

**EFFECTS OF FREE TRADE AGREEMENTS**

**ON U.S. AUTOMOBILE PRICES**

by

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of the requirements for the degree

of

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## ABSTRACT

Trade in automobiles and automotive parts between the United States, Canada and Mexico has more than doubled since 1985. Trade agreements implemented during this time period could be a reason for the increased trade. No earlier research has been conducted for this time period to determine the price effects of the free trade agreements. This thesis explores the price effects of reallocating automobile assembly capacity outside the United States, focusing on the price effects for U.S. automobile consumers. The regression results suggest that automobiles assembled in Canada or Mexico have not become cheaper compared to U.S. only assembled automobiles after implementation of the trade agreements. However, U.S. new automobile buyers have benefitted from the free trade agreements. Prices of new automobiles in the U.S. have fallen relative to other goods. These price decreases are for all automobiles regardless of assembly origin.

## CHAPTER 1

### INTRODUCTION

Many of the trade barriers that have separated the world's automobile markets are slowly falling. The United States has signed three major multilateral trade agreements in the last ten years. In 1989, the Canada-U.S. Free Trade Agreement (FTA), and in 1994, the North American Free Trade Agreement (NAFTA), came into effect. Also the U.S. signed the Uruguay Round treaty of the General Agreement on Tariffs and Trade (GATT) in 1994. These agreements reduced and eliminated tariffs and trade barriers between Canada, Mexico, the United States, and other countries. The U.S. automobile sector is one of the main market sectors affected by the trade agreements. Since the introduction of the agreements trade in automobiles and automotive parts with Canada and Mexico has doubled (U.S. Dept. of Commerce, 1998). The automotive sector is the biggest manufacturing trade flow among the three countries.

The purpose of this thesis is to study the effects of trade agreements on the (re)allocation of automobile assembly capacity outside the United States on U.S. automobile prices. No automobiles were assembled in Mexico for the U.S. market in 1986 but, in 1998, more than 750,000 new automobiles and light trucks were imported from Mexico, an increase of more than 100 percent since the implementation of NAFTA. The same pattern applies for imports from Canada. In 1998, more than two million new automobiles and light trucks were exported to the United States. North American (Chrysler, Ford, General Motors), European and Asian automobile producers have (re)allocated assembly capacity in North America.

The primary question addressed in this thesis is whether or to what degree U.S. new automobile consumers have benefitted from (re)allocating assembly capacity in North America. This is important because the purchase of a new automobile is the second biggest purchase (after buying a house) for most Americans. Automobiles however, are purchased more frequently. To estimate the effects of (re)allocation on U.S. automobile prices this thesis uses a data set with automobile prices, country of assembly and quality variables for the time period 1985 through 1998. Ordinary Least Squares (OLS), Auto Regressive (AR(1)), Fixed effect and Random effect estimation techniques are used to estimate the price effects of assembling automobiles in Canada and Mexico.

In general, the U.S. automobile consumer has benefitted from the free trade agreements. Automobiles assembled in Canada and Mexico have not become cheaper compared to U.S.-made-only automobiles. However, the U.S. new automobile price index has increased more slowly than the Consumer Price Index (CPI) (Economic Report of the President, 1998), which indicates that automobiles have become relatively cheaper. This result accords with the theoretical analysis of the introduction of free trade agreements. Free trade agreements lower or eliminate tariffs and barriers and lower import prices. Freer trade allows a more efficient (lower cost) use of inputs (automotive parts) which will lower output prices (automobiles) on the U.S. automobile market. At the same time, the reduction of trade barriers increases competition which also can lead to lower prices.

The effect of trade policy on U.S. automobile prices has been the subject of previous research in the United States. Wharton (1983) and Feenstra (1987) studied U.S. automobile price effects of the U.S. voluntary export restraint (VER) for Japanese

automobile imports in the 1980's. Earlier research by Grilliches (1971) studied the effects of quality changes on automobile prices. This thesis distinguishes itself from previous studies by studying the Canada-U.S. free trade agreement and NAFTA effects on automobile prices. The time period 1985-1998 has not been investigated in earlier studies. Furthermore, new control variables are introduced to capture the price effects of free trade and quality changes. In addition to the production location coefficients, several different quality and brand coefficients are estimated in this thesis. The quality variables' coefficients are included in the regression results as control variables but are not the primary feature of the study of effects on U.S. automobile prices as a result of free trade agreements.

The thesis is divided in several sections. Chapter 2 presents a theoretical analysis of free trade agreements and price effects. In addition, an overview of the Canada-U.S. FTA and NAFTA impact on the automobile sector is given. Chapter 3 discusses the background on the North American automobile and automotive industry. Chapter 4 describes the different estimation techniques and the data set. Chapter 5 presents the regression results and discusses the implications of these results. Chapter 6 concludes this thesis.

## CHAPTER 2

# ECONOMIC INTEGRATION IN NORTH AMERICA

### Introduction

Regional integration in North America is not a recent issue. In the 19th and early 20th centuries, attempts were made to establish freer trade between the United States and Canada. The first agreement between the two countries was signed in 1934 and was called the Reciprocal Trade Agreement Act. The Act provided reciprocal reductions of tariffs on bilateral trade and started unwinding the protectionism of the Depression Era.

Additional steps were taken after World War II. Two important agreements were negotiated in the 1950's and 1960's, the Defense Production Sharing Agreement of 1958 and the Auto Pact of 1965. The Defense agreement opened U.S. military procurement to Canadian firms. The Auto Pact reduced tariffs on bilateral trade in the automobile and automotive sector.

By the end of the 1980's, the United States, Canada and later, Mexico revived their interest in trade liberalization in North America. After 20 months of bilateral negotiations, the Canada-U.S. FTA was signed in January 1988 and implementation began on January 1, 1989. On December 17, 1992, the United States, Canada and Mexico signed the North American Free Trade Agreement (NAFTA).

### Free Trade Area Theory

Before discussing the free trade agreements between Canada, Mexico and the United States, it is very useful to discuss the underlying economic free trade theory. With this

theory it is possible to develop hypotheses in regard to price effects on the U.S. automobile market after eliminating import and export tariffs and barriers. Free trade theory can be separated into two parts: static effects, which tend to be small, and dynamic effects, which may have a bigger impact but are harder to estimate. Competition and economies of scale effects are the main dynamic effects to be discussed.

### Static Effects

Before Viner (1950) published his custom union analysis, it was believed that the formation of a custom union was a step toward free trade and therefore tended to increase welfare. Viner showed that this was not always correct.

The term trade creation is used when a custom union creates new trade among partners in certain goods or services. For example, suppose two countries, Canada and Mexico, are self sufficient in the production of good X. Assume that neither Canada nor Mexico imported good X before the trade agreement. After forming a custom union and elimination of internal barriers, Canada starts importing good X from Mexico because Mexico is more efficient in the production of good X. The production shifts from the higher cost producer Canada to the lower cost producer Mexico. New trade is generated between Canada and Mexico. This effect is called trade creation.

When production of goods diverts old trade from one country to another it is called trade diversion. For example, suppose that before forming a custom union, Canada imports good X from Japan. Japan is the most efficient (lowest cost) producer of good X in the world. After implementation of the custom union and after removing the internal

barriers, Canada finds it cheaper to import good X from union member Mexico because the imports are now duty free. As a result of the custom union between Canada and Mexico the production of good X moves from the lower cost producer in Japan to the higher cost producer in Mexico. This effect is called trade diversion. Trade diversion decreases the efficiency of the allocation of production in the world by shifting production from the lower cost producer outside the union to the higher cost producer inside the union. Viner's analysis of trade creation and diversion may be applied to free trade areas as well (Robson, 1987). Viner showed that the formation of a custom union has elements of free trade but may also have elements of protection and can improve or worsen welfare and resource allocation.

Viner's static effects are trade diversion and trade creation. Trade creation tends to increase welfare, but trade diversion tends to decrease welfare. The net effect of trade creation and trade diversion depends on the magnitude of both effects (Viner, 1950).

Whether trade creation or trade diversion dominates is determined empirically.

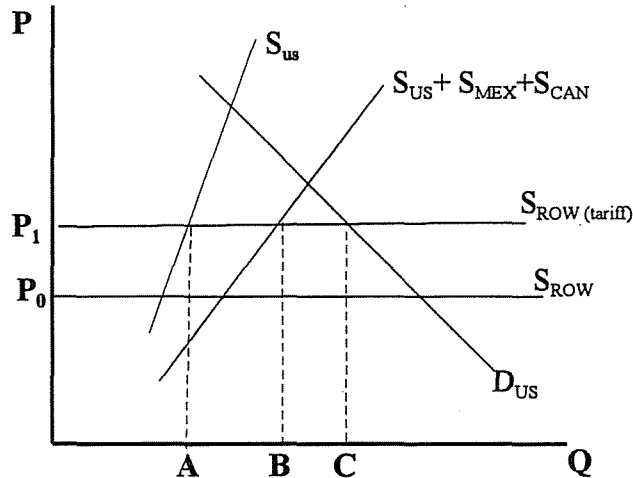
There are some general tendencies to be mentioned:

- 1) The positive welfare effect of trade creation is larger when the tariff prior to the formation of the customs union is higher.
- 2) The positive welfare effect is greater if the demand and supply schedules are less steep (inelastic).
- 3) The negative welfare effect of trade diversion is smaller if the difference between the cost of production between the partner country and the third country is smaller.
- 4) The probability of trade diversion decreases if the common external tariff is smaller.

- 5) The probability of a net increase in welfare is greater if the customs union is larger in terms of market size.
- 6) A net increase in welfare is larger if the share of third countries in the trade of the respective country is smaller.

Trade theory applied to the automobile and automotive parts market is discussed in the following section and is similar to Viner's approach. It is reasonable to assume that Rest of the World (ROW) supply of automotive parts is elastic ( $S_{ROW}$ ). The supply and demand for automotive parts on the U.S. market is represented by line  $S_{US}$  and  $D_{US}$ . In the situation where the United States imposes a tariff on automotive part imports, ROW supply (including tariff) will shift upward. In the situation with import restrictions, the United States will produce  $A$  domestically and import  $C-A$  from ROW. After implementation of a free trade agreement with Canada and Mexico, tariffs are removed for Canadian and Mexican automotive parts imports into the United States. Trade restrictions are still in place for ROW. The elimination of the tariff allows the adding up of the supply schedules of the United States, Canada and Mexico which will result in a total North American automotive parts supply of  $S_{US} + S_{MEXICO} + S_{CANADA}$ . For the U.S. automotive parts market,  $B$  automotive parts are manufactured in North America and  $C-B$  are imported from ROW. The implementation of the free trade agreements shifts supply from ROW to North America but does not necessarily imply a price decrease in automotive parts. This can be a result of the upward sloping supply schedule of North American automotive parts manufacturers. Figure 1 gives a graphical presentation.

**Figure 1:** Automotive parts import under a free trade agreement



### Dynamic Effects

The main reason why countries negotiate trade agreements are the long term dynamic effects. Empirical estimates by Chacoliades (1981) indicated that the figures for inter-specialization were between one and two percent of gross national product. Dynamic effects are greater but are harder to analyze and estimate. However, they can be split up in two main groups: competition and scale effects.

**Competition Effects** After trade liberalization, domestic businesses will face more potential competitors from other free trade area countries. At the same time, companies from countries outside the free trade area will reallocate their production to a country in the free trade area in an effort to benefit from the reduced trade barriers.

Furthermore, it can be more profitable for domestic industries to do business abroad (within the free trade area) since trade barriers are removed and the market

expands. Market structures of monopoly and oligopoly are exposed to outside pressures and may disappear. The market can become more efficient, which benefits consumers in the trade area. But the expected effect on the internal market is even larger. There is also a possible reduction in the level of domestic marginal costs as a result of cheaper input import prices, reducing marginal cost for domestic firms and reducing output prices.

**Economies of Scale** With bigger markets, industries can benefit from economies of scale.

The creation of a large market leads to more specialization, which results in lower costs because industries have a fuller utilization, and a pool of skilled employees and management is developed. Whether a country can benefit from economies of scale depends on the size of the industry. Large countries often have firms big enough to be able to benefit from economies of scale. The biggest gains from economies of scale are for two inefficient industries. After formation of the trade area, industries can benefit from the larger market and become more efficient.

Trade blocs between big countries with markets large enough to have efficient industries can also have economies of scale. After the formation of the trade bloc, it is possible for the industries to subdivide their production process better and allocate the production capacity more efficiently between the free trade area countries. Individual firms will concentrate on different steps of the production process, in different locations. This subdivision into different firms at different locations leads to a better labor and resource allocation. Different firms in the trade bloc can concentrate on different versions of one standard product and consumers benefit from the variety of products.

### **Canada- U.S. Free Trade Agreement**

In October 1987, the United States and Canada announced the successful negotiations of a bilateral free trade agreement. President Reagan and Prime Minister Mulroney signed the agreement on January 2, 1989. Later that year, the agreement was approved by the U.S. Congress and the Canadian Parliament. The world's largest Free Trade Agreement came into effect on January 1, 1989 and stretched from the Arctic Circle to the Rio Grande.

Because Canada is the largest trading partner of the United States, and the United States is the largest trading partner of Canada, FTA served to benefit both countries. About 70% of Canadian exports go to the United States. At the time of the agreement Canada had a large trade surplus. Protectionist pressures grew in the United States in the late 1980's. Many blamed the U.S. trade deficit with Canada on unfair trading practices<sup>1</sup> (Watkins, 1988). The U.S. answer to these trading practices was to impose countervailing tariffs or anti-dumping duties in specific cases.

Canada's reliance on exports to the United States was evident. The Canadian government wanted to make a deal with the United States to exempt Canada from the protectionism trend in the United States (Hughes, 1989). The FTA eliminated all tariffs on U.S.-Canada trade by 1998. However, 73% of exports were already duty free. Both countries were concerned about the reduction of the more significant non-tariff trade barriers. Areas in which non-tariff trade barriers were reduced include: government procurement, services, investment and energy. Aside from the elimination of tariff and non-tariff barriers, the FTA includes: strict rules of origin requirements applied to imports,

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<sup>1</sup> These practices included: regional development policies and special unemployment insurance.

eased border crossing procedures and dispute settlement.

The FTA expanded trade and investments, increased economic growth, lowered prices, expanded employment opportunities and improved the competitiveness of the two countries since 1989 (Hufbauer and Schott, 1993). The similarity in economies between both countries, its geographic proximity and the common language spoken made the gains from the FTA substantial for both countries.

### **Automotive Agreement**

The FTA built on the existing trade agreement between the United States and Canada, the Automotive Products Trade Agreement of 1965 (Auto Pact). The FTA did not change the basic automobile industry environment since the 1965 Auto Pact but did introduce small modifications compared to the 1965 Auto Pact. For example, more than 95% of U.S.-Canadian automotive trade was duty free under the Auto Pact (Gaines, 1989).

The Auto Pact eliminated most of the tariffs between the United States and Canada. While introducing a "rules of origin" requirement under the agreement, products and automobiles with a minimum of 50% North American content could enter the United States from Canada tariff free. Canada allowed free entry from the United States and other countries as long as the automotive trade met a number of production safeguards. The Canadian safeguards were designed to guarantee a minimum ratio of Canadian production to total Canadian sales and added value (Berry, 1992). Second, automobiles or parts produced in Canada must contain a minimum of 60% Canadian content.

Expansion of the FTA resulted in:

- ◆ Stricter North American content rule
- ◆ Canadian consumers import duty-free directly from the United States
- ◆ Elimination of Canadian automotive duty remission programs.
- ◆ Elimination of Canadian embargo on the importation of used vehicles into Canada
- ◆ Elimination of Canadian tariffs for non-Auto Pact members in Canada
- ◆ Removal of tariffs on dutiable original equipment and aftermarket parts

The stricter FTA North American content rule required that 50% of the materials and 50% of the direct manufacturing costs have to be North American. The content rule created narrower definitions for automotive products entering the United States from Canada. An automotive part producer can no longer include expenses like marketing, distribution and salary for supervisory, administrative or clerical employees in order to meet the new content rule. Essentially, manufacturers were forced to increase their purchasing and manufacturing in North America. (Canada-U.S. FTA, 1989).

The FTA also includes a list of 194 Canadian vehicle and parts manufacturers who meet the safeguards of the 1965 Auto Pact and will be able to import duty-free from third countries. In 1988, no non-North American auto manufacturer, except Volvo Canada Ltd., qualified for the Auto Pact status by meeting the safeguards. Most automobile producers have restricted their activities in Canada to distribution and sales.

Manufacturers who assemble automobiles in Canada are required to meet the 50% rule to transport automobiles across the Canada-United States border duty free. If automobile manufacturers do not meet these content rules, they are forced to pay duties on an

automobile manufactured in one of the two countries and shipped to the other.

Asian/European automobiles produced in Canada with less than 50% content will be treated as a non-North American automobiles.

Two duty-remission programs were set up to encourage foreign vehicle manufacturers to purchase parts in Canada. The first program allowed a foreign manufacturer, who sold automobiles in Canada, to purchase Canadian parts and export these parts to assembly plants around the world. For every \$1 of Canadian content in these parts, the Canadian federal government awarded these foreign producers a 70-cent credit. The credit was used to reduce the price of the producers' automobiles at the Canadian border, reducing the payable duty. The FTA prohibits the companies who qualified for these export-based duty remissions to export parts purchased in Canada to the United States. The FTA included the elimination of the program by January 1998 to give the foreign manufacturers time to adjust. The second program, the production-based duty remission scheme, applied to four companies or joint ventures. Because these companies have made substantial investments in Canada, the companies will be entitled to a \$1 reduction of custom duties for every \$1 of Canadian content in the parts they purchase. The program was in place until January 1, 1996. Aside from these specific trade rules, tariffs are phased out in ten years on non-Auto Pact eligible vehicles and original equipment automotive parts. Tariffs on aftermarket automotive parts were eliminated after five years.<sup>2</sup>

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<sup>2</sup> Canadian consumers benefitted from the FTA agreement because the Canadian government lifted the ban on the import of used automobiles from the United States. Canadians can import second hand automobiles duty free if these automobiles are eight years or older per 1989. In 1994, the FTA allowed any used automobile import from the United States into Canada.

**NAFTA**

The NAFTA agreement is complex and consists of 21 articles. These articles each describe the many topics that are covered by NAFTA. The basics of the NAFTA agreement can be found in the Canada-U.S. Free Trade Agreement. NAFTA is a newer, and more extensive version of the Canada-U.S. FTA. Intellectual property rights, export commitments and local added value are covered more extensively in NAFTA than FTA.

An overview about the NAFTA agreement is on Table 1, which gives a list of the workgroups, divided into six main groups. Special for NAFTA are the three side accords which deal with environmental coordination, labor coordination and import surges.

**Tariffs:** 75 percent of U.S. exports to Mexico will be free of tariffs before January 1, 1999. The remaining 25 percent of the tariffs will be eliminated before January 1, 2004 (Table 2). The Canada-US FTA will continue to eliminate tariffs through 1998. For a number of special products (textiles) a period of 15 years from 1994 is agreed upon.



**Table 2: NAFTA: Scheduled tariff reductions (Gruben and Welch, 1994)**

<b>Category and time schedule</b>	<b>Exports from USA</b>	<b>Exports from Mexico</b>
<b>Eliminate tariffs on:</b>	<b>to Mexico</b>	<b>to USA</b>
<b>A. January 1, 1994</b>	67.7	48.9
<b>B. January 1, 1999</b>	8.5	17.4
<b>C. January 1, 2004</b>	23.1	31.8
<b>D. January 1, 2009</b>	0.7	1.4

**Rules of origin:** These rules are important in free trade agreements because the member countries do not have the same external import tariff. With these differences, non-member countries will export to the country with the lowest tariff and then export to other free trade agreement countries since there are no internal trade barriers. This is called trade deflection. To avoid deflection, free trade agreement partners introduce rules of origin. With these rules of origin, avoiding high trade barriers by one of the member countries is not possible anymore. There are two ways to define where products originated.

The first method is to look at the parts and production processes which were used for the product. If two or more countries produce the product, it is supposed to be produced in the last country if there were substantial transformations.

The second method classifies a product as produced in the free trade area only when the product is produced with imported parts and after production the product is in another classification. This is called change in tariff heading. The system used for this classification

is the Harmonized System of the International Custom Board. NAFTA uses both methods to apply rules of origin, depending on the sector.

Two North American sectors use this way of protection. Only automobiles manufactured with 62.5 percent North American parts are classified as produced within the NAFTA countries. The "Big Three" U.S. automobile producers try to avoid automobile imports via Mexico by Japanese and European automobile manufacturers. This prevents Japanese and European automobile producers from just assembling automobiles in Mexico, using Japanese or European parts and then exporting the automobiles from Mexico to the United States without any tariffs.

The other sector is the textile and apparel industry. Import quotas under NAFTA are abandoned. For textiles and apparel to qualify for preferential treatment, products must pass a triple transformation test. This test requires that finished products are cut and sewn from fabric spun from North American fibers in order to qualify for NAFTA preferences<sup>3</sup>.

### **Automotive Agreement**

The U.S.-Canada automotive trade agreement has been a guideline for the NAFTA automotive agreement. Both Canada and the United States worked to open the highly protected Mexican automotive market. Mexico had the fastest growing major automobile market in the world (Hufbauer and Scott, 1993). The U.S. "Big Three" wanted better access to this market. Other interest groups were the automotive parts firms in all three countries, the U.S. and Canadian auto workers, and Nissan, Volkswagen, Toyota, Honda

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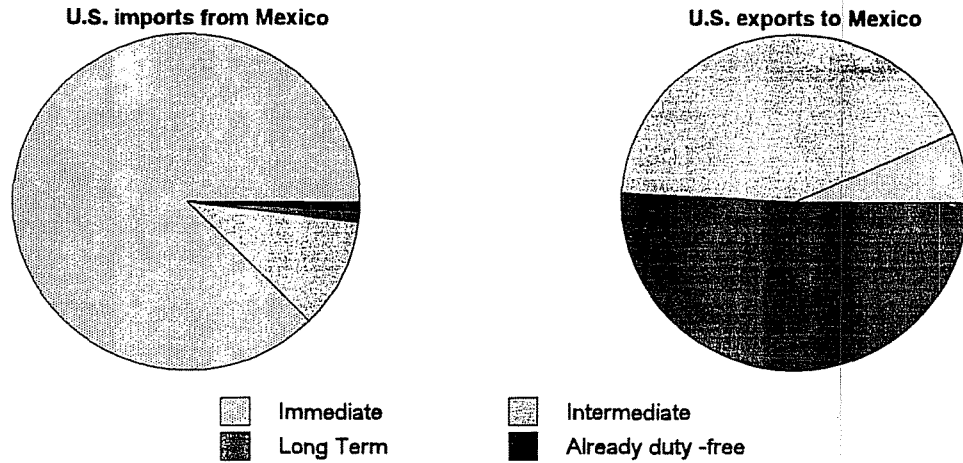
<sup>3</sup> This is called the yarn forward rule.

and Hyundai. With so many interest groups, the NAFTA automotive section (annex 300-A) was one of the last to be agreed upon. The "Big Three" wanted to ensure that Japanese and European automobile manufacturers would not use Mexico as an export platform to the U.S. market. Canada wanted to prevent overly strong rules of origin which would have negative effects on Canadian assembly factories but still maintain its safeguards which were in use since the 1965 Auto Pact. Mexico wanted to continue its liberalization process in the automotive industry, but at a speed that would protect the Mexican firms. The Canadian and U.S. firms wanted to ensure that parts from Mexico would be made by Mexican firms instead of European or Asian firms. Interestingly, U.S. and Canadian auto workers were against the NAFTA automotive agreement. Mexico's low wages and lower labor standards could attract companies to Mexico, causing job losses and lower wages in the U.S. and Canadian automotive industries.

**Tariffs:** Mexico reduced its automobile and light truck import tariff from 20% to 10% in 1994. The remaining tariff on light trucks will be phased out in five years from 1994; the tariff on automobiles will be phased out in 10 years. Mexico also agreed to reduce tariffs on imports of automotive parts. In five years from 1994, 75% of U.S. and Canadian imports will be tariff free; the rest will be phased out in 10 years. Lowering Mexican tariffs increases the competitiveness of the U.S. automotive industry.

The U.S. tariff on Mexican automobile imports of 2.5% was eliminated immediately. The tariff on light truck imports was cut to 10% in 1994 and phased out in the next five years. Most Mexican automotive parts entered the U.S. tariff free, the remaining import tariffs are eliminated in 10 years. (NAFTA, 1992)

**Table 3: NAFTA tariff elimination schedule in automotive industry**  
(U.S. Trade Statistics 1993)



**Rules of Origin:** The automotive rules of origin ensured tariff preferences only for Mexican, Canadian and U.S. made products. Automotive products qualify for NAFTA tariff treatment if they are 100% manufactured with North American inputs. Automotive products containing non-North American inputs can qualify for NAFTA tariff status by undergoing significant processing shifts in North America. These parts must contain a specified percentage of North American content and undergo a change in tariff classification within the United States, Canada and Mexico. The automotive goods will be traced to improve the accuracy of the content calculation. All products subjected to the rules of origin tracing are listed (Article 403, Annex 403.1, 403.2).

At the end of the transition period, NAFTA rules of origin for automotive products will be 62.5% for automobiles, light trucks, engines and transmissions, and 60% for other

vehicles and automotive parts. The NAFTA rules of origin are stricter than the Canada-U.S. FTA rule of 50%. The NAFTA rules of origin started at 50%, increased to 56% after four years, and will ultimately be increased to 62.5% after eight years. New firms entering the market in North America will have a five year, 50% grace period before they have to meet the 62.5% rule.

Automobile manufacturers and automotive parts producers have different options to meet the NAFTA automotive rules of origin. Automobile producers can meet the requirements annually with the production by model line or class of an automobile produced in the same plant, or by model line in any NAFTA country. Automotive parts producers can meet the rules of origin requirements averaging for the production according to specific categories of automotive parts (U.S. Dept. of Commerce, 1993).

**Automotive standards:** Some automotive parts are subject to mandatory safety standards, as well as labeling and/or certification requirements. The safety standards can create trade obstacles. GATT requires that standards have to be developed in a transparent way and that all parties have an opportunity for public comment. NAFTA allows a 60-day comment period on suggested draft standards. A single designated NAFTA laboratory will certify that safety standards of all three countries are met. An accredited lab can certify a product for sale in all three NAFTA countries, reducing cost for the automotive producers. Mexico met the standards within four years. The United States and Canada met the standards immediately.

**Intellectual property rights:** The automotive industry is heavily dependent on patent, trademark, trade secret and industrial design protection. NAFTA will provide the best intellectual property protection in these areas compared to other trade agreements of the United States. NAFTA contains extensive provisions on Intellectual Property Rights (IPR) enforcement including civil and administrative procedures, provisional remedies, criminal penalties and border enforcement mechanisms (U.S. Dept. of Commerce, 1993).

**Corporate Average Fuel Economy (CAFE):** The United States will include content added in Mexico as "domestic" content only for purposes of the definition of a "domestically manufactured vehicle" under CAFE provisions (small-car production) of U.S. laws. Mexican producers may choose when to begin counting Mexican content as "domestic" for purposes of CAFE and must apply the new definition ten years after implementation. Now auto firms can meet the CAFE standards for the U.S. fleet by producing small cars in Mexico. Canadian content is already accorded this treatment and has been since the implementation of CAFE in 1975 (U.S. Dept. of Commerce, 1993).

**Harmonized Automotive Standards:** NAFTA will establish a North American Standards Council which will support harmonization of safety and emission regulations to the highest level. The automotive industry will benefit from production based upon one North American standard (Report of the Administration, 1991).

Hufbauer and Scott (1993) predict that, within 10 years from 1994, an integrated North American automobile market will exist. Compared to world standards, the automotive industry should be highly competitive as a result of economies of scale and a

variety of labor skills. North America can become the world's low-cost producers of automobiles.

## CHAPTER 3

# THE NORTH AMERICAN AUTOMOTIVE INDUSTRY

### Introduction

Today's automotive industry is characterized by increased globalization of production and markets. The increasingly international nature of automobile and automotive parts production makes it difficult to draw clear national borders for the automotive industry. Automobile companies and automotive parts companies continue to diversify the location of their production. North American companies are among those who diversify their production across the national borders. These production shifts from the United States to Mexico and Canada may be a result of the free trade agreements signed between these countries in 1989 and 1994. This chapter will discuss the effects of the U.S.-Canada FTA, and NAFTA, and other factors on the North American automotive industry.

### Automobile Industry

The automotive industry is the largest manufacturing sector for both the American and Canadian economy, accounting for more than 4% of GDP and an estimated 1.2 million jobs (Cooper, 1994), and is of growing importance to the Mexican economy. The North American automotive industry is dominated by General Motors, Ford and Chrysler, also known as the "Big Three." Combined, they operate about fifty assembly plants in the United States, and ten in Canada.

U.S. - Canada automotive trade liberalization dates back to the 1965 Auto Pact. In the same year, Mexico introduced the Maquiladora program. Foreign automotive companies were allowed to establish factories in Mexico and export part of the production with (partial) exemption of tariffs. The Big Three were among the U.S. companies who took part in the Maquiladora program.

In Mexico all automotive plants are owned and operated by international companies (Volkswagen, Nissan, General Motors, Ford, Chrysler). In general, Mexican automotive plants are less productive and the automotive market is less competitive compared to the United States. Mexico's specific pre-NAFTA trade policies protected the automotive market and less productive plants (Cooper, 1994).

Before any new trade agreements were signed in North America in the mid 1980's, the U.S. automobile industry was recovering from the second oil crisis and economic recession in the early 1980's. Automobile demand shifted from large, fuel consuming automobiles to smaller more fuel efficient (imported) automobiles. The U.S. government introduced fuel economy standards which forced the automobile manufacturers to produce small and compact automobiles or make larger automobiles more fuel efficient (U.S. Industrial Outlook, 1985). The import of small Japanese models increased in the 1980's in response to this new demand, making Japanese companies the main competitive challenge for the U.S. automobile industry. The Japanese automobile firms not only had a comparative advantage in producing small fuel efficient automobiles, they had lower production costs as well as excellent product quality. To control the automobile trade deficit with Japan, the United States imposed an import quota on Japanese automobiles in

1981. The voluntary export restraint (VER) limited Japanese automobile sales in the United States to 1.68 million units annually. In March 1984, the VER was increased to 1.85 million and in 1985 the VER was further increased to 2.3 million automobiles a year (Feenstra, 1987). This VER decreased the competition in the U.S. market and increased Japanese automobile prices.

The U.S. automobile industry tried to reduce manufacturing cost by closing inefficient plants, cutting wages of automobile workers by 25%, reducing inventories and streamlining operations and organizations (U.S. Industrial Outlook, 1985). U.S. automakers introduced computer-aided design and manufacturing while adopting parts of the Japanese Just in Time (JIT) production techniques. Furthermore, the number of parts, components and suppliers was reduced to produce more cost efficiently. As a result, the U.S. automobile industry maintained market share in this critical and challenging time period (U.S. Industrial Outlook, 1985).

As discussed in Chapter 2, the U.S.-Canada FTA did not cause a main change in trade rules between the two countries. Most automobiles and automotive parts were already tariff free as a result of the 1965 Auto Pact. U.S. automobile manufacturers started increasing assembly capacity in Canada. Competition in the U.S. automobile market further intensified and put more pressure on profit margins. The non-North American market share stabilized around 28% (U.S. Industrial Outlook, 1990). Most manufacturers developed higher margin automobiles in an effort to survive since most of the sales were low margin automobiles. To reduce cost, automobile manufacturers started to reallocate assembly facilities to different countries. Production technology transfers

easily from country to country. Assembly plants opened in Mexico, Brazil and South Korea. The increased competition between the U.S., European and Japanese producers on the U.S. market led to a consistent quality increase of U.S. manufactured automobiles (Table 4).

**Table 4:** Consumers evaluation of automobile quality (U.S. Industrial Outlook, 1990)

Origin	1985	1986	1987	1988	1989
Asia	114	119	119	122	130
Europe	106	106	102	110	111
USA	87	94	98	102	112

The light truck market was one of the few strong holds for the U.S. automobile manufacturers, dominated by the "Big Three"<sup>1</sup>. The market share of imported light trucks and sport utility vehicles dropped in the late 1980's (U.S. Industrial Outlook, 1990).

When NAFTA was introduced, the U.S. automobile market was more competitive compared to the 1980's. In 1994, U.S. consumers had a choice between 31 domestic and foreign manufacturers offering a total of 337 different automobiles and 143 different light truck models. The severe competition had caused some foreign manufacturers to leave the U.S. market (e.g. Peugeot, Daihatsu). Also, the U.S. "Big Three" faced increased pressure on their profits margins. The industry had to keep reducing costs while improving production technology and productivity. The U.S. automobile trade deficit increased year after year as automotive imports increased faster than U.S. automotive exports (U.S.

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<sup>1</sup> The Big Three market share increased to 68 percent in 1990.

Industrial Outlook, 1998).

The trade deficit may be a result of the (re)allocation of assembly capacity to Mexico and Canada by both U.S. and foreign automobile manufacturers. Ford, G.M. and Chrysler have substantial assembly capacity in Canada (11 plants) and Mexico (six plants). The "Big Three" have managed to maintain their market share in the light truck sector, with a market share of 86%. (U.S. Industrial Outlook, 1994).

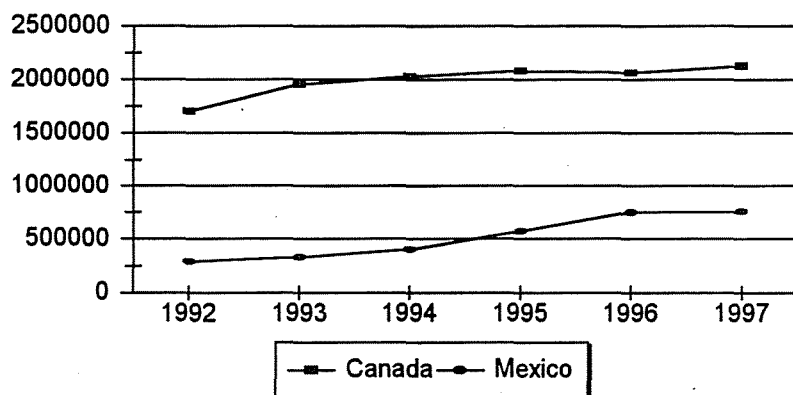
Today's U.S. automobile industry is still dominated by G.M., Chrysler and Ford but the market share of imported automobiles has fallen in recent years. This is the result of the increase of assembly facilities in North America by European and Asian automobile producers. Assembly capacity has moved south from Detroit. Michigan, however, is still the biggest automobile producing state. As a result of the maturing of the U.S. market, U.S. automobile producers have joined their forces to a certain level with European and Japanese automobile manufacturers. Ford has an alliance with Mazda, G.M. has some alliances with Toyota under the NUMMI project, and Chrysler has relations with Mitsubishi. In 1998, one of the largest mergers in automobile history took place between Chrysler and Daimler Benz.

Four years after the introduction of NAFTA, automobile trade is booming between the three countries. The reduction of trade barriers allows automobile producers to optimize assembly facilities within in the three countries, improving productivity and cost efficiency. Imports of automobiles from Mexico into the United States have increased substantially since 1994 (Figure 2).

Figure 2: U.S. automobile imports (U.S. Dept. of Commerce)

## Passenger Cars & Light Trucks

Imports in Units, 1992-1997

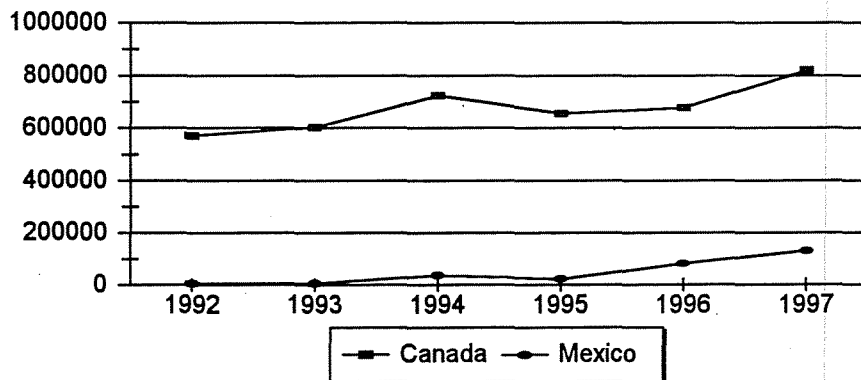


Since 1994, imports from Mexico doubled, both in dollar terms and in units. On the export side, U.S. exports to Mexico increased after the introduction of NAFTA (Figure 3).

Figure 3: U.S. automobile exports (U.S. Dept of Commerce)

## Passenger Cars & Light trucks

Exports in Units, 1992-1997



Exports to Mexico increased in the first year of NAFTA. The 1995 devaluation of the Mexican peso had an adverse effect on the Mexican economy, resulting in a decrease of U.S. exports to Mexico. Since 1995, the Mexican economy slowly recovered and U.S. automobile exports to Mexico increased. Most trade between Canada and the United States is intra-industry shipments by the "Big Three". Both exports and imports of automobiles with Canada increased in the last years.

Currently Mexico is a net exporter of automobiles (Figure 2, 3). Recovering from the economic crisis, within ten years Mexico can become a net importer of automobiles from the United States. To serve this market, Volkswagen, Nissan and Ford are planning investments of more than \$1 billion in the next years to meet this Mexican market demand (Orme, 1993,1995).

### **Automotive Parts Industry**

Manufacturing and sale of original equipment parts to motor vehicle manufacturers for assembly into automobiles, trucks and buses is the main business of the motor vehicle parts industry. The secondary market of replacement parts is smaller. In the 1980's about 3,000 U.S. companies manufactured automotive parts for original equipment and the replacement market. The quality improvements and cost reduction in the mid 1980's had major effects on the automotive parts industry. Automotive parts manufacturers had to improve their quality standards and improve coordination with the end users. Major competition came from Japanese automotive parts producers. The cost reduction efforts in the automobile industry had their effect on the parts industry. The introduction of JIT

production reduced the inventory of parts for automobile manufacturers and required coordination between suppliers and buyers. The automobile industry, under international competition pressure, started sourcing more parts outside their own company, which was beneficial for automotive part suppliers.

From 1972 to 1982 the United States had a positive trade balance in automotive parts. In 1984 this surplus reversed into a deficit of \$1 billion. This change in trade flows had different causes. First, more Japanese automobile production in the United States required more part imports from Japan, both for assembly and replacement. Second, U.S. automobile producers began purchasing parts in foreign countries to reduce cost. Third, changes in trade policies by a major trade partner, Mexico, slowed exports of U.S. automotive parts (U.S. Industrial Outlook, 1985).

Automotive parts production increased as a result of the strong new vehicle sales (U.S. Industrial Outlook, 1990). At the same time, the average age of U.S. registered automobiles increased, benefitting the replacement parts industry. Strong foreign competition kept pressure on U.S. automotive parts producers and forced them to be as efficient as possible, keeping prices low, while stimulating the improvement and quality of products. Japanese automotive parts imports fell as a result of the reallocation of Japanese parts producers to the United States. Japanese parts suppliers took advantage of the relatively low value of the dollar versus the yen. In 1990, over 200 Japanese automotive parts producers were producing or had plans to start producing parts in the United States.

The growth of Japanese automotive parts producers put more pressure on the U.S. automobile producers. Both compete for new customers and to maintain their current

customers. The U.S. - Canada FTA did not have a great impact on the U.S. automotive industry. The gradual elimination of the duty-remission program in Canada helped the U.S. automotive parts industry in the long run. Furthermore, the agreement eliminated the remaining tariffs on aftermarket parts before 1991.

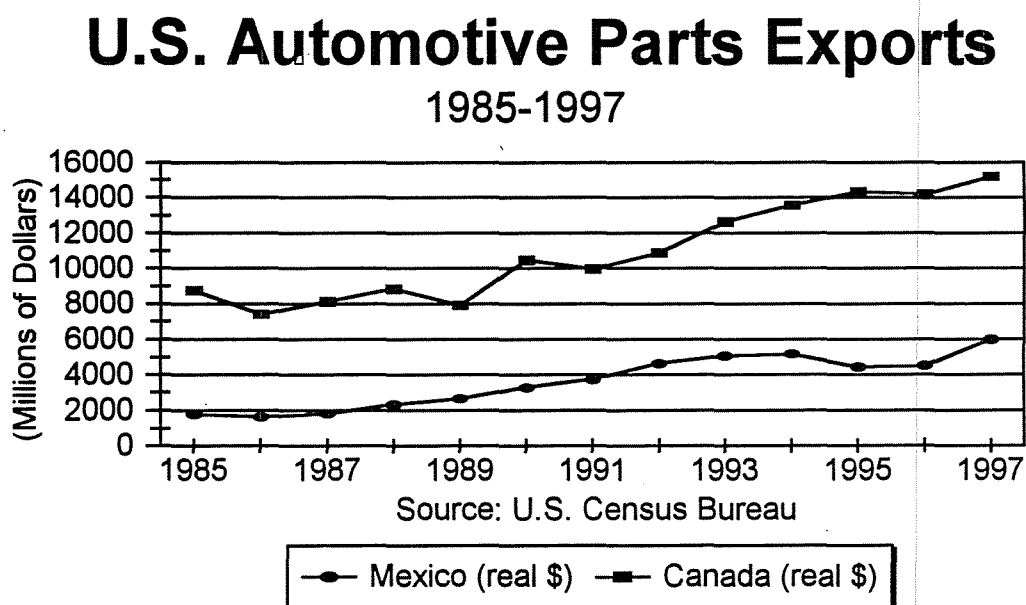
In 1993, the U.S. automotive industry posted another year of growth. The parts industry kept playing its important role in the U.S. economy. Industry employment was 4.5 percent of total manufacturing employment (U.S. Industrial Outlook, 1994). GM, the biggest purchaser of U.S. automotive parts, implemented a plan to reorganize its suppliers' base (including its in-house parts producer). GM strived for significant cost reductions from all its suppliers and a leaner organization. Ford and Chrysler, who restructured their operations in the 1980's, decreased their number of parts suppliers. Both companies will reduce the number of parts suppliers to fewer than 1000 by the year 2000. Independent parts manufacturers, under pressure from the "Big Three", focus on reorganizing their operations by closing, reorganizing, selling or acquiring companies. Japanese, Canadian and European parts manufacturers invested in 462 automotive parts plants in the United States. Japanese firms have slowly increased their U.S. sourcing since the 1980's (U.S. Industrial Outlook, 1994).

As automobile producers have started to move production capacity across the border into Canada and Mexico, automotive parts suppliers have followed their customers into these markets. Automotive parts producers opened new plants or entered into joint ventures with local automotive parts manufacturers. The same situation applied to Japanese automobile producers when they moved production plants into the United

States. Restructuring efforts continued under pressure from the Japanese competition. Productivity has increased 2 percent or more every year since 1989 and product quality has improved significantly. The bigger and more efficient automotive parts suppliers have been able to increase their profit margins in recent years. The smaller suppliers still have trouble meeting the demands of the automobile industry and have seen their profit margins grow slowly (U.S. Industrial Outlook, 1994).

Mexico (and perhaps Brazil) hold the biggest potential for U.S. automotive parts producers. Before NAFTA came into effect, Mexico was the biggest export market for both the automobile and automotive parts industry. Since the implementation of NAFTA in 1994, U.S. automotive parts producers have gained better access to the fast expanding Mexican market. Despite the economic crisis in 1995, U.S. exports have increased since then (Figure 4).

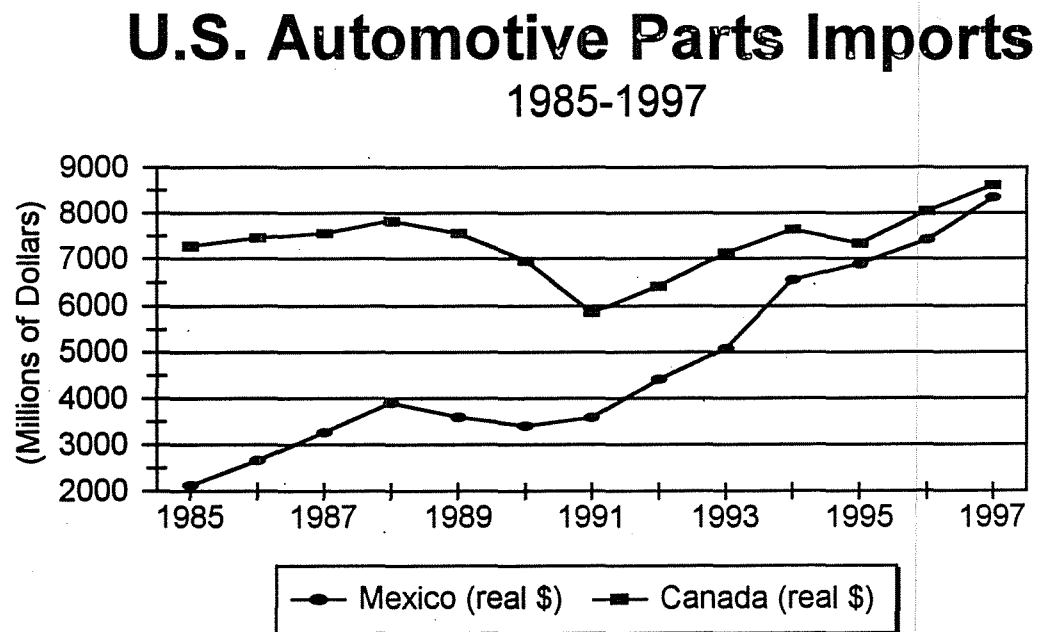
**Figure 4:** U.S. automotive parts exports (U.S. Dept. of Commerce)



Mexico is a perfect springboard to other Latin American markets which are more accessible since the 1994 GATT agreement. The Uruguay Round reduced automotive parts tariffs by 58 percent and other non-tariff trade barriers were eliminated. This opened up the major emerging automotive markets for U.S. and other automotive parts suppliers.

Since the implementation of NAFTA more joint-venture operations opportunities have emerged in Mexico. Many Mexican parts producers are less efficient and have outdated production techniques. Seeking joint-ventures with U.S. automotive parts producers will allow these Mexican firms to modernize their plants and become more efficient. Mexican export of automotive parts have increased since the early 1990's and almost equal Canadian exports of automotive parts to the United States (Figure 5).

**Figure 5:** U.S. automotive parts imports (U.S. Dept. of Commerce)

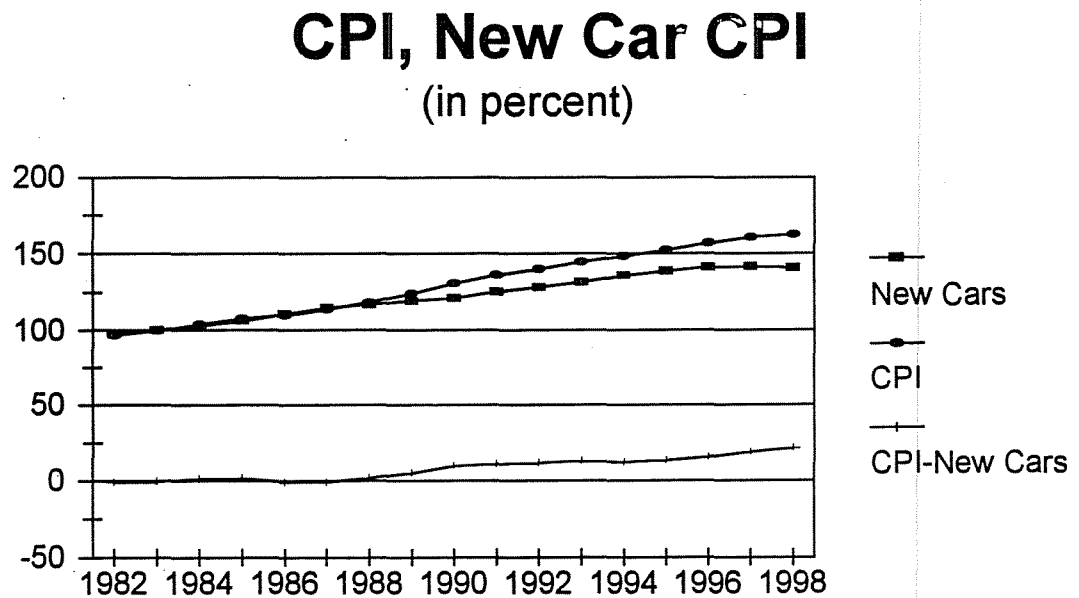


### Price Effects

The free trade agreements may have increased competition in the U.S. automotive market. Reducing trade barriers may have led to the increase in automotive parts trade between Canada, Mexico and the United States. The increased competition possibly lowered automotive parts prices for automobile producers. Lower input prices can reduce the cost of assembling automobiles in North America, possibly resulting in a decrease of U.S. automobile prices (Figure 6).

Lower import barriers increased competition for the "Big Three" on the U.S. automobile market with profit margins under pressure, so prices of new automobiles in the United States tend to decrease. In general, U.S. automobile prices have decreased<sup>2</sup> since 1989 (Figure 6).

**Figure 6:** CPI, new car price indexes (Economic Report of the President, 1998)



<sup>2</sup> Relative to other goods.

## CHAPTER 4

### DATA COLLECTION AND REGRESSION ANALYSIS THEORY

#### Data Collection and Test Variables

The analysis of the relationship between the price, quality and production origin is based on data for U.S. automobiles for the 1985-1998 time period. For each automobile, for each year available on the U.S. market, data were collected on the suggested retail price of standard models (that is, without options), quality variables and country of assembly. Various characteristics are used as a measure of quality or place of assembly changes in the regression analysis. Similar models have been estimated by Grilliches (1971), and Feenstra (1987). The suggested retail prices at the beginning of each model year are listed in the Automotive News Market Data Books 1985-1998.<sup>1</sup> There are no published data on actual transaction prices available. Both Grilliches and Feenstra used the same data source in their estimations.<sup>2</sup>

Suggestions have been made to use second-hand automobile prices to estimate quality differences over certain time periods. Grilliches compared new versus used automobile prices since both are close substitutes and should reflect similar quality differentials. Grilliches' empirical results showed, by comparing coefficients, that

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<sup>1</sup> These prices exclude taxes, transportation fees, and preparation charges.

<sup>2</sup> One problem associated with the use of suggested retail price is the extent to which these prices represent pricing mistakes by manufactures (Grilliches, 1971). The U.S. automobile market is more competitive now compared to the time period used by Grilliches (1937-1960). Over and under pricing will be corrected by the market when more players are on the market and consumers have more information available.

differences are minor and within the range of the estimated standard errors, that is quality weights that could be derived from the regressions using the prices of 1-year-old automobiles are likely to be similar to those obtained by using suggested retail prices. Based on Grilliches' results new automobile prices are used because estimated quality and production coefficients with used automobile prices are likely to be similar to the estimated coefficients with new automobile prices.

This thesis uses data collected for major automobile manufacturers on the U.S. market.<sup>3</sup> Automobile manufacturers included in the sample are: Buick, Chevrolet, Chrysler, Dodge, Ford, Honda, Mercury, Nissan, Oldsmobile, Plymouth, Pontiac, Toyota, Volkswagen. Only two major automobile manufactures were excluded: Cadillac and Lincoln. Both brands sell more than 100,000 new vehicles a year on the U.S. market but are considered luxury automobiles because of their dimensions and price class and are therefore hard to compare to the other models in the data set. Included in the sample are small to near luxury models for the years 1985 through 1998. The data sample only includes models available for two or more years in the time period 1985 -1998. There are a total of 943 observations including 129 different models.

All automobile prices in the Automotive News Market Data Book are reported in U.S. dollars. In the regression analysis the price of all observations are estimated as a function of quality and production variables. Using U.S. dollar prices (natural units) will give different results compared to the use of log prices in the regression analysis. Price increases (in percent) are studied as a result of quality and production variable changes (in

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<sup>3</sup> A minimum limit of 100,000 new vehicles in 1998 sold on the U.S. market was imposed.

natural units). The use of the absolute dollar price would provide price changes in absolute dollar terms as a result of change in a quality or production variable. Using the log of price unit, gives a price change in percent as a result of a unit change in production or quality variables. A change in price of \$1,000 is a 20% increase for a \$5,000 automobile and a 2% increase for a \$50,000 automobile. Related to the data set, changing a quality variable, such as adding one unit of displacement, will likely cost more in dollar units for an expensive automobile compared to an inexpensive automobile. Hence, the use of log of prices is preferred because with changes in quality or production variables the unit price of the automobile is taken into consideration. The estimated quality and production origin coefficients can be interpreted as the percent change in price as a result of a unit change in the quality or production origin variable.

For every observation a production-origin dummy is included. The production-origin dummy is used to measure the price effects of (re)allocating assembly capacity. Production dummies included are: Canada(year), indicating where and in what year a model was assembled with value one for automobiles assembled in Canada in a specific year, Mexico(year) with value one for automobiles assembled in Mexico in a specific year<sup>4</sup> and Other(year) with value one for automobiles assembled outside North America.<sup>5</sup> The production-origin dummies do not necessarily imply that all the production of that specific model takes place in one country. A value of one implies that part (or in a few cases all) the production takes place in that country in the indicated year. The base model for the

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<sup>4</sup> No automobiles for the U.S. market were assembled in Mexico in 1985 and 1986.

<sup>5</sup> Overlapping is possible, because some models are assembled in more than two countries.

production-origin explanatory variables is an automobile assembled only in the United States and sold on the U.S. market.

The explanatory variables in this study include overall length (inches), displacement (liters) and horsepower. All three variables are used by Feenstra and Griliches. In addition, dummy variables are included for a variety of features offered as standard equipment on the base model: air conditioning, driver air bag, passenger air bag, anti-lock brakes, automatic transmission. Both Feenstra and Griliches use the automatic transmission variable. Feenstra uses the air-conditioning variable. Air bags and anti-lock brakes are included as a quality feature because all were introduced as a standard quality item on most models between 1985 and 1998.<sup>6</sup>

Zero-one year dummy variables for the years 1985 through 1998 are added when the year variable is set equal to one for the model year. The value of the estimated year dummy coefficient can be interpreted as the base price of that specific U.S. made only model. With the base model price estimate, quality features can be added and a U.S. market price can be estimated. The difference between two year dummies is the price change (in percent) between the two time periods, holding all other variables constant. Using the base model, production features can be added to estimate the price effect of assembling a specific model automobile outside the United States.

Since the dependent variable is the logarithm of list price, the resulting regression coefficients can be interpreted as the estimated percentage change in price due to a unit

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<sup>6</sup> A variety of quality variables for which no convenient or consistent data are available are not included. Most of these variables are performance features of a vehicle: gasoline mileage, acceleration, handling, durability, and styling.

change in a particular quality or production variable, holding other variables constant.

### **Model Specification**

The time series - cross section model in this regression analysis is specified as:

$$P_{ij} = f(\text{DUM}_i, \text{LENGTH}, \text{DISPL}, \text{HP}, \text{AIRCO}, \text{DAIRBAG}, \text{PAIRBAG}, \\ \text{ANTILOCK}, \text{AUTOTRAN}, \text{CANADA}_i, \text{MEXICO}_i, \text{OTHER}_i)$$

$i = 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998$

$j = 1, 2, \dots, 129$  (model indication)

**DUM<sub>i</sub>** = zero-one dummy for year of production

**LENGTH** = length of automobile in inches

**DISPL** = engine displacement in liters

**HP** = horsepower

**AIRCO** = zero-one dummy if automobile has standard air conditioning

**DAIRBAG** = zero-one dummy if automobile has standard driver airbag

**PAIRBAG** = zero-one dummy if automobile has standard passenger airbag

**ANTILOCK** = zero-one dummy if automobile has standard anti-lock brakes

**AUTOTRAN** = zero-one dummy if automobile has standard automatic transmission

**CANADA<sub>i</sub>** = zero-one dummy if automobile is assembled in Canada in year  $i$

**MEXICO<sub>i</sub>** = zero-one dummy if automobile is assembled in Mexico in year  $i$

**OTHER<sub>i</sub>** = zero-one dummy if automobile is assembled in rest of the world (ROW) in year  $i$ ,

### Estimation Techniques

The data set includes a total of 943 observations divided over 129 different models. Ordinary Least Square (OLS), the most common method of estimating coefficients, is used first. OLS estimation techniques are used by Feenstra and Grilliches. However, OLS is not necessarily the correct estimation technique for estimating quality and production variable changes overtime. Using the OLS method places more weight on observations with large error variances and less weight on observations with small variances. OLS parameter estimates are unbiased and consistent under the homosekdasticity assumption<sup>7</sup>. In this data set OLS parameter estimates are inefficient because of the presence of heteroskedasticity. The variances of the estimated parameters are not the minimum variances. The OLS estimated standard errors are also incorrect. If the inefficiency of OLS is believed to be a serious drawback, testing for the presence of heteroscedasticity is desirable (Johnstone and DiNardo, 1997). Another problem is serial correlation. In the data set it is very likely that first order serial correlation is present. Errors in one time period are correlated directly with errors in the following time period. The price of a given automobile model in year t may be correlated with its price in the previous period even if explanatory variables are used. To account for the above-mentioned problems different estimation techniques are introduced.

Panel data analysis uses time-series cross-sectional data. The data set used to study the effects of free trade has both cross sectional and time dimensions. A total of 129

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<sup>7</sup>  $E(\sigma_1^2) = E(\sigma_2^2) = \dots E(\sigma_i^2)$

different models are included in the data set. The time dimension is the years between 1985 and 1998 in which the models are assembled. The data set is organized by grouping the 129 models together, sorted by years. There is likely serial correlation within different years of a model. Organizing the data by model and year facilitates the construction of estimators that include serial correlation. The sample set is unbalanced; not all models have observations for the full time period between 1985 and 1998. Including numbers for the different models introduces artificial gaps in the observations. This way the regression analysis program will only include observations with legitimate lagged variables. The first-order autoregression AR(1) estimation technique will take into account the serial correlation between the different years within a model and not calculate the serial correlation between the different models. Autoregressions of order one are structured so that the influence of some given disturbance fades as it recedes into the more distant past but vanishes only asymptotically if  $\rho < 1$  (Greene, 1997).

AR(1) is applied in time-series processes such as the data set in this regression analysis. Models can potentially be improved by different estimation techniques but are often sensitive to the specifications. With stationarity, the autocorrelation fades over time. There are several tests for testing autocorrelation. The most common test is the Durbin Watson<sup>8</sup> test. With positive serial correlation in the time series data, the DW statistic is

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<sup>8</sup> The Durbin Watson test is based on the residuals of the OLS regression and is generally defined

$$\text{as: } DW = \frac{\sum_{t=2}^T (\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=1}^T \varepsilon_t^2}$$

low. The DW statistic will have a value between zero and four, where a value of two will indicate no first order serial correlation.

The two most common applied models with panel data estimation are fixed effects models and random effects models. The fixed effects model is a reasonable approach when there is confidence in the fact that differences between units can be viewed as parametric shifts of the regression function. The automobile sample set requires the use of the unbalanced panel technique. Model groups differ because not all data on different models are available for the entire time period. The fixed effects model assumes that there are common slopes, but that each cross section unit has its own intercept, which may or may not be correlated with the quality and/or production variables.

The random effects model resembles the fixed effects model, but it assumes that the intercepts are drawn from a common distribution with mean  $\alpha$  and variance  $\sigma_{\alpha}^2$ . The estimates of this model are not consistent if the individual intercepts are correlated with the independent variables. Hausman (1978) devised a test<sup>9</sup> to see if the random effect model or fixed effect model should be used. This test is based on the covariance matrix of the difference vector. Hausman's essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero (Greene, 1997). This test is applied in Chapter 5.

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<sup>9</sup> Under the null hypothesis  $W$  is distributed as a chi-squared. In general the Hausman test is defined as:

$$W = \chi^2[K] = [b - \hat{\beta}]' \hat{\Sigma}^{-1} [b - \hat{\beta}]$$

### Testable Hypothesis

After discussion of the Canada-U.S. FTA, NAFTA, the U.S. automotive industry, and different estimation techniques, a testable hypothesis can be derived to be able to test for price effects as a result of (re)allocation of assembly capacity outside the United States: *ceteris paribus*, a decrease in trade barriers does not reduce the price of assembled automobiles in Canada, and Mexico compared to automobiles assembled only in the United States. If such is the case, the production dummies should reflect no price effects for Canadian imports starting in 1989, and for Mexican imports starting in 1994. Specifically, the coefficients on the production dummies for Canada and Mexico are expected not to decrease after the implementation of the free trade agreements. The production coefficients are tested with different estimation techniques in the next chapter. With the estimation result it is possible to reject the null hypothesis or otherwise fail to reject the null hypothesis. Rejecting or failing to reject depends on the t-values of each estimated production origin coefficient.

## CHAPTER 5

### REGRESSION RESULTS

This chapter presents the empirical results based on the data discussed in chapter 4. Only the main results will be discussed. The regression output estimates for different estimation techniques are included in the appendix.

#### OLS

The first approach in the regression analysis is to estimate parameters of the variables using OLS procedure (Table 5). A standard automobile in this regression is a 1985 Ford U.S. made only with no displacement, length, horsepower, etc. The intercept of this U.S. made Ford is \$2312 (in 1985 prices). Coefficients are estimated for the years between 1985 and 1998. The dependent variable is log (price) so the resulting regression coefficients can be interpreted as the estimated percentage change in price due to a unit change in a particular quality, production, or brand variable, holding all other variables constant. Results show that an increase of ten horsepower on average will increase the automobile price by 5 percent<sup>1</sup>. An addition of an air conditioning unit (AIRCO), holding all other variables constant, leads to a price increase of 12 percent.

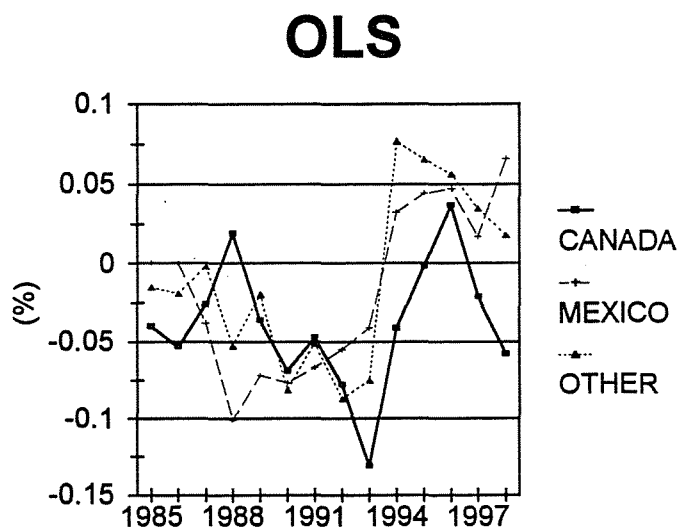
The production dummies for assembly in Canada, Mexico, or outside North America (OTHER) test the null hypothesis. The estimated coefficients for Canada are all

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<sup>1</sup> The standard error is .3 percent.

negative for the years 1985 through 1998 (except Canada88,Canada96). These results indicate that automobiles assembled in Canada are cheaper relative to USA made-only automobiles (except Canada88, Canada96). From 1994 until 1998, the Mexico and Other coefficients are positive which indicates that assembling a specific automobile outside the United States would be more expensive compared to assembling a U.S. made only automobile<sup>2</sup>. Compared to Mexico and Other each year, assembled automobiles in Canada are relatively cheaper. Notice that most coefficients are not significantly different from zero. The OLS results fail to reject the null hypothesis. The coefficients of Canada, Mexico, and Other are plotted (Figure 7).

**Figure 7: OLS estimated production coefficients 1985-1998**



<sup>2</sup> Coefficients for Mexico85 and Mexico86 are omitted because no automobiles for the U.S. market were assembled in Mexico.

It is not possible to identify a clear pattern in the production coefficients. If the implementation of the trade agreements reduced the price of Canadian and Mexican automobiles relative to U.S. made automobiles, in 1989 and 1994 a decrease in the coefficients is expected for Canada and Mexico. The estimated coefficient for Canada increases in 1990 and decreases between 1991 and 1993. The coefficient for Mexico increases in 1994 which does not imply the price decrease after the implementation of NAFTA. Further, coefficients are mostly within one standard error from the previous and next year coefficient.

Several other things are worth noting. The fit of the equation is reasonable. About 89 percent of the variance of logarithm of automobile prices in the data can be explained with the included variables. The year dummies' coefficients indicate that prices of the base automobile slowly increased over the years until 1990 and 1995 when a price decrease for a short time period occurred. All quality variables are positive and significantly different from zero (5 percent level) except displacement (DISPL, highly correlated with horsepower) and anti-lock brakes (ANTILOCK) (insignificant). A longer, larger displacement model with more quality features is more expensive than a small non-luxury automobile. Automobile manufacturers' dummies are significantly different (10 percent level) from Ford, the base model automobile, except Chevrolet (CHEVY). These coefficients indicate the price differences from Ford. Most U.S. made basic models by other automobile makers would be more expensive compared to a U.S. made only Ford.<sup>3</sup>

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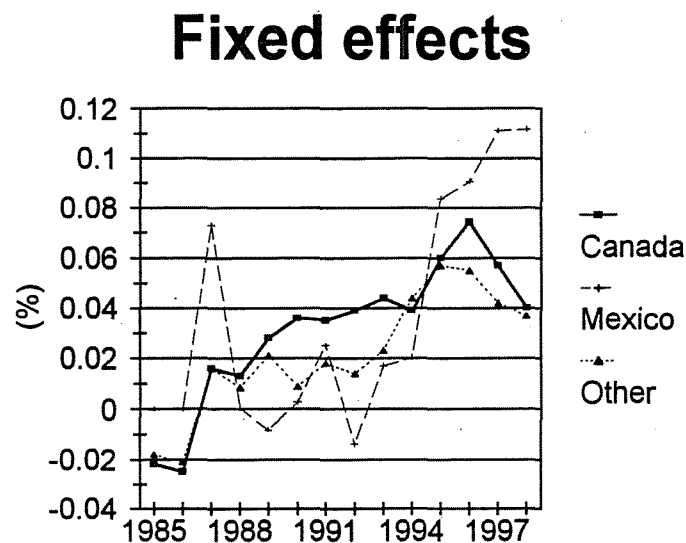
<sup>3</sup> Including all Cadillac and Lincoln models in the OLS regression (Table 6) gives similar coefficient estimates. Coefficients are mostly within one standard error of the results in Table 5. All production coefficients for Canada, Mexico, Other are negative but not significant (10 percent level). These results can be driven by the fact

In Chapter 4 it is explained that the OLS estimate might not be the most desirable technique to apply in the regression analysis. The Durbin-Watson test indicates that there is positive serial correlation. A better estimation technique can be the use of Fixed Effects or AR(1) methods.

### Fixed Effects

Fixed Effects coefficient estimates are shown in Table 9. Automobiles assembled outside the United States become more expensive between 1985 and 1998 compared to U.S. made only automobiles (Figure 8). The effects of the two trade agreements in 1989 and 1994 are not distinguishable and the null hypothesis is failed to be rejected.

**Figure 8:** Fixed effects estimated production coefficients 1985-1998



that none of the Cadillac and Lincoln models are assembled outside the United States. Because of higher prices of the Cadillac and Lincoln models, automobiles assembled outside the United States are smaller and cheaper, which could influence the production coefficients.

The year coefficient estimates are all significant and are based on a 1985 U.S. made only automobile. The quality variables are all positive and significant (10 percent level) except anti-lock brakes. Furthermore, the fit of the equation is very good. The regressed model explains more than 98 percent of the variance in the logarithm of automobile prices. The Durbin-Watson test indicates positive serial correlation in the data set.<sup>4</sup>

### AR(1)

The output of the AR(1) regression is given in Table 7. There a fewer observations reported because the estimation procedure drops the first year for each model in order to use legitimate lagged variables. Because AR(1) makes distinctions between the different models, automobile manufacturer dummies are not included. The base automobile in this estimate is a U.S. made only automobile with no specific brand. The base price for each year is given by the year dummy variables. The price of a standard U.S. made only automobile ranges from \$9606 (1985) to \$23042 (1998). All year dummies are significant (5 percent level) and increase over time. All quality variables are positive, and significant (5 percent level) except length, passenger air bag (PAIRBAG), and anti-lock brakes (ANTILOCK).<sup>5</sup>

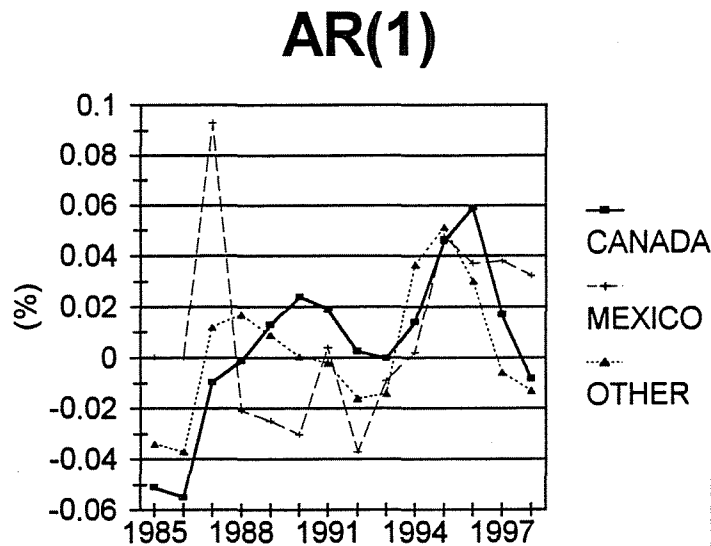
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<sup>4</sup> Including Cadillac and Lincoln (Table 10) in the data set yields similar results.

<sup>5</sup> Statistics based on the transformed data set, by adding numbers for each number, indicate that the fit is lower (55 percent) than the OLS estimates.

The Durbin Watson test indicates that the serial correlation is negative but smaller (2.27). Only one production coefficient (Mexico87) is significant (5 percent level). The other production coefficient estimates are not significant and as in the OLS case do not follow a specific pattern (Figure 9). No significant price changes occur after introduction of the free trade agreement in 1989 and 1994 and moving assembly capacity to Canada and/or Mexico.<sup>6</sup> The results indicate that automobiles assembled only in the United States have become relatively cheaper compared to those assembled outside the United States.

**Figure 9:** AR(1) estimated production coefficients 1985-1998



<sup>6</sup> Including Cadillac and Lincoln yields similar results (Table 8). There is a clearer pattern in the production coefficients although all (except Mexico85) are insignificant.

The estimated Rho auto correlation coefficient is .96 and convergence is obtained after 113 iterations.<sup>7</sup> These results indicate that the AR(1) coefficient estimation is stable.

### Random Effects

The Hausman(1978) test of the random effects vs. fixed effects rejects the use of Random Effects<sup>8</sup>. The results from the different estimation techniques indicate that fixed effects provides the most reliable coefficient estimates.<sup>9</sup>

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<sup>7</sup> Including Cadillac and Lincoln (Table 8) convergence is achieved after 189 iterations.

<sup>8</sup> CHISQ(58) = 240.72 (Cadillac, Lincoln excluded). CHISQ(58) = 251.22 (Cadillac, Lincoln included).

<sup>9</sup> The production dummy analysis with Random effects show a similar pattern in production coefficient estimates as the Fixed Effects estimation. Automobiles assembled outside the United States have become relatively more expensive versus U.S. assembled only automobiles. Most of the coefficients are insignificant (10 percent level). Including Cadillac, and Lincoln (Table 12) shows similar results, except that the production variables for Canada and Mexico become negative later (1997).

## CHAPTER 6

### CONCLUSION

The Canada-U.S. FTA and NAFTA have lowered or eliminated tariffs and barriers between Canada, Mexico and the United States. The effect of NAFTA and other free trade agreements has been a key topic of debate in recent years. The effect of the free trade agreements on U.S. automobile prices is one important issue. Before the introduction of NAFTA, several studies forecasted the potential effects of NAFTA. Four years after the introduction of NAFTA, and nine years after the introduction of the Canada-U.S. FTA, more data are available to estimate the effects of both free trade agreements.

Trade theoretical analysis predicts that automobiles assembled outside the United States would become cheaper after the implementation of trade agreements. A U.S. automobile price decrease for Canadian imported automobiles was predicted by some trade theories in 1989, and for Mexican assembled automobiles in 1994. If the U.S. automobile market is competitive, a price decrease is expected for automobiles of all origin (including U.S.-made-only).

This thesis estimates the price effects of (re)allocating assembly capacity to Canada and Mexico. Four years after the implementation of NAFTA, the effects on U.S. automobile prices from (re)allocating assembly capacity in North America are estimated for the time period 1985-1998. No earlier research projects have estimated the effects of (re)allocation of assembling capacity to Canada and Mexico.

The data set collected on automobiles sold in the United States between 1985 and 1998 includes retail price, quality variables and production variables to test for price effects on automobiles assembled in Canada and Mexico before and after the implementation of the free trade agreements. Furthermore, new quality variables are included to estimate the price effects of airbags, anti-lock brakes and air conditioning. Different regression techniques are used to estimate the price effects. All estimation techniques include the same explanatory variables. OLS is the first approach used to estimate the price effects. The high serial correlation coefficient in the OLS regression results indicates that different estimation techniques have to be applied. The second approach is the AR(1) technique which corrects for serial correlation within the automobile model series. The AR(1) method is a better approach but does not fully consider the two dimensions of the data set. The best applied estimation technique is the fixed effects method. The fixed vs. random effects test rejects the use of random effects; hence, the fixed effects estimation technique probably provides the most reliable production coefficient estimates using this data set.

All the estimation methods produce results that fail to reject the null hypothesis that the introduction of the free trade agreements had no effect on relative prices of U.S. and other North American made automobiles. In general, U.S. new automobile buyers could have benefitted from the free trade agreements between Canada, Mexico and the United States. Prices of new automobiles in the U.S. have fallen relative to other goods. These price decreases are for all automobiles and not specifically for automobiles assembled in Canada or Mexico.

In general, trade in automobiles and automotive parts has increased in the last ten years between Canada, Mexico and the United States. This increase in trade can be an indication of the increase of competition on both the automobile and automotive parts market. Automobile producers are better able to allocate the assembly facilities among the three countries and are able to benefit from the intensified competition in the North American automotive parts market. Real prices for automobiles have declined on the U.S. market which can be a result of the effects of the free trade agreements. Furthermore, the increased competition has led to more models with more options and better quality. To conclude, U.S. automobile consumers have benefitted from both free trade agreements.

Of other interest are the parameter estimates of the quality variables. The estimated parameter coefficients for length, displacement, horse power, and automatic transmission show similar positive signs in the line with Grilliches and Feenstra's regression results. However, quality variables for air conditioning, driver airbag, passenger airbag and anti-lock brakes were never included in earlier research. All these new quality have positive coefficients in most regression estimates. This indicates that adding these quality features onto a automobile will increase the price but not necessarily by the amount that is given in price lists.

All the regression results have their limitations for several reasons. First, no automobile assembling costs for the different countries are directly available. Most of these data, if known, are held by the automobile producers and in general are not accessible for scientific research. Second, only suggested retail prices are used in the regression analysis. Collecting dealer prices for every model in every year is a costly and

time-consuming task and likely will give the same outcome in regression results. Third, cost reductions from reallocating assembly capacity within North America are not necessarily passed fully on to U.S. new automobile consumers. Fourth, different demand fluctuations (e.g. oil prices) might not affect demand for all automobiles the same way. In the case of a oil price increase, demand is more likely to shift outward for small engine automobiles and shift inward for large engine automobiles. Fifth, since Canada, Mexico and the United States have different currencies it might be of future interest to include an exchange rate variable to control for exchange rate fluctuations. These exchange rate fluctuations can influence trade flows. The Mexican peso crisis benefitted Mexican exports but likely decreased U.S. exports to Mexico. These last two effects take the demand side of the automobile market more into consideration. The estimated equation in this thesis is supply side only. Further research could be applied to both the supply and demand sides of the automobile market.

However, the regression estimates are interesting because none of the results provide any evidence that the two trade agreements between Canada, Mexico, and United States reduced the price of automobiles assembled in Canada or Mexico relative to automobiles made only in the United States. In general, the null hypothesis cannot be rejected. This thesis finds no evidence that automobiles assembled outside the United States decreased in price (relative to U.S. made only automobiles) after the implementation of the free trade agreements. Consumers have likely benefitted from the trade agreements because prices of new automobiles decreased relative to other goods as demonstrated in Figure 6. These price effects can be a result of the lower input prices

(automotive parts) and the increase in competition in the automotive parts and automobile market. These price effects are according to what would be expected in a more competitive market.

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**APPENDIX****List of coefficient abbreviations**

DUM(year) = year dummy

LENGTH = length

DISPL = displacement

HP = horse power

AIRCO = air conditioning

DAIRBAG = driver air bag

PAIRBAG = passenger air bag

ANTILOCK = anti lock brakes

AUTOTRAN = automatic transmission

BUICK = Buick

CHEVY = Chevrolet

CHRYSLER = Chrysler

DODGE = Dodge

HONDA = Honda

MERCURY = Mercury

NISSAN = Nissan

OLDS = Oldsmobile

PLYMOUTH = Plymouth

PONTIAC = Pontiac

TOYOTA = Toyota

VW = Volkswagen

CANADA(year) = Canada dummy

MEXICO(year) = Mexico dummy

OTHER(year) = Other dummy

YEAR = 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996,  
1997, 1998

Table 5: OLS (1)

Method of estimation = Ordinary Least Squares

Dependent variable: LOGP

Number of observations: 943

Mean of dep. var. = 9.42924  
 Std. dev. of dep. var. = .413210  
 Sum of squared residuals = 16.2165  
 Variance of residuals = .018726  
 Std. error of regression = .136842  
 R-squared = .899176  
 Adjusted R-squared = .890328  
 Durbin-Watson = .591613 [ $<.000$ ]  
 F (zero slopes) = 101.621 [ $.000$ ]

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
C	7.74587	.215387	35.9626	[.000]
DUM98	.168941	.056491	2.99057	[.003]
DUM97	.182110	.057387	3.17336	[.002]
DUM96	.149746	.050545	2.96262	[.003]
DUM95	.136084	.049500	2.74919	[.006]
DUM94	.196244	.043469	4.51461	[.000]
DUM93	.158104	.037566	4.20871	[.000]
DUM92	.150759	.035690	4.22408	[.000]
DUM91	.149079	.036512	4.08307	[.000]
DUM90	.145950	.034379	4.24538	[.000]
DUM89	.154291	.033650	4.58517	[.000]
DUM88	.084333	.034149	2.46952	[.014]
DUM87	.080908	.032213	2.51165	[.012]
DUM86	.044133	.032971	1.33855	[.181]
LENGTH	.551497E-02	.706750E-03	7.80329	[.000]
DISPL	-.044397	.012236	-3.62831	[.000]
HP	.536067E-02	.274619E-03	19.5204	[.000]
AIRCO	.120442	.016169	7.44877	[.000]
DAIRBAG	.101113	.020673	4.89105	[.000]
PAIRBAG	.010063	.029717	.338632	[.735]
ANTILOCK	-.018734	.018507	-1.01229	[.312]
AUTOTRAN	.088958	.016928	5.25515	[.000]
BUICK	.075660	.023394	3.23420	[.001]
CHEVY	-.035174	.022177	-1.58606	[.113]
CHRYSLER	.132349	.027638	4.78860	[.000]
DODGE	-.064047	.023135	-2.76836	[.006]
HONDA	.055923	.029689	1.88365	[.060]
MERCURY	.038705	.022656	1.70835	[.088]
NISSAN	.087641	.026961	3.25067	[.001]
OLDS	.044116	.023745	1.85795	[.064]
PLYMOUTH	-.045839	.024440	-1.87558	[.061]
PONTIAC	-.040906	.023389	-1.74892	[.081]
TOYOTA	.108859	.025415	4.28323	[.000]
VW	.147940	.026754	5.52969	[.000]

CANADA98	-.057793	.057843	-.999143	[.318]
CANADA97	-.020823	.060761	-.342710	[.732]
CANADA96	.036990	.053322	.693709	[.488]
CANADA95	-.168769E-02	.058786	-.028709	[.977]
CANADA94	-.040963	.055000	-.744781	[.457]
CANADA93	-.131431	.053680	-2.44842	[.015]
CANADA92	-.077942	.057449	-1.35672	[.175]
CANADA91	-.047173	.050492	-.934257	[.350]
CANADA90	-.068792	.049064	-1.40208	[.161]
CANADA89	-.036171	.050498	-.716282	[.474]
CANADA88	.019131	.051389	.372284	[.710]
CANADA87	-.026113	.049002	-.532888	[.594]
CANADA86	-.053238	.047058	-1.13133	[.258]
CANADA85	-.039995	.047196	-.847425	[.397]
MEXICO98	.066071	.054601	1.21005	[.227]
MEXICO97	.017544	.062690	.279846	[.780]
MEXICO96	.047272	.059498	.794515	[.427]
MEXICO95	.044380	.056275	.788618	[.431]
MEXICO94	.032190	.059624	.539894	[.589]
MEXICO93	-.041158	.065718	-.626286	[.531]
MEXICO92	-.055455	.057642	-.962047	[.336]
MEXICO91	-.067000	.047806	-1.40149	[.161]
MEXICO90	-.076975	.049581	-1.55250	[.121]
MEXICO89	-.071851	.046887	-1.53242	[.126]
MEXICO88	-.100982	.044570	-2.26569	[.024]
MEXICO87	-.038023	.083631	-.454653	[.649]
OTHER98	.018317	.053740	.340849	[.733]
OTHER97	.034802	.056010	.621363	[.535]
OTHER96	.056167	.045053	1.24668	[.213]
OTHER95	.065455	.045235	1.44700	[.148]
OTHER94	.076835	.045103	1.70353	[.089]
OTHER93	-.075212	.043369	-1.73424	[.083]
OTHER92	-.087063	.042538	-2.04670	[.041]
OTHER91	-.051239	.040983	-1.25026	[.212]
OTHER90	-.081308	.038288	-2.12359	[.034]
OTHER89	-.019628	.037148	-.528372	[.597]
OTHER88	-.052738	.036193	-1.45711	[.145]
OTHER87	-.181214E-02	.034255	-.052902	[.958]
OTHER86	-.019402	.034423	-.563629	[.573]
OTHER85	-.014923	.035010	-.426264	[.670]

Table 6: OLS (2)

Method of estimation = Ordinary Least Squares

Dependent variable: LOGP

Number of observations: 1051. (incl. Cadillac and Lincoln)

Mean of dep. var. = 9.51853  
 Std. dev. of dep. var. = .478905  
 Sum of squared residuals = 30.6355  
 Variance of residuals = .031453  
 Std. error of regression = .177351  
 R-squared = .872785  
 Adjusted R-squared = .862859  
 Durbin-Watson = .529340 [<.000]  
 F (zero slopes) = 87.9257 [.000]

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
C	9.03830	.258552	34.9574	[.000]
DUM98	.183198	.069847	2.62284	[.009]
DUM97	.153946	.070861	2.17251	[.030]
DUM96	.131741	.063041	2.08977	[.037]
DUM95	.112135	.061818	1.81397	[.070]
DUM94	.195669	.054876	3.56566	[.000]
DUM93	.188273	.048098	3.91433	[.000]
DUM92	.217939	.045522	4.78755	[.000]
DUM91	.213522	.046665	4.57561	[.000]
DUM90	.217704	.044128	4.93353	[.000]
DUM89	.196252	.043397	4.52229	[.000]
DUM88	.143071	.043915	3.25790	[.001]
DUM87	.087033	.041709	2.08668	[.037]
DUM86	.045987	.042720	1.07648	[.282]
LENGTH	.588484E-02	.821121E-03	7.16683	[.000]
DISPL	.069999	.013241	5.28643	[.000]
HP	.187479E-03	.439423E-04	4.26649	[.000]
AIRCO	.259569	.018980	13.6758	[.000]
DAIRBAG	.083163	.025149	3.30680	[.001]
PAIRBAG	.108022	.035233	3.06590	[.002]
ANTILOCK	.128736	.021027	6.12234	[.000]
AUTOTRAN	.091879	.021332	4.30712	[.000]
BUICK	-.123397	.023040	-5.35582	[.000]
CHEVY	-.238514	.024077	-9.90637	[.000]
CHRYSLER	-.481940E-02	.030524	-.157887	[.875]
DODGE	-.197459	.026145	-7.55242	[.000]
HONDA	-.044042	.036431	-1.20891	[.227]
MERCURY	-.144007	.025776	-5.58681	[.000]
NISSAN	.036806	.031633	1.16352	[.245]
OLDS	-.157173	.023691	-6.63426	[.000]
PLYMOUTH	-.166088	.028518	-5.82403	[.000]
PONTIAC	-.216697	.025509	-8.49496	[.000]
TOYOTA	.090220	.028495	3.16617	[.002]
VW	.052869	.031475	1.67969	[.093]

CANADA98	-.132946	.068820	-1.93180	[.054]
CANADA97	-.051107	.074630	-.684804	[.494]
CANADA96	-.105895	.064534	-1.64091	[.101]
CANADA95	-.174574	.071513	-2.44115	[.015]
CANADA94	-.147354	.066563	-2.21376	[.027]
CANADA93	-.128286	.066080	-1.94138	[.052]
CANADA92	-.088891	.070998	-1.25202	[.211]
CANADA91	-.101543	.063152	-1.60792	[.108]
CANADA90	-.133385	.061457	-2.17040	[.030]
CANADA89	-.119489	.064145	-1.86279	[.063]
CANADA88	-.024880	.065466	-.380050	[.704]
CANADA87	-.139560	.061290	-2.27702	[.023]
CANADA86	-.125617	.059269	-2.11944	[.034]
CANADA85	-.122467	.059347	-2.06359	[.039]
MEXICO98	-.071367	.064053	-1.11418	[.265]
MEXICO97	-.022873	.077268	-.296026	[.767]
MEXICO96	-.084346	.072934	-1.15647	[.248]
MEXICO95	-.101563	.068098	-1.49143	[.136]
MEXICO94	-.111049	.073683	-1.50712	[.132]
MEXICO93	-.087324	.082401	-1.05975	[.290]
MEXICO92	-.071309	.071244	-1.00092	[.317]
MEXICO91	-.093977	.059611	-1.57652	[.115]
MEXICO90	-.163217	.062080	-2.62916	[.009]
MEXICO89	-.110065	.059080	-1.86297	[.063]
MEXICO88	-.128709	.056079	-2.29515	[.022]
MEXICO87	-.059828	.107232	-.557929	[.577]
OTHER98	-.114943	.061948	-1.85546	[.064]
OTHER97	-.046791	.066799	-.700479	[.484]
OTHER96	-.119084	.052814	-2.25480	[.024]
OTHER95	-.134306	.052489	-2.55875	[.011]
OTHER94	-.060175	.053018	-1.13499	[.257]
OTHER93	-.112925	.051894	-2.17607	[.030]
OTHER92	-.085289	.050328	-1.69467	[.090]
OTHER91	-.061836	.049632	-1.24587	[.213]
OTHER90	-.113178	.045867	-2.46751	[.014]
OTHER89	-.064303	.044608	-1.44150	[.150]
OTHER88	-.057545	.043754	-1.31520	[.189]
OTHER87	-.071622	.041374	-1.73109	[.084]
OTHER86	-.069741	.042256	-1.65044	[.099]
OTHER85	-.057983	.042945	-1.35018	[.177]

Table 7: AR(1) (1)

## MAXIMUM LIKELIHOOD ITERATIVE TECHNIQUE

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CONVERGENCE ACHIEVED AFTER 113 ITERATIONS

Dependent variable: LOGP  
 Number of observations: 801

(Statistics based on transformed data)

Mean of dep. var. = .313707  
 Std. dev. of dep. var. = .084755  
 Sum of squared residuals = 2.57015  
 Variance of residuals = .348731E-02  
 R-squared = .552758  
 Adjusted R-squared = .514527  
 Durbin-Watson = 2.26760  
 Rho (autocorrelation coef.) = .961496  
 Standard error of rho = .971026E-02  
 t-statistic for rho = 99.0185

(Statistics based on original data)

Mean of dep. var. = 9.40937  
 Std. dev. of dep. var. = .408967  
 Sum of squared residuals = 2.5701  
 Variance of residuals = .3487E-02  
 R-squared = .980885  
 Adjusted R-squared = .979251  
 Durbin-Watson = 2.26760

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	10.0451	.459046	21.8826	[.000]
DUM97	9.98757	.456414	21.8827	[.000]
DUM96	9.91377	.453425	21.8642	[.000]
DUM95	9.86315	.451258	21.8570	[.000]
DUM94	9.82837	.448543	21.9117	[.000]
DUM93	9.72405	.446865	21.7606	[.000]
DUM92	9.66134	.444568	21.7320	[.000]
DUM91	9.59224	.443233	21.6416	[.000]
DUM90	9.54461	.442209	21.5839	[.000]
DUM89	9.49608	.440902	21.5379	[.000]
DUM88	9.43181	.439619	21.4545	[.000]
DUM87	9.35069	.437629	21.3667	[.000]
DUM86	9.24882	.435547	21.2350	[.000]
DUM85	9.17016	.434189	21.1202	[.000]
LENGTH	.846739E-03	.870306E-03	.972921	[.331]
DISPL	.041465	.013139	3.15587	[.002]
HP	.186140E-02	.180770E-03	10.2971	[.000]
AIRCO	.059071	.962466E-02	6.13751	[.000]
DAIRBAG	.025834	.928927E-02	2.78101	[.005]
PAIRBAG	.306754E-02	.012070	.254143	[.799]
ANTILOCK	.827604E-02	.010694	.773876	[.439]
AUTOTRAN	.088579	.014795	5.98700	[.000]

CANADA98	-.811801E-02	.060676	-.133793	[.894]
CANADA97	.017134	.054479	.314504	[.753]
CANADA96	.059101	.048773	1.21176	[.226]
CANADA95	.045830	.045819	1.00024	[.317]
CANADA94	.014951	.040720	.367174	[.713]
CANADA93	-.206272E-03	.038848	-.530968E-02	[.996]
CANADA92	.246679E-02	.036796	.067040	[.947]
CANADA91	.019194	.032435	.591780	[.554]
CANADA90	.024932	.031101	.801665	[.423]
CANADA89	.013316	.028572	.466056	[.641]
CANADA88	-.123629E-02	.028812	-.042909	[.966]
CANADA87	-.963404E-02	.037683	-.255663	[.798]
CANADA86	-.055640	.041002	-1.35702	[.175]
CANADA85	-.051394	.044108	-1.16518	[.244]
MEXICO98	.032256	.059423	.542813	[.587]
MEXICO97	.038049	.054084	.703522	[.482]
MEXICO96	.037890	.051016	.742706	[.458]
MEXICO95	.047641	.046684	1.02049	[.307]
MEXICO94	.192574E-02	.041416	.046497	[.963]
MEXICO93	-.895753E-02	.040936	-.218820	[.827]
MEXICO92	-.037672	.035900	-1.04936	[.294]
MEXICO91	.389237E-02	.030370	.128166	[.898]
MEXICO90	-.030317	.028854	-1.05067	[.293]
MEXICO89	-.025117	.027289	-.920396	[.357]
MEXICO88	-.020951	.026535	-.789536	[.430]
MEXICO87	.092915	.041399	2.24438	[.025]
OTHER98	-.013074	.059054	-.221389	[.825]
OTHER97	-.574152E-02	.052935	-.108464	[.914]
OTHER96	.030881	.046931	.658000	[.511]
OTHER95	.051116	.042475	1.20344	[.229]
OTHER94	.036560	.038433	.951257	[.341]
OTHER93	-.014209	.036536	-.388905	[.697]
OTHER92	-.016042	.034128	-.470049	[.638]
OTHER91	-.208244E-02	.030937	-.067312	[.946]
OTHER90	.338186E-03	.028720	.011775	[.991]
OTHER89	.900693E-02	.027643	.325836	[.745]
OTHER88	.017618	.027644	.637312	[.524]
OTHER87	.012754	.029362	.434380	[.664]
OTHER86	-.037993	.032366	-1.17383	[.240]
OTHER85	-.034030	.034331	-.991232	[.322]

Table 8: AR(1) (2)

## MAXIMUM LIKELIHOOD ITERATIVE TECHNIQUE

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CONVERGENCE ACHIEVED AFTER 189 ITERATIONS

Dependent variable: LOGP

Number of observations: 899 (incl. Cadillac and Lincoln)

(Statistics based on transformed data)

Mean of dep. var. = .216793  
 Std. dev. of dep. var. = .081524  
 Sum of squared residuals = 3.27033  
 Variance of residuals = .391656E-02  
 Std. error of regression = .062582  
     R-squared = .452046  
     Adjusted R-squared = .410704  
     Durbin-Watson = 2.36226  
 Rho (autocorrelation coef.) = .972042  
     Standard error of rho = .783128E-02  
     t-statistic for rho = 124.123  
     Log likelihood = 1248.94

(Statistics based on original data)

Mean of dep. var. = 9.50470  
 Std. dev. of dep. var. = .479478  
 Sum of squared residuals = 3.27033  
 Variance of residuals = .391656E-02  
 Std. error of regression = .062582  
     R-squared = .984191  
     Adjusted R-squared = .982998  
     Durbin-Watson = 2.36226

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	11.1577	.509116	21.9158	[.000]
DUM97	11.0821	.505372	21.9287	[.000]
DUM96	10.9890	.501393	21.9170	[.000]
DUM95	10.9199	.498162	21.9203	[.000]
DUM94	10.8610	.494473	21.9647	[.000]
DUM93	10.7370	.491598	21.8411	[.000]
DUM92	10.6624	.488285	21.8365	[.000]
DUM91	10.5782	.485817	21.7740	[.000]
DUM90	10.5164	.483624	21.7450	[.000]
DUM89	10.4425	.481395	21.6921	[.000]
DUM88	10.3672	.479003	21.6432	[.000]
DUM87	10.2538	.476017	21.5408	[.000]
DUM86	10.1319	.472776	21.4307	[.000]
DUM85	10.0346	.470232	21.3396	[.000]
LENGTH	.656136E-03	.770651E-03	.851405	[.395]
DISPL	.067388	.010488	6.42551	[.000]
HP	-.317795E-05	.114507E-04	-.277534	[.781]
AIRCO	.074165	.010025	7.39777	[.000]
DAIRBAG	.021679	.881955E-02	2.45805	[.014]
PAIRBAG	.011479	.011787	.973838	[.330]
ANTILOCK	.017979	.988759E-02	1.81834	[.069]
AUTOTRAN	.088144	.014589	6.04163	[.000]

CANADA98	.034320	.057825	.593517	[.553]
CANADA97	.041340	.052602	.785901	[.432]
CANADA96	.031441	.047487	.662096	[.508]
CANADA95	.012565	.045189	.278055	[.781]
CANADA94	.012138	.040979	.296207	[.767]
CANADA93	.011371	.039232	.289831	[.772]
CANADA92	.960214E-02	.037571	.255575	[.798]
CANADA91	.939256E-02	.033770	.278134	[.781]
CANADA90	.019201	.032587	.589219	[.556]
CANADA89	.427983E-02	.030028	.142529	[.887]
CANADA88	-.679380E-02	.030258	-.224528	[.822]
CANADA87	-.039013	.039340	-.991667	[.321]
CANADA86	-.073767	.042828	-1.72242	[.085]
CANADA85	-.079951	.046375	-1.72401	[.085]
MEXICO98	.052139	.056509	.922660	[.356]
MEXICO97	.061034	.052094	1.17160	[.241]
MEXICO96	.014841	.049881	.297524	[.766]
MEXICO95	.023610	.046024	.512984	[.608]
MEXICO94	.571204E-02	.041748	.136820	[.891]
MEXICO93	.930095E-02	.041352	.224921	[.822]
MEXICO92	-.026908	.036508	-.737052	[.461]
MEXICO91	.759853E-02	.031472	.241437	[.809]
MEXICO90	-.032853	.030125	-1.09055	[.275]
MEXICO89	-.020857	.028652	-.727941	[.467]
MEXICO88	-.015085	.027817	-.542291	[.588]
MEXICO87	.085987	.043251	1.98811	[.047]
OTHER98	.020914	.055772	.374990	[.708]
OTHER97	.025140	.050746	.495412	[.620]
OTHER96	.016735	.045394	.368650	[.712]
OTHER95	.026645	.041406	.643502	[.520]
OTHER94	.028107	.038340	.733091	[.464]
OTHER93	-.863840E-02	.036620	-.235894	[.814]
OTHER92	-.506880E-02	.034539	-.146757	[.883]
OTHER91	.266080E-02	.031947	.083288	[.934]
OTHER90	.940880E-02	.029866	.315036	[.753]
OTHER89	.011246	.028910	.389016	[.697]
OTHER88	.026665	.028912	.922262	[.356]
OTHER87	-.350445E-02	.030385	-.115335	[.908]
OTHER86	-.045416	.033317	-1.36315	[.173]
OTHER85	-.049296	.035559	-1.38631	[.166]

Table 9: Fixed effects(1)

PANEL DATA ESTIMATION  
=====

Unbalanced data: NI= 129, TMIN= 1 TMAX= 14, NOB= 943

WITHIN (fixed effects) Estimates:

Dependent variable: LOGP

Mean of dep. var. = 9.42924  
 Std. dev. of dep. var. = .413210  
 Sum of squared residuals = 2.64403  
 Variance of residuals = .352538E-02  
 Std. error of regression = .059375  
 R-squared = .983561  
 Adjusted R-squared = .979353  
 LM het. test = 1.43435 [.231]  
 Durbin-Watson = 1.06750 [.000,.000]

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	.464806	.027428	16.9464	[.000]
DUM97	.452410	.027593	16.3960	[.000]
DUM96	.420693	.024413	17.2323	[.000]
DUM95	.398471	.023857	16.7026	[.000]
DUM94	.403306	.020797	19.3922	[.000]
DUM93	.343366	.017826	19.2625	[.000]
DUM92	.315105	.016756	18.8051	[.000]
DUM91	.274657	.017043	16.1151	[.000]
DUM90	.249051	.016193	15.3798	[.000]
DUM89	.226283	.015579	14.5253	[.000]
DUM88	.175432	.015550	11.2816	[.000]
DUM87	.129502	.014292	9.06102	[.000]
DUM86	.054184	.014323	3.78304	[.000]
LENGTH	.128958E-02	.781908E-03	1.64927	[.100]
DISPL	.019391	.011743	1.65137	[.099]
HP	.144209E-02	.189585E-03	7.60654	[.000]
AIRCO	.064182	.910987E-02	7.04527	[.000]
DAIRBAG	.035698	.010192	3.50251	[.000]
PAIRBAG	.025021	.013977	1.79012	[.074]
ANTILOCK	.012248	.984736E-02	1.24376	[.214]
AUTOTRAN	.042693	.013935	3.06380	[.002]

CANADA98	.040272	.036838	1.09323	[.275]
CANADA97	.057260	.038001	1.50678	[.132]
CANADA96	.074450	.034813	2.13854	[.033]
CANADA95	.060948	.037035	1.64569	[.100]
CANADA94	.039087	.034489	1.13332	[.257]
CANADA93	.044930	.034114	1.31703	[.188]
CANADA92	.039910	.035279	1.13125	[.258]
CANADA91	.035622	.031409	1.13415	[.257]
CANADA90	.036520	.030441	1.19972	[.231]
CANADA89	.028151	.028467	.988872	[.323]
CANADA88	.013157	.029745	.442320	[.658]
CANADA87	.016401	.034221	.479278	[.632]
CANADA86	-.025064	.034043	-.736254	[.462]
CANADA85	-.022114	.033959	-.651189	[.515]
MEXICO98	.111101	.034841	3.18880	[.001]
MEXICO97	.111720	.039465	2.83087	[.005]
MEXICO96	.090639	.037033	2.44751	[.015]
MEXICO95	.083748	.036032	2.32428	[.020]
MEXICO94	.020377	.035461	.574630	[.566]
MEXICO93	.017109	.038077	.449333	[.653]
MEXICO92	-.013806	.034603	-.398999	[.690]
MEXICO91	.025082	.029970	.836917	[.403]
MEXICO90	.274053E-02	.029149	.094016	[.925]
MEXICO89	-.831912E-02	.027703	-.300293	[.764]
MEXICO88	.372093E-03	.027840	.013365	[.989]
MEXICO87	.073725	.045971	1.60374	[.109]
OTHER98	.037304	.035214	1.05935	[.290]
OTHER97	.042006	.035047	1.19857	[.231]
OTHER96	.055447	.031428	1.76428	[.078]
OTHER95	.057276	.031447	1.82139	[.069]
OTHER94	.044803	.031472	1.42355	[.155]
OTHER93	.023228	.030397	.764141	[.445]
OTHER92	.014168	.030206	.469039	[.639]
OTHER91	.018312	.028896	.633731	[.526]
OTHER90	.897105E-02	.027968	.320759	[.748]
OTHER89	.021111	.027395	.770610	[.441]
OTHER88	.844525E-02	.027510	.306986	[.759]
OTHER87	.016045	.027711	.578994	[.563]
OTHER86	-.021495	.028333	-.758675	[.448]
OTHER85	-.018206	.028516	-.638467	[.523]

Table 10: Fixed effects (2)

PANEL DATA ESTIMATION  
=====

Unbalanced data: NI= 139, TMIN= 1 TMAX= 14, NOB= 1051  
(incl. Cadillac and Lincoln)

WITHIN (fixed effects) Estimates:

Dependent variable: LOGP

Mean of dep. var. = 9.51853  
 Std. dev. of dep. var. = .478905  
 Sum of squared residuals = 3.11420  
 Variance of residuals = .367240E-02  
 Std. error of regression = .060600  
     R-squared = .987068  
 Adjusted R-squared = .983988  
     LM het. test = .041492 [.839]  
     Durbin-Watson = 1.11450 [.000,.000]

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	.516009	.026228	19.6736	[.000]
DUM97	.502981	.026435	19.0272	[.000]
DUM96	.467607	.023449	19.9416	[.000]
DUM95	.442641	.022975	19.2663	[.000]
DUM94	.440741	.020282	21.7303	[.000]
DUM93	.379656	.017532	21.6549	[.000]
DUM92	.352905	.016403	21.5147	[.000]
DUM91	.309227	.016801	18.4056	[.000]
DUM90	.282499	.015951	17.7102	[.000]
DUM89	.250733	.015599	16.0740	[.000]
DUM88	.200290	.015537	12.8908	[.000]
DUM87	.139136	.014537	9.57103	[.000]
DUM86	.057100	.014612	3.90790	[.000]
LENGTH	.511710E-03	.684965E-03	.747061	[.455]
DISPL	.031917	.911762E-02	3.50062	[.000]
HP	.119346E-04	.158822E-04	.751441	[.453]
AIRCO	.072788	.897600E-02	8.10921	[.000]
DAIRBAG	.030702	.967424E-02	3.17360	[.002]
PAIRBAG	.039148	.013083	2.99241	[.003]
ANTILOCK	.026230	.908910E-02	2.88585	[.004]
AUTOTRAN	.038049	.013764	2.76439	[.006]

CANADA98	.044389	.034934	1.27067	[.204]
CANADA97	.058701	.036816	1.59444	[.111]
CANADA96	.041331	.033748	1.22470	[.221]
CANADA95	.028584	.035939	.795355	[.427]
CANADA94	.034525	.033585	1.02799	[.304]
CANADA93	.047498	.033572	1.41481	[.157]
CANADA92	.035543	.034888	1.01875	[.309]
CANADA91	.023050	.031460	.732693	[.464]
CANADA90	.029903	.030556	.978601	[.328]
CANADA89	.025102	.028813	.871199	[.384]
CANADA88	.013088	.030115	.434593	[.664]
CANADA87	.015671	.034325	.456563	[.648]
CANADA86	-.014412	.034079	-.422908	[.672]
CANADA85	-.016897	.034063	-.496066	[.620]
MEXICO98	.089437	.032635	2.74048	[.006]
MEXICO97	.101880	.038285	2.66108	[.008]
MEXICO96	.050808	.035914	1.41471	[.158]
MEXICO95	.046967	.034680	1.35431	[.176]
MEXICO94	.450551E-02	.034889	.129139	[.897]
MEXICO93	.683769E-02	.037792	.180928	[.856]
MEXICO92	-.022555	.034135	-.660764	[.509]
MEXICO91	.020287	.029948	.677417	[.498]
MEXICO90	-.132366E-02	.029239	-.045270	[.964]
MEXICO89	-.598811E-02	.027936	-.214353	[.830]
MEXICO88	.017061	.028050	.608221	[.543]
MEXICO87	.085086	.046484	1.83042	[.068]
OTHER98	.026433	.032962	.801919	[.423]
OTHER97	.041851	.033507	1.24902	[.212]
OTHER96	.027344	.030057	.909741	[.363]
OTHER95	.025275	.029926	.844574	[.399]
OTHER94	.029293	.030410	.963260	[.336]
OTHER93	.018273	.029710	.615046	[.539]
OTHER92	.016411	.029421	.557798	[.577]
OTHER91	.018135	.028685	.632209	[.527]
OTHER90	.015534	.027808	.558640	[.577]
OTHER89	.028270	.027430	1.03063	[.303]
OTHER88	.027552	.027575	.999147	[.318]
OTHER87	.020443	.027582	.741178	[.459]
OTHER86	-.813695E-02	.028143	-.289132	[.773]
OTHER85	-.662254E-02	.028377	-.233378	[.816]

Table 11: Random effects (1)

PANEL DATA ESTIMATION  
 =====

Unbalanced data: NI= 129, TMIN= 1 TMAX= 14, NOB= 943

Variance Components (random effects) Estimates:

VWITH (variance of  $U_{it}$ ) = 0.35254E-02  
 VBET (variance of  $A_i$ ) = 0.18651E-01  
 (computed from small sample formula)  
 THETA (0=WITHIN, 1=TOTAL) = 0.13321E-01  
 (evaluated at TMAX = 14)

Dependent variable: LOGP

Mean of dep. var. = 9.42924  
 Std. dev. of dep. var. = .413210  
 R-squared = .809319  
 Adjusted R-squared = .795420  
 Sum of squared residuals = 34.4132  
 LM het. test = .023187 [.879]  
 Variance of residuals = .039195  
 Durbin-Watson = .084538 [.000,.000]  
 Std. error of regression = .197977

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	.404258	.026964	14.9922	[.000]
DUM97	.388760	.027071	14.3606	[.000]
DUM96	.364538	.023991	15.1948	[.000]
DUM95	.345513	.023470	14.7215	[.000]
DUM94	.358893	.020453	17.5475	[.000]
DUM93	.305662	.017543	17.4232	[.000]
DUM92	.281677	.016524	17.0470	[.000]
DUM91	.246410	.016868	14.6085	[.000]
DUM90	.221202	.016002	13.8237	[.000]
DUM89	.201376	.015407	13.0708	[.000]
DUM88	.154645	.015438	10.0174	[.000]
DUM87	.119438	.014256	8.37809	[.000]
DUM86	.053202	.014321	3.71485	[.000]
DUM85	-.140281	.091609	-1.53131	[.126]
LENGTH	.406117E-02	.677809E-03	5.99162	[.000]
DISPL	.029974	.010728	2.79389	[.005]
HP	.207351E-02	.181654E-03	11.4146	[.000]
AIRCO	.076583	.890632E-02	8.59869	[.000]
DAIRBAG	.038797	.010133	3.82886	[.000]
PAIRBAG	.027522	.013914	1.97799	[.048]
ANTILOCK	.013711	.972387E-02	1.41003	[.159]
AUTOTRAN	.065245	.013182	4.94942	[.000]

CANADA98	.023119	.033117	.698109	[.485]
CANADA97	.041668	.034284	1.21538	[.224]
CANADA96	.058342	.030964	1.88421	[.060]
CANADA95	.042013	.033365	1.25919	[.208]
CANADA94	.021704	.030960	.701032	[.483]
CANADA93	.992477E-02	.030440	.326047	[.744]
CANADA92	.016149	.031852	.507015	[.612]
CANADA91	.012263	.028149	.435646	[.663]
CANADA90	.779057E-02	.027331	.285049	[.776]
CANADA89	.682176E-02	.026298	.259403	[.795]
CANADA88	-.215676E-02	.027281	-.079056	[.937]
CANADA87	-.024232	.029327	-.826265	[.409]
CANADA86	-.063734	.029054	-2.19362	[.028]
CANADA85	-.051985	.029169	-1.78221	[.075]
MEXICO98	.094861	.031234	3.03713	[.002]
MEXICO97	.089662	.035685	2.51257	[.012]
MEXICO96	.072691	.033378	2.17778	[.029]
MEXICO95	.058633	.032141	1.82423	[.068]
MEXICO94	.900880E-02	.032235	.279470	[.780]
MEXICO93	-.874519E-02	.034973	-.250059	[.803]
MEXICO92	-.034644	.031319	-1.10615	[.269]
MEXICO91	-.476036E-02	.026691	-.178350	[.858]
MEXICO90	-.020704	.026355	-.785568	[.432]
MEXICO89	-.026668	.025177	-1.05920	[.290]
MEXICO88	-.030076	.024769	-1.21424	[.225]
MEXICO87	.040396	.043161	.935936	[.349]
OTHER98	.022805	.031212	.730633	[.465]
OTHER97	.019872	.031313	.634620	[.526]
OTHER96	.036913	.027208	1.35667	[.175]
OTHER95	.039457	.027208	1.45018	[.147]
OTHER94	.038040	.027359	1.39039	[.164]
OTHER93	-.635457E-02	.026315	-.241485	[.809]
OTHER92	-.012552	.026057	-.481713	[.630]
OTHER91	-.904611E-02	.024927	-.362905	[.717]
OTHER90	-.024175	.023814	-1.01519	[.310]
OTHER89	-.864807E-02	.023229	-.372300	[.710]
OTHER88	-.021508	.023163	-.928540	[.353]
OTHER87	-.748773E-02	.023008	-.325437	[.745]
OTHER86	-.042407	.023599	-1.79701	[.072]
OTHER85	-.034811	.023904	-1.45631	[.145]
C	8.04629	.286247	28.1096	[.000]

Hausman test of H0:RE vs. FE: CHISQ(58) = 240.72, P-value = [.0000]

Table 12: Random effects (2)

Unbalanced data: NI= 139, TMIN= 1 TMAX= 14, NOB= 1051  
(incl. Cadillac and Lincoln)

## Variance Components (random effects) Estimates:

VWITH (variance of  $U_{it}$ ) = 0.35254E-02  
VBET (variance of  $A_i$ ) = 0.18651E-01  
(computed from small sample formula)  
THETA (0=WITHIN, 1=TOTAL) = 0.13321E-01  
(evaluated at TMAX = 14)

Dependent variable: LOGP

Mean of dep. var. = 9.42924  
Std. dev. of dep. var. = .413210  
R-squared = .809319  
Adjusted R-squared = .795420  
Sum of squared residuals = 34.4132  
LM het. test = .023187 [.879]  
Variance of residuals = .039195  
Durbin-Watson = .084538 [.000,.000]  
Std. error of regression = .197977

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
DUM98	.404258	.026964	14.9922	[.000]
DUM97	.388760	.027071	14.3606	[.000]
DUM96	.364538	.023991	15.1948	[.000]
DUM95	.345513	.023470	14.7215	[.000]
DUM94	.358893	.020453	17.5475	[.000]
DUM93	.305662	.017543	17.4232	[.000]
DUM92	.281677	.016524	17.0470	[.000]
DUM91	.246410	.016868	14.6085	[.000]
DUM90	.221202	.016002	13.8237	[.000]
DUM89	.201376	.015407	13.0708	[.000]
DUM88	.154645	.015438	10.0174	[.000]
DUM87	.119438	.014256	8.37809	[.000]
DUM86	.053202	.014321	3.71485	[.000]
DUM85	-.140281	.091609	-1.53131	[.126]
LENGTH	.406117E-02	.677809E-03	5.99162	[.000]
DISPL	.029974	.010728	2.79389	[.005]
HP	.207351E-02	.181654E-03	11.4146	[.000]
AIRCO	.076583	.890632E-02	8.59869	[.000]
DAIRBAG	.038797	.010133	3.82886	[.000]
PAIRBAG	.027522	.013914	1.97799	[.048]
ANTILOCK	.013711	.972387E-02	1.41003	[.159]
AUTOTRAN	.065245	.013182	4.94942	[.000]

CANADA98	.023119	.033117	.698109	[.485]
CANADA97	.041668	.034284	1.21538	[.224]
CANADA96	.058342	.030964	1.88421	[.060]
CANADA95	.042013	.033365	1.25919	[.208]
CANADA94	.021704	.030960	.701032	[.483]
CANADA93	.992477E-02	.030440	.326047	[.744]
CANADA92	.016149	.031852	.507015	[.612]
CANADA91	.012263	.028149	.435646	[.663]
CANADA90	.779057E-02	.027331	.285049	[.776]
CANADA89	.682176E-02	.026298	.259403	[.795]
CANADA88	-.215676E-02	.027281	-.079056	[.937]
CANADA87	-.024232	.029327	-.826265	[.409]
CANADA86	-.063734	.029054	-2.19362	[.028]
CANADA85	-.051985	.029169	-1.78221	[.075]
MEXICO98	.094861	.031234	3.03713	[.002]
MEXICO97	.089662	.035685	2.51257	[.012]
MEXICO96	.072691	.033378	2.17778	[.029]
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MEXICO94	.900880E-02	.032235	.279470	[.780]
MEXICO93	-.874519E-02	.034973	-.250059	[.803]
MEXICO92	-.034644	.031319	-1.10615	[.269]
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MEXICO89	-.026668	.025177	-1.05920	[.290]
MEXICO88	-.030076	.024769	-1.21424	[.225]
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OTHER98	.022805	.031212	.730633	[.465]
OTHER97	.019872	.031313	.634620	[.526]
OTHER96	.036913	.027208	1.35667	[.175]
OTHER95	.039457	.027208	1.45018	[.147]
OTHER94	.038040	.027359	1.39039	[.164]
OTHER93	-.635457E-02	.026315	-.241485	[.809]
OTHER92	-.012552	.026057	-.481713	[.630]
OTHER91	-.904611E-02	.024927	-.362905	[.717]
OTHER90	-.024175	.023814	-1.01519	[.310]
OTHER89	-.864807E-02	.023229	-.372300	[.710]
OTHER88	-.021508	.023163	-.928540	[.353]
OTHER87	-.748773E-02	.023008	-.325437	[.745]
OTHER86	-.042407	.023599	-1.79701	[.072]
OTHER85	-.034811	.023904	-1.45631	[.145]
C	8.04629	.286247	28.1096	[.000]

Hausman test of H0:RE vs. FE: CHISQ(58) = 240.72, P-value = [.0000]