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The Automotive Sector

Disputes in the automotive sector led to the first postwar trade agreement between the United States and Canada—the 1965 Canada–United States Automotive Agreement (commonly known as the 1965 Auto Pact). Clearing up residual automotive trade and investment frictions was central to the 1989 Canada-US Free Trade Agreement (CUSFTA). Likewise, no industrial sector was more critical to the success of NAFTA than the automotive sector.

By far, motor vehicles and parts account for a larger share of intraregional trade in North America than any product sector. Three-way auto trade in 2003 was \$125 billion, representing 20 percent of total trade among NAFTA partners. Between 1993 and 2003, the value of NAFTA auto trade almost doubled, accounting for 18 percent of the total growth in NAFTA trade over this period (calculated using data in appendix table 6A.1). Trade in vehicles and parts with non-NAFTA countries also increased sharply; North American auto-sector imports grew almost twice as fast as auto exports to the rest of the world. Together, the auto sector in 2003 accounted for 12 percent of merchandise trade between non-NAFTA and NAFTA countries.

To a considerable extent, NAFTA, like its predecessors, deepened integration of the North American automotive market. The same “Big Three” automotive producers (General Motors, Ford, and Chrysler) operated in all three NAFTA countries well before negotiations commenced for the 1965 Auto Pact, the 1989 CUSFTA, and the 1994 NAFTA. When the NAFTA negotiations began, all three trade ministers understood (with relief) that the elimination of trade barriers and investment incentives would not prompt huge segments of the automotive industry to shut

down in one North American location and move to another. Instead, they expected that plants would continue to accelerate the ongoing process of specialization and that intraindustry trade would flourish—exactly as happened in the wake of the 1965 Auto Pact. Our analysis shows that these expectations have been borne out.

Besides being an important sector in its own right, the auto industry provides a substantial market for other industries, particularly those processing raw materials (such as textiles, rubber, steel, and aluminum). Accordingly, the performance of the auto industry has a direct and substantial impact on the entire economy—and on trade policy.

Policy in the Auto Sector

Policy integration of the North American auto industry followed the production and distribution initiatives of the Big Three. The policy process began with the 1965 Auto Pact, expanded through the Mexican Automotive Decree of 1977,¹ and culminated in the extension of the North American auto regime to Mexico in 1994, when NAFTA entered into force. Big Three investment in the Mexican automotive sector long preceded NAFTA negotiations, and a de facto hexagonal trade regime in vehicles and auto parts already existed between Mexico, the United States, and Canada. NAFTA institutionalized the existing degree of integration and created a more stable and competitive environment for auto production and trade. The more integrated North American market also attracted new investment from European and Japanese automakers. Today, Volkswagen produces the new Beetle in Mexico for the world market and is investing \$100 million to begin producing the Golf there in 2005; Nissan produces the Sentra in Mexico to supply the Western Hemisphere. Toyota invested \$140 million to open its first Mexican assembly plant in Tijuana in 2004. The plant, located near its pickup bed factory, will produce the Tacoma pickup truck.²

1. The 1977 Automotive Decree made participation by foreign firms in the domestic Mexican market contingent upon exports. Contrary to economic doctrine, the decree's trade-balancing requirements and ownership limitations accelerated Mexican auto industry rationalization. See Moran (1998) and Samuels (1990).

2. Rather than representing a zero-sum game, integration of the auto sector under NAFTA could spawn more investment in US auto plants. As an example, when its Tijuana plant expanded, Toyota overhauled its Long Beach plant by investing several hundred million dollars. This represented the first vehicle production investment in southern California since 1992. By 2003, Toyota added about 12,000 workers to its US employment base. Based on extensive written comments provided by Theodore Moran, February 2005. See also "Toyota Plans to Move Production of Parts of Pickup to Mexico," *Wall Street Journal*, January 4, 2002, A8; and John O'Dell, "Toyota to Add Assembly Site in Southland," *Los Angeles Times*, June 7, 2002.

The 1965 Auto Pact

The 1965 agreement linked the auto industries of Canada and the United States by ending Canadian policies aimed at self-sufficiency in automobiles and major components.³ The higher level of integration and better access to the world's largest auto market allowed Canada to develop an internationally competitive auto industry. The Auto Pact created a tariff-free region for automotive trade; at the same time, it provided a degree of "safe-harbor" protection to ensure that the major firms continued their investment and production in Canada. The Auto Pact allowed the Big Three to rationalize production between Canada and the United States and form a single integrated production and marketing system. The ensuing rationalization enabled some parts and assembly firms to choose a unique production location to supply the regional market. As a consequence, each country specialized to a greater degree in particular automotive lines (e.g., trucks or large cars) and components (e.g., engines or transmissions).

In the margins of the Auto Pact, Canada imposed safeguards to ensure that Canadian production corresponded to a high percentage of Canadian consumption of vehicles and parts.⁴ Under the Auto Pact, Canadian vehicles and parts entered the United States duty-free, based both on the place of origin (Canada) and the extent of regional content (at least 50 percent North American, meaning Canadian or US components). However, US and other vehicles and parts entered Canada duty-free from any country, based on the fulfillment by the importing manufacturer of the Auto Pact performance criteria (volume of Canadian production and Canadian value added requirement), not on the place of origin.

The Canada-US Free Trade Agreement

As a result of the Auto Pact, the US and Canadian automotive sectors were already largely integrated by the 1980s. The primary changes in CUSFTA for the automotive sector pertained to imports from outside North America. Under the Auto Pact, Canadian firms could import automobiles or parts from Europe or Japan and then sell them in the US market without

3. According to Paul Wonnacott (1965), the Canadian government ran a narrowly focused trade-balancing policy in parts under the pre-1965 auto regime. The idea was to encourage the manufacture of engines and transmissions in Canada, but allow the importation of other parts. We thank Paul Wonnacott and others for providing written comments to an earlier draft of this chapter.

4. The US government acquiesced to Canadian value added requirements because they were viewed as transitional arrangements. As a continuing source of bilateral trade friction, Canadian value added requirements almost led to the repudiation of the Auto Pact in August 1971.

paying duties at any step along the way, provided that the European and Japanese exporters maintained a certain production-to-sales ratio and a value added threshold through their Canadian manufacturing subsidiaries. Japanese auto firms, apart from Honda, never chose to meet these requirements, but Volvo and European subsidiaries of the Big Three did.

CUSFTA terminated duty-free entry based on a production-to-sales ratio test but “grandfathered” firms that already enjoyed duty-free preferences in the auto sector (allowing them to continue doing so). Also, before CUSFTA, Canada offered foreign firms reduced tariffs if they met certain value added thresholds for production in Canada. The United States regarded these tariff waivers as a disguised subsidy, and CUSFTA phased them out.⁵ Finally, CUSFTA set a stronger origin threshold for “North American” production: Fifty percent of the cost of manufacturing must occur in Canada or the United States in order for the final product to qualify for duty-free treatment. CUSFTA effectively set the standard for future FTA content requirements, unlike the Canadian value added tests under the post-1965 agreement.⁶

Mexico

The Big Three started investing in Mexico in the 1930s. In the 1960s, Nissan and Volkswagen joined them as Mexican producers. During the 1960s and 1970s (the era of import substitution), Mexico decided that its domestic motor industry should supply essentially the entire domestic market. In 1962 the Mexican government prohibited imports of finished vehicles and imposed high local-content requirements on the foreign companies producing cars in Mexico (Ford, GM, Chrysler, Nissan, and Volkswagen). The Mexican Automotive Decree of 1977 made continued participation by foreign firms contingent on exports—essentially a trade-balancing requirement. By 1980, the Mexican policy package had created a 500,000-unit motor vehicle industry producing vehicles with 50 percent local content, plus substantial exports of parts and components (to meet

5. Japanese and European automobile producers ultimately won a WTO case, claiming that the Canadian practice of giving US auto firms duty-free entry if they meet the Canadian production and value added tests, while phasing out the tariff waivers for third-country producers, was discriminatory (Canada—Certain Measures Affecting the Automotive Industry, WT/DS139 [brought by Japan], and WT/DS142 [brought by the European Commission]). In response, Canada abandoned the production and value added tests, effectively “ending” the Auto Pact for good. Canada now imposes a 6.1 percent tariff on all non-NAFTA automobile imports. However, imports from Mexico and the United States, which constituted 82 percent of Canadian automotive imports in 2002, enter duty-free under NAFTA.

6. We thank Paul Wonnacott for emphasizing this point to us.

the trade-balancing requirements). But the industry as a whole was uncompetitive when benchmarked against international standards.⁷

When Mexico joined the General Agreement on Tariffs and Trade (GATT) in 1986, its schedule of tariff liberalization conspicuously excluded autos. However, the Mexican government soon recognized that its protective auto regime, while eminently successful in jump-starting domestic production, had fostered a high-cost and uncompetitive industry. The Mexican Automotive Decree of 1989 substantially liberalized Mexican rules on the auto industry, even though the national value added requirement and native ownership requirement remained huge impediments to industry rationalization.⁸

NAFTA

NAFTA had only an indirect impact on Canada-US automotive-sector integration, because each country already enjoyed relatively unfettered access to the other's market.⁹ The difficult negotiating issues for the automotive sector all pertained to Mexico.

First, the rule-of-origin threshold was raised in two phases to 56 percent in 1998 and ultimately to 62.5 percent in 2002 for most automotive products, a substantial increase from the 50 percent threshold in CUSFTA. The threshold was raised to prevent foreign automotive producers (especially Japanese producers) from using Mexico as an export platform to sell into the United States. Canada resisted pushing the rule of origin threshold too high because it did not want to disrupt existing production chains, which rely to some extent on non-North American components.

The second order of business for the five established auto firms was to gain better access to the Mexican market. Although Mexico had taken steps to liberalize its automotive sector since joining GATT in 1986, full liberalization of the Mexican auto industry culminated with NAFTA. The agreement ultimately dismantled the protectionist auto regime but al-

7. See Womack, Jones, and Roos (1991, 264). Even in this period, some Mexican plants (e.g., Ford in Hermosillo) manufactured good-quality autos at competitive costs for export to the US market.

8. Moran (1998) contends that unlike the ownership and value added requirements in the Mexican policy package, the trade-balancing requirements fostered rationalization and lower costs. Requirements under the Mexican Automotive Decree of 1989, however, remained onerous enough that very few vehicles were imported into Mexico. We thank G. Mustafa Mohatarem for extensive written comments on the Mexican auto regime and other issues.

9. Under the surface, however, US-Canadian tensions were mounting over secret deals between Canada and Big Three firms involving production incentives. These issues were quietly resolved in the context of NAFTA talks.

lowed a long phaseout period. National-content requirements were transformed into regional-content requirements, and a ten-year phaseout period (starting in 1995) was scheduled for the Mexican Automotive Decree of 1989. These measures gave the Mexican auto industry breathing room to meet import competition; meanwhile NAFTA ensured immediate and unfettered access of Mexican automotive products to the US and Canadian markets.

Mexican tariffs on cars and light trucks imported from the United States and Canada were lowered from 20 to 10 percent in 1994. Duties were phased out for light trucks in 1998 and for cars in 2003. Duties on parts were fully phased out in 2003 (75 percent of US parts exports have entered the Mexican market duty-free since 1998). However, Mexico maintained its most favored nation (MFN) tariffs on autos and parts imported from non-NAFTA sources. As Mexico has extended its network of bilateral trade agreements, however, these tariffs have been reduced or eliminated.¹⁰

NAFTA also required the gradual phaseout of nontariff auto trade barriers. In 1994, Mexico lowered the trade-balancing requirement from \$1.75 of exports for every dollar of imports to \$0.80 of exports per dollar imported. The requirement was phased down to \$0.55 in 2003 and then eliminated in 2004. The national value added requirement dropped from 36 percent in 1994 to 29 percent in 2003 and was eliminated at the start of 2004. The national-content requirement was lowered from 30 to 20 percent both for the auto parts industry and "national suppliers" (maquiladoras qualify as national suppliers if they are not owned by the assembler they supply). Finally, import quotas were eliminated for heavy trucks and buses in 1998, and the surviving import ban on used cars will be eliminated by 2009.

Before the 1990s, the Mexican auto parts industry was relatively modest and highly protected from international competition.¹¹ Mexican firms feared NAFTA would mean the end of the domestic parts industry, and in fact many small companies did suffer from intense competition.

Despite these pressures, however, Mexico's auto parts industry as a whole is in good health and competitive internationally. NAFTA allowed

10. For example, the EU-Mexico trade pact contains special provisions for the automotive sector. Mexico agreed to eliminate its Automotive Decree by 2004, and improve access for EU vehicles. Mexican tariffs on vehicles were reduced from 20 to 3.3 percent when the pact entered into force in July 2001 and eliminated in 2003. Favorable access is also accorded to European car parts and components. A transitional relaxation of EU rules of origin will allow Mexican industry to comply with European content standards. See the "Communication from the Commission to the Council and the European Parliament, accompanying the final text of the draft decisions by the EC-Mexico Joint Council," http://europa.eu.int/comm/external_relations/news/2000/01_00/doc_00_2.htm (accessed on April 29, 2005).

11. According to Nunez (1990), by 1984, the Mexican automotive parts industry included 310 firms, 40 with sales over \$10 million and 50,500 employees.

a long and generous transition period for Mexican parts suppliers—permitting Mexican firms to retain some protection from imports, both by phasing out the national-content requirement over 10 years and by maintaining the 49 percent maximum foreign investment share in national-supplier firms for five years (until 1999).

In fact, the Mexican parts industry adapted faster to competition than negotiators expected. Mexican producers established strategic alliances with foreign companies. Instead of replacing local suppliers, foreign suppliers teamed with Mexican auto parts manufacturers; the former provide the technical and design know-how, and the latter provide the plant and workforce. Links with foreign companies have given Mexican producers the technology to sell competitively in North America and have made Mexico a more attractive location for assembly plant investment from Europe and Japan.

Mexican trade diplomats are trying to enlarge the scope of automotive export destinations to take advantage of markets outside North America (in 2003, 93 percent of Mexican auto exports were destined for the United States and Canada; calculated using data in appendix table 6A.1). The slew of trade agreements that Mexico has negotiated with other partners has become a central feature of the nation's trade strategy.

In fact, Mexico has constructed a large network of FTAs with countries in Europe, East Asia, and Latin America as part of an aggressive strategy to become a global trade and investment hub. As of May 2005, Mexico has entered into FTAs with the European Union, Israel, Japan, Chile, Costa Rica, Colombia, Venezuela, Bolivia, Uruguay, Nicaragua, Guatemala, Honduras, El Salvador, and the European Free Trade Association (EFTA) countries, in addition to NAFTA. FTA talks are ongoing with the four South American nations of the Southern Cone Common Market (Mercosur). On the regional level, Mexico is one of the 34 countries negotiating the Free Trade Area of the Americas (FTAA). These trade agreements encourage new investment in Mexico, in the auto industry and elsewhere, to serve the North American market and to open opportunities in the Western Hemisphere, Europe, and Asia.

As a precursor to free trade with Mercosur, Mexico and Brazil signed a bilateral auto pact in July 2002 to export 140,000 automobiles to each other's markets at a duty of 1.1 percent. Before the agreement, Brazil and Mexico could trade only 50,000 units annually at a duty of 8 percent, while additional exports faced a 35 percent tariff in Brazil and a 23 percent tariff in Mexico.¹² The tariffs and the quota of 140,000 autos will be progressively liberalized and eliminated in 2005.

12. Nevertheless, in 2003, over 95 percent of Mexican auto and parts exports were still destined for the United States and Canada.

North American Auto Trends

What has happened to the auto industry since NAFTA went into effect, and what, if anything, has NAFTA done to change the North American auto industry? In this section, we look at data on production, sales, employment, wages, investment, and trade to discover the answers. Overall, the effect of NAFTA appears to be very positive, particularly for the Big Three and for Mexico.

Production and Sales

Table 6.1 shows production and sales figures for the auto industry in Canada, Mexico, and the United States between 1993 and 2003. Auto production in the United States has remained rather flat since NAFTA went into effect, averaging 12.1 million units per year over this period, with a peak level of 13.1 million units in 1999. Canada's auto production also peaked in 1999 at 3.1 million units, which was 35 percent above the 1993 level. While auto production in the United States and Canada trailed off during the recession of 2001, Mexico's auto production was slower to decline but had fallen to 1.6 million units in 2003. Within Mexico, roughly 60 percent of the units were produced by the Big Three in 2003; Nissan and Volkswagen accounted for about 15 percent each (Ward's Communications 2004).¹³

Although the United States exports automobiles to most parts of the world, the US appetite for imported cars is particularly strong, and automobile sales in the United States run well ahead of production (table 6.1). In 2003, the number of automobile units sold in the United States was 17 million, down from the 2000 peak of 17.8 million but well above the 1993 figure of 14.2 million. Domestic auto sales exceeded US production by 45 percent. By contrast, domestic production exceeded sales by 1 million units in Canada and 600,000 units in Mexico. Nonetheless, domestic purchases of autos have grown sharply in all three countries under NAFTA. Sales in Mexico plummeted during the peso crisis but reached 1 million units in 2002 and 2003 (some 5 percent of NAFTA sales compared with 3.8 percent in 1995).

13. Two new foreign-owned assembly plants are scheduled to open in Mexico in 2005 (Toyota and Volkswagen), compared with only one new assembly plant built in Canada since 1990. As a result of weak demand, operations like Ford's Oakville assembly plant sharply reduced the number of shifts. See "Ford to Build a New Plant in Oakville," *CBC News*, October 29, 2004; and Steve Arnold, "Weak Sales Are Idling Auto Plants," *The Hamilton Spectator*, November 16, 2004. In an effort to maintain its footing in the auto industry, in March 2005, the Canadian government provided \$435 million to attract a \$2.5 billion GM upgrade in Ontario. See "GM to Boost Production Plant in Canada," *Wall Street Journal*, March 3, 2005.

Table 6.1 Auto production and sales in North America, 1993–2003

Year	United States		Canada		Mexico		NAFTA
	Millions of units	Percent of NAFTA	Millions of units	Percent of NAFTA	Millions of units	Percent of NAFTA	Millions of units
Production							
1993	10.9	76.5	2.3	15.9	1.1	7.6	14.2
1994	12.3	78.1	2.3	14.8	1.1	7.2	15.7
1995	12.0	78.2	2.4	15.7	0.9	6.1	15.4
1996	11.9	76.6	2.4	15.5	1.2	7.9	15.5
1997	12.2	75.6	2.6	16.0	1.4	8.4	16.1
1998	12.0	74.9	2.6	16.0	1.5	9.1	16.1
1999	13.1	74.0	3.1	17.3	1.5	8.7	17.6
2000	12.8	72.4	3.0	16.7	1.9	10.9	17.7
2001	11.5	72.3	2.5	16.0	1.9	11.7	15.8
2002	12.3	73.5	2.6	15.7	1.8	10.8	16.7
2003	12.1	74.6	2.6	15.7	1.6	9.7	16.2
Sales							
1993	14.2	88.8	1.2	7.5	0.6	3.8	16.0
1994	15.4	89.1	1.3	7.3	0.6	3.6	17.3
1995	15.1	91.8	1.2	7.1	0.2	1.1	16.5
1996	15.5	90.9	1.2	7.1	0.3	2.0	17.0
1997	15.5	88.9	1.4	8.2	0.5	2.9	17.4
1998	16.0	88.4	1.4	7.9	0.7	3.7	18.1
1999	17.4	88.6	1.5	7.8	0.7	3.6	19.7
2000	17.8	87.7	1.6	7.8	0.9	4.5	20.3
2001	17.4	87.3	1.6	8.0	0.9	4.7	20.0
2002	17.1	86.2	1.7	8.7	1.0	5.1	19.9
2003	17.0	86.6	1.6	8.3	1.0	5.1	19.6

Source: Ward's Communications (2004).

Viewed from the US perspective, mercantilist thinkers would be alarmed. But since NAFTA entered into force, we have not heard the same hue and cry from the Big Three or the United Auto Workers (UAW) about imports that was common in the 1980s and early 1990s—a time when automobile imports from Japan were characterized as a scourge.¹⁴ The Big

14. There is concern, however, that NAFTA facilitated increasing production by foreign-owned companies (transplants) in the United States. (Nissan, Volkswagen, and other foreign companies are major investors in Mexico and the southern United States.) While Big Three production declined significantly under NAFTA, total US production, including transplants, experienced a much smaller overall decline. Transplants, rather than imports, now account for a larger portion of market share lost by the Big Three. Based on extensive written comments provided by G. Mustafa Mohatarem in March 2005. A more likely cause for the rise in transplants (a trend that began in the 1980s) is voluntary export restraints imposed by Japan to calm trade frictions with the United States, which inter alia encouraged Japanese firms to produce in the United States (Cooney and Yacobucci 2005, 56). Nonetheless job loss

Table 6.2 Self-sufficiency index, North America, 1997–2003
(billions of dollars)

Year	Domestic shipments		Imports		Exports		Self-sufficiency index (percent)	
	Autos	All manu- facturing	Autos	All manu- facturing	Autos	All manu- facturing	Autos	All manu- facturing
1997	504.3	4,269.3	159.6	975.6	121.1	798.2	92.9	96.0
1998	525.1	4,328.4	169.4	1,055.2	122.5	818.1	91.8	94.8
1999	601.1	4,505.2	201.0	1,175.0	137.9	868.6	90.5	93.6
2000	581.8	4,734.7	224.4	1,362.9	145.9	983.9	88.1	92.6
2001	527.0	4,464.9	215.7	1,281.5	137.3	917.5	87.1	92.5
2002	682.1	4,396.9	231.6	1,288.9	142.3	883.6	88.4	91.6
2003			237.7	1,356.7	144.9	907.7		

Notes: Imports and exports include intra-NAFTA trade, which is cancelled out in the self-sufficiency index calculation. Auto trade is defined as SITC 78 (road vehicles). Manufacturing trade is defined as SITC 5-8. Shipments data are an aggregation of national statistics. Auto shipments data are defined as NAICS 3361, 3362, and 3363 for Canada and the United States and as Mexican Class 3841 for Mexico. NAICS data for the United States are available starting in 1997.

Sources: UN Comtrade Database, 2004; US Census Bureau (2003, 2005); INEGI (2005); and Statistics Canada (2005).

Three have substantial production capacity in Canada and Mexico. Consequently, Canadian and Mexican “export platforms” for sales to the US market do not harm the Big Three; indeed, they actually improve operating margins by reducing production costs. That of course does not put an end to labor concerns, but it is a side benefit of NAFTA.¹⁵

To examine the extent to which the North American region supplies its own market, we constructed a NAFTA self-sufficiency index (table 6.2). This index is the ratio of North American production to consumption, where consumption is calculated as the total value produced within NAFTA plus imports from third countries and minus exports to third countries. In 1997, the self-sufficiency index in the auto industry was 93 percent (meaning that the North American auto industry supplied 93 percent of North American auto consumption).¹⁶ By 2002 the index had fallen to 88 percent. Throughout this period, North America has been less self-sufficient in autos than in manufacturing as a whole. Depending on one’s

concerns persist. Representative Marcy Kaptur’s (D-OH) claims that the Big Three auto-producing states (Ohio, Michigan, and Indiana) lost over 115,621 jobs under NAFTA. See “An Open Letter to President George W. Bush and Mexican President Vicente Fox,” September 6, 2001, www.uaw.org/atissue/01/090601kaptur.html (accessed March 2005).

15. As an example, in 2002, Canadian Auto Workers (CAW) plant workers won pay increases of 9 percent over three years and an average hourly wage of C\$22.40. But there is growing concern that big companies are unable to meet pension obligations for assembly workers. See Greg Keenan, “CAW Renews Drive to Unionize Toyota,” *Globe and Mail*, July 13, 2004.

16. The detailed NAICS data, which underlie this index, go back only to 1997.

point of view, the trend indicates that North America's ability to meet its own automotive needs is regrettably decreasing or that its level of integration with the rest of the world is happily increasing.

Employment and Wages

Although Big Three managers may not be concerned when production shifts from the United States to Mexico, autoworkers in the United States are far from indifferent. Contrary to the contemporary fear when NAFTA was ratified, however, NAFTA has not harmed US autoworkers to the extent imagined. Their fortunes are primarily tied to the business cycle and to a lesser extent to the dollar exchange rate versus the yen and the euro. Meanwhile, working conditions have improved for autoworkers in Canada since the 1965 Auto Pact and for their counterparts in Mexico since NAFTA went into effect in 1994.

Table 6.3 shows total employment in the auto assembly and auto parts sectors, as well as manufacturing as a whole, between 1994 and 2004 for Canada, Mexico, and the United States. Not surprisingly, fluctuations in employment correspond to changes in production. In all three countries, total auto employment trends followed the business cycle, rising through the 1990s, and receding in the economic slowdown of 2001–02. In the auto industry, as well as the entire manufacturing sector, employment in the United States and Mexico is substantially below levels in the late 1990s. Canada experienced a decline in autoworkers as well, although less severe. In fact, Canada is the only NAFTA country where auto and manufacturing employment are greater today than when NAFTA entered into effect.

Since table 6.3 does not reveal a pronounced migration of US auto jobs to Mexico, we investigate the question further. Using quarterly data from the first quarter of 1994 to the third quarter of 2003, we estimated a regression model to explain the level of US auto employment. The three independent variables are US real GDP (to capture the business cycle and real income growth), time (as a proxy for productivity gains), and Mexican auto employment. We expect US auto employment to be positively correlated with real GDP and negatively correlated with time. To the extent that Mexican auto production substitutes for US production, we also expect US auto employment to be negatively correlated with Mexican auto employment.

The model gives a reasonably good fit, with an R-squared coefficient of 0.56.¹⁷ The model coefficients, taken together, predict a loss of 74,000 US auto jobs between 1994 and 2003, while the actual loss was 43,000. However, the model is most interesting when we consider each independent

17. The R-squared statistic, which ranges from 0 to 1, indicates the regression model's goodness of fit.

Table 6.3 Employment in the auto sector and manufacturing industry, 1994–2004

Year	Assembly ^a	Bodies ^b	Parts ^c	Total auto	Manufacturing
Canada					
1994	56,200	—	72,542	128,742	1,716,245
1995	56,050	—	77,130	133,180	1,748,443
1996	57,508	—	80,210	137,718	1,788,952
1997	54,524	—	81,127	135,651	1,855,391
1998	57,687	—	87,281	144,968	1,916,170
1999	56,913	—	93,175	150,088	1,955,914
2000	55,712	—	98,154	153,866	2,253,900
2001	51,435	—	95,060	146,495	2,229,500
2002	50,985	—	98,114	149,099	2,291,000
2003	48,735	—	103,413	152,148	2,283,400
2004	47,897	—	101,254	149,151	2,297,000
Mexico					
1994	46,838	—	75,225	122,063	1,409,238
1995	38,926	—	64,616	103,542	1,298,665
1996	40,777	—	69,782	110,559	1,332,931
1997	43,987	—	79,752	123,739	1,409,849
1998	49,047	—	89,664	138,711	1,459,307
1999	52,168	—	90,008	142,176	1,475,223
2000	53,950	—	94,539	148,489	1,495,822
2001	51,628	—	86,285	137,913	1,432,840
2002 ^d	47,262	—	80,497	127,759	1,360,866
2003 ^d	41,101	—	74,345	115,446	1,290,526
2004 ^d	38,569	—	74,316	112,885	1,260,103
United States					
1994	281,500	151,400	735,600	1,168,500	17,021,000
1995	294,700	159,900	786,900	1,241,500	17,241,000
1996	285,300	155,100	799,900	1,240,300	17,237,000
1997	286,800	158,200	808,900	1,253,900	17,419,000
1998	283,600	169,700	818,200	1,271,500	17,560,000
1999	291,300	184,200	837,100	1,312,600	17,322,000
2000	291,400	182,700	839,500	1,313,600	17,263,000
2001	278,700	159,400	774,700	1,212,800	16,441,000
2002	265,400	152,200	733,600	1,151,200	15,259,000
2003	264,600	153,000	707,800	1,125,400	14,510,000
2004	256,100	164,500	688,500	1,109,100	14,329,000

a. For United States and Canada: NAICS 3361. For Mexico: 205 Clases de Actividad Económica 384110.

b. For United States: NAICS 3363. Canada and Mexico do not provide separate employment statistics for bodies; instead, employment in auto bodies is included in other automotive categories.

c. For United States and Canada: NAICS 3362. For Mexico: 205 Clases de Actividad Económica 384121, 384122, 384123, 384124, 384125, and 384126.

d. Preliminary estimates.

Sources: Statistics Canada, 2005, www.statcan.ca; INEGI (2005); BLS (2005).

Table 6.4 Compensation cost per hour for autoworkers, 1993–2002 (US dollars per hour)

Year	United States	Canada ^a	Mexico
1993	25.52	20.83	3.98
1994	26.64	20.65	4.09
1995	26.55	20.81	2.56
1996	27.23	21.02	2.51
1997	28.00	20.86	2.93
1998	26.44	20.50	3.02
1999	26.73	19.97	3.45
2000	27.99	21.14	4.18
2001	29.84	20.83	5.04
2002 ^b	31.67	21.12	5.12

a. Canadian data for 2000–02 are estimated using the Canadian compensation cost for all manufacturers.

b. Revised BLS methodology contributed to the increase in US compensation rate in 2002.

Note: Industry defined as SIC 371 in all three countries.

Source: BLS (2004).

variable separately. While the coefficients for GDP and time are highly significant and show the expected signs, the coefficient for Mexican employment is not significant, though it does show the expected sign. The magnitudes of the two significant coefficients (GDP and time) are surprisingly large. The time coefficient suggests that technology is removing jobs from the US auto industry at a rate of 117,000 per year. Taking this coefficient by itself (and with a tablespoon of salt), the process of innovation appears to have removed 1.1 million jobs from the industry between 1994 and 2003! Fortunately demand has grown, and the model calculates that 371 auto jobs are created for every billion dollars of additional real GDP (measured in 2000 US dollars). With GDP growth of \$2.8 trillion over the period, the coefficient suggests that demand growth created more than 1 million jobs.

The estimated effect of Mexican employment, which is not statistically significant, is to remove 896 auto jobs from the United States for every 1,000 Mexican auto jobs created. Since Mexican auto employment fell by 9,600 jobs over the period, the supposed impact was to *create* about 8,600 US auto jobs. This effect is negligible. The much larger technology and demand effects easily overwhelm any influence of Mexican employment, positive or negative. This analysis suggests that so far as auto jobs are concerned, the fear of southward migration is vastly overstated in popular discussion.

Hourly compensation figures (inclusive of fringe benefits) in table 6.4 tell a less cheerful story from the standpoint of US autoworkers. The earnings figures are expressed in current US dollars and are compiled by the Bureau of Labor Statistics for the purpose of comparison across national boundaries. Although autoworkers in the United States took home more dollars in 2002 (the latest year available) than in 1993, the earnings gain of

24 percent only matched cumulative inflation of 24 percent over the same period. In other words, the real purchasing power of auto wages remained the same. For most US workers, by contrast, the 1990s was a decade when real wages increased. Autoworkers did not do as well, but the auto premium is still large: In 2002 the average autoworker's hourly compensation was \$10.34 per hour above the average blue-collar manufacturing worker.

In nominal dollar terms, wages in the Mexican auto industry regained their 1993 level only in 2000, after falling precipitously in 1995. A hasty interpretation would say that nothing improved in the first years of NAFTA. But wages throughout Mexico were unsustainably high in 1993 given the overvalued peso and perilous condition of the Mexican financial system just before the financial crisis of 1994–95. Between January 1990 and January 1994, the peso increased in real value by 35 percent (taking into account both inflation and exchange rates), causing Mexican workers to be paid that much more in dollar terms. The fundamentals of the Mexican economy simply did not support this real appreciation of the peso. The postcrisis path of earnings in the Mexican auto industry is consistent with the general increase in earnings in the Mexican manufacturing sector as a whole. Once the peso crisis settled down, real wages in the automotive sector and the manufacturing sector as a whole managed to increase (see chapter 2).

Mexicans who work in auto assembly earned roughly 30 percent more than the average manufacturing worker in 2002.¹⁸ This differential was the same in 1994 when NAFTA went into effect. The earnings premium in Mexico reflects the fact that auto firms need to attract workers with higher-than-average skills and good work habits. The union influence is decidedly less in Mexico, compared with the United States or Canada.

It is clear from table 6.4 that Mexican autoworkers earn only a fraction of US pay levels. After the peso crisis, the compensation cost for a Mexican autoworker was less than 10 percent that of a US autoworker. Since then, Mexican compensation has steadily risen, to 16 percent of US compensation in 2002.

Although US union leaders argue that Mexico is putting downward pressure on the earnings of US autoworkers (and this may be partly true), another explanation is that the wage premium paid to unionized autoworkers—the amount they earn in excess of the average for manufacturing workers—was compressed in the early 1990s largely as a result of US nonunion auto plants.¹⁹

18. This percentage is calculated using total remuneration and employment data from INEGI (2005).

19. In recent years, the number of auto plants has significantly grown in southern US states, an area traditionally less receptive to unions than the industrial midwest. The UAW has struggled to organize these plants, without significant success ("Rural Alabama auto plant turns UAW battleground," *Detroit News*, October 27, 2003).

To test the hypothesis that international trade with low-wage countries puts downward pressure on US wage premiums, we attempted to find a correlation between the changes in trade balance for an industry and the changes in compensation premiums between 1992 and 2001. If the hypothesis is correct, compensation premiums in an industry should rise (fall) relative to other industries when the industry trade balance improves (worsens).

To start, we examine trends in the trade balance and compensation premiums in the manufacturing sector. First, we consider US industry-level trade balances with Mexico and with all low-wage countries.²⁰ Industry trade balances are expressed as a percentage of total domestic shipments (the value is negative in the case of a trade deficit). To control for year-on-year variation, we use three-year averages to gauge the shift in trade balances from 1992–94 to 1999–2001. A positive change represents a shift toward exports, while a negative change shows a shift toward imports.²¹ Table 6.5a presents trade balance data for ten industries at the SITC two-digit level. Scaled by industry size, the auto industry is a heavy importer, both from Mexico and from all low-wage countries (the majority of the industry's trade deficit with low-wage countries is attributable to Mexico). Over the past ten years, the US auto industry has turned from a net exporter to a net importer with respect to low-wage countries.

Turning to compensation, we calculate the compensation premium of an industry in two ways: (1) as the dollar difference between the hourly compensation of an industry's production workers and the hourly compensation of all civilian employees and (2) relative to all blue-collar workers in manufacturing industries. (If the average industry worker is compensated below the reference rate, then the compensation premium is negative.) Table 6.5b presents data on compensation premiums for ten representative industries and compares the three-year average for 1992–94 with the three-year average for 1999–2001. A quick glance shows a wide variation in compensation premiums. Autoworkers do well, with a premium second only to iron- and steelworkers, another industry with a strong union structure. When examining the trend in premiums, however, things are less bright for the auto industry. Among the ten selected industries, autoworkers experienced the largest fall in premiums compared with all civilian employees.²² Among the ten industries, autoworkers also had the smallest gain relative to all blue-collar manufacturing workers.

20. "Low-wage countries" are defined as those nations not in the Organization for Economic Cooperation and Development (OECD) before 1992. Six countries—the Czech Republic, Hungary, South Korea, Mexico, Poland, and Slovakia—have acceded to the OECD since 1992 but are still commonly considered low-wage countries.

21. Wage data are from BLS (2004), trade data from USITC's Interactive Tariff and Trade Dataweb 2004, and US shipments data from BEA (2002).

22. When weighted by the number of employees, the pay premiums of all industries (our representative ten industries plus all others) should sum to zero.

Table 6.5a United States trade balances with Mexico and all low-wage countries

SITC code/industry	2001 trade balance (millions of dollars)		Domestic shipments, 2001 (millions of dollars)		Trade balance as percent of domestic shipments, 2001		Change in trade balance as percent of domestic shipments, 1992-94 to 1999-2001	
	Mexico	Low-wage countries	Mexico	Low-wage countries	Mexico	Low-wage countries	Mexico	Low-wage countries
	57 Plastics in primary forms	2,039	5,957	127,823	1,60	4,66	0.83	0.87
63 Cork and wood manufactures	10	-2,046	85,083	0.01	-2,40	-0.14	-0.86	
64 Paper and paper products	1,629	2,668	219,016	0.74	1,22	0.18	-0.17	
65 Textiles	1,819	-2,886	152,704	1.19	-1,89	0.90	-0.54	
67 Iron and steel	380	-3,600	83,842	0.45	-4,29	-0.34	-3.54	
74 Industrial machinery and equipment	550	3,839	348,502	0.16	1,10	-0.18	-1.11	
77 Electrical machinery and equipment	-10,874	6,075	489,361	-2.22	1,24	-1.77	1.88	
78 Road vehicles	-15,258	-21,251	495,591	-3.08	-4,29	-2.28	-4.65	
82 Furniture	-2,244	-10,047	169,187	-1.33	-5,94	-1.06	-3.34	
84 Clothing	-6,079	-52,466	173,544	-3.50	-30,23	-2.97	-8.34	

Sources: USITC Interactive Tariff and Trade Dataweb 2005; BEA (2002).

Table 6.5b Compensation premiums, United States (dollars per hour)

SITC code/SIC code/industry	Compensation cost per hour, 2001		Compensation premium, 2001		Change in premium, 1992-94 to 1999-2001	
	Relative to all civilians	Relative to blue-collar manufacturing	Relative to all civilians	Relative to blue-collar manufacturing	Relative to all civilians	Relative to blue-collar manufacturing
	57/28 Plastics in primary forms	26.69	6.46	4.54	1.15	1.15
63/24 Cork and wood manufactures	16.13	-4.10	-6.02	-0.58	-0.58	0.67
64/26 Paper and paper products	24.38	4.15	2.23	0.68	0.68	1.93
65/22 Textiles	15.20	-5.03	-6.95	-0.28	-0.28	0.96
67/331-2 Iron and steel	31.13	10.90	8.98	0.46	0.46	1.70
74/35 Industrial machinery and equipment	22.13	1.90	-0.02	0.36	0.36	1.60
77/36 Electrical machinery and equipment	20.36	0.13	-1.79	0.15	0.15	1.39
78/371 Road vehicles	29.84	9.61	7.69	-0.82	-0.82	0.43
82/25 Furniture	16.50	-3.73	-5.65	-0.11	-0.11	1.13
84/23 Clothing	12.39	-7.84	-9.76	-0.66	-0.66	0.58

Note: Compensation data compiled by SIC code were linked to SITC categories for comparison with trade data. A majority of domestic shipments for any given SITC industry are within the associated SIC category.

Sources: BLS (2004, 2005).

Table 6.5c Regression models linking compensation premiums to trade balances, 1993–2001^a

	I	II	III	IV	V	VI
Low-wage balance	0.148* (0.069)		0.132 (0.070)			
Low-wage balance, 1-year lag		-0.097 (0.075)	-0.078 (0.074)			
Mexico balance				-0.206 (0.205)		-0.214 (0.200)
Mexico balance, 1-year lag					-0.444* (0.195)	-0.447* (0.195)
SITC 57/SIC 28 Plastics in primary forms	0.094 (0.219)	0.416 (0.226)	0.210 (0.245)	0.382 (0.224)	0.496* (0.219)	0.595* (0.237)
63/24 Cork and wood manufactures	-0.130 (0.212)	0.135 (0.220)	-0.030 (0.232)	0.092 (0.215)	0.178 (0.210)	0.250 (0.220)
64/26 Paper and paper products	0.104 (0.215)	0.397 (0.224)	0.214 (0.238)	0.352 (0.218)	0.451* (0.213)	0.533* (0.226)
65/22 Textiles	-0.121 (0.214)	0.158 (0.221)	-0.019 (0.235)	0.137 (0.224)	0.264 (0.221)	0.362 (0.239)
67/331-2 Iron and steel	0.305 (0.206)	0.469* (0.207)	0.355 (0.211)	0.477* (0.212)	0.537* (0.206)	0.602* (0.214)
74/35 Industrial machinery and equipment	0.020 (0.212)	0.288 (0.220)	0.121 (0.233)	0.242 (0.214)	0.326 (0.209)	0.396 (0.219)
77/36 Electrical machinery and equipment	-0.033 (0.220)	0.313 (0.231)	0.096 (0.252)	0.191 (0.205)	0.242 (0.201)	0.267 (0.202)
78/371 Road vehicles	0.124 (0.202)	0.279 (0.212)	0.193 (0.213)	0.207 (0.204)	0.259 (0.200)	0.267 (0.200)
82/25 Furniture	0.060 (0.205)	0.193 (0.212)	0.078 (0.217)	0.156 (0.209)	0.217 (0.204)	0.263 (0.208)
84/23 Clothing (reference case)						
Constant	0.003 (0.163)	-0.292 (0.172)	-0.106 (0.193)	-0.242 (0.161)	-0.330* (0.157)	-0.405* (0.172)
R-squared	0.136	0.105	0.148	0.098	0.142	0.154

* = significant at 5 percent level

a. The dependent variable is the change from previous year of the industry premium (in dollars) over mean hourly compensation for all civilian employees. The independent variables are the change from the previous year of the industry trade balance normalized by domestic shipments, and industry-specific dummies.

Note: Standard errors are in parentheses.

Source: Authors' calculations using data from BEA (2002), BLS (2004, 2005), and USITC Interactive Tariff and Trade Dataweb 2005.

With that overview in mind, we used a simple fixed-effects regression model to detect whether a positive correlation exists between a larger trade deficit (or larger trade surplus) and a falling (or rising) compensation premium for our ten representative industries.²³ The analysis was performed using two measures of the compensation premium (civilian employees and blue-collar workers) and with and without lags in the trade balance. Data for this exercise, drawn from the experience of the ten SITC two-digit manufacturing industries mentioned above, consisted of 90 observations of year-on-year changes in compensation premiums and year-on-year changes in the US industry's trade balance, with both Mexico and all low-wage countries. In only one trial did we find a regression parameter that confirms the hypothesis of a positive link between trade balances and compensation premiums.²⁴ In table 6.5c, we present the results of the "successful" trial in the first column, along with several unsuccessful trials.²⁵

The results from the one "successful" trial suggest that a 1 percent shift toward imports supplied by low-wage countries (normalized by the value of domestic shipments) results in a 14.8-cent decline in the industry's hourly compensation premium. Between 1992 and 2001, the auto industry experienced a 5.98 percent shift toward imports. Hence the 14.8-cent parameter suggests that auto trade with low-wage countries might explain an 89-cent decline in the hourly compensation premium for autoworkers. (The actual change in premium was an increase of 26 cents.) However, the R-squared statistic for this trial is very low, only 0.14. Roughly speaking, this indicates that the model accounts for only 14 percent of the variance in the data. Even in the "successful" trial, other influences on compensation premiums appear to swamp the effect of trade balances with low-wage countries as a group. Moreover, we were unable to detect support for the hypothesis when the independent variable was confined to the US trade balance with Mexico alone.

Foreign Direct Investment

Since the NAFTA ratification debate, no one has heard a "giant sucking sound"—in the form of capital (and associated jobs) moving from the United States to Mexico. Nevertheless, both Mexico and Canada have attracted substantial amounts of US foreign direct investment (FDI) in the

23. In a fixed-effects model, a distinct dummy variable for each industry is intended to capture all the forces that affect the compensation premium in that industry, except the impact of separately identified independent variables—here a changing trade balance.

24. In order to confirm the hypothesis, the coefficient on the trade balance should be positive and statistically significant.

25. Other unsuccessful trials, measuring the industry compensation premium relative to total blue-collar manufacturing employees, are not reported.

Table 6.6 US transportation FDI outflows versus domestic plant and equipment expenditures in the motor vehicles industry, 1994–2003 (billions of dollars)

Year	World	Canada	Mexico	NAFTA total	Rest of the world	Domestic plant and equipment
1994	5.2	2.1	1.0	3.1	2.1	18.0
1995	5.9	2.6	0.7	3.3	2.6	16.0
1996	0.7	-0.6	-0.2	-0.8	1.5	17.9
1997	4.7	2.0	0.1	2.2	2.5	18.3
1998	-1.4	-2.2	1.3	-0.9	-0.5	27.5
1999	4.5	0.2	1.4	1.6	2.9	24.9
2000	7.8	4.5	1.1	5.5	2.3	29.8
2001	1.9	2.1	-1.0	1.1	0.7	24.2
2002	2.5	2.1	0.6	2.7	-0.3	23.6
2003	1.5	0.6	—	0.6	0.9	24.2 ^a
Total	33.3	13.4	5.0	18.4	14.9	224.4

— = Information suppressed to avoid disclosure of data of individual companies.
FDI = foreign direct investment

a. Estimated from total nonresidential domestic investment.

Note: FDI data are for all manufactured transportation equipment. Domestic data are total capital expenditure on structures and equipment for motor vehicles industry, defined as SIC 371 from 1994 to 1998 and NAICS 3361, 3362, 3363 from 1999 to 2001.

Sources: BEA (2005a), US Census Bureau (2004).

road vehicle sector. Since the 2001–02 economic downturn, however, FDI outflows have remained cool.

For a poor country like Mexico, whose principal development constraint was lack of capital, foreign firms may add to Mexican capital stock, contribute to “capital deepening,” and thus raise the level of output. This conceptual approach, dating from the 1960s, views foreign firms primarily as providers of capital. More recent research, starting in the 1980s, considers the provider-of-capital model an overly narrow interpretation of the contribution of FDI to host-country development. In addition, FDI plays an important role in opening the host economy to global opportunities for best practice, production processes, quality control procedures, research and development, advanced marketing techniques, and improved access to international markets.²⁶

Table 6.6 presents data on US domestic capital expenditure and FDI from 1994 to 2003. After NAFTA entered into force, US FDI flows to both the

26. This conception of FDI arises within the concept of newer growth models, associated with endogenous growth theory and dynamic comparative advantage. See Grossman and Helpman (1991) and Aghion and Howitt (1998). We thank Theodore Moran for extensive written comments on FDI and other issues, in the context of an earlier draft.

Table 6.7 Inward FDI in the automotive sector, 1999–2003 (billions of dollars)

Country/region	Mexico	United States ^a
From:		
United States	3.69	—
Canada	0.79	0.66
European Union	1.24	14.10
Japan	1.66	12.16
All others	–0.01	–0.34
Total	7.37	26.59

a. US inward FDI flows for all transportation equipment.

Sources: BEA (2005b), Secretaría de Economía (2005).

Canadian and the Mexican transportation industries accelerated rapidly, if erratically. In the wake of NAFTA, more than half of all US foreign investment in the transportation sector has been directed to NAFTA partners. In 2003, the stock of US FDI in the Canadian transportation industry, measured on a historical cost basis, reached \$17.9 billion. The stock of US FDI in the Mexican transportation industry reached \$4 billion in 2002.²⁷

While FDI is significant, the scale of US auto investment in Canada and Mexico pales in comparison with domestic spending. Between 1994 and 2003, the US transportation industry invested \$224 billion domestically, compared with \$18 billion in other NAFTA countries. In 2003, domestic fixed assets in the motor vehicles, bodies, trailers, and parts manufacturing industry on a historical-cost basis were estimated at \$88 billion. This is almost twice the \$45 billion stock of *all* US transport-sector FDI in the rest of the world (including NAFTA) in the same year.²⁸ Moreover, domestic assets are roughly four times the US transport manufacturing sector FDI stock in Mexico and Canada combined (around \$22 billion in 2002–03).

Table 6.7 presents recent FDI inflows to the United States and Mexico disaggregated by source country. The European Union and Japan contribute almost all inward FDI in the United States. Recent flows make up a significant portion of the total inward FDI position of \$64 billion on a historical-cost basis. While Mexico does not report the inward stock of FDI in its auto sector, the United States does report the historical cost of its outward transport manufacturing FDI stock in Mexico as \$4 billion (in 2002). In Mexico, over half of the incoming auto FDI comes from NAFTA sources. Not surprisingly, the bulk of non-NAFTA FDI flows come from the European Union and Japan. FDI flows from these sources are likely to

27. Data are from BEA (2005a). The Mexican position at year-end 2003 was suppressed to avoid disclosures of individual companies.

28. Figures are from BEA (2005c, Table 3.3ES) and BEA (2005a). Note that the FDI figure includes transport-sector manufacturing beyond motor vehicles.

increase, as Toyota and Volkswagen are planning to open new assembly lines in Mexico by the end of 2005. Currently, assembly plants account for 36 percent of Mexico's inward FDI in the automobile industry.

Trade

Trade is the most common indicator of economic integration. Among North American countries, trade has increased substantially since NAFTA, both for the motor vehicles and parts industry and for merchandise as a whole. But aggregate trade figures can obscure more complex trade relationships. In this section, we look at both the overall value of auto trade and intraindustry auto trade.

Overall Value

Appendix table 6A.1 summarizes the value of trade in the vehicles and parts industry and merchandise as a whole in 1993 and 2002 for Canada, Mexico, and the United States. In 1993, vehicles and parts made up 22 percent of Canadian total merchandise trade. In 2002, when the figure was 20 percent of total trade and the value had reached nearly \$100 billion, Canada's trade surplus in the auto sector was \$12 billion. Canadian auto trade is heavily concentrated in North America (91 percent of the sector total), almost all of which is with the United States. Between 1993 and 2002, Canadian vehicles and parts trade with NAFTA countries increased 60 percent, with slightly faster growth for imports (64 percent) than exports (58 percent).

The pattern of US auto trade was similar in the post-NAFTA period. Half of US auto trade was with Canada and Mexico in 1993, when auto trade with NAFTA partners totaled \$65 billion. The United States then had a \$14 billion auto trade deficit with its NAFTA partners. By 2002, all of these numbers had expanded: Auto trade with NAFTA partners nearly doubled to \$123 billion, while the US trade deficit in vehicles and parts with NAFTA partners more than doubled to \$34 billion. Mexico accounted for the fastest growth (total auto trade with Mexico grew 243 percent), but US auto trade with Canada also increased sharply, up 58 percent. By 2002, Canada accounted for \$86 billion of two-way US auto trade, while Mexico accounted for \$37 billion. The US trade deficit in the auto sector reflects not only the comparative advantage of other producers but also the strong US dollar that prevailed through 2002. Only since February 2002 has the dollar declined against other "major currencies" on a trade-weighted basis; as of March 2005, it was 28 percent below its peak (Federal Reserve Bank of St. Louis 2005).

The United States accounts for 80 percent of Mexico's total trade in automobiles. Between 1993 and 2003, Mexican auto trade with the United States increased fivefold (from a low base). The auto sector now accounts

for 13 percent of Mexico's total trade and 16 percent of its exports. Still, Mexican automotive exports to the United States are only half as large as shipments from Canada. Mexico's two-way trade with NAFTA partners in the vehicles and parts sector is only 40 percent that of Canadian trade.

At the same time, the US auto trade deficit also expanded; the deficit with NAFTA countries grew 135 percent (in nominal dollar terms) between 1993 and 2003, while the US deficit with the world as a whole grew 155 percent. Although much of the deficit increase is due to the higher volume of trade, the balance of US auto and parts trade has also shifted toward imports. In 1993, the value of US exports in autos and parts to the world was equivalent to 48 percent of its world auto and parts imports. By 2003, the ratio had declined to 36 percent. The gap with NAFTA countries is narrower, and its growth has been less steep. NAFTA auto export value amounted to 65 percent of auto import value in 1993, declining to 58 percent in 2003.

Intraindustry Trade

Is the auto industry atypical in the sense that there is far more two-way trade within the auto sector compared with other industries? To determine the answer to this question, we calculated a familiar intraindustry trade index (ITI), defined as follows:

$$ITI_{ij} = 1 - \left[\frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \right]$$

In this formula, X and M stand for exports and imports, respectively, the subscript i indexes the country or region with which the United States is trading, and the subscript j indexes the product that is being traded. If the United States were to export \$3 billion of product j to country i and not import any product j from country i —a situation that illustrates extreme specialization—then the index would equal zero. The same would be true if the United States only imported product j from country i and did not export any of product j to country i . By contrast, when US trade in a product with a country is balanced—i.e., if exports equal imports—then the ITI would equal 1.

Table 6.8 shows ITIs for road vehicles trade between the United States and several partners: Brazil, Germany, Japan, the United Kingdom, Canada, and Mexico. Between 1992 and 2004, the ITI declined for all countries except Canada. Canada's ITI remains over .75, showing that trade is largely two-way. Mexico's ITI has declined sharply from .87 to .58 but remains higher than all other partners besides Brazil, whose total trade volume is extremely small.

How does NAFTA intraindustry trade in autos compare with other broad industries? Table 6.9 presents the ITIs for the same ten manufactur-

Table 6.8 US intraindustry trade index in SITC 78 (road vehicles), selected countries

Country	1992	2004
Brazil	0.84	0.66
Germany	0.49	0.34
Japan	0.10	0.07
United Kingdom	0.77	0.42
Canada	0.78	0.79
Mexico	0.87	0.58

Source: Authors' calculations using data from USITC Interactive Tariff and Trade Dataweb 2005.

ing sectors used in our comparison of wage premiums. US-Canada ITIs have increased or remained steady in most sectors (including autos) since 1992, with three notable exceptions: furniture, clothing, and wood manufactures. By contrast, the sharp decline in auto ITI between the United States and Mexico placed it in the minority, along with furniture and textiles, while other categories remained steady or saw significant increases.²⁹

Table 6.10 presents a finer set of ITIs, in order to examine subsectors of the auto industry in North America between 1997 and 2004. Over the past decade, the auto parts ITI with Canada rose substantially, signaling an expansion of NAFTA supply lines for auto manufacturers. The overall auto ITI for Canada is larger than any of the three categories individually; this is because the United States has a trade surplus in the parts category that offsets a trade deficit in assembly.³⁰ Intraindustry activity with Mexico is primarily focused in bodies and parts, not finished vehicles. However, while the ITIs of bodies and parts have been falling since 1997, the ITI of finished vehicles has been rising. Decrease in overall auto ITI reflects both internal trends in the three subsectors and the growth of the share of US-Mexican trade in finished vehicles versus bodies and parts.³¹

To summarize: First, US intraindustry auto trade is greater with Canada than with Mexico; second, auto trade is more two-way with NAFTA part-

29. One reason for declining auto ITI between the United States and Mexico is that while non-NAFTA imports supply the Mexican domestic auto market, Mexican auto plants produce vehicles for the US market. Based on extensive written comments provided by G. Mustafa Mohatarem, March 2005.

30. The United States also maintains a surplus in the bodies category, but trade in this category is small relative to the other two.

31. In 1997, 43 percent of US-Mexico auto trade was classified in NAICS 3361 (assembly); in 2004, the share was 47 percent.

Table 6.9 US intraindustry trade index with NAFTA partners, selected industries, 1992 and 2004

SITC industry	1992	2004
Canada		
57 Plastics in primary forms	0.69	0.97
63 Cork and wood manufactures	0.52	0.22
64 Paper and paper products	0.43	0.59
65 Textiles	0.57	0.88
67 Iron and steel	0.83	0.92
74 Industrial machinery	0.56	0.75
77 Electrical machinery	0.60	0.62
78 Road vehicles	0.78	0.79
82 Furniture	0.95	0.69
84 Clothing	0.87	0.67
Mexico		
57 Plastics in primary forms	0.19	0.31
63 Cork and wood manufactures	0.67	0.98
64 Paper and paper products	0.24	0.49
65 Textiles	0.66	0.64
67 Iron and steel	0.44	0.76
74 Industrial machinery	0.67	0.94
77 Electrical machinery	0.99	0.95
78 Road vehicles	0.87	0.58
82 Furniture	0.89	0.31
84 Clothing	0.77	0.32

Source: Authors' calculations using data from USITC Interactive Tariff and Trade Dataweb 2005.

ners than with other major trading partners; and third, intraindustry trade in NAFTA is focused on bodies and parts, not finished vehicles.

Conclusion

Owing to the 1965 Auto Pact, US-Canada integration in the auto industry received a head start over other sectors. Although a latecomer to the process, Mexico started to dismantle its protectionist auto programs in the late 1980s and had begun the process of integration before NAFTA came into force. Thus, the North American auto industry has reached a more mature state of development than many of its peers. Auto trade accounts for a fifth of trade among NAFTA partners. Supply lines routinely cross national boundaries, as individual firms in the three countries pursue specializations and sell into the North American market based on their comparative advantage.³² While the Big Three were the first to benefit from

32. Trefler (2004) uses plant-level manufacturing data to show that productivity enhancements in Canada have occurred both at the industry and the plant levels. He notes that "popular press reports that US-owned multinationals have been reorganizing their Canadian plants in order to produce fewer product lines, each with a global mandate." This is

Table 6.10 US intraindustry trade index in autos by NAICS subsector, NAFTA partners

Subsector	Partner	1997	2004
3361-Assembly	Canada	0.57	0.56
	Mexico	0.28	0.36
3362-Bodies	Canada	0.71	0.73
	Mexico	0.53	0.49
3363-Parts	Canada	0.70	0.81
	Mexico	0.88	0.64
All auto ^a	Canada	0.86	0.82
	Mexico	0.62	0.51

a. Defined as the sum of NAICS 3361, 3362, and 3363.

Source: Authors' calculations using data from USITC Interactive Tariff and Trade Dataweb 2005.

NAFTA and its precursors, foreign auto producers are now investing in all three countries.

We have argued that NAFTA codified the reality of integration within the North American auto industry. The US auto companies limited the loss of market share to Japanese and European imports in the 1980s and 1990s, in part on the basis of cost and quality advantages that came from offshore sourcing of parts and components (Womack, Jones, and Roos 1991). Despite the outcry of "runaway plants" and a "giant sucking sound," the data show that outsourcing strategies of the parent firms *support* the jobs of unionized workers in the United States.

The relevant comparison is not whether aggregate employment in the US auto industry has expanded or shrunk in the last three decades, nor whether a given plant in Mexico or Canada has taken over functions formerly carried out in Michigan, but what would have happened to the parent firms, workers, and communities if the Big Three had not invested outside the United States.³³ In 2004, Ford launched a new version of its best-selling F150 truck. Ford's Essex Engine Plant in Windsor, Canada is the exclusive source of the Triton V-8 engines for the F150. Ford's partner IMMESA of Monterrey, Mexico is the maker of the M450 chassis for the F150. Ford's fortune in the global market (against challenges from Toyota, Nissan, and DaimlerChrysler) depends on the intimate relationship be-

consistent with Baldwin, Beckstead, and Caves (2002), who find that for foreign-owned plants operating in Canada, increases in exports are associated with reductions in the number of commodities produced. Thus plant rationalization may have contributed to rising productivity. Although Treffer's study focuses exclusively on Canada, there is reason to believe that rationalization, or specialization, is also occurring in Mexico.

33. We thank Theodore Moran for providing the example in this paragraph, which draws heavily on written comments he provided to an earlier draft.

tween the Ford assembly workers in Michigan, IMMSA in Mexico, and Ford's Essex plant in Canada. Despite the UAW's opposition to NAFTA, the fate of Ford workers depends on trade-and-investment relationships that are enhanced by the agreement.

Ten years after NAFTA, the development that attracts most attention is security. The growth of cross-border supply lines in the industry has promoted efficiency; however, new security concerns have put these lines at risk. The costs of the "security tax" cannot be measured simply by border delays and increased paperwork. They also include the risk of a prolonged shutdown of border trade in the aftermath of an actual terrorist attack or a highly specific threat. This risk, if perceived to be high, will certainly chill investment in Mexico and Canada. Thus far, increased border security has not adversely affected the auto industry. The industry has a strong interest in the implementation of border security measures that are predictable, efficient, and most important, effective. Moreover, big firms are able to build security into their operations. But who can accurately foretell the public reaction to a terror event within the United States whose perpetrators were found to use the Canadian or Mexican border as a point of entry? Assuming the NAFTA partners can keep themselves free of terrorism, the auto industry provides a look ahead for other North American industries. Dire forecasts as to the consequences of free trade for US workers have not been borne out in the auto industry. In terms both of compensation and overall employment, the Mexican bogeyman appears more phantasm than reality. Worker fortunes are tied more strongly to productivity developments and growth in North American demand than to the pace of industrial integration. "Capital flight" within the auto industry has scarcely slowed domestic investment within the United States. Instead, trade has allowed firms in each country to specialize in the areas of the auto industry where they are most efficient—to the benefit of all three countries. While North America is somewhat less self-sufficient in the auto sector today than a decade ago, it seems likely that in the absence of NAFTA far more auto jobs would have been lost to Asian and European competitors.

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Appendix 6A

Table 6A.1 Trade in road vehicles and parts, 1993 and 2003 (billions of dollars)

Partner/sector	Imports			Exports			Total trade			Trade balance	
	1993	2003	Percent growth	1993	2003	Percent growth	1993	2003	Percent growth	1993	2003
Canada											
With world											
All merchandise	131	240	83	145	272	88	276	512	85	13	32
Vehicles and parts	25	45	80	35	55	56	60	100	66	10	9
Auto share (percent)	19	19		24	20		22	19			
With Mexico											
All merchandise	3	9	213	1	2	150	3	10	201	-2	-7
Vehicles and parts	1	2	110	0	0	135	1	3	112	-1	-2
Auto share (percent)	41	28		15	14		36	26			
With United States											
All merchandise	88	145	65	117	233	100	205	379	85	29	88
Vehicles and parts	20	34	71	34	53	57	54	87	63	14	18
Auto share (percent)	23	24		29	23		26	23			
With NAFTA											
All merchandise	91	154	70	117	235	100	208	389	87	27	81
Vehicles and parts	21	37	74	34	53	57	55	90	64	12	16
Auto share (percent)	23	24		29	23		26	23			
With non-NAFTA											
All merchandise	41	86	111	27	37	36	68	123	81	-13	-49
Vehicles and parts	4	8	114	1	1	24	5	10	93	-3	-7
Auto share (percent)	9	10		4	4		7	8			
NAFTA's share of total trade (percent)	69	64		81	86		75	76			
NAFTA's share of auto trade (percent)	85	82		97	97		92	90			
Mexico											
With world											
All merchandise	65	171	162	52	165	219	117	337	187	-13	-6
Vehicles and parts	2	17	816	7	27	285	9	44	396	5	10
Auto share (percent)	3	10		14	16		8	13			
With United States											
All merchandise	48	106	120	43	147	242	91	253	177	-5	41
Vehicles and parts	1	10	665	6	25	330	7	35	393	4	15
Auto share (percent)	3	10		13	17		8	14			
With Canada											
All merchandise	1	4	317	2	3	81	3	7	173	1	-1
Vehicles and parts	0	1	8,850	1	1	57	1	2	182	1	0
Auto share (percent)	1	26		53	46		33	34			
With NAFTA											
All merchandise	49	110	123	44	150	237	94	260	177	-5	40
Vehicles and parts	1	11	738	7	26	296	8	37	371	5	15
Auto share (percent)	3	10		15	17		8	14			
With non-NAFTA											
All merchandise	16	61	283	7	16	110	23	77	228	-9	-46
Vehicles and parts	1	6	1,015	0	1	138	1	7	597	0	-5
Auto share (percent)	3	10		7	7		4	9			
NAFTA's share of total trade (percent)	76	64		86	91		80	77			
NAFTA's share of auto trade (percent)	72	66		93	96		89	84			

(table continues next page)

Table 6A.1 (continued)

Partner/sector	Imports			Exports			Total trade			Trade balance	
	1993	2003	Percent growth	1993	2003	Percent growth	1993	2003	Percent growth	1993	2003
United States											
With world											
All merchandise	603	1,305	116	465	724	56	1,068	2,029	90	-138	-581
Vehicles and parts	85	175	106	41	63	53	127	239	89	-44	-112
Auto share (percent)	14	13		9	9		12	12			
With Canada											
All merchandise	114	228	100	100	169	69	214	397	86	-13	-58
Vehicles and parts	33	53	57	21	35	71	54	88	62	-13	-17
Auto share (percent)	29	23		21	21		25	22			
With Mexico											
All merchandise	41	140	243	42	97	134	82	237	188	1	-42
Vehicles and parts	6	26	310	5	10	108	11	35	224	-2	-16
Auto share (percent)	15	18		11	10		13	15			
With NAFTA											
All merchandise	154	367	138	142	267	88	296	634	114	-13	-100
Vehicles and parts	40	78	97	25	45	77	65	123	89	-14	-33
Auto share (percent)	26	21		18	17		22	19			
With non-NAFTA											
All merchandise	449	938	109	323	457	41	772	1,394	81	-126	-481
Vehicles and parts	46	97	113	16	18	15	61	115	88	-30	-79
Auto share (percent)	10	10		5	4		8	8			
NAFTA's share of total trade (percent)	26	28		31	37		28	31			
NAFTA's share of auto trade (percent)	47	45		62	71		51	52			
North America											
With world											
All merchandise	800	1,716	115	661	1,161	76	1,461	2,877	97	-138	-555
Vehicles and parts	112	238	112	83	145	74	195	383	96	-29	-93
Auto share (percent)	14	14		13	12		13	13			
With NAFTA											
All merchandise	147	316	115	152	326	115	299	642	115		
Vehicles and parts	31	63	103	33	62	89	64	125	96		
Auto share (percent)	21	20		22	19		21	20			
With non-NAFTA											
All merchandise	653	1,400	115	509	835	64	1,162	2,235	92	-143	-565
Vehicles and parts	81	174	115	50	83	65	131	257	96	-31	-92
Auto share (percent)	12	12		10	10		11	12			
NAFTA's share of total trade (percent)	18	18		23	28		20	22			
NAFTA's share of auto trade (percent)	28	27		40	43		33	33			

Notes: Trade in SITC 78 (Road Vehicles) includes vehicles and parts. For world and intra-NAFTA trade, a good traded between NAFTA countries is counted twice, once as an import and once as an export. Sums may not add up due to rounding.

Source: Compiled by authors from country data from UN Comtrade database, 2005, <http://unstats.un.org/unsd/comtrade> (accessed on May 2, 2005).

