing role of intermediate imports in an increasingly outward oriented Mexican economy.

From the 1940s to the mid-1980s, the pattern of Mexican trade was based primarily on the importation of intermediate goods for the production of domestic goods behind high tariff barriers, a pattern know as Import Substituting Industrialization.[57] Mexican exports were focused on primary products (mining and agriculture) and some intermediate products, particularly petroleum and petroleum products (See Figure 4.12). Manufacturing exports were very low as late as the mid-1980s and the *maquiladora* program still represented only a very small share of manufacturing production and employment (Figure 4.13). Beginning in the mid-1980s, however, manufacturing exports and intermediate imports began growing rapidly, coinciding with the Mexican unilateral trade opening, financial liberalization, the 1986 devaluation, and the start-up of a number of large automotive investments.[58]

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[56] Data presented here is from the INEGI series on Mexican trade. Note that INEGI began including data from the Maquiladora sector as a part of total trade in 1991. While this resulted in a one time growth of exports and imports, overall manufacturing exports and intermediate imports continued to grow at an even faster rate.

[57] See Hinojosa and Robinson (1991) for an analysis of the shift from ISI to NAFTA.

[58] See Hinojosa and Morales (1992) for a historical analysis of the relationship between U.S.-Mexico trade patterns and the evolution of the North American automotive industry.

This transformation in the structure of Mexican trade patterns is also closely linked with the series of Mexican policy decisions that began the process of unilateral trade liberalization in 1986. The post-1986 tariff liberalization extended to many sectors and firms the option of producing for exports in a way similar to the *maquiladora*.

While *maquiladora* exports have been growing since the 1970s, and grew at an increasing rate after the 1986 peso devaluation, the recent growth of non-*maquila* manufactured exports and imports of intermediate goods is now rapidly outpacing *maquiladora* growth (as defined by the United States). NAFTA is expected to accelerate these trends, in part as many *maquiladoras* switch to non-*maquiladora* status because NAFTA will eliminate the need for *maquiladora* firm preferences, which will be phased out in 2001.

Table 4.5(a) shows the growth in Mexican "*maquiladora*" exports, as defined by the U.S. government, before and after NAFTA. First, it is revealing to recognize the extent of Mexican exports to the United States before NAFTA under the HTS 9802.00.60 subheading, usually referred to in U.S. publications as *maquiladora* trade.[59] In 1990, 44.1 percent of Mexican exports came to the United States under this program, reaching a peak of 49.1 percent in the year before NAFTA. Since NAFTA began, however, this percentage has continued to fallen to under 30 percent by 1998. What this most likely represents is that under NAFTA this same production no longer requires an HTS 9802.00.60 temporary duty-free classification for importing intermediate goods where tariffs have now been permanently liberalized. In fact, as NAFTA proceeds, the entire need for temporary duty- free import programs will be eliminated.

A second important fact revealed in Table 4.5a is that approximately half of the value of U.S. imports under the HTS 9802.00.60 subheading were actually once U.S. exports that were processed and are now contained in Mexican export products. Thus about 25 percent of what is counted as a U.S. export to Mexico is in fact only a temporary intermediate good export that returns to the United States under the 9802.00.60 subheading. Notice that this percentage peaked in 1995 and has been falling rapidly in recent years.

This U.S. data should by no means be taken as an indicator that this practice of cross-border production is declining. It merely indicates that the U.S. HTS subheading is becoming less and less a reliable indicator of the extent of cross border production. Table 4.5(b), on the other hand, shows Mexican data on imports and exports with the U.S. through both the Mexican Maquiladora program and the PITEX.[60] Notice that under this Mexican side

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[59] USITC (1995), p. 41. This is technically not a correct use of the term *maquiladora*, which actually refers to the Mexican in-bond legal framework which is not entirely symmetric in scope to the U.S. HTS 9802.00.60 subheading.

[60] The Program for Temporary Importation to Manufacture Exported Products (PITEX) is essentially a maquiladora program for Mexican registered corporations that devote part of their production capacity to

accounting, the share of Mexican exports to the U.S. under the Maquiladora and PITEX programs has been rising in the last few years, from 76 percent in 1996 to 86 percent in 1998. Similarly, the share of imports from the U.S. that are destined to the Maquiladora and PITEX programs has been increasing, from 50 percent in 1996 to 60 percent in 1998. Table 4.5(b) also shows that the U.S. share of total worldwide imports into Mexico for the Maquiladora and PITEX programs has been rising, from 67 percent to 82 percent from 1996 to 1998. Thus it does it does not appear that non-North American imports for the purpose of exports to the U.S. are growing faster than imports from the U.S. for the same purpose.

The extent of the shift to intermediate imports as a source for manufacturing exports is also much clearer in the Mexican data shown in Figure 4.11 and Table 4.6. Manufactured exports have grown from 12.5 percent of exports in 1982 to 83.7 percent in 1995, while intermediate imports have also soared, from 53 percent in 1982 to over 80 percent in 1995.

This trend of Mexican intermediate imports and manufactured exports raises the question as to whether the Mexican and U.S. productive structures have become more complementary, increasing the global competitive position of the United States, Mexico and North America in general. Alternatively, the move to off-shore final production could be a strategy for avoiding new technological innovation, choosing instead a low-wage/low-cost path of continuation of increasingly non-competitive practices. What is indisputable, however, is that this production-sharing began and radically transformed North American trade before NAFTA.

IV.4. Testing Structural Change in the Mexican Economy

It has been proposed by several authors that before the inception of NAFTA, and increasingly after NAFTA, the Mexican economy has been experiencing a substantial structural transformation (Hinojosa-Ojeda, et al., (1996) Alberro (1997)). As we demonstrated in the data above, starting in the late 1980's and increasingly the early 1990s, the nature of imports shifted from being the input for the production of domestically consumed goods, to be inputs for export-oriented activities. In order to test the robustness of this claim, a linear regression model was built.

The model structure is as follows:

$$M= a_0^t + a_1^t C + a_2^t G + a_3^t K + a_4^t V + a_5^t X + a_6^t R,$$

where

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the export market. To qualify under this program, companies must record annual sales of at least $50,000 and such exports must account for at least 30 percent of total sales. See "Decreto Que Establece Programas De Importacion Temporal Para Producir Articulos De Exportacion" avaliable at http://www.secofi.gob.mx/biblioteca/marco.asp.

M is Total Imports

C is Private consumption

G is Government consumption

K is capital formation coefficient

V is Change in inventories

X is Total Exports

R is the exchange rate

t indicates the period of time, and t=1,2 (t=1 before 1993; t=2 after 1993)

The table below shows the *beta* (β) *coefficients* for the variables in each period:

Variable	*t=1 (before 1993)*	*t=2 (after 1993)*
Private Consumption	0.306(*)	0.107
Government Consumption	0.024	-0.049(*)
Capital Formation	0.567(*)	0.430(*)
Inventories	0.016	-0.018
Exports	-0.165	0.758(*)
Exchange Rate	0.456(*)	-0.137
R^2	0.954	0.998

(*) Indicates significant at 0.05 levels or higher.

Data source. INEGI. Quarterly data for each variable from 1st quarter 1980 to 2nd quarter 1999 in constant 1993 pesos.

The β coefficients indicate the amount of net change –in standard deviation units – of the dependent variable for an independent variable change of 1 standard deviation. It can be seen that, in the period before 1993, about 30% of the variation in imports is due to changes in private consumption, and that the β coefficient for total exports is not significantly different from zero. Conversely, in the period after 1993, one observes that the β coefficient for private consumption drops to about 11%, while the coefficient for total exports climbs to almost 76%.

Although more sophisticated tests can be performed to find the exact location of the inflection point, it is clear from the analysis that 1993 appears as a clear cutting point in the evolution of structural changes in the Mexican economy. It is also unknown from the analysis which sector or sectors might have been driving the transformation process.

In a second scenario, the time-series was divided into three periods. t_1 corresponds to the period before 1987, t_2 is the period between 1987 and 1993 and t_3 corresponds to the period after 1993. The results are shown in the table below.

Variable	*t=1 (before 1987)*	*t=2 (between 1987 and 1993)*	*t=3 (after 1993)*
Private Consumption	0.145	0.609(*)	0.105
Government Consumption	0.120	-0.01	-0.048
Capital Formation	0.648(*)	0.168	0.414(*)
Inventories	0.035	0.062	-0.018
Exports	-0.432(*)	-0.089	0.787(*)
Exchange Rate	0.146(*)	0.170	-0.147
R^2	0.911	0.977	0.995

(*) Indicates significant at 0.05 levels or higher.

The results for t2 and t3 in this scenario are consistent with the results in the first scenario, showing an important shift in the way imports are absorbed into the economy. In this scenario, as in the first one, the β coefficients show that the variation in imports is explained by the variation in private consumption for the period between 1987 and 1993, and by the variation in exports after 1993.

With respect to the period before 1987, the analysis is less conclusive. Although the β coefficient for exports is significant, the coefficient for private consumption is not. This prevents us from absorbing imports into the economy through consumption only, and needs further considerations. The first point to be made is to recognize the limits of this methodology for allocating imports and exports as totals, demanding the analysis to be performed by type of good (i.e. according to final use: capital, consumer and intermediate goods). The second consideration is regarding the level of openness of the Mexican economy before 1987. If tariff and non-tariff barrier trade were maintained, then there is a substantial distortion in the patterns of trade, both imports and exports that eventually would affect the way in which resources are allocated throughout the economy. This limitation of the model is also implied by the relatively lower value of R^2.

IV.5. Impact of NAFTA Trade Liberalization

The implementation of NAFTA was seen as a major event by both supporters and critics because it will eliminate virtually all tariff and many non-tariff trade barriers between two relatively rich countries (United States and Canada) and a relatively poorer country (Mexico).[61] NAFTA was indeed historic because full trade liberalization had never been attempted between countries of such wide economic differences. Yet, as was pointed out by some during the NAFTA debates, trade integration in North America was highly advanced and trade barriers were already relatively low. Given this original structure of trade and protection, our research predicted that many of the major aspects of NAFTA, particularly tariff and non tariff barrier reductions, should not in itself be expected to dictate major changes in the level and even the structure of trade, particularly in the short run.[62]

Post-NAFTA research presented here indicates that, in fact, the lowering of tariffs through NAFTA has had only a moderately significant impact on the rate of growth of exports from Mexico and the United States. In fact, an analysis of the pattern of U.S. Mexico trade since NAFTA indicates that U.S. imports in those commodities liberalized by NAFTA actually rose less rapidly than imports in commodities that were not effected by NAFTA liberalization.[63] The latter finding corroborate our earlier findings (Hinojosa-Ojeda, et. al., (1996), as well as those by Shelburne (1998). It can also be shown that the evolving structure of trade is unlikely to have been substantially determined by NAFTA tariff liberalization or any other tariff liberalization, but rather still needs to be explained though other causes.

These findings should not be surprising given a review of the pre-NAFTA levels and structures of protection. As we saw previously, Figure 4.5 displays the resulting change in the mean tariff rates for the Mexican economy and Table 4.3 displays the various policy shifts the Mexican Government staged in the 1980s. On the Mexican side, notice that the unilateral tariff liberalizations that Mexico undertook during the late 1980s represent a steeper decline in protection rates than will be required by NAFTA, both initially and over the entire life of the agreement.

Figure 4.14 compares the U.S. and Mexican tariff reductions before and after NAFTA. Notice that by the time NAFTA began implementation in January of 1994, U.S. and Mexican tariff rates (average trade weighted) were already quite low: 12 percent for

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[61] See Hinojosa, et. al. (1992, 93, 94,95, 96) for discussion on the comparative data on NAFTA countries and their levels of protection compared to other regional integration agreements around the world.

[62] Ibid.

[63] Either because they were already liberalized before NAFTA, were liberalized by other means, or have not yet been liberalized.

Mexico and about 5 percent for the United States. NAFTA has, nevertheless, already made a significant difference in these tariff levels: down to 5 percent for Mexico and 1.5 percent for the United States. As Table 4.7 demonstrates, 80 percent of the dutiable goods have already had their tariffs fully eliminated, indicating that any immediate shock that might accompany tariff liberalizations should be observable now.

To determine the impact of NAFTA tariff liberalization, we conducted a detailed (8 digit HS) sectoral analysis of trade patterns in commodities that can be considered having undergone NAFTA liberalization compared to sectors that should not be considered as having undergone NAFTA liberalization. Our analysis concentrated on U.S.-Mexico imports and exports from 1993 to 1998.

In this section, we present the aggregate results of our analysis which compares post-NAFTA levels of trade in “NAFTA liberalized” and “NAFTA non-liberalized” commodities. A commodity is considered “NAFTA liberalized” if its tariff has been fully eliminated or reduced due to NAFTA. A commodity is considered “NAFTA non-liberalized” either because it was already liberalized before NAFTA, was liberalized by other means, or has not yet to be liberalized.

Following Shelburne (1998), we developed Table 4.8 which provides a framework for differentiating between trade “liberalized” and “not-liberalized” by NAFTA. The top row of this table specifies the duty status of items in 1993. The GSP-FR column contains trade in items that were eligible for duty free entry under the GSP program. The next column sums items that were part of the GSP but were ineligible for duty free entry because they entered from Mexico due to the competitive need limit of the GSP program. The No-PREF column sums items that were subject to regular MFN column 1 tariff rates in 1993. The MFN-FR column sums items entering duty free under MFN. The final column provides sums of the rows.

The duty status after NAFTA are given in the various rows of Table 4.8. Those items that enter duty free under NAFTA are on the first row which is labeled NAFTA-FREE. The NAFTA_QUOTA row contains the items where a fixed amount is allowed to enter duty-free with the remaining items subject to tariffs which many or may not be lower than the MFN rate. Those items that are subject to the reduced NAFTA duty rate are labeled NAFTA-RATE. The No-PREF, MFN-FR and Total Rows are defined as in the column headings. The top row in each cell presents the sums of U.S. import items from Mexico in 1997 while each successive row provides annual data with the bottom row providing data for 1993.

Table 4.9 provides a summary of the annual data by the various categories displayed in Table 4.8 and arranged by their “liberalized” versus “non-liberalized” aggregations based on Shelburne (1998). Table 4.9 also displays the major components of this dichotomous aggregation.

The results in Table 4.9 indicate that while imports have been growing in both the "liberalized" and "non-liberalized" aggregations, they have actually been growing faster in the "non-liberalized" aggregation. This result is thus similar to what Shelburne (1998) confirmed with data through 1996 and what Hinojosa-Ojeda et. al., (1996), found using a less complete accounting method. This more rapid growth in the "non-liberalized" items is due primarily to rapid growth in Case (1), that is in items that were already duty free under GSP before NAFTA and simply remained duty-free as a part of NAFTA. It is also important to point out that rapid growth in U.S. imports also occurred in those items in Case (2) that became duty free under NAFTA. Interestingly, imports in Case (4-B) actually declines, despite this being classified as "liberalized." This is less surprising, however, given that this case only includes those items that were subject to duty before NAFTA and are now still subject to duty at a reduced rate. As is the case throughout this framework of aggregation, there is not accounting for how much tariffs actually were reduced. Thus this analysis has to be complemented with a more detailed regression concerning the impact of the level of tariff reductions on the changing pattern of trade.

A Regression Analysis of the Impact of NAFTA Trade Liberalization

In this section we examine imports from Mexico in the period from 1990 to 1998 to determine whether there is a relationship between post-NAFTA tariff reductions and changes in import patterns by replicating Shelburne's (1998) regression exercise. The only difference with our regressions is that we extend the analysis to include 1998 imports data – instead of stopping at 1996 as did Shelburne.

We also used the least aggregated, and most meaningful, data set of the three regressions performed by Shelburne. This data set uses the Harmonized Schedule of Tariffs (HTS) at the 8 digits level, which is the level at which commodities are classified for duties. The value of commodities and duties have been adjusted for inflation and are in 1997 dollars. Because HTS numbers change over the years, not all commodities in all years were included. Therefore, the set of 8 digits HTS commodity numbers common in all years, from 1990 to 1998, includes 2136 observations.[64]

The dependent variable in this regression analysis is the percentage change of imports from Mexico between 1998 and 1993 (Rate of Change of Mex Imp 98-93). Following Shelburne's procedure, and in order to increase the symmetry of percentage changes, we divided the change in imports by the average of the two years.

The independent variables included in our regression are also identical to Shelburne's and are the following:

64 Since Shelburne's set included about 2,600 observations, we assume that the difference is because additional changes in HTS resulted in more commodity classifications being dropped since 1996.

- Tariff Rate Change 98-93: This is the effective rate for imports from Mexico calculated by dividing the actual duty paid by the customs value. The difference of the effective rates in the two years is divided by the average of the two values.

- Rate of Change of Mex Imp 93-90: This is the change in imports from Mexico between 1993 and 1990.

- Rate of Change of WORLD Imp 98-93: This is the change in total U.S. imports between 1998 and 1993 – also normalized by dividing it by the average of the two years.

- Mex Share of WORLD Imp 93: This is Mexico's share of U.S. imports in 1993. This variable is believed to reflect the degree of Mexico competitiveness in exporting to the U.S. prior to NAFTA.

- NAFTA Quota: This is a dummy variable to account for those commodities that entered under provisions allowing for a portion (quota) to be dutied at a NAFTA rate and the rest at a higher rate.

Before running the regression we analyzed the correlation between the variables.

While it is clear that the rate of change of imports from Mexico between 1998 and 1993 is weakly correlated to the remaining variables, the correlation coefficients signs are worth noting.

The rate of change of imports from Mexico between 1998 and 1993 is negatively correlated with 1998-93 tariff changes, with pre-NAFTA growth of imports (Rate of Change of Mex Imp 93-90), and with the Mexican share of U.S. imports from the world in 1993 (Mex Share of WORLD Imp 93).

This can be translated to mean that an item's lower tariffs after 1993 result in an increase imports of that item in 1998. Similarly, declining imports of an item prior to NAFTA and a smaller Mexican share of U.S. imports are associated with an increase in imports of that item in 1998.

	Rate of Change of Mex Imp 98-93
Rate of Change of Mex Imp 98-93	1
Tariff Rate Change 98-93	-0.115632332
Rate of Change of Mex Imp 93-90	-0.262641584

Rate of Change of WORLD Imp 98-93	0.11340092
Mex Share of WORLD Imp 93	-0.159471183
NAFTA Quota	0.067788708

The regression analysis generated the following results:

Adjusted R Square	0.127093121

	Coefficients	*Standard Error*	*T Stat*	P-value
Intercept	49.78961225	2.871565681	7.33883804	4.19562E-63
Tariff Rate Change 98-93	-3.096958615	0.562760538	-5.503155256	4.17936E-08
Rate of Change of Mex Imp 93-90	-0.235936793	0.020542095	-11.48552727	1.14319E-29
Rate of Change of WORLD Imp 98-93	0.279155127	0.033855936	8.245381957	2.8445E-16
Mex Share of WORLD Imp 93	-0.770966431	0.085943822	-8.97058577	6.30585E-19
NAFTA Quota	49.61676942	19.64175715	2.526086086	0.011606059

Once more, while all the variables were statistically significant at the 99% level,[65] the explanatory power of the regression is quite limited by an adjusted R square of less than 0.13.

While the overall regression results are consistent with Shelburne's, it is worthwhile noting that the data set used in this exercise, which was based on the original data base modified by Shelburne,[66] consist of about 2,600 and 2,100 observations out of a total that ranges between a minimum of more than 4,000 for 1990 to almost 6,000 in 1997. Accordingly, the set of commodities used in the regression represents between 36 and 60 percent of the number of commodities at the 8 digits HTS for the years between 1990 and 1998. The commodities represented in the data set includes between 65 and 73 percent of the customs value of imports and 63 and 70 percent of the duties paid.

65 98.8% for NAFTA Quota.

66 Shelburne obtained similar results using 3 and 4 digit SIC categories, and the data in these regressions contained over 99 percent of the customs value of imports.

The omission of about half the imported commodities and a third of the imports values may well be one of the causes behind the low explanatory power of the regression model. However, other factors, such as the devaluation of the peso and the structure of U.S. exports and of the U.S. economy in general before and after NAFTA should be considered as potentially more significant explanatory factors in shaping the sectoral growth rate of U.S. imports than reductions in tariffs.

V. Results of the NAID-Armington Potential Employment Impact of Trade Estimation Method

As discussed in Section III, we developed an alternative methodological approach to tracking the potential employment impacts of trade. This approach uses partial equilibrium CES aggregation functions at a 4-digit SIC sectoral level to estimate U.S. domestic demand for domestic production, given a particular level of imports. These production estimates are then translated into domestic labor requirements using direct and indirect input-output labor coefficients. By utilizing the econometrically estimated Armington elasticities, these functions attempt to account for the complementarity in production between the United States and a given country in a given sector.

On the export side, we use a slightly simplified version of the approach adopted by the Department of Commerce to estimate jobs "supported by exports." Again, these are partial equilibrium estimates at a 4-digit sectoral level.

In the discussion that follows, we first present the results of the baseline estimates of import impacts, where total demand and labor productivity in the United States are held constant and only trade with a particular country varies over time. We then allow labor productivity to change and compare the results to the baseline case. Finally, we also allow total domestic demand in the United States to grow. On the export side, we compare the fixed productivity case to one with varying productivity. There are many empirical problems with these estimates, which make the magnitude of the numbers difficult to interpret, and these problems are discussed in detail following the presentation of the results.

V.1. Baseline Imports Scenario: Fixed Productivity, Fixed Demand

Tables 5.1 and 5.2 show the baseline estimates of potential direct and indirect employment impacts of trade with Mexico by 4-digit SIC; Tables 5.3 and 5.4 show the results for the similar equations for trade with Canada.[67] In these partial equilibrium models, only the level of imports from the selected country varies over time, thus forcing all adjustment onto U.S. domestic production, as demand does not grow, nor can imports from other countries decline. These are, therefore, clearly overestimates of potential impact.

The point of this highly unrealistic model is to isolate the impact of imports and to show that even in the most exaggerated scenario for import impact – with demand and

[67] Note that the indirect impacts do not occur in the sector they are associated with, but in other, undetermined sectors.

productivity fixed – the potential job impact is relatively small. If we add up these estimates across sectors,[68] as shown in Table 5.5, we find the totals are not large. Total estimated potential job impact in the United States from 1990 to 1997 due to imports from Mexico would be 299,000, and it would be 458,000 for imports from Canada. That is an average of 37,000 jobs *per year* for Mexican trade and 57,000 *per year* for Canadian trade. Considering that the U.S. economy has been creating over 200,000 jobs *per month*, while causing the separation of about 400,000 workers *per month* from their jobs, the small relative share of potential job impacts from this trade is apparent.

V.2. Further Import Scenarios: Varying Labor Productivity and U.S. Demand

In this section, we seek to compare the relative magnitude of estimates under the various scenarios. In order to do that, we again sum the 4-digit sectoral partial equilibrium estimates for each scenario, recognizing that while the meaning of the absolute value of the sums is unclear, the relation among the estimates should be consistent as they are all estimated in the same way.

Table 5.5 presents the summary of results from the baseline import scenario, Tables 5.6 and 5.7 show the results of the second scenario with varying productivity, and Tables 5.8 and 5.9 show the results of the third scenario with varying productivity and varying demand. Comparing the first two scenarios, it is apparent that productivity change (i.e. technological change) has a much greater potential impact on job requirements in the United States than do imports from any one country. Over 11 million jobs are eliminated between 1990 and 1997 by increases in labor productivity in the sectors of the traded goods being considered, while even the highly overestimated baseline scenario projects at most a potential impact of 750,000 jobs over this period due to NAFTA trade.

In Scenario 2, with productivity variable (Tables 5.6 and 5.7), the potential employment impact of the imports falls relative to the baseline case, as every year there are fewer workers who could be displaced. The impact of imports from Mexico – 273,000 jobs 1990-1997 – falls about 9 percent relative to the baseline scenario, and the impact of imports from Canada – 429,000 jobs 1990-1997 – falls about 6 percent relative to the baseline estimate.

In Scenario 3, we allow U.S. demand to grow (Tables 5.8 and 5.9), which should greatly decrease the potential impact on U.S. jobs. In this scenario, the impact of imports from Canada falls to 130,000 jobs, 1990-1997, about 30 percent of the Scenario 2 estimate, which had demand fixed. Confusingly, the impact of imports from Mexico stays about the same, at 275,000 jobs. We do not have a complete explanation for this result, but it is clear

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[68] Because they are partial equilibrium estimates, we have no theoretical basis upon which to add them, nor to interpret the magnitude of the sum. But certainly the sum is an overestimate of the true general equilibrium impact.

that some of the "problem" sectors we identify in the discussion that follows play a large role.

Tables 5.10 and 5.11 present the estimates of direct potential employment impacts for trade with Mexico and Canada at the 4-digit sectoral level, utilizing the Scenario 3 model, with productivity and demand variable. These are our best estimates of potential import impact due to NAFTA, and can be compared to the baseline case in Tables 5.1 and 5.3. Making such a comparison, particularly in the case of Canada, shows quite startling changes in the degree of impact and the sectoral composition of that impact.

V.3. Exports

Growth in exports can, of course, offset any potential job impact due to imports or productivity improvements. Table 5.12 shows the estimates of jobs directly and indirectly supported by exports in the United States for trade with Mexico and Canada, summarizing these impacts for both the fixed productivity and variable productivity scenarios. [69]

In the baseline scenario – with productivity held constant and only trade varying – the estimates for both Mexico and Canada are about double the earlier baseline estimates for potential import impact. This is logical because we are filtering the import impact through the Armington elasticities, which reflect complementarity in production. If we had more information about exports of intermediate goods, a similar exercise could be attempted on the export side. That is, if a final assembly plant is moved from the United States to Mexico and the sources of the intermediate goods remain unchanged, then no jobs have been created (in the short run) in the United States, but we are nevertheless adding all those intermediate goods jobs to the "jobs supported by exports" column. Therefore, the export multiplier approach is not an estimate of job *creation* any more than our import functions are an estimate of job *destruction*, and it does not take account of the complementarity of production between countries.

With productivity allowed to increase in a second scenario (Table 5.12), the labor impact due to exports is reduced drastically – by 46 percent for exports to Mexico and by 69 percent for exports to Canada, as simply less labor is required to produce the exports. These estimates include direct and indirect effects and are quite close to U.S. Department of Commerce estimates.

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[69] Here summing the sectoral estimates makes more sense, as they are simply the value of exports multiplied by the direct and indirect input-output coefficients. We do not report the complete 4-digit level estimates separately, since the Department of Commerce publishes these.

V.4. Rankings of Sectors by Potential Employment Impact

Table 5.13 ranks the top 50 4-digit SIC sectors (from Table 5.10, Scenario 3) by potential direct employment impacts of post-NAFTA (1993-1997) imports from Mexico.[70] Audio and video equipment, motor vehicles, and auto parts head the list. Eight of the top ten sectors – all manufacturing sectors – showed potentially large negative impacts in the years immediately prior to NAFTA as well, suggesting that processes of restructuring represented by increasing imports were already well underway before NAFTA. On the other hand, of these top ten sectors, seven also showed increasing numbers of jobs related to exports to Mexico after NAFTA, indicating a high degree of two-way trade at this level of aggregation.

Table 5.14 ranks the top 50 4-digit SIC sectors by post-NAFTA (1993-1997) increases in jobs supported by U.S. exports to Mexico. Here, a variety of agricultural commodities and industrial intermediate goods – auto parts, electronics, plastics, metal parts – head the list. SIC 3714, motor vehicle parts and accessories, number one on the export list, shows up fourth on the import list, and various garment sectors on the export list mirror similar sectors appearing on the import list. In fact, 19 of the top 50 import impact sectors also appear among the top 50 export impact sectors, a demonstration of the degree of intra-industry two-way trade between the United States and Mexico.

Table 5.15 ranks the top 50 4-digit SIC sectors (from Table 5.11, Scenario 3) by potential direct employment impact of post-NAFTA (1993-1997) imports from Canada. Interestingly, three of the top ten sectors are in the garment industry (SIC 2325, 2341, 2322). Given the concordance problems in the garment industry, this potential impact requires further research.

Table 5.16 ranks the top 50 4-digit SIC sectors by post-NAFTA (1993-1997) increases in jobs supported by U.S. exports to Canada. Ten of the 50 sectors also appear on the import list, compared to 19 in the case of Mexico.

V.5. Sensitivity Analysis

We performed a sensitivity analysis on how the magnitudes of the Armington elasticities affect the employment impact estimates. For this purpose we used only the baseline model, where both productivity of labor and total demand in the United States are held constant. For purposes of comparison, we summed the partial equilibrium results across the sectors. The results are shown in Table 5.17.

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[70] We consider only direct impacts because the indirect impacts occur in other sectors.

Halving the elasticities across all sectors – i.e. making U.S. production less sensitive to import changes – raises the estimates of labor requirements in the United States by about 10 percent in the case of Mexico, but lowers them slightly in the case of Canada. On the other hand it lowers the projected impact over the 1990-1997 period by 20 percent for Canada, while raising it slightly for Mexico. We would have expected that reducing the elasticities would have raised U.S. labor requirements and lowered import impacts, so these results may indicate that the equation – which is sensitive to certain values of the variables and exhibits occasional discontinuities – is not behaving properly for some values of the elasticities.

Doubling the elasticities – i.e. making U.S. production more sensitive to import changes – lowers the U.S. labor requirements by about 24 percent in the case of trade with Mexico and about 29 percent in the case of trade with Canada. It also increases the potential impact on U.S. employment over the 1990-1997 period by 32 percent in the case of trade with Mexico and 15 percent in the case of trade with Canada. Doubling the elasticities therefore creates the expected direction of change for both countries.

In any case, it is worth noting that all of the estimates of potential employment impacts are of the same order of magnitude and all are relatively small, certainly in comparison to the general level of turnover in the economy discussed earlier.

V.6. Empirical problems with the analysis

After a great deal of experimentation, we have concluded that as long as the data are complete, the function yields the expected type of results. However, there are a considerable number of sectors where data for trade with Mexico or Canada are zero for some year. With trade at zero, the function does not produce an estimate for D, and the analysis is not possible. We were forced to exclude all such sectors from this analysis. As a result, we are missing 11.8 percent of merchandise trade over the 1990-1997 period with Mexico and 9.8 percent of trade with Canada. Therefore, though the estimates are uniformly overestimates of impact, they are missing about 10 percent of trade, and hence some unknown percentage of potential impact.

The second problem confronted is the concordance issue discussed above in Section III. It is not that the function does not behave properly, but that the data being used are erroneous. The trade data are not matching the U.S. production data, and the U.S. labor coefficients may be mistaken.

A good example of this is SIC based output code 0211, matched to SIC based import code 0211. SIC 0211 is "beef cattle feedlots," whereas SIC 0212 is range cattle. SIC based import code 211 is all beef cattle, and cattle imported either from the range or from feedlots would fall into this same category. In the case of Mexico, it is well known that breeding stock and some calves are exported from the U.S. to Mexico, while cattle pastured on the extensive ranches of northern Mexico are exported to the U.S. to be finished in feedlots. Most of the live cattle being imported from Mexico are thus part of a system of production sharing, and have as their destination U.S. feedlots. They are not *competing* with U.S. feedlots, as the analysis assumes, rather they are inputs to those feedlots. If anything, they are competing with range cattle in the United States (SIC 0212) or Canada, though perhaps with a lag of some years.

Including this sector in the analysis, matching SIC 0211 to SIC based import code 0211, produces the results shown in Table 5.18. Taking it out of the analysis greatly smoothes the overall estimates. This can be seen in Figure 5.1, which accompanies the table. Particularly in years 1995 and 1996 of the analysis, the decline and rise of imports from Mexico in this single sector has an enormous impact on the overall results. However, this impact is clearly specious, as employment in the U.S. is unlikely to be significantly affected by a shift in beef cattle imports from Mexico in any one year.

Figure 5.2 shows U.S. live cattle trade with Mexico over a longer period. One can see the cyclical nature of imports from Mexico and the large discontinuity represented by 1995 and 1996. As explained by Runge and Fox:

> "…the Mexican cattle herd was seriously reduced over 1995 and 1996, and was about 15 percent lower at the end of 1996 than in the previous two years, due to a serious drought in Northern Mexico. This, in combination with the peso devaluation, made it attractive to sell live cattle into the United States, so that a surge of Mexican imports into the United States occurred in 1995, rising by 55 percent, including a significant number of culled cows and bulls in addition to the usual feeder cattle." [71]

We prepared a table of potential outliers (Table 5.19) for Mexican imports, which includes all sectors for which the estimated net employment impact in a given year is more than one standard deviation from the mean. The number of such sectors in any year ranges from 5 sectors in 1996 to 24 sectors in 1992. These sectors account for 55 percent to 65 percent of the total employment impact in a year. On average, 15 sectors per year account for 59 percent of the employment impact. Many of these sectors appear repeatedly. Table 5.20 is a list of all such sectors from 1991 to 1998, and the number of years in which they appear. Sector 0211, which we have been discussing, leads the list, appearing in all eight years. It, along with three other sectors – 3711 (Motor vehicles and car bodies), 0913 (Shellfish), and 3494 (Valves and pipe fittings, nec) – were identified in Section 2 as having concordance problems between the SIC and SIC based import codes. While many of these "outliers" are simply the sectors of fast-growing imports, each one would require both statistical and

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[71] C. Ford Runge and Glenn Fox, "Feedlot Production of Cattle in the United States and Canada: Some Environmental Implications of the North American Free Trade Agreement," *Assessing Environmental Effects of the North American Free Trade Agreement: An Analytic Framework (Phase II) and Issue Studies.* Environment and Trade Series no. 6, Montreal: Commission for Environmental Cooperation, 1999, p. 221.

institutional research in order to confirm that. Such research is beyond the scope of this paper.

The beef cattle example points up another general problem with the analysis, namely that we assume that there is instantaneous employment adjustment in any year. If imports rise, U.S. employment falls, and if imports fall, U.S. employment rises. While perhaps true in some sectors, this assumption is clearly untenable in sectors that have alternative sources of supply or long lags in production. The beef cattle sector – or almost any agricultural sector – is a good example, as is SIC 1311, Crude Petroleum and Natural Gas, which also experiences large fluctuations in imports from year to year from any one country.

And this in turn identifies the last major problem with the analysis, namely that it does not consider sources of supply other than those treated in the model: imports from the one country being studied or U.S. production in the same SIC sector. It ignores both imports from other countries as well as the possibility of substitution of products from other SIC sectors. Live beef cattle from Mexico could be substituted for by imports of live cattle from Canada, or by imported fresh or frozen beef, SIC 2011. Therefore, job impacts could occur in a different SIC sector than the one analyzed, but the model ignores this.

V.7. How this analysis could be improved

First, the constant A should be re-estimated as time passes. In essence, we would be shifting the base year estimate, D_0, forward in time, i.e. changing the base year from which are estimated "marginal" changes. As it is now, each change is estimated not with respect to the prior year but with respect to the base year. As we move forward in time, the marginality assumption becomes more and more tenuous. Put another way, the formula does not now take account of previous changes in U.S. employment, i.e. the equation is not cumulative. By re-estimating A, we would also change the import share vs. the domestic share of the market as this changes over time, a ratio that is currently fixed.

Second, estimation of the Armington elasticities could be improved. We have utilized a set of estimates for U.S. trade with the whole world, when in fact we are dealing with the trade of individual countries. Country-specific elasticities could be estimated, and more recent data utilized. The current elasticities were estimated with data through the mid-1980s. If NAFTA is causing structural change in trading relationships in North America, then these elasticities do not reflect it. Since the U.S. conducts more intermediate good trade with Canada and Mexico than it does with the rest of the world, the current set of elasticities are likely overestimating the impact of trade under NAFTA.

Third, sectors where there are serious harmonization problems between the trade data and the U.S. SIC system could be fixed. As the case of the beef cattle feedlots showed, such problems can have large impacts on the estimates. This would require a systematic evaluation of the concordance and the plausibility of the estimates of labor requirements.

Fourth, trade with the rest of the world could be included, so that the estimates would be able to take into account trade diversion and not force all residual impact onto U.S. domestic production.

Finally, substitution elasticities across sectors could be considered, and included where they are found to be important.

The U.S. International Trade Commission's COMPAS model, used for analyzing particular commodities, takes into account some of these factors, such as trade with the rest of the world and cross price elasticities. Because their model is only used for analyzing individual commodities, it is feasible to research and estimate such elasticities.

V.8. Discussion of Direction of Biases in NAID-Armington Partial Equilibrium Approach

As stated above, these partial equilibrium estimates are not the final word on NAFTA tracking, but do represent a conceptual improvement over back-of-the-envelope methodologies currently in use. These calculations should be considered biased towards overstating direct job losses due to several factors. We can break those factors down into two groups, external and internal, as follows:

External

Many U.S. imports from Mexico are direct substitutes for U.S. imports from the rest of the world. We have not yet determined how much of the Mexican import surge since 1994 represents the displacement of imports from third countries (directly or indirectly through capital investments and transplanting of production into Mexico). There is some evidence that trade diversion is occurring with respect to Asia since the devaluation of the peso at the end of 1994.[72]

Many Mexican imports include high amounts of U.S. intermediate exports. As explained above, the interactions between exports and imports of intermediate and final goods is incredibly complex, and confounds any partial equilibrium modeling effort. Properly treating intermediate goods that cross the border in both directions is the single most compelling reason for ultimately adopting general equilibrium methods.

Many Mexican exports include large amounts of Asian intermediate exports. These are often goods produced by Asian multinationals, that have either raised "domestic content"

72 See Section V.2.3

to comply with NAFTA, or shifted their production base to Mexico as a result of NAFTA. Thus, the U.S. components of these imports have generally risen as a result of investment diversion and changing production technologies due to NAFTA.

Indirect complementarities may exist. In this case, the transfer of some labor-intensive segments of the production process to Mexico allows the rest of production, plus home office, research and development, etc. jobs to stay in United States. In some cases, the relevant alternative to importing from Mexico is not that the import be produced in the United States, but that related jobs move off-shore as well.

Internal

Mexican imports could be complementary to U.S. production across sectors, requiring a CGE framework. Our partial equilibrium model compensates for the fact that Mexican imports may not be perfect substitutes for domestic production in the same sector. But what if these exports are actually complementary to production in a different sector? Our very detailed sectoral breakdown is appropriate for comparing final demand, but magnifies the possibility of such inter-sectoral complementarities.

Mexican imports could be used as intermediate goods in sectors undergoing a rapid growth in exports. Thus a surge in Mexican imports could actually be a response to a U.S. export boom. Furthermore, if imports from Mexico, after tariff reductions, displace higher-priced substitutes, they may even *cause* the export boom.

VI. NAFTA-TAA: An Empirical Examination

One development that emerged from the negotiation of NAFTA was the creation of the NAFTA-TAA (Trade Adjustment Assistance) Program within the U.S. Department of Labor.[73] The NAFTA-TAA Program is significant not only because it provides an unprecedented level of training and adjustment resources to a targeted population, but it is also proving to be a valuable database of firms and workers by sector and region that have been certified as having been affected by trade and investment relations with Mexico and Canada. Nevertheless, it was not designed to be an accounting of trade impacts and it has significant limitations in this regard.

The reporting system of NAFTA-TAA is particularly significant for several reasons: first, it is presently the only public effort to document and record the impacts of NAFTA on workers and businesses; second, it is the basis on which mitigation efforts are implemented by the Department of Labor; and third, the NAFTA-TAA reports, due to the absence of other measures, have become the yardstick for assessing impact – by scale, by sector, and by region – and thus are the basis for identifying communities and industries that are in need of assistance.

Schoepfle (1996) has summarized the nature of the program:

> "A petition for assistance under the NAFTA-TAA program may be filed by a group of 3 or more workers (including farm workers), a union or other duly authorized representative (including community-based organizations), or a company official. The workers on whose behalf a petition is filed must be (or have been) related to the production of an article (i.e. the provision of a non-tangible service is not covered). NAFTA-TAA petitions must be filed within one year of the impact date of a layoff…

[73] The NAFTA-TAA Program was created as a part of the NAFTA implementing legislation that was approved by the U.S. Congress in November 1993.

"The NAFTA-TAA program is similar to the existing TAA program that has been available in various forms since 1962 to workers dislocated as the result of increased U.S. imports. The TAA program offers assistance (training and extended unemployment benefits) to displaced workers whose employment is the direct result of increased imports from any source. The NAFTA-TAA program has a new requirement that a claimant must be enrolled in training in order to qualify for extended income support; waivers of the training requirement are allowed under the TAA program, but not under the NAFTA-TAA program…

"In determining whether a significant number or proportion of workers in a firm or subdivision of the firm covered by a NAFTA-TAA petition have become totally or partially separated, or are threatened to be totally or partially separated, the following criteria are applied, either:

(i) the sales or production, or both, of the firm or subdivision have decreased absolutely; (ii) imports from Mexico or Canada of articles like or directly competitive with articles produced by the firm or subdivision have increased; and (iii) the increase in such imports contributed importantly – that is, be a cause that is important but not necessarily more important than any other cause – to the workers' separation or threat of separation and to the decline in sales or production of the firm or subdivision; or

there has been a shift in production by the workers' firm or subdivision to Mexico or Canada of articles like or directly competitive with articles which are produced by the firm or subdivision."

NAFTA-TAA allocates the displacement impact into three categories, applicable to either Mexico or Canada (or unspecified country). The classification of impacts, with their certification codes, are the following:

Table 6.1: NAFTA TAA Criteria For Certification

	Mexico	Canada	Country not specified
Production moved to other country	C-1	C-2	
Increased company imports	C-3	C-4	C-5
Increased customer imports	C-6	C-7	C-8
Increased general imports			C-9

The presumption of this system is that firms, or the affected union, or a group of workers will obtain and prepare a NAFTA TAA application, which then is submitted to the designated state agency which, as the partner to the Department of Labor, handles the "intake" of applications and makes an initial review. The application is then passed on to the Department of Labor in Washington, which relies upon a variety of procedures to either "certify" or deny the application.

NAFTA-TAA is an incomplete accounting of employment impacts due to trade with Mexico and Canada, mainly because:

1. Workers often know nothing about such programs and depend on the firms laying them off or unions to help them apply. Since unions represent only a small proportion of workers, it is likely that a large number of displaced workers are unaware of the availability of NAFTA-TAA.

2. Workers indirectly displaced by an increase in imports or a decline in exports would be unlikely to be aware of such market share shifts unless informed of them by their firm or union.

3. Within some industries, even the firms may be unaware of the details (causes) of displacement due to shifts by clients to suppliers from Mexico or Canada. The position of apparel industry contractors is an example of this.

4. In general the whole process of monitoring and applying for TAA by firms is biased in favor of larger firms with the resources to carry out the requisite information gathering and application.

5. Even if there are applications for DOL assistance in response to perceived NAFTA impacts, there is no assurance that the NAFTA-TAA route will be taken to address the problem. There are a variety of considerations related to the rules and administration of NAFTA-TAA, TAA, and JTPA Title 3 that cause us to doubt that all workers displaced by NAFTA will apply for NAFTA-TAA. In particular, as noted above, TAA allows workers to collect extended unemployment without being in job training and has a less stringent time schedule.

Of course, NAFTA-TAA not only misses many displaced workers, it also contains some false positives, i.e. workers who were laid off for conjunctural market reasons unrelated to trade, yet were certified because of rising imports.

In sum, while it is useful that some form of impact measurement is in place, the count of NAFTA-TAA certified workers or firms must not be treated as the definitive measure of NAFTA impacts, something it was not designed to be. In the following sections we examine the NAFTA-TAA database to determine what it says about types of impact and where the impact falls. The results of the empirical analysis clearly demonstrate the limitations of relying solely upon NAFTA-TAA, and lead to the development of additional (not substitute) measures that address the issue of increased trade impacts in particular.

VI.1. NAFTA-TAA Data

Given the unique role NAFTA-TAA plays currently as the only official recording system of NAFTA impacts, it is essential to assess the findings that result from the NAFTA TAA process[74]. What do the data show with regard to magnitude, source (Mexico/Canada), type (shift of production versus trade impact), sector, and region?

Overall, 238,015 workers were certified as being affected by NAFTA by the beginning of July 1999, resulting in an average of 3,662 workers per month for 65 months. Schoepfle (1996) compares this to the U.S. Bureau of Labor Statistics' (BLS) Mass Layoff Statistics, which show that a total of 947,799 workers were separated from their employers in 5,155 mass layoff events in one year (July 1995-June 1996), or 78,893 workers per month, making NAFTA-TAA certifications on average about 4.6 percent of these separations. Schoepfle also compared NAFTA-TAA to the dislocated worker survey conducted by the BLS: "The survey reported that – out of a total labor force of over 110 million – 4.2 million workers were displaced between January 1993 and December 1995 (a period of employment expansion and declining unemployment) from jobs that they had held for at least 3 years…The survey also reported that another 5.2 million workers were displaced from jobs that they had held for less than 3 years. Thus, a total of 9.4 million workers were displaced over the last survey period…" (Schoepfle, 1996:12-13) These data imply an average of 175,000 long-term workers displaced per month, or 391,667 total workers displaced per month, making NAFTA-TAA certifications potentially 2.1 percent of the long-term layoffs or 0.9 percent of all displacements.

In fact, despite this high rate of churning, the U.S. economy has also had a high rate of net job creation of over 200,000 jobs per month. The Council of Economic Advisors (1996) noted that BLS establishment survey data showed growth in U.S. non-farm employment of 8.5 million from January 1993 to March 1996, or about 224,000 more jobs per month.

The distribution of NAFTA-TAA certifications according to the type of job loss and source country is portrayed in Table 6.2, which shows that 65 percent of worker certifications were related to Mexico, 18 percent to Canada, and the rest unspecified. The single largest category is C1, shifts of production to Mexico, which accounts for 45 percent of certified workers and 42.5 percent of certified firms.

[74] Given the larger context of macro economic changes in both the U.S. and, more strikingly, in Mexico, including the peso devaluation, it is more accurate to adopt a broader conception of assessment: what have been the impacts *since* NAFTA was implemented, rather than *due to* NAFTA's implementation.

The non-manufacturing component of NAFTA impact is relatively small, as can be observed in Table 6.3, which focuses only on NAFTA-TAA certified non-manufacturing companies. The top two sectors account for over half of the non-manufacturing workers certified (Table 6.5): the electric services industry (SIC 4911), where all 4,574 jobs were lost to Canada due to the C4 or C7 ruling; and the vegetables and melons sector, where increasing imports from Mexico (C1, C3, C6) have been used to certify 2,579 workers in California and Florida. Because of its size and consequent greater significance, most of the following NAFTA-TAA analysis will focus on manufacturing, with a total of 1,859 certified sites – accounting for 94 percent of all the NAFTA-TAA certified workers.

Tables 6.3 through 6.7 provide several different ways of summarizing the distribution of country and type of trade impact at an aggregate level. Mexico accounts for 65 percent of certified job losses, Canada accounts for 18 percent, with 17 percent unspecified (Table 6.6). Mexico has a slightly larger share in manufacturing than in the total NAFTA-TAA certifications; if we assumed that the unspecified impacts were evenly divided between Mexico and Canada, then Mexico would account for about three-quarters of NAFTA-TAA manufacturing certifications (Table 6.4).

The most common type of NAFTA manufacturing impact is due to production shifts, according to the NAFTA-TAA database: 55 percent of both the firms and the certified workers (Table 6.4). This finding about the higher level of production shifts provides a possible clue about the bias of the NAFTA-TAA system. Plant closings and major production layoffs are salient and indisputable manifestations of trade impacts, in contrast to lost sales. Plant shutdowns are more likely to lead to petition filings – whether it be by the company, workers, or a union – because the source of the job dislocation is easier to identify. Though the NAFTA-TAA self-reporting system may be an indicator of production shifts, it may be somewhat less appropriate to rely upon NAFTA-TAA as a general means to identify job losses due to imports, especially since one would expect that import impacts would be more widespread.

But even the shifting of production is not as self-evident as it might appear. There are additional factors, such as the structure of the industry, which may obscure the cause of a plant shutdown, layoffs, and actual shifting of production. With declining unionization, and regions of the country (and particular sectors) in which union density is quite low, there is an absence of advocates for workers who are adversely impacted.

VI.2. Sectoral Distribution of NAFTA-TAA

Sectorally, of the 223,072 certified NAFTA-TAA manufacturing workers at 1,859 sites, the greatest employment impact has been in the apparel sector (SIC 23), followed by the electronics/electrical sector (SIC 36). These two sectors alone account for 43.7 percent of the 223,072 NAFTA-TAA certified manufacturing workers and 46.2 percent of the manufacturing firms (Table 6.8). Certain sectors with high levels of certified workers, such as leather products (but a very small manufacturing employer in the United States) and lumber/wood products, were primarily affected by Canada (Tables 6.9 and 6.10).

- With regard to Mexico alone, apparel and electronics account for over 51 percent of the certified manufacturing workers, and with the addition of transportation equipment (SIC 37) account for about 60 percent (Table 6.9). Additional manufacturing sectors affected by Mexico include fabricated metal (SIC 34), machinery [and computers] (SIC35), instruments (SIC 38), and textile mill products (SIC 22), which together account for another 21 percent of Mexico-certified manufacturing workers.

- The certified job losses are a tiny fraction of total U.S. manufacturing employment, and even when calculated as a portion of employment change over the same time period, the job losses did not significantly impact the majority of the twenty SIC categories. The NAFTA-TAA job losses are more than one percent of employment only in the apparel industry and the very small and long-declining leather industry.

VI.3. Geographic Distribution of NAFTA-TAA

Just as the sectoral distribution of NAFTA-TAA represents a distribution distinct from both the overall employment levels, the regional distribution of the NAFTA-TAA certifications shows the uneven impact of NAFTA as reflected by the NAFTA-TAA certifications – and thus highlights the need to pursue detailed tracking. As may be noted in Table 6.11 – which ranks states by the total number of NAFTA-TAA certified workers, whether attributed to Mexico, Canada, or undetermined – eight states account for over 50 percent of the certified workers: North Carolina, Texas, Pennsylvania, New York, California, Georgia, Tennessee, and Indiana.

Table 6.11 also shows the total labor force by state. With the exception of California, all of the top 11 NAFTA-TAA states are over-represented in NAFTA-TAA certifications, and a total of 24 states are over-represented when compared to their shares of the total U.S. labor force. The NAFTA-TAA ranking is not simply a ranking of states by their population or the number of manufacturing employees. Rather, the NAFTA-TAA tally reflects the particular concentrations of industries in different regions, as well as factors that may make firms in a state or region more likely to file for NAFTA-TAA certification. However it should be noted that the distribution of impacts differ according to country of origin: the Canada impact is not surprisingly largely concentrated in the northern tier of the United States; the Mexican impact predominates throughout the southern portion of the United States as well as in the Northeast, which are both regions of significant electronics and apparel employment.

Tables 6.12 and 6.13 delineate the concentration of apparel and electronics certified workers by state. As may be noted, most of the apparel certifications are concentrated in the

South and the Northeast, with Texas, North Carolina, and Georgia together accounting for 37.6 percent of certified workers. Electronics has a somewhat similar geography, but with a greater emphasis on the Upper Midwest and the Northeast, as well as California. North Carolina stands out with 13 percent of SIC 36 certifications.

VI.4. NAFTA-TAA Reporting Biases

Because NAFTA-TAA is not an active survey or monitoring system, such as the Current Employment Survey or the Current Population Survey, but rather relies upon a self-identification and application process, a review of the factors that affect the structure of the self-reporting process and possible structural biases is in order. That is, are all workers, firms and industry sectors (that may be impacted by NAFTA) equally likely to enter into the reporting process that NAFTA-TAA requires?

The areas of the United States that have been more significantly affected, as reflected by the self-reporting and application process of NAFTA-TAA, are the result of a number of factors: the special coincidence of a few large plants closing; the geographic concentration of particular sectors, due to the historical outcome of industrial agglomeration; and the structural/organizational characteristics of sectors that may make them more likely to become part of the NAFTA-TAA reporting system.

Unionization is a structural factor that increases the likelihood that an adverse NAFTA-related impact will be translated into a NAFTA-TAA application. Given the advocacy role of unions, it is not surprising to note the high percentage of union participation in the NAFTA-TAA certifications. Union petitions made up 22 percent of all the petitions that were certified, but accounted for 31 percent of certified workers – a much higher union rate than prevails nationally.

Another crucial structural factor reveals itself in the NAFTA-TAA database: firm size.[75] As of August 1996, only 14 percent of the certified firms had more than 250 workers, but these 87 firms made up over half (54 percent) of all the certified workers (44,461). Overall, the average firm size of the 620 firms with NAFTA-TAA certified workers was 283. The average size of the 325 C1 and C2 (shift of production) manufacturing plants was 240 workers. Compare this with the U.S. average manufacturing establishment size of 47 (1993 County Business Patterns). Furthermore, the average plant size of the 161 union-petition-certified firms was 508 employees. We believe there is little doubt the NAFTA-TAA-certified firms represent a bias towards larger and unionized workplaces, with the consequence that additional NAFTA impacts are not being caught in the NAFTA-TAA net.

[75] Unfortunately, the Department of Labor has stopped reporting firm size in the public data set, so the figures reported here are based on certifications from January 1994 through August 1996 only.

The more indirect (or subtle) impacts of trade penetration and possible job displacement are far more difficult to discern through the NAFTA-TAA system. The average size of the manufacturing firms that had been certified for trade-based job displacement (C3-C8) by August 1996 had an even larger average size: 301 employees. Larger companies have the resources and the institutional connections that make it more likely for them to be able to monitor, assess, and act upon the less manifest impacts of trade. And many of those smaller firms that may well be affected by trade are structurally disadvantaged in their ability to pursue inclusion in the NAFTA-TAA program.

For example, all these factors appear to be present within the non-union and small-firm segment of the apparel industry in Southern California. And, not surprisingly, the Los Angeles industry, despite extensive acknowledgement by local apparel businesses about production shifts to Mexico, has only 12 NAFTA-TAA certifications for 1,615 workers. Consequently, we believe that supplementary estimating approaches need to be developed to properly take into account the trade impacts of NAFTA.

VI.5. Comparison of NAFTA-TAA to NAID-Armington Estimates

The NAFTA-TAA process more likely leads to identifying plant closings and production shifts, rather than the more subtle effects of import penetration. Thus, in order to place NAFTA-TAA sectoral results in context, we can juxtapose the NAFTA-TAA industry distributions with our estimates of the potential employment impacts of the trade changes since the implementation of NAFTA in January of 1994. Do they have a *prima facie* correspondence? No obvious aggregate relationship exists between the rate of increase of Mexican imports following the onset of NAFTA and the NAFTA-TAA certifications. However, the correlation is quite high between the sectors that show a negative employment impact (for the sum of Mexico and Canada imports) in the NAID-Armington analysis of direct impacts of imports, presented below, and the NAFTA-TAA data. Under the scenario where demand and technology vary, the simple correlation between the 173 sectors is 67 percent.

VI.6. Trade Diversion

A free trade area such as NAFTA is expected to result both in trade creation, i.e. increased trade among the trade area partners which displaces domestic production, as well as trade diversion, i.e. the substitution of imports from trade area partners for imports from outside the region. In an analysis conducted before NAFTA, Wylie (1995) concluded that this trade diversion should be relatively small, particularly with respect to the U.S. market, and that growth induced by NAFTA could well compensate for most trade diverting tendencies. Nevertheless, he conceded that trade diversion could be potentially large in certain sectors, such as clothing and textiles, and have significant impacts on particular third countries. In this section, we look at some of the changes in U.S. imports from Mexico and the rest of the world to gain insight into the degree to which trade diversion might be occurring.

Table 6.14 reports on Mexico's growth in share of U.S. imports for the three years prior to NAFTA and the three years since NAFTA at the 4-digit SIC level, for those sectors for which data are available. Overall, Mexico averaged a growth in share of 3.8 percent in the three years prior to NAFTA, and 11.8 percent in the three years since NAFTA. Clearly, U.S. imports from Mexico are growing faster than are U.S. imports overall.

Utilizing U.S. import data at the 10-digit Harmonized System level (here termed "commodities"), we find that Mexico gained import market value share in the United States between 1993 and 1996 in commodities where Mexican exports to the United States were worth $63.9 billion in 1996 (all values are in constant 1995 dollars). Total U.S. imports from Mexico were $72.7 billion, so Mexico gained value share relative to the rest of the world in commodities accounting for 88 percent of the value of its exports to the United States. Of course Mexico only accounts for 9.2 percent of all U.S. imports, so Mexico gained share in commodities that account for 8.1 percent of the value of all U.S. imports.

NAFTA (and the peso devaluation) is having a positive effect on Mexico's competitiveness in the U.S. market across a wide array of sectors. But is this occurring at the expense of U.S. production (as assumed in the NAID-Armington method) or at the expense of third countries? If we look at the traded commodities, we see that the United States imported 15,882 distinct commodity categories in 1996. Of these, Mexico had exports to the United States in 8,281 commodities, or 52 percent. Mexico gained value share between 1993 and 1996 in 7,109 commodities. Of those 7,109, the value of U.S. imports from the rest of the world increased in 5,408 commodities, or 76 percent, and declined in 1,672 commodities, or 24 percent. Of the 1,672 where the rest-of-world lost not only value share to Mexico but also absolute value, this was due to a decline in the quantity of U.S. imports from the rest-of-world in 70 percent of the commodities. These commodities where rest-of-world imports declined in both quantity and value as Mexico gained value share are concentrated in 6 sectors (accounting for 60 percent of all such commodities): SIC 23 (apparel), 20 percent; SIC 22 (textiles), 13 percent; SIC 28 (chemicals) 9 percent; SIC 20 (food), 7 percent; SIC 32 (stone, clay, glass), 6 percent; SIC 31 (leather), 5 percent.

This very preliminary analysis indicates that some trade diversion is occurring with respect to U.S. imports from Mexico versus the rest of the world. The data suggest that the leading candidate sectors where this trade diversion could be occurring are garments and textiles. Hufbauer and Schott (1994) and Wylie (1995) both concluded that garments and textiles would be the principal area of trade diversion in the U.S. market, and this may well prove to be correct as NAFTA proceeds, unless adjustments are made to the entire trade regime governing world clothing trade.

VII. Conclusion and Policy Implications

In debates preceding the implementation of NAFTA, a wide range of estimates were offered as to the likely employment impacts of enhanced trade and investment integration in North America. The multiple methodologies presented in this report indicate that the employment impacts of NAFTA trade and investment liberalization so far are on the low end of the estimates suggested. Furthermore, the trends in the levels of employment either supported or put at risk by trade with Mexico have not been altered significantly by NAFTA liberalizations. What emerges as the most important determinant of U.S. employment related to North America is in fact not NAFTA, but rather the recurrence of macroeconomic instability in Mexico. This remains the largest obstacle to sustained growth and development in North America.

The key findings of this report indicate that:

1. The overall pattern of U.S.-Mexico trade and investment began to change radically nearly a decade before NAFTA with Mexico's unilateral trade liberalization, ushering in a dramatic growth in the two-way trade of intermediate goods, and has not significantly changed since the implementation of NAFTA.

2. The lowering of tariffs through NAFTA has not yet had a significant impact on the rate of growth of imports or exports between Mexico and the United States.

3. Using a partial equilibrium methodology for estimating direct and indirect employment impacts related to trade, we find that the total estimated potential job impact in the United States from 1990 to 1997 due to imports from Mexico would be 299,000, and it would be 458,000 for imports from Canada. That is an average of 37,000 jobs *per year* for Mexican trade and 57,000 *per year* for Canadian trade. Considering that the U.S. economy creates over 200,000 jobs *per month* and causes the separation of about 400,000 workers *per month* from their jobs, the small relative share of potential job impacts from this trade is apparent.

4. The NAFTA-TAA program is a relatively better indicator for estimating employment losses due to plants moving to Mexico, but is less reliable as an indicator of employment loss due to import penetration.

5. Estimates of employment impacts due to trade have a limited but important role to play in the public discussion of trade.

In general, jobs gain/loss accounting methodologies should <u>not</u> be used to evaluate the relative benefits of trade. In general, changes in aggregate demand created by a changing trade balance and/or trade policy are likely to be counteracted by general macro-economic policy and thus trade policy changes are likely to have only a very insignificant impact on overall employment in the short run and no impact in the long run. What is much more significant as a measure of trade policy is the impact on economies of scale, technological change, new investments, and productivity growth in the liberated sectors and the ability of the economy as a whole to reap benefits from these productivity increases.

The trade and employment impact methodologies presented here should, however, be central to our understanding of the adjustment costs of the impacts of trade. Accurately identifying employment displacement risks is very important to assist workers and communities take adequate steps to prepare for a positive adjustment. Failure to identify and address adjustment risk will inevitably generate exaggerated political opposition to trade liberalization, in some cases based on ignorance and fear, and in some cases based on the legitimate defense of uncompensated individual costs which are incurred on behalf of the overall societal welfare.

The results reviewed also have important implications for the scope and operations of NAFTA-related programs and institutions, such as NAFTA-TAA and NADBANK-CAIP, which were created to provide labor and community adjustment assistance in the context of North American integration. The criteria used by both NAFTA-TAA and the NADBANK-CAIP criteria for identifying trade adjustment with Mexico underestimate these impacts. Yet the analysis shows that the scope and size of the programs are approximately on target in terms of their orders of magnitude with respect to addressing the most serious adjustment impacts. Existing U.S. government criteria for NAFTA-related programs, however, could be made much more inclusive.

According to the alternative partial equilibrium methodology summarized here, current attempts to determine the employment impact of import penetration may significantly undercount at the sectoral or regional level, especially if one included indirect impacts. Therefore, we conclude that the NADBANK and NAFTA-TAA programs must adopt new criteria based on a methodology that more accurately estimates employment impacts related to import penetration. In particular, both the NADBANK and the NAFTA-TAA certification processes must be more serious about identifying the impact of NAFTA on smaller firms. In both programs, selected sectors and regions demonstrating strong import penetration should be targeted for aggressive outreach efforts.

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