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U.S. STRATEGIC TRADE POLICY AND JAPANESE AUTOMOBILES: A THEORETICAL AND EMPIRICAL EVALUATION OF VOLUNTARY EXPORT RESTRAINTS AND JAPANESE TRANSPLANTS

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JINSUP KIM

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By

Jinsup Kim

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ABSTRACT

U.S. STRATEGIC TRADE POLICY AND JAPANESE AUTOMOBILES: A THEORETICAL AND EMPIRICAL EVALUATION OF VOLUNTARY EXPORT RESTRAINTS AND JAPANESE TRANSPLANTS

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This dissertation is a theoretical and empirical analysis of the U.S. restrictive trade policy with respect to Japanese automobiles.

In theory, one would expect a VER to raise U.S. prices on imported cars and cause a loss in consumers' welfare. One should also expect quality upgrading. Using a hedonic equation model, the empirical work examines how the price of U.S., Japanese and European cars changed in the U.S. automobile market after the imposition of the Japanese VER. Further, this work investigates the effect of quality upgrading, and the effects of changes in the U.S.-Japanese exchange rate and the U.S. average prime rate on the price trend.

The main results can be summarized as follows: U.S. cars experienced substantial mark-ups during the early 1980s. This is seen even after controlling for both quality upgrading and macroeconomic effects. The adjusted price of Japanese cars sold in the U.S. declined steadily throughout 1981-1994, suggesting that the increase in Japanese price reflected mostly quality upgrading. Consumers' welfare loss in the U.S. during

the earliest VER period was therefore not due to the Japanese cars. The empirical results indicate that Japanese automobile producers responded to U.S. VER-induced price increases by upgrading the quality of their exports, as one would expect from theory. Thus there is no support for the claim of a loss in U.S. domestic consumers' welfare due to the imports from Japan. In particular, the U.S. exchange rate with respect to the Japanese yen is crucial to the pricing of Japanese cars, but not to the pricing of U.S. or European cars in the U.S. market according to the empirical findings.

In the light of these findings it is puzzling that the U.S. invested much effort in securing VER restraints on Japanese automobile exports into the U.S. National policy goals involve a complex mix of political pressures, powerful economic interest groups, and underlying shifts in the structure of industry interests. Also, many symbolic issues of national prestige are involved. These involve complex question of political economy which we touch on only indirectly. Given the importance of the automobile industry, one can safely predict, however, that trade policy conflicts will continue to be important. My study provides empirical results which I hope will be a useful guide to debates which are often contentious and dominated by exaggerated views.

THIS DISSERTATION IS DEDICATED TO MY PARENTS,

TO MY WIFE, CHUNGRYE, AND TWO SONS, JOSEPH AND DANIEL,

TO MY SWORN BROTHER, SANGHOON,

AND TO THE MEMORY OF MY DEAR GRANDMOTHER

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CHAPTER I

INTRODUCTION

1.1. Overview

Since the end of the Second World War, the U.S. has been a supporter of an international trade system based on multilateralism and non-discrimination, as shown by its leadership of the General Agreement on Tariffs and Trade (GATT). Under this new post-war regime of multilateral trade liberalization, the world economy has expanded and prospered at an unprecedented rate.

Classical trade theory suggests manufacturing specialization based on country-specific comparative advantage. However, this neglects important location-specific and technological reasons underlying today's global economic interactions and the spread of multinationals. Japanese automobiles may be designed and assembled in North America or anywhere in the world and consist of parts manufactured in those countries. Globalization, therefore, implies an increase in intraindustry trade in components as well as manufacturers who go from one country to another. The traditional horizontal patterns of trade in final products is thus being overtaken by a similar trade at various levels of specialization in the vertical chain of production for individual products.

The United States experienced macroeconomic difficulties during the 1970s and 1980s. The real gross national product (GNP) grew at an average rate of 4% during the 1960s but slowed to 2.8% during the 1970s, and to less than 2.0% from 1980 to 1985. The unemployment rate averaged 4.5% during the 1960s, 6.1% during the 1970s, and 8.0% from 1980 to 1985, reflecting the adverse effect of the slowdown in economic activity. The trade balance on goods and services has been in deficit since the early 1970s and the deficit expanded tremendously in the 1980s, growing from $28 million in 1981 to $148 million in 1986. This imbalance fostered a growing feeling that the trade deficit was unsustainable and had to be eliminated.

There has been an increasing trend in U.S. trade policy since the 1980s towards regional and bilateral trade including non-tariff trade barriers. A fundamental change in U.S. trade policy was signaled with the new interest in regional arrangements, and the departure from the multilateralism based on GATT. The trade conflict, especially over the auto trade, has accelerated the transformation of U.S. trade policy towards restrictive and discriminative protection of U.S. manufacturers.

The world automobile industry underwent major structural changes from the late 1970s until the mid 1980s. There was the decline of the U.S. auto manufacturers, who had been the top auto producers in the world for over sixty years, and the rapid development in the international competitiveness of the Japanese automobile industry.

This also had a great impact on the European automobile industry, which has been in decline since 1973. The decline of both the U.S. and European automobile industries coupled with the rapid penetration of their markets by the Japanese led to restrictions against Japanese exports, automotive exports in particular.

In the early 1980s, a main issue in American trade politics was the struggle over trade in automobiles. With the second wave of oil shocks in 1979-1980 and demand shifts toward smaller cars, the American automobile industry found itself vulnerable due to the rapid surge of imported cars, mainly from Japan. According to the estimation by Economic Strategic Institute[1] (ESI, 1992), more than 300,000 workers out of a total of almost one million employees in the U.S. auto industry lost their jobs. Faced with heavy pressure from domestic automakers, the U.S. government pressed for Voluntary Export Restraint (VER), but refrained from discriminatory tariffs or import quotas which were prohibited by GATT.

The concept of managed trade refers to a variety of trade and investment restrictions, ranging from trade limitations placed on particular industries to a cap placed on the absolute level of deficit in trade or investment. However, the policy instruments available for a managed bilateral trade policy are problematic since the restricted country may retaliate. A compromise took the form of the VER. Japanese auto producers were not necessarily unhappy with the VER, because they could still make a profit.

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[1] *Final Report: The Future of the Auto Industry: It Can Complete, Can It Survive*? (Washington, D.C.: Economic Strategic Institute, 1992).

1.2. A Brief Introduction to the U.S. Auto Market prior to the VER

The U.S. auto market has become increasingly internationalized during the last few decades in contrast to its isolation until the mid 1970s. In Table 1, Volkswagen (VW) was filling a specialty demand for small vehicles, and a few other imports including the Japanese autos were operating on the fringes of the market. In 1970, VW accounted for nearly 7% of the U.S. market (569,000 cars), and the other European producers accounted for 3% of sales, a total of only 10%.

However, things began to change after Japan began to invade the U.S. market. Their smaller, lower cost vehicles were initially disregarded by the U.S. auto industry and consumers alike since most Japanese models were tiny, badly designed and built, and had a tendency to rust. Although the first oil crisis and resulting fuel shortage of 1973 helped the Japanese sell their fuel efficient cars more easily, the Japanese manufacturers developed their cars and their market position grew only gradually. However, the impact of the Japanese imports as they grew in the 1970s and 1980s was much more serious than the European case a decade ago, as the Japanese built a strong base of marketing within the U.S.

The Europeans had entered the U.S. market during a period of rapid growth in domestic car sales. The U.S. car market grew by 44% between 1960 and 1970. That meant there was room for new entrants. Unlike the Europeans, Japan experienced a stiff climb, and took steps to ensure long-term success in the U.S. market and, incidentally, to eradicate the share of the over-confident European entrants.

Table 1 Market Shares(%) by Firm in the U.S. prior to the Japanese VER

Firm	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970
GM	46.0	46.6	48.3	46.7	48.0	43.9	41.9	44.5	44.4	45.2	39.7
Ford	17.3	20.7	23.6	23.4	22.6	23.6	25.0	23.5	24.4	23.5	26.4
Chrysler	8.8	10.0	10.7	11.7	13.3	11.8	13.6	13.3	13.8	13.7	16.1
AMC	2.0	1.6	1.5	1.7	2.5	3.7	3.8	3.4	2.8	2.5	3.0
U.S.	**74.1**	**78.9**	**84.1**	**83.5**	**86.4**	**83.0**	**84.3**	**84.7**	**85.4**	**84.9**	**85.2**
VW	3.6	3.3	2.7	2.9	2.0	3.0	3.8	4.1	4.7	5.4	6.3
Volvo	.7	.5	.4	.4	.4	.7	.6	.5	.6	.5	.5
Europe	**4.3**	**3.8**	**3.1**	**3.3**	**2.4**	**3.7**	**4.4**	**4.6**	**5.3**	**5.9**	**6.8**
Toyota	6.3	4.7	3.8	4.5	3.4	3.1	2.7	2.4	3.0	3.1	2.5
Nissan	5.7	4.4	3.0	3.6	2.7	3.0	2.1	2.0	2.6	2.6	1.8
Honda	4.1	3.3	2.4	2.0	1.5	1.2	.5	.3	.2	.1	-
Japan	**16.1**	**12.4**	**9.2**	**10.1**	**7.6**	**7.3**	**5.3**	**4.7**	**5.8**	**5.8**	**4.3**

Source: *Ward's Automotive Yearbook* (Detroit: Ward' Communications)

In the mid-1960s, General Motors (GM) held 50% of the U.S. car market. At the end of the 1970s, its share had fallen to 46% due to the European wave. Its share had fallen, but it was still the biggest car producer in America. GM's share was only 35% by the end of the 1980s after the Japanese wave. Its sales were down by more than a third compared with the previous decade.

While GM was still the world's biggest vehicle manufacturer, it had been hurt badly by the Japanese invasion. The positions of Ford and Chrysler were little better. Ford had suffered years of losses, while Chrysler was almost driven to bankruptcy. By the end of the 1970s, the Japanese share of the U.S. car market had reached nearly 22% and by 1991, 28%. Toyota had become the third largest vehicle manufacturer in the world. Nissan was the fifth while Honda, Mitsubishi and Mazda were all among the top 12.

The Japanese auto industries led the world in terms of productivity and design cycle, and were able to produce cars at a lower cost than their competitors. They had even set up international transplants to overcome quantitative restraints and the strong yen. By 1991, the Japanese auto assembly capacity in the U.S. was equivalent to 30% of the entire U.S. market. Japanese manufacturers also supplied engines and various parts to traditional U.S. competitors to increase their share of the market. The Japanese impact on the European manufacturers was even more serious. The European share in the U.S. market had been halved to 3.5% by 1993 compared with 7% in 1980.

Furthermore, the top-of-the-line models have suffered from competition from the Japanese luxury auto lines. While the Japanese assault began in small cars over a few decades, they began to penetrate further with upgraded models since the late-1980s. They developed mid-sized cars as well as larger and more luxurious vehicles. Each of the major Japanese suppliers launched luxury divisions: Toyota introduced Lexus, Honda developed Acura, and Nissan brought in Infiniti. These cars had an even more drastic impact on the U.S. market.

When the Lexus LS 400 was launched in 1989, few believed that it was a significant threat to traditional luxury car suppliers in the U.S. like Cadillac, Mercedes-Benz and BMW. Mercedes-Benz had a reputation that had taken almost 100 years to establish, yet Lexus was outselling them in just 2 years. In 1993, Lexus' U.S. sales were 50% more than its rival and growing nearly twice as fast. Thus the European auto makers began to fall back after a few decades of success in the U.S. market.

The world's motor industry is increasingly dominated by five main vehicle manufacturers[2]. They dominate two of the three largest car markets in the world, Japan and North America. They account for 81% of car sales in the U.S. and Canada. They also account for two of three cars sold in Japan. The battle for global dominance by vehicle manufacturers is more advanced in the U.S. than elsewhere. The Japanese automakers have been particularly successful in taking market share from the U.S. Big Three and European auto makers in just about two decades.

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[2] They are GM, Ford, Toyota, Nissan and Honda.

Figure 1 illustrates the market share by country in the U.S. market during the last a few decades. A major change in the U.S. market has been the increase in the share of imports and the change in their composition, due to the growth of Japanese imports and the decline of VW's share. As the market has shifted toward Japanese imports, the total share of imports has grown from 11% in 1970 to 27% in 1980, and to 34% in 1990. Japanese vehicles accounted for 82% of the total imports in 1980 and 86% in 1990. Total sales of U.S.-produced cars have increased little since 1970. Foreign entrants, especially Japanese auto exporters, have captured most of the growth in the U.S. domestic market[3].

The second oil crisis in 1979-80 brought about a new phase for the Japanese automobile industry in the U.S. market. This reflected the fact that the Japanese automobile industry became more competitive as the Big Three were switching to a compact car strategy in response to the fuel shortage, following the rapid rise in oil prices. Figure 2 shows a radically changing pattern of distribution in car sizes before and after the oil shock in the U.S. domestic market. While the structure of market demand changed in favor of small, fuel efficient, and compact cars, Japanese cars increased their share of the U.S. market from 15% to about 25% despite a decline in total U.S. demand. As a result, the unemployment rate[4] rose to the its highest levels since the Great Depression, thereby worsening trade friction which was already fierce.

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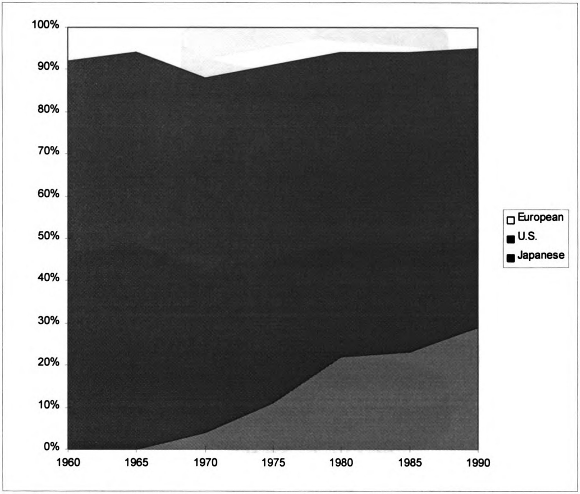
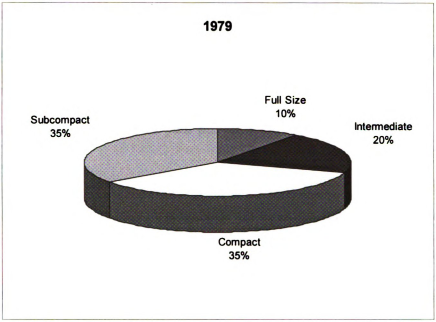
[3] Foreign imports captured 85% of total growth in U.S. domestic auto sales until the early 1980s.
[4] More than 300,000 workers out of a total of almost one million employees in the automobile industry lost their jobs during the period according to the ESI estimates.

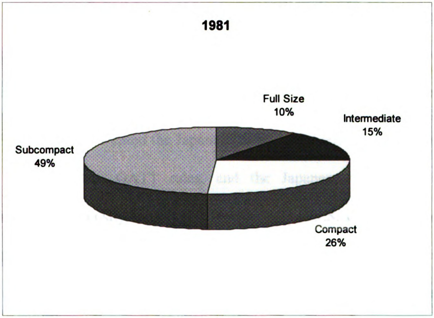
Figure 1 Car Market Share by Country in the U.S.



Source: *Facts and Figures* (Washington, D.C.: American Automobile Manufacturers Association, 1993).

Figure 2 <u>Distribution of Car Sizes in the U.S. before and after Second Oil Shock</u>





Source: *The Changing U.S. Automobile Industry* (Chicago, Ill: Arthur Anderson & Co., 1984).

Faced with heavy pressures from the domestic automobile industry and United Automobile Workers (UAW), the U.S. government pressed for a Voluntary Export Restraint on Japanese autos, but refrained from discriminatory import tariff or import quotas that were prohibited by GATT. In 1981, the Japanese government decided on a self-imposed restriction of their passenger car exports to the U.S. setting the limit at 1.68 million cars during the first three year period beginning 1981, and to 1.86 million cars in the fourth year.

The U.S. market is not only strategically important to Japanese car makers but also to others. To risk a trade war and suffer the cost of U.S. retaliation would have been extremely burdensome for Japan. For Japan, accommodation at the least possible cost was preferable to risking the potentially high costs of confrontation. Given the asymmetry of the two countries' market dependence, and the structure of the VER option, Japan could gamble at a very low cost that VER cooperation would ward off more general tensions over market liberalization and deflect American retaliation.

The U.S. government wanted the Japanese to act positively without resorting to measures that might violate GATT rules, and the Japanese wanted to prevent Americans from imposing costly import restrictions. The U.S. obtained a series of agreements with Japan for import liberalization and the VER. Japanese auto producers, on the other hand, benefited from the profitable quota rents from the export restraints. At the same time, the appreciation of the yen made Japanese auto exports relatively expensive. From 1981, the value of the Japanese yen continued to be strong against the U.S. dollar, and Japanese automakers increased the number of highly valued compact cars, which allowed Japanese auto exporters to gain large profits from exports to the U.S. The yen appreciated from ¥240/$ to ¥130/$ in 1982, and this quickly reduced the volume of exports to the U.S., forcing the Japanese to raise prices several times. Their exports thus fell below the permitted number of 2.3 million.

However, the U.S. dollar rose dramatically to ¥265/$ in 1984. This rise was translated into production cost changes in U.S. local production. The average cost of manufacturing a Japanese car in the U.S. fell to $5,000 in 1984 from $7,400 in 1978[5] solely because of exchange rate changes. This cost gap encouraged Japanese firms to invest in transplants in the U.S. more intensively and thus turned a large share of the U.S. market over to Japanese transplants, thereby reducing the volume of U.S. automakers' production and further worsening their cost position. Locally-based Japanese auto production in America rose to about to 1.2 million units[6] in 1990 and 1.54 million units in 1994 and has tended to increase continuously since then.

In 1985, the U.S. officially announced that it would not renew the VER since the recovery of U.S. automobile manufacturers rendered it unnecessary. However, Japan's MITI officially announced that the VER would be voluntarily renewed again. The quantity of imports permitted had been, in million units, 1.68 in 1981, 1.86 in 1984 and 2.3 in 1985, and was set at 1.65 in 1992 by Japan.

[5] In 1978, the exchange rate was ¥178/$.

[6] This included the Original Equipment Manufacturer (OEM) supplies to the U.S. auto company according to *Ward's Automotive Yearbook*, 1995..

Japanese auto firms had learned the benefits of restricting their U.S. automobile supply, and they were not anxious to depress prices or stimulate protectionist reactions by overexporting. The Japanese government stressed that some restraint would continue to rein in its record trade surplus with U.S. and foster good relations with the U.S. In the mid 1980s, U.S. domestic demand fueled recovery of the U.S. automobile industry, and pressure for import protection subsided. In exchange for dropping the VER, the U.S. expected trade liberalization and did not view Japan's VER extension as enough.

The first VER was the product of U.S. coercive protectionism and an accommodative Japan, but later renewals were part of a Japanese strategy to deflect U.S. pressure with collusive responses. This behavior influenced the GATT regime in two ways: first, it reinforced policymaker's preferences for VER to solve domestic competitiveness problems and, second, it undermined GATT procedures for mutual market access. U.S. bargaining for foreign trade expansion in the earlier period had included the reciprocal promise of wider access to the U.S. market. The U.S. first accommodated domestic manufacturers with unilateral coercive protectionism, then sought a reciprocal strategy that coupled U.S. market access with balanced treatment from Japan for U.S. exports. For the U.S., securing the voluntary restraint agreement with Japan was inexpensive and politically beneficial. With regard to Japan's import policies, the U.S. could buttress its own demands for liberalization with congressional retaliatory fervor in reserve to threaten Japan if no agreement were forthcoming.

In the meantime, the Japanese domestic automobile market expanded rapidly due to the number of units sold increasing from 5.7 million units in 1986 to 6.02 million in 1987, 6.72 million in 1988 and 7.78 million in 1990. The appreciation of the yen reduced the dependency of the Japanese industry on exports, and enabled the industry to profit from its own domestic market. Also the appreciation of the yen accelerated the promotion of locally based production and an international division of labor in North America as well as the EC.

The self-restriction on the export of Japanese passenger cars to the U.S. is still in effect today. From 1988 to 1991 the limit was increased to 2.3 million passenger cars. But it should be noted that exports of Japanese cars consistently fell short of this limit during this period except in 1986. For 1992, the limit was cut at a maximum of 1.65 million cars due largely to increased Japanese auto transplants production in the U.S.

The U.S. preferred to maintain free trade, but retaliation was very popular at home. Abroad, such threats could also be useful, because they demonstrated the U.S. willingness to punish unfair trade. Although costs to U.S. consumers would be high, the benefits to the potentially unemployed in the auto sector would be politically preferable in the short run. The U.S., therefore, could press Japan at every turn to further liberalize the import policies and still obtain voluntary export restraint without surrendering one demand for the other.

1.3. Auto Trade Conflicts and Agreement between the U.S. and Japan in the 1990s

Two distinct bilateral conflicts with Japan have dominated U.S. trade in automobiles during the last two decades. The first developed in the early 1980s, and the second in the 1990's, both centering around auto imports. The first emerged from increasing competition between the Big Three and Japanese imports, and was characterized by U.S. demands for export restraint and for access to the Japanese market. The specific U.S.-Japanese relationship resulted from negotiations in which the U.S. utilized coercive projectionist threats to secure VER.

U.S. concerns over the growing trade deficit with Japan made friction over this particular bilateral problem part of a much wider issue of reciprocal trade relations. The auto sector increasingly symbolized U.S. grievance over Japan's penetration of the U.S. markets and difficulties of access to Japan's. Thus U.S. retaliatory threats from bilateral disputes became part of a larger strategic trade policy of trying access to the U.S. markets to reciprocal Japanese market liberalization.

The second U.S. trade conflict involving Japanese automobiles was forged during the 1990s. In 25 years, the Japanese have sold about 40 million Japanese cars in U.S. markets, while the U.S. sold only 400 thousand U.S. cars in Japan. It's a 100-to-1 ratio. U.S. imports of Japanese auto parts have risen steadily since 1981, when the U.S. forced Japan to accept VER. But, Japanese auto companies also set up auto assembly plants in the U.S., mainly utilizing auto parts imported from Japan.

The U.S. negotiated a deal with Japan to increase Japan's imports of U.S. made auto parts in early 1992. Japan's commitment also envisaged an increase of sales of U.S. autos, auto parts and access to Japanese markets. Further, in 1993, the U.S. and Japan settled on a framework agreement to govern future auto trade negotiations. In 1994, both countries also reached an agreement on some framework issues but failed to strike a deal on autos. The U.S. bilateral trade deficit with Japan in automotive products grew to nearly $38 billion in constant dollars in 1994.

By the ESI estimate, more than 300,000 U.S. domestic jobs have been lost in the auto industry in the last ten years. There is an annual net $6 billion transfer of income from autoworkers in Big Three plants who lost their jobs to the Japanese transplants. The U.S. faces a superior rival by all reasonable measures: productivity, cost, and quality. At last, in 1995, the U.S. planned a punitive import tariff of 100% on about $1 billion of Japanese luxury cars in retaliation for a breakdown in the latest round of U.S.-Japan auto trade talks. The targeted cars included Toyota's Lexus models, Nissan's Infinity, Honda's Accura, Mazda and Mitsubishi[7]. They had been picked because they are not assembled in the U.S. and provide Japanese manufacturers with their biggest profit margins. The import value of these cars in 1994 was $5.9 billion.

The primary object of the sanctions against Japanese imports was to press for greater access for U.S. automakers and parts suppliers to sell in Japan, and of course to ultimately reduce the chronic trade deficit. This plan gets high marks from Detroit's Big

[7] The targeted models are: Lexus LS400, SC400, SC300 and ES 300; Infiniti Q45, J30 and I30; Mazda 929 and Millenia; Mitsubishi Diamante.

Three, U.S. auto parts makers, and the UAW . Many believed that the threat of a trade restriction was necessary as two years of previous talks failed.

After a month of disputes and negotiations, the United States and Japan reached a major new agreement on auto trade in 1995, just hours before the U.S. was set to impose retaliation tariffs on Japanese luxury cars. The agreement ended the threat of a potentially devastating trade war between the world's two largest economies. The key points of the agreement are:

- The number of Japanese dealers selling General Motors, Ford and Chrysler products will increase by 200 in 1996 and by 1,000 over the next five years. Today, only about 300 of Japan's approximately 4,400 dealers sell non-Japanese vehicles in Japan. In the United States, however, 80 % of the dealers sell vehicles made by companies other than the Big Three.

- The safety inspection system in Japan will change to allow Japanese consumers to purchase non-Japanese replacement parts without penalty.

- Japanese automakers, who have factory capacity to build 3.1 million vehicles a year in the United States, Canada and Mexico, will add 500,000 vehicles to that by 1998.

- Japanese automakers will increase purchases of American auto parts by $9 billion over the next three years. In 1994, they bought about $20 billion worth from American suppliers.

The Big Three would obviously be a major beneficiary of the agreement. The agreement also was accompanied by a commitment from Japanese companies that they will use more U.S. built parts. The agreement, however, lacks the guarantees the U.S. sought and fell short of what the U.S. had said was necessary to call off tariffs on Japanese luxury cars. By the agreement, Japan will increase dealerships that display U.S. cars by 200 next year and by a total of 1,000 in five years. But it is unclear how that pledge will be enforced or what will happen if it is not achieved. The Japanese promise to increase auto parts purchase by $9 billion over three years also lacks guarantees from the Japanese government. Although Japan promised to dismantle safety and inspection regulations that kept U.S. cars and parts out of the Japanese market, such a deregulation had been planned already.

The agreement could be also incorporated as a Japanese victory because it avoided tariffs on popular luxury cars over the next three years and rigid quotas. Of the $9 billion in additional auto component purchases, only $2 billion would be exported to Japan. On the plus side, however, it is expected that Japanese auto makers plan to build more cars in the U.S. and buy more U.S. made parts given the high value of Japanese yen. The sharp increase in the yen's value against the U.S. dollar has made Japanese products more costly and U.S. products less costly during the last decade. Thus, it is much cheaper for the Japanese companies to buy American parts. The biggest beneficiaries of the new trade agreement are thus likely to be Japanese parts makers with major American manufacturing operations and large American parts suppliers.

Historically, compared to many trade agreements signed in the past, there is a far less explicit Japanese government commitment to reaching goals. They look great on paper in the short-run, but it can be hard to see any real change in the long-run. Therefore, the agreement could be a total Japanese victory. The U.S. came away with too little, especially considering the severity of the sanctions threat. The trade pact thus will not end the auto trade issues with Japan.

1.4. Organization of the Dissertation

The objectives of this study are:

(a) to examine the impacts of Japanese auto transplants on the U.S. economy.

(b) to estimate policy effect on price and it's trend in the long-run by applying the hedonic equation model.

(c) to suggest implications for policy on the U.S. auto trade with Japan as well as Japanese auto transplants in the U.S.

This study begins with a discussion of the theoretical aspects of the VER and its economic effect. A general equilibrium analysis by trade offer curves and trade indifference curves is presented in the context of two-country and three-country framework.

Chapter III investigates how the Japanese automobile industry had dealt with VER against a background of a persistent strong yen. Japanese direct investment into their transplant in the U.S. is the core of the Japan's countermeasure against quantitative constraints. This paper develops the rationale for the Japanese transplant operation and presents evidence of their success and their effects on the U.S. economy during the last two decades. This chapter also briefly discusses some policy implications for the U.S. to pursue in its auto trade conflict with Japan.

Chapter IV presents an empirical work to evaluate the effects of the VER by conducting a hedonic equation model. In this chapter, the empirical work uses time series and cross section data to examine the effect of quality upgrading and macroeconomic variables on price trends in the U.S. market. I examined how the price of U.S., Japanese, and European cars changed in the U.S. automobile market. Further, I investigated the effects of changes in the U.S.-Japanese exchange rate and the U.S. average prime rate on the price trend. It is important to control for both quality upgrading and macroeconomic effects on the price, so that we can isolate changes in price mark-ups from the overall variation in price.

The summary and conclusion of the paper then, are placed at the end.

CHAPTER II

THEORETICAL FRAMEWORK OF THE VER

2.1. General Equilibrium Analysis

2.1.1. Two-country Model

Harris (1985) analyzes a VER in a duopoly model. He assumes that the imposition of a VER forces the foreign firm to set a price so that demand for its product does not exceed the level of the VER. He ensures this by assuming that the VER makes the domestic firm into a Stackelberg leader which gives it Stackelberg leadership profits associated with a first mover advantage. There has also been a good deal of work on the effects of VER in other market structures, and with other strategic variables. Duopoly models are used in most cases.

Ono (1982) analyzes Stackelberg leadership models and show that tariffs are not equivalent to quotas in these models. Repeated game models have also been used to analyze VER and tariffs by Davidson (1984) and Saloner (1986). A computable partial equilibrium model predicts that the imposition of a VER at the free trade level would change the degree of competition as measured by the conjectural variations term. In oligopolistic markets, different trade restrictions can have effects of different kinds on the game played between firms. These effects can differ depending upon a variety of factors such as the form of the restriction, demand conditions, technology and the specification of out-of-equilibrium payoffs.

In Krishna's (1989) model[8], there are assumed to be two firms, one home and one foreign that produce differentiated products which are substitutes or complements for each other, and compete in prices in the domestic product market. The equilibrium concept is that of Nash equilibrium. Suppose there are two countries in oligopolistic automobile trade and Japanese cars are substitutes in the U.S. market. Let P be the price of U.S. car, and P^* that of Japanese car. Q, Q^* and C, C^* are the demand and cost functions facing the U.S. and Japanese producer, respectively. Then the profit function of each country is :

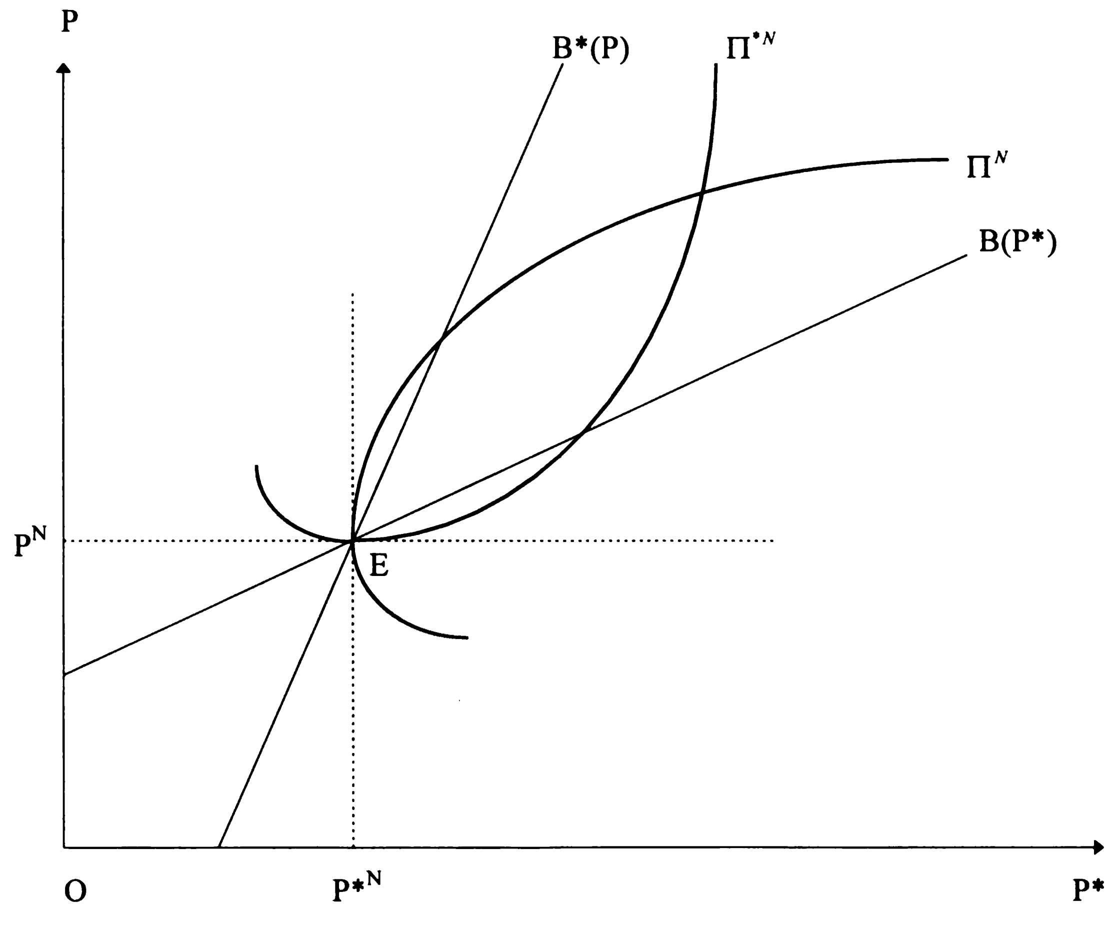
$$\Pi \quad (P, P^*) = P \cdot Q(P, P^*) - C(Q(P, P^*)),$$

$$\Pi^* \ (P, P^*) = P^* \cdot Q^*(P, P^*) - C^*(Q^*(P, P^*)).$$

Nash equilibrium is given by the point (P^{*N}, P^N) which satisfies $B^*(P) = P^*$ and $B(P^*) = P$ as illustrated by Figure 3. $B^*(P)$ is the level of P^* such that the highest iso-profit contour, for the Japanese firm is reached, given domestic price P. Hence, the iso-profit contours of the Japanese firm are horizontal along $B^*(P)$, while the U.S. firm's iso-profit contours are vertical along $B(P^*)$. The equilibrium is thus at the intersection of $B(P)$ *and* $B^*(P)$ denoted by the point E. The corresponding profit

[8] Kala Krishna, "Trade Restrictions as Facilitating Practices," *Journal of International Economics*, 1989, v26, pp. 251-270.

Figure 3 Nash Equilibrium under Free Trade

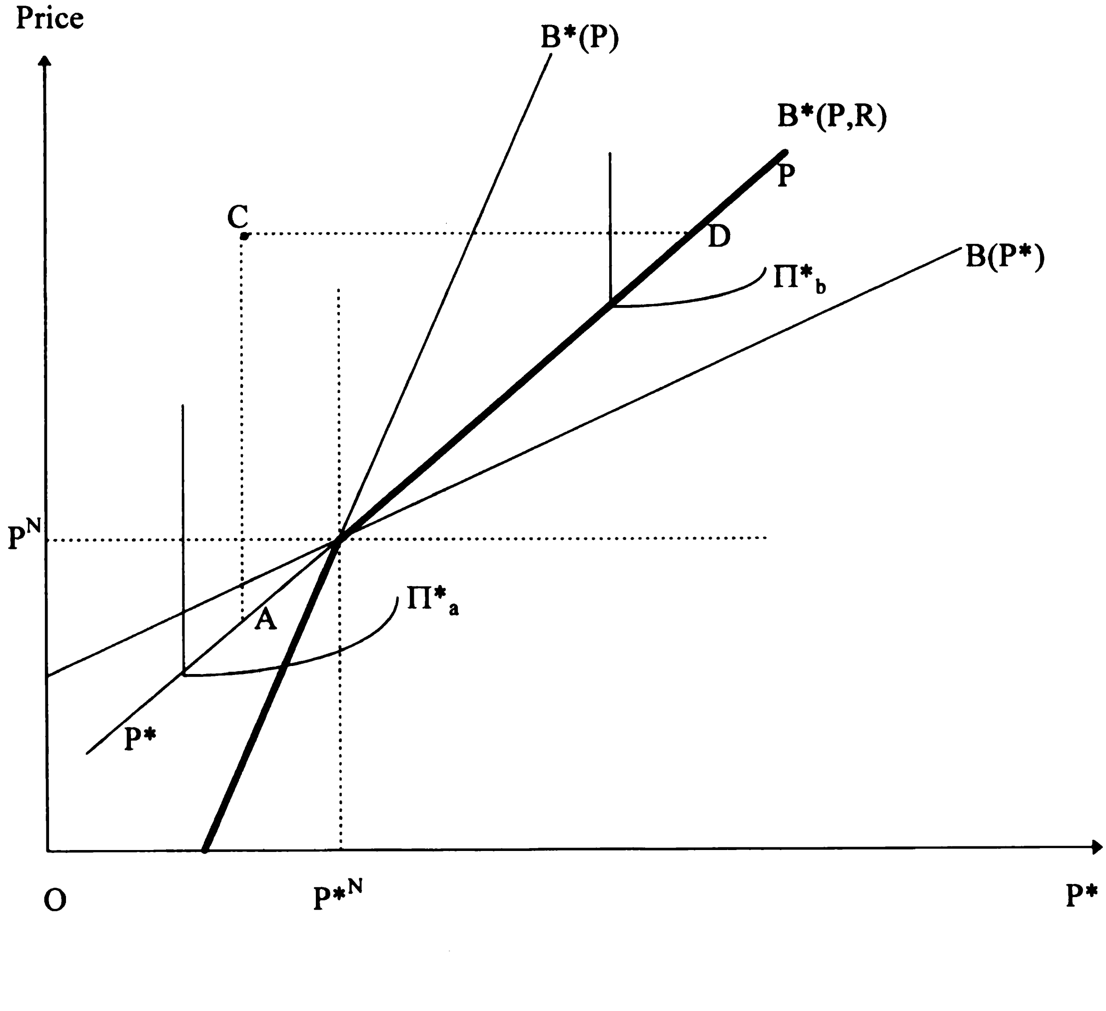


levels are given by Π^N and Π^{*N} respectively. Profits increase with an increase in the competitor's price into the direction where higher profit contours are reached when goods are substitutes like automobiles in the U.S. market. If goods are complements, profits would decrease with an increase in the competitor's price.

Suppose a VER at the level R is binding at (P,P^*) if $R=Q^*(P,P^*)$. This implies the Japanese price $P^* = f^*(P,R)$ requires to maintain imports at R for a given P. The price line of PP^* is depicted in Figure 4 when R is set at the level of imports under free trade. The Japanese price is less than $f^*(P,R)$ at the points to the left of PP^* and thus import restraints are binding while imports are not constrained at points to the right of PP^*. This implies the Japanese exporter's iso-profit contours above PP^* in the presence of VER are vertical lines because its profits are independent of the domestic firm's price in this region. Below PP^*, they are unaffected by the existence of a VER. The iso-profit contours are thus kinked along PP^*.

So, if the profit-maximizing foreign price $B^*(P)$ under free trade is to the left of PP^*, then the import restraint as a VER is binding at $B^*(P)$ and thus $f^*(P,R)$ is the Japanese firm's best response as illustrated by PP^*. If the profit-maximizing Japanese exporter's price $B^*(P)$ is to the right of PP^* under free trade, then the VER is not binding at $B^*(P)$ and thus the best Japanese firm's response function is $B^*(P,R)$. The dark line in the figure thus represents the best reaction function for Japanese exporters under a VER.

Figure 4 Nash Equilibrium under the VER



In summary:

$$B^{*V}(P,R) = f^*(P,R) \qquad \text{if } f^*(P,R) \geq B^*(P) \text{ or } P \geq P^N,$$

$$= B^*(P) \qquad \text{if } f^*(P,R) \leq B^*(P) \text{ or } P \leq P^N.$$

If prices of U.S. cars are sufficiently high above the line P, then the U.S. consumers' demand for the Japanese cars exceeds the level of the VER. Hence, some domestic consumers of Japanese cars would be rationed. This would affect the demand for the domestic firm's product. If the firms charge prices such that the demand for the foreign goods exceeds R, there is room for arbitrage profits to be made. When prices are such that the VER binds on the Japanese firm, the U.S. domestic firm's demand depends only on its own price and is given by $Q(f^*(P,R),P)$.

If the domestic firm charges the price $\widetilde{P}$ and the Japanese firms charge the price $\widetilde{P}^*$ at the point C, then demand for the Japanese cars exceeds R. In this case, the Japanese price that enters the U.S. demand function is $f^*(\widetilde{P},R)$ and not $\widetilde{P}^*$. Also, U.S. auto producers can raise the price of their own products above the PP^* lines no matter what price Japanese exporters charge on their exports. $F(P^*,R)$ is thus defined as the price of the U.S. domestic product that makes demand for the Japanese cars equal R for any price P^* charged by the Japanese exporter with VER at level R. So, if $P \geq F(P^*,R)$, the constraint binds on the Japanese firm and does not bind if $P \leq F(P^*,R)$. Hence, the U.S. profit function under the Japanese VER can be stated as:

$$\Pi^V(P^*, P, R) = \Pi\ (P^*, P) \qquad if\ P \leq F(P^*, R),$$

$$= \Pi\ (f^*(P, R), P) \qquad if\ P \geq F(P^*, R).$$

In the analysis of a VER with substitute goods, the imposition of a VER on the foreign firms makes the domestic firm's demand function less elastic for price increases, since a price increase makes the VER bind on the foreign firm, and makes it profitable for the domestic firm to raise the price at the free trade equilibrium. The increase in the domestic firm's price makes the constraint bind on the foreign firm since the goods are substitutes, and makes it optimal for the foreign firm to also raise its price since it is effectively supply constrained.

However, the imposition of a VER on the complementary goods makes the domestic firm's demand function less elastic for price decreases, since a price decrease makes the VER bind on the foreign firm. Thus, it is not profitable for the domestic firm to reduce its price. For this reason, a VER at the free trade level has no effect with complementary goods.

The effect of qualitative restrictions in oligopolistic markets is shown to depend on whether imports are substitutes or complements for domestic products. In the former case, they have profound effects even when set at free trade levels because they impede the ability of the foreign firm to compete in the domestic market, thereby acting to facilitate collusion and raise prices and profits. For this reason, tariffs and quotas are fundamentally non-equivalent with substitute goods. When goods are complements, a voluntary export restriction at the free trade level has no effect, and tariffs and quotas are equivalent.

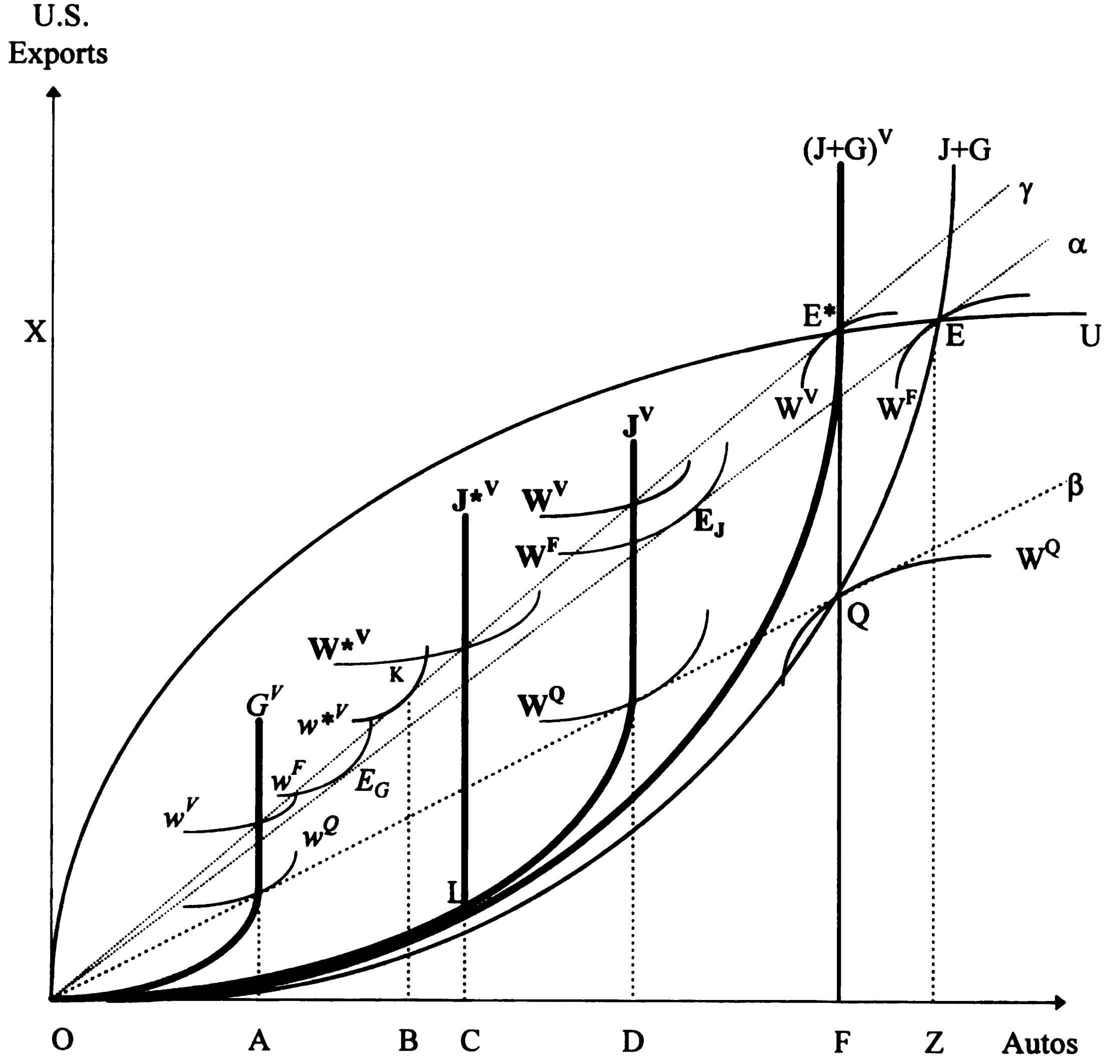
2.1.2. Three-country model

Because a VER is inherently discriminatory[9], two-country analysis may be inadequate to compare its economic effects with other restrictive methods. Brecher and Bhagwati (1987) illustrate a two-country general equilibrium model with perfect competition in all markets. However, their study did not state the essential distinction between the two policy instruments. While an import quota is often levied on imports from all sources of supply, a VER is usually negotiated with one specific country at a time, leaving other suppliers unaffected. The auto VER in the U.S. market was only negotiated with Japan for the protection of the U.S. domestic auto industry, while other suppliers, including Germany, were not subject to a VER.

A general equilibrium model with two goods and a three-country model is illustrated in Figure 5. Trade offer curves and trade indifference curves[10] are used to examine the welfare effects of a VER and an import quota. The free trade offer curve of Germany can be regarded as an aggregate offer curve of all suppliers except Japan. Equivalence between a VER and an import quota is defined in terms of import

[9] Bhagwati (1987) noted another new policy device which is also inherently discriminatory: Voluntary import expansions (VIE), analyzed in Dinopoulous and Kreinin (1987).
[10] This method is first developed by Meade (1952) and Vanek (1967).

Figure 5 General Equilibrium Analysis of the VER in Three-country Model



quantity[11]. *OU* is the U.S. free trade offer curve. The combined offer curve from both Japan and Germany is *O(J+G)*. The terms of trade (TOT)[12] under free trade line α. The equilibrium point under free trade, *E*, is derived from the intersection of both *OU* and combined *O(J+G)*. This implies U.S. imports *OZ* of cars from foreign suppliers and can export *OX* of other commodity within the range of TOT. Thus, the intersection of α with ***OJ*** (not shown) and *OG* (not shown) determines the free trade equilibrium of Japan, $\boldsymbol{E_J}$ and Germany, E_G..

Suppose the U.S. imposes a global quota of *OF* on imported cars from both sources of supply. Total auto imports are now reduced with *FZ* being excluded. The U.S. quota-ridden offer curve becomes *OE*QF*. Then, point *Q* where the new U.S. offer curve intersects the offer curve *O(J+G)* becomes the new equilibrium point. At this point, the terms of trade also changed into β. Japan can export *OD* cars and Germany can export *OA* of cars which add up to *OF* cars in the U.S. market. Each country's welfare level is represented by the trade indifference curve (TIC). W^F, $\boldsymbol{W^F}$, and w^F are the TICs of the U.S., Japan, and Germany respectively, under free trade, and W^Q, $\boldsymbol{W^Q}$, and w^Q under the import quota.

The TOT of the U.S. is improved and welfare is better off after imposing an import quota. In contrast, both export suppliers experience the deterioration of TOT and their welfare worsens. When the U.S. imposes a quantity-equivalent VER on Japan

[11] The quantity excluded by a VER from the total imports of importing country equal in amount to that excluded by an equivalent import quota levied by importing country.
[12] Terms of trade is defined as the price ratio between import and export in two-country comparison.

and Germany, the combined offer curve of both exporters is now $O(J+G)^V$ and the TOT becomes γ. Each country's welfare is represented by W^V, $\mathbf{W}^V$, and w^V. Japan can export *OD* cars at a maximum and Germany can export *OA* cars. The TOT and welfare level of the U.S. deteriorates while both exporters experience higher welfare. Thus, the exporters under a VER will be better off and the importing country will be worse off in terms of welfare and TOT.

If a VER is imposed on Japanese exports only, then *CD* of imports from Japan should be excluded. The reduced quantity by a Japanese VER is greater than the reduced quantity of an imposed quota levied on Japan because the VER in this case is imposed on Japanese exports only. Japan's new offer curve with a VER becomes $\mathbf{OJ^{*V}}$, kinked at point *L*. German exporters have improved TOT and this stimulates additional exports to the U.S. This ***trade substitution effect*** results from the reduced quantity of Japanese exports into the U.S. market. Since the Japanese auto exporters receive part of the rents, the VER-ridden TOT becomes γ. The U.S. welfare level represented by the TIC, w^V, passes through $O(J+G)^V$.

It is obvious that it is lower than the welfare level under an equivalent import-quota situation. The quantity of the U.S. import is set to *OF* at the same level as under a quota, but both Japan and Germany capture the rents, so the U.S. TOT deteriorates[13]. Germany's new trade equilibrium point with a Japanese VER is point *K* under the TOT of γ. Its welfare level, w^{*V}, represented by TIC passing through point *K*, is higher

[13] This is a well known result from Brecher and Bhagwati (1987).

than the w^Q under the import quota regime. Germany's export volume rises by *AB* and its TOT improves to γ. Thus, Germany captures the rents in terms of export volume, welfare level and TOT when a VER is imposed on Japanese autos only.

In the Japanese case, it is not obvious whether Japan's welfare is improved or not. Japan's TOT is improved as does Germany's but the volume of exports declines by a greater quantity than the amount excluded by the import quota. Japan's new welfare level is represented by the W^{*V}. It is not clear whether Japan is better off or not under this situation. This ambiguous welfare effect for Japan is a drastic departure from the theory developed in a two-country model. The substitution effect from the other source of supply results in this ambiguity. Japanese market power in the U.S. and its welfare level thus depend on the elasticity of Germany's offer curve. The more elastic Germany's offer curve, the less is the Japanese share of the U.S. market.

However, if the *revenue-transfer effect* represented by an improved TOT is greater than the *trade substitution effect* represented by a decline in export volume, then Japan's trade welfare with a VER is greater than in the import quota case. If Germany's offer curve is sufficiently elastic, there is a greater negative *trade substitution effect* on Japan's exports and thus, a further deterioration in Japanese welfare.

2.2. Profitability of the VER

A VER is designed to protect the domestic industry from imported foreign goods by limiting the volume of goods. Caves and Jones (1977), and Kindleberger and Lindert (1978) stated that exporters prefer VER to import tariffs since the VER allows exporters to capture a portion of the revenues generated by higher prices and tends to reduce the number of exporters, enabling exporters to behave monopolistically to increase profits.

The difference in profits between unrestricted trade and a VER situation is crucial in determining the effects of the VER. The profit differential between free trade and the VER depends on the degree of industry collusion and the cost structure of imported goods in comparison to domestic goods. By Harris (1988), a VER on a competitive industry at the free trade level of imports raises its profits by increasing its effective degree of collusion among domestic producers. Under Cournot conjectures, a VER only confirms domestic producers' conjectures about each other and thus has no effect.

Suppose Japanese auto exporters behave as price leaders in the U.S. market and oligopolistic U.S. producers are price followers. Every follower can supply as much as it desires without regard to the leader's supply by undercutting the leader's price. In this price-competitive equilibrium, the domestic U.S. automakers can not set any higher price than the price set by Japanese exporters. Under a VER which sets the same volume of imports as in a price competitive equilibrium, U.S. auto producers can raise the price above the equilibrium price in the residual domestic market without causing in any increase in the supply of Japanese cars. Therefore, U.S. auto makers can increase their profits by raising the price through their oligopolistic behavior. Japanese exporters can also benefit since they can supply the same volume of exports as the optimal supply under free trade at a higher price. If the volume of Japanese exports set by VER is smaller than the optimal volume of exports for them as price leaders, the Japanese auto exporters may still earn greater profits than can be obtained under free trade. In either case, it is obvious that both the domestic producers and Japanese auto exporters can earn higher profits under a VER on Japanese auto exports at the expense of U.S. domestic consumers' welfare.

Ono (1982) proved that if one domestic producer behaves as a price leader under a VER, every other domestic producer could earn greater profits as a price follower than as a price leader. Under a VER, the new domestic price leader faces the following demand function:

$$D(P) = D(P) - S(P) - V \Leftrightarrow D(P) = \tilde{D}(P) - V,$$

$D(P)$ is the total U.S. domestic demand function, $S(P)$ is the total supply function by the other U.S. domestic producers as price followers and V is the quantity restraint by a VER. Thus, $\tilde{D}(P)$ represents the residual demand for the domestic price leader. The profit maximizing optimal price[14] by the domestic price leader would be:

[14] The monopolistic profit maximizing price is set by the rule which satisfies marginal revenue equals to marginal cost.

$$P+[\tilde{D}(P) - V]\,/\,\tilde{D}'(P) = C'(\tilde{D}(P) - V) \Leftrightarrow P = F(V),$$

This equation shows the relation between the volume of export restraint and price. The Japanese producer as a price leader under free trade faces the following demand:

$$V = \tilde{D}(P) - C'^{-1}(P) \Leftrightarrow G(V).$$

The Japanese producer maximizes his profit given $F(V)$ and $G(V)$. By Ono (1982), the marginal revenue under $F(V)$ is greater than under $G(V)$ if the restrained volume of exports, V, is sufficiently small. If V is sufficiently large, then there will be the opposite result. So, the profitability of VER depends on the marginal cost of each producer.

Suppose the Japanese producer's marginal cost is relatively low compared to the U.S. producer's marginal cost. Then, the optimal restraint for the Japanese producer under a VER is smaller than his optimal volume of exports as a price leader under free trade. The U.S. auto industries, whether they are price leaders or followers in the U.S. market, will have greater profits, the greater the volume of export restraints on Japanese autos.

When the Japanese producer has a sufficiently low marginal cost to produce a car, the U.S. auto industry may eagerly seek a VER to protect its domestic producers from imports. In this case, Japanese exporters capture more profits than in the non-VER case. Thus, imposing a VER may be a strategic trade behavior for the Japanese exporters, rather than U.S. producers. So, the lower marginal cost Japanese producers have relative to their U.S. competitors, the better flexibility in coping with restrictive policy. Most of the Japanese autos imported into the U.S. in the 1980s were compact or sub-compact cars. Japanese producers have a comparative advantage in marginal cost terms for the small car categories compared to the U.S. auto makers.

A VER as export quota thus may increase both U.S. domestic producers' and foreign exporters' profits at the expense of U.S. domestic consumers, not only in the case where the foreign producers are price leaders under free trade, but also in the more realistic case where they behave as price followers in relation to U.S. domestic auto producers in the U.S. market. Since the automobile industry in the U.S. and Japanese auto exports have a few large producers, it is plausible that one big producer such as GM behaves as a price leader in the U.S. market.

Next, assume one of the U.S. producers such as General Motors behaves as a price leader in the U.S. market and all other producers including Ford, Chrysler, and Japanese auto exporters are price followers. Under this type of price leadership, the U.S. price leader conjectures that its rival companies, including Japanese exporters, supply a large volume of cars as it raises the price above the competitive equilibrium price level. Thus, a large volume of Japanese autos are imported at a domestic price set by the U.S. price leader.

If a VER on Japanese auto exports is imposed and Japanese auto producers fix the volume of exports at the optimal level as a price leader, the U.S. price leader now faces a less elastic demand curve than before. Then, the U.S. price leader can increase its profits by raising the price and all the other domestic producers also receive benefits by such a price rise. Furthermore, Japanese exporters' profits are also increased since they can supply the same volume as before but at the higher price.

All domestic auto producers in the U.S. can be better off and Japanese auto exporters may be worse off to the extent that the domestic producers behave perfectly competitively. However, both U.S. and Japanese producers can get higher profits by raising the price if the U.S. domestic producers behave more oligopolistically. Furthermore, the Japanese exporters increase their profits by restricting the volume of exports more than is needed when they have a sufficiently low marginal cost in comparison to that of U.S. producers, whether a Japanese auto exporter acts as a price leader or a price follower under free trade. In any case, a VER typically increases the U.S. domestic producer's profits as well as those of Japanese exporters at the expense of U.S. consumers' welfare. The higher the profits the domestic producer or foreign exporters earn, the larger the cost the domestic consumers pay.

CHAPTER III

JAPANESE AUTO TRANSPLANTS IN THE U.S.

3.1. Determinants of Foreign Direct Investment (FDI)

Since the early 1980s, considerable attention has been focused on Foreign Direct Investment (FDI)[15] in the U.S., particularly that from Japan. Table 2 provides the information on total FDI and the Japanese share in the 1980s and 1990s. In 1980, Japan's total investment was only $4.2 billion, and accounted for 6.4% of the total FDI, but by the end of 1994, it had increased to $103.1 billion, or for 20.4% of the total amount. The annual growth rate of Japanese investment in the 1980s was always higher than that of the total FDI. Japanese investment as a percentage of the total FDI thus increased steadily except for 1993 and 1994 when other FDIs showed a substantial jump.

Many economists and scholars argue that the FDI is both a consequence of and a solution to U.S. declining international competitiveness. Edward Graham and Paul Krugman (1991) argue that Japanese firms invest in the U.S. when import restrictions

[15] FDI in the U.S. is ownership or control, directly or indirectly, by one foreign person of 10% or more of the voting securities or an equivalent interest.

Table 2 Foreign Direct Investment in the U.S., 1980-1994 (Amounts in billions of U.S. dollars)

	FDI in the U.S.		Japanese FDI in the U.S.		Japanese share as
Year	Total	% increase	Amount	% increase	% of total FDI
1980	65.5	20.2	4.2	20.8	6.4
1981	107.5	64.3	7.7	83.3	7.2
1982	123.6	14.9	9.7	26.0	7.9
1983	135.3	9.5	11.1	14.4	8.2
1984	164.6	21.7	16.0	44.1	9.7
1985	184.6	12.2	19.3	20.6	10.5
1986	220.4	19.4	26.8	38.9	12.2
1987	271.8	23.3	35.2	31.3	13.0
1988	328.9	21.0	53.3	51.4	16.2
1989	373.8	13.7	67.7	27.0	18.1
1990	403.7	8.0	83.5	23.3	20.7
1991	414.4	2.7	92.9	11.3	22.4
1992	419.5	1.2	96.7	4.1	23.1
1993	464.1	10.6	99.2	2.6	21.4
1994	504.4	8.7	103.1	4.0	20.4

Source: *Survey of Current Business*, 1995.

limit their ability to profit from their superior technology through direct exports or technology licensing. Robert Reich (1990) argues that FDI brings valuable skills, training and knowledge to the U.S. Advocates of FDI contend that the U.S. would be better off if it allowed foreign firms to produce U.S. products in areas where they have superior technology and organization thus enabling the U.S. thus to reallocate scarce resources to alternative uses. Reich (1990) shows that foreign-owned companies displace U.S.-owned companies mainly in those industries where they have a comparative advantage.

There may be further benefits for U.S. industries to the extent that U.S. workers and managers are exposed to Japanese managerial practices and work organization. Increased FDI will also reduce the trade deficit as FDI and the domestic production replace imports. Graham and Krugman thus conclude that the gains from FDI outweigh the losses. The strategic advantage of Japan's automobile industry comes from a production organization which evolved over 30 years when it was protected from foreign competition in the Japanese market and had nearly unlimited access to the U.S. market. The rapid growth and stability permitted by Japanese trade and investment policies gave Japanese firms a significant competitive advantage. That advantage is embodied in a production organization and technology which cannot be readily transferred to the U.S. Since the transfer is incomplete, Japanese FDI in the U.S. does not close the competitive gap for U.S. firms in contrast to the Graham and Krugman's expectation.

There are many reasons for the growth of Japanese FDI in the U.S. One is related to the U.S. market structure and the others concern the technical side of production. Some studies[16] which incorporate many factors underlying FDI growth explain it in terms of a model of monopolistic competition. Their explanation is that FDI occurs primarily in markets for differentiated products dominated by oligopolistic firms. It is presumed that the multinational corporations (MNCs) pose some advantages over the host country firms in terms of production, technology or management. It is also assumed that the rents from these advantages can only be earned through direct investment.

FDI secures Japanese access to the U.S. market and evades existing trade restrictions by establishing production facilities within the U.S. The U.S. market is the world's largest market. U.S. consumers have considerable discretionary income to spend. FDI enables foreign MNCs to gain access to the U.S. market directly. FDI is also the quickest way to establish a presence in the U.S. market because production and distribution channels are already in place. Furthermore FDI in the U.S. provides access to a large and relatively inexpensive supply of natural resources and energy sources. In addition, the U.S. labor supply is well educated and trained, and wages are competitive compared to other industrialized countries[17]. All these factors have played a favorable role in providing incentives to foreign investors.

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[16] See Dixit and Stiglitz (1977), Williamson (1981), and Ethier (1986).

[17] In comparison, other nation's average wage rates do not usually tell the exact comparisons because of different systems in tax and social policies, and variation of living costs.

The quantity of the U.S. infrastructure is also a draw for foreign MNCs. The U.S. has the most extensive and well-equipped communications channels and transportation networks in the world. MNCs thus enjoy an advantage in terms of lower transportation costs. They can react quickly to changes in shifting patterns and changing consumer tastes through a reliable and continuous supply of goods to the U.S. market. Another contributing factor to the increase in FDI in the U.S. in the 1980s has been the course of the dollar-yen exchange rate. The dollar's rise during the early 1980s translated into lower U.S. production costs in terms of yen. In 1984, the average cost of U.S. local production of a Japanese car was $5,000 in contrast to $7,400 in 1978. This huge cost gap also stimulated the Japanese automakers to invest directly in the U.S. during the period in when the U.S.-Japan VER was in place.

3.2. Japanese Transplants

3.2.1. The Coming of the Transplants

The transplant phenomenon in the U.S. occurred in the context of a changing global economy and a weak U.S. economy. The background to the arrival of the Japanese transplants was the surge of imports from Japan in 1978-81 and the factory closings and layoffs by the U.S. Big Three auto producers. The resulting political pressure led to the negotiation of a Japanese auto VER and a commitment by Japanese producers to put plants in the U.S. that would create jobs.

Early in 1980, the Big Three auto makers and the UAW began systematically to press for restrictions on imports of foreign-made cars and urged the Japanese to open auto plants in the U.S. Japanese automakers initially expressed great reluctance to build plants in the U.S., arguing the large investment required by such plants and the negative impacts it could have on their profitability. Japanese automakers proposed, instead, to slow the growth of their exports. This proposal, however, received a cool response from U.S. auto and labor leaders.

The Japanese agreed to a VER to avoid more protectionist legislation. The VER limited the volume of Japanese exports to 1.68 million passenger cars annually beginning in 1981. While the VER restricted the level of car imports, trucks were excluded from such volume limitations since truck imports was not a big problem for the U.S. industry. The VER was negotiated annually and the minimum volume level rose at an annual average rate of about 8.6% to 2.3 million units by 1986. The Japanese Ministry of International Trade and Industry (MITI) was responsible for determining the export limits for individual Japanese companies.

In theory, the VER was meant to encourage Japanese firms to invest in local production as a condition of expansion in the U.S. market. Table 3 contains basic information on the Japanese auto assembly plants established in the U.S. The VER forced Japanese auto firms to reorganize their export strategy in the U.S. market. In 1982, following the imposition of the VER, Japanese firms began to invest in the U.S.[18]

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[18] Honda built the first automotive assembly plant in Ohio. Nissan and Toyota followed in 1984.

Table 3 Japanese Transplants' Operations in the U.S.

Japanese Firms	Launch	Location	Workers	Capacity	Ownership
Honda of America Mfg. Inc.	1982 1986	Marysville, OH E. Liberty, OH Anna, OH	10,100	360,000 150,000 500,000 engines	Honda 100%
Nissan Motor Corp. U.S.A.	1983	Smyrna, TN	5,900	450,000	Nissan 100%
New United Motor Mfg. Inc.	1984	Fremont, CA	4,300	240,000	GM 50% Toyota 50%
AutoAlliance International Inc.	1987	Flat Rock, MI	3,800	240,000	Ford 50% Mazda 50%
Diamond-Star Motors Corp.	1988	Normal, IL	3,100	240,000	Mitsubishi 100%
Toyota Motor Mfg. U.S.A. Inc.	1988	Georgetown, KY	5,000	400,000 500,000 engines	Toyota 100%
Subaru-Isuzu Automotive Inc.	1989	Lafayette, IN	1,900	170,000	Fuji 51% Isuzu 49%

Source: *Ward's Automotive Yearbook* (Detroit, MI, 1994).

According to Candace Howes (1993)[19], the estimates of company investment at each site are substantial, ranging between $500 million to almost $2 billion. Many plants have plans for expansion that include addition of engine plants and research facilities. In order to attract new assembly plants, state and local governments provided many favorable incentives. Typically these have included job training funds and infrastructure improvement such as road, water, electricity, sewers and bridges. Plant sites usually have been purchased by the states. Tax abatement is allowed up to 100% for more than 15 years. The typical direct incentive averages $50 to $100 million per plant by the Howes' estimation. For example, Kentucky offered Toyota a total package of direct and indirect incentives worth more than $300 million. Indiana spent $85 million to get the Fuji-Isuzu plant.

According to Howes' study, a state subsidy of $200 to $300 million on average is a hefty subsidy for the typical investment of $500 million in a transplant at a new location. Some of the states, including Tennessee, are paying as much as $100,000 per job. That is equivalent to paying the entire wage bill for two to three years. The number of employees at the transplants ranges between two and five thousand. The hourly wage for product employees is about $14.00 per hour, which exceeds the wage levels of other non-auto manufacturing workers in the same region[20].

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[19] Candace Howes, *Japanese Auto Transplants and the U.S. Automotive Industry*, Economic Policy Institute (Washington, D.C., 1993).

[20] The transplants' hourly wage rate is below the $16.41, wage in the Big Three plants which are unionized. Only Mazda and Diamond Star have union representatives for production workers.

Table 4 shows the growth of production in Japanese transplants in the U.S. from just 1,500 units in 1982 to 1.3 million in 1991, and over 1.5 million in 1993. Production capacity for each transplant varied between 120,000 vehicles and 440,000 vehicles per year in 1994. The aggregate production capacity of Japanese transplants in the U.S. is about 2 million vehicles which was about the number of cars imported from Japan in 1980. Adding to these major auto assembly plants is the large number of auto parts suppliers that have located in the same general area.[21] This allows transplants to obtain needed parts within a proper transit time. It reduces the need for costly stockpiling of parts and the construction of expensive storage facilities.

Estimates of the number of auto supplier companies located in the same areas as the transplants vary, and the number appears to be growing as new suppliers come to the United States. U.S. supplier firms already existed, but they were concerned primarily with supplying the U.S. auto firms. With the arrival of the transplants, attention has turned to Japanese suppliers that have followed the transplants. In 1988, it was estimated that there were over one hundred Japanese-owned part suppliers and 41 Japan-U.S. joint venture suppliers in the Midwest area. The estimate of total Japanese suppliers in the U.S. had grown to 270 by 1991.

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[21] It has been suggested that the emerging relationships between transplants and suppliers resemble the *keiretsu* system that is followed in Japan. *Keiretsu* refers to an economic or corporate group composed of companies that are linked in horizontal or vertical relationships.

Table 4 Japanese Transplants' Car Production in the U.S.

Year	Honda	Nissan	Toyota	Auto Al.	Dia-Star	NUMMI	SIA	Total	Big Three
1982	1,500	-	-	-	-	-	-	1,500	4,877,722
1983	55,337	-	-	-	-	-	-	55,337	6,423,410
1984	138,572	-	-	-	-	-	-	138,572	7,367,789
1985	145,337	43,180	-	-	-	64,601	-	253,118	7,724,689
1986	234,159	65,147	-	-	-	205,795	-	505,101	7,186,316
1987	324,064	117,334	-	4,200	-	187,378	-	632,976	6,400,157
1988	366,355	109,897	18,527	167,205	2,409	129,978	-	794,371	6,307,028
1989	361,670	115,584	151,150	216,200	90,741	192,235	2,600	1,130,180	5,693,778
1990	465,467	95,844	218,195	184,418	143,379	205,287	32,461	1,345,051	4,757,854
1991	451,197	133,504	187,726	165,314	153,936	206,634	57,945	1,356,256	1,083,608
1992	458,241	171,402	240,382	168,859	139,783	180,960	57,623	1,417,250	4,249,641
1993	403,755	293,182	234,060	219,096	136,022	207,025	47,117	1,540,277	4,441,843

Source: *Ward's Automotive Yearbook* (Detroit, MI, 1994).

3.2.2. Comparison between the U.S. and Japanese automobile industries

3.2.2.A. Productivity

Providing an exact comparison of relative productivity is very difficult; this is especially true when the plants are located in different countries. Total factor productivity, the average product of all inputs, is the best measure of productivity. Its measurement, however, is problematic and very difficult to attain. An inferior measure of productivity, the average product per worker or per hour of work is thus more commonly used in the automobile industry. The Telesis study (1984)[22] found that there were 15% fewer total laborers in Japanese subcompact car plants than a similar U.S. plant, and 32% fewer Japanese hours at the assembly level.

Krafcik and MacDuffie (1989)[23] confirms these findings and extends the research to measure productivity differences between U.S. plants, transplants and Japanese plants in Japan. They found that the average Japanese plant required 33% fewer hours to assemble an automobile than the average U.S. plant. The average Japanese transplant required only 13% fewer hours than the average U.S. plant, and 30% more hours than the average Japanese plant. They determined that labor hour differences were primarily due

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[22] Telesis, *A Study for the United Automobile Workers and Ford on the Relative Productivity of a U.S. and Japanese Plant*, Report for Economic Policy Institute (Washington, D.C., 1984). This study compared two plants, one in the U.S., and one in Japan producing a similar subcompact vehicle.

[23] The Krafcik-MacDuffie study was based on a sample of 52 plants which included 10 U.S. plants, 3 Japanese transplants, and 8 Japanese local plants. This study compared products standardized by size, options, level of vertical integration in automobile industry.

to differences in the level of automation, management practices, and the age of the product design.

These results indicate that Japanese transplants are considerably less productive than the plants in Japan and only slightly more productive than the U.S. plants. Automation and age of product design explain two-thirds of the difference, management practices about one-third. What the study does suggest by the productivity advantage of transplants over U.S. firms is that a lot of details that may make the Japanese system more productive are probably not being transferred. One reason is that transplants may fail to bring in the more sophisticated aspects of the system pertaining to design, quality control, inventories, and worker participation. The differences in labor hours per vehicle at the regional level also reflect this limited transfer.

Toyota employs 65,000 workers in Japan for designing, manufacturing, and assembling 3.6 million vehicles which works out to 55 autos per worker in 1987. In the U.S., Toyota plans to employ only 5,500 employees when it reaches full production of 550,000 cars, which leaves U.S. with 100 autos per worker. The difference in cars per worker is not a measure of productivity differences. Rather, it is clear evidence of the difference in levels of integration between U.S. and Japanese operations. In a transplant at California, it needs about 20% more hours to assemble a car than in Japan (Krafcik, 1987). This example shows that the Japanese unit must be substantially better in terms of work-design, engineering, high-technology parts fabrication, and R&D than the one in the U.S. More hours are required at the assembly level due to differences in automation and management practice for Japanese plants in the U.S. compared to Japanese plants in Japan. Japanese transplant production in the U.S. requires almost twice as many total hours of labor than are performed in Japanese production facilities in Japan. Together these facts suggest that Japanese firms are not transferring their system to the U.S. Table 5 demonstrates the most productive plants in the U.S. in terms of workers per each car produced.

3.2.2.B. Production Cost

By the estimates from Harbour and Associates (1982)[24], the cost of producing a small car for Japanese firms was $1,500 less than that for U.S. Big Three. According to this study, the Japanese advantage was only partially due to the labor costs which had been the usual explanation for low-cost Japanese production. According to the report done for Ford and the UAW, the Japanese costs per car were $2,500 to $3,000 lower than U.S. costs, giving the Japanese producers a 55% cost advantage.

It is very difficult, however, to make a meaningful cost comparisons since no two companies build exactly the same car or have the same product. According to Howes (1991)[25], the Big Three had substantial cost disadvantages in terms of labor, materials, and parts as well as capital and productivity. On average, the cost difference was more

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[24] Harbour and Associates, *Analysis of the Japanese Landed Cost Advantage for the Manufacture of a Subcompact Cars* (Troy, MI: 1982).
[25] Candace Howes, "Total Factor Productivity in the U.S. and Japanese Auto Industries," *Ph.D. dissertation* (University of Berkeley, 1991).

Table 5 Most Productive Auto Plants in the North America

Rank	Country	Company	Plant	Product	Workers/Car
1	U.S.	Ford	Atlanta	Taurus/Sable	2.66
2	U.S.	Ford	Chicago	Taurus/Sable	2.68
3	U.S.	Ford	Kansas City	Tempo	2.68
4	U.S.	Ford	Oakville	Tempo/Topaz	2.82
5	Japan	Honda	Alliston	Civic	2.88
6	Japan	Honda	E. Liberty	Civic	2.89
7	Japan	Nissan	Smyrna	Sentra	2.98
8	Japan	Mitsubishi	Normal	Eclipse/Laser/Talon	3.00
9	U.S.	Chrysler	Sterling Hei.	Sundance/Shadow	3.18
10	U.S.	Ford	Dearborn	Mustang	3.24
11	Japan	Subaru-Isuzu	Lafayette	Legacy	3.32
12	Japan	Toyota	Georgetown	Camry	3.54
13	Japan	Mazda-Ford	Flat Rock	626/MX-6/Probe	3.56
14	Japan	Honda	Marysville	Accord/Civic	3.61
15	U.S.	Ford	Wayne	Escort	3.61
16	Japan	Toyota-GM	Fremont	Corolla/Prizm	3.73
17	U.S.	Chrysler	Belvidere	Dynasty/ New Yorker	3.74
18	U.S.	Ford	Lorain	Cougar/Thunderbird	3.76
19	U.S.	Ford	St. Thomas	Crown Vic./Marquis	3.93
20	U.S.	GM	Linden	Corsica/Beretta	3.94
21	U.S.	Chrysler	Newark	Acclaim/Sprit	3.95
22	U.S.	GM	Buick City	LeSabre/88	4.04
23	Japan	Toyota	Cambridge	Corolla	4.05
24	U.S.	GM	Wilmington	Corsica/Beretta	4.31

Source: Harbour & Associate, *A decade later*, 1990.

than $2,000 per car in the favor of Japanese producers. The cost structure of the Big Three was very similar, with GM in the low cost position that it had held for many years as a result of economies of scale, while the Japanese industry had similar cost structures among themselves, lower on average than the U.S. producers with Toyota in the lowest cost position. Nevertheless, a recent analysis by ESI indicates that Ford and Chrysler are among the world's lowest cost producers, and that the Big Three may have a slight cost advantage over the Japanese producers.

Tables 6 and 7 show the comparison between U.S. and Japanese cost structures. U.S. auto makers still have higher labor costs in terms of wage rates and benefits than Japan, but the difference is much less than in the early 1980s. The difference in capital costs is also narrower, as is the productivity differential. The U.S. parts and components makers are by far the lowest cost producers. Ford and Chrysler have taken advantage of this development by sourcing more of their parts outside and by building cooperative, long-term relationships with key part suppliers. GM continues to source most of its parts internally and thus benefits less than its domestic competitors.

According to these tables, Ford is the lowest cost producer. It holds a $527 per car advantage over Toyota in Japan and a $990 advantage over the average Japanese manufacturers in Japan. But the weight of GM in overall U.S. costs puts the U.S. at a slight disadvantage of $123 per car. The cost structure of the Japanese makers is less varied than the Big Three in U.S., although Toyota has widened its margin of superiority.

Table 6 Comparison of U.S. and Japanese Production Costs for Small Cars in 1992

Costs (U.S. Dollar)	Ford	GM	Chrysler	Honda	Mazda	Nissan	Toyota	Ave. U.S.	Ave. Japan
Wage Rate ($/hour)	19.10	18.75	18.25	21.72	21.72	21.72	21.72	18.76	21.72
Benefits ($/hour)	13.22	13.22	13.22	4.06	4.06	4.06	4.06	13.22	4.06
Sum	32.32	31.97	31.47	25.78	25.78	25.78	25.78	31.97	25.78
Man-hours/Car	50	75	60	40	45	43	36	64	42
Total Labor									
Costs	1,629	2,388	1,872	1,031	1,161	1,118	928	2,057	1,071
Parts & Materials	3,802	4,560	3,906	4,867	4,867	4,867	4,619	4,202	4,818
Other Mfg. Costs	580	978	677	648	689	689	608	798	665
Non-Mfg. Costs	312	435	339	741	787	787	695	379	760
Total Prodn. Costs	**6,323**	**8,361**	**6,794**	**7,288**	**7,505**	**7,461**	**6,850**	**7,436**	**7,313**
Difference from Best	-	2,037	470	965	1,182	1,138	527	123	-

Source: William J. Abernathy, *Industrial Renaissance: Producing a Competitive Future for America* (New York: Basic Books, Inc., 1994).

Table 7 Comparison of U.S. and Japanese Transplants Production Costs for Small Cars in 1992

Costs(U.S. Dollar)	Ford	GM	Chrysler	Honda	Mazda	Nissan	Toyota	Ave. U.S.	Ave. Japan
Wage Rate	19.10	18.75	18.25	18.00	18.00	18.00	18.00	18.76	18.00
Benefits	13.22	13.22	13.22	5.00	5.00	5.00	5.00	13.22	5.00
Sum	32.32	31.97	31.47	23.00	23.00	23.00	23.00	31.97	23.00
Man-hours/Car	50	75	60	40	45	43	36	64	42
Total Labor									
Costs	1,629	2,388	1,872	920	1,036	997	828	2,057	956
Parts & Materials	3,802	4,560	3,906	4,867	4,867	4,867	4,619	4,202	4,818
Other Mfg. Costs	580	978	677	648	689	689	608	798	665
Non-Mfg. Costs	312	435	339	741	787	787	695	379	760
Total Prodn. Costs	6,323	8,361	6,794	7,177	7,380	7,341	6,750	7,436	7,198
Difference from Best	-	2,037	470	854	1,057	1,017	426	238	-

Source: William J. Abernathy, *Industrial Renaissance: Producing a Competitive Future for America* (New York: Basic Books, Inc., 1994).

3.2.2.C. Quality

Quality change and product upgrading have important implications for the welfare effects of the VER. A usual response to a quantitative restraint is that a firm may upgrade its products through innovative engineering, design changes, adding extra features and developing more elaborate and luxurious models[26].

Feenstra (1988)[27] estimated quality effects of a VER by adopting the hedonic price model of Rosen (1976). He investigates the quality change in Japanese car and truck imports over 1979-1985. He finds evidence of substantial upgrading in Japanese car imports, with ambiguous quality change in trucks in U.S. the market. The welfare cost of the quota restraint in cars exceeds $1,000 per import in 1983 and 1984. One half of the nominal increase in car prices over 1980-1985 is explained by quality improvement. By the estimation, the pure price effect of the VER exceeds $1,000 per import in 1983 and 1984. The result also shows that the pricing patterns of Japanese cars have significantly changed in 1985, which may be due to more collusive behavior than before. The survey by Arthur Anderson & Co. in 1994 indicates that the Japanese automobile industry has a competitive advantage over the U.S. automobile industry. Auto manufacturers and parts suppliers as well as consumers put the reliability of a car at the top of the quality index. Fits and finishes are also very important. In this survey, fuel economy and corrosion protection proved to be less important than other factors.

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[26] Honda first launched Acura as its luxury division in 1986, while Toyota and Nissan followed to launch Lexus in 1989 and Infiniti in 1990 in the U.S. market, respectively.

[27] Robert C. Feenstra, "Quality Change under Trade Restraints in Japanese Autos," *The Quarterly Journal of Economics*, February 1988, pp. 131-147.

The quality gap between Japan and the U.S. has narrowed, however, since the mid-1980s. A survey by the U.S. Consumer Union (1992), found Japanese quality still to be ahead of the U.S. on average as Table 8 illustrates. Ten years ago, all of the top ten brands in terms of least defects per 100 cars in a given period were Japanese cars, while the bottom ten were American cars. Today, three of the top ten brands are U.S. cars and two of the bottom are Japanese cars. This implies specific U.S. brands and models are completely competitive although the U.S. average may not have caught up entirely. According to J.D. Power & Associates[28] , six of the fourteen best quality cars priced under $20,000 are U.S. Big Three products as shown in Table 9.

3.2.3. The impacts of Japanese Transplants on the U.S. Economy

3.2.3.A. Local Content

One of the major economic contributions of a new transplant is its use of American labor, parts, and materials. Most transplants are claiming domestic content in the range of 50% to 70%[29]. This is calculated by the measure of CAFE[30] based on the factory wholesale price. This includes transportation to the dealer, cost of selling (e.g.,

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[28] J.D. Power and Associates, "New Comers Dominate Quality Lists," *USA Today*, May 1992.

[29] In contrast, local content of the Big Three models ranged from 86% to 99% in 1988 according to Howe's study (1982).

[30] Corporate Average Fuel Economy (CAFE) is calculated for the U.S. Department of Transportation based on the factory wholesale price. Under CAFE regulations which implement the law, each firm should report the domestic contents of its vehicle for the purpose of assigning the vehicle to the import or domestic fleet.

Table 8 Average Number of Problems per 100 New Cars

Manufacturer	1980	1985	1990
Ford	100	48	35
GM	108	55	40
Chrysler	89	59	31
Average U.S.	**99**	**54**	**35**
Honda	34	20	14
Nissan	47	28	15
Toyota	24	17	16
Average Japan	**35**	**22**	**15**

Source: Consumer's Union, 1994.

Table 9 Top Quality Cars Selling for under $20,000

Manufacturer	Model	Problems/100 Cars	Country
GM	Pontiac 6000	78	U.S.
Toyota	Camry	79	Japan
Toyota	Cressida	80	Japan
Honda	CRX	89	Japan
GM	Buick Century	91	U.S.
Toyota	Corolla	91	Japan
Ford (Mercury)	Grand Marquis	91	U.S.
GM	Olds Ciera	97	U.S.
Toyota	Tercel	97	Japan
GM	Geo Prizm	98	Japan
GM	Buick LeSabre	99	U.S.
Ford (Mercury)	Topaz	99	U.S.

Source: J.D. Power & Associates, 1994.

advertising and dealer preparation), and profits and, all costs which would be incurred regardless of whether the vehicle was imported or built in the U.S.

If local content is to measure the contribution to the U.S. economy of local production relative to imports, it should be based on the cost of production which excludes delivery costs, selling costs and profits. The real contribution of Japanese transplants to the U.S. economy is thus considerably smaller after adjustment than is calculated by their proclaimed content levels. For example, Honda was claiming its local content to be about 75% , while McAlinden and Smith (1991) calculated Honda's local content as 62%. All other Japanese transplants reported their local content as 60% or above while their actual content rates, on average are probably below than 50% when we consider that the content based on the factory wholesale price is much higher than the content based on cost of production.

Another measure for local content is derived from a formula developed by the U.S. Environmental Protection Agency (EPA). Under this formula, domestic content[31] is calculated using the declared value of imported components divided by the average wholesale price of the vehicle. Then, the EPA domestic content percentage is derived by the substitution of this ratio from 100. Since only the cost of material directly imported is considered as foreign content, the EPA formula treats as U.S. content every other component of cost, such as equipment purchased abroad, the technical assistance fees paid abroad, distributor margins, interest on loans from foreign banks and even exchange

[31] Domestic Content used in U.S. automobiles includes the U.S. and Canada content. This is because the U.S.-Canada Auto Pact of 1965 effectively integrated the two countries into a single North American entity.

paid abroad, distributor margins, interest on loans from foreign banks and even exchange rate losses. A parts maker can import components and incorporate them into subassemblies. Regardless of the foreign content of these components, they are considered domestic because they were not imported directly by the assembler and because some degree of transformation took place. As a result, a vehicle which has the actual U.S. content as low as one third of the total material cost could be classified as having two thirds U.S. content.

Table 10 shows the U.S. local content of a selected Honda transplant. Honda is considered to have the highest domestic content of the transplants. Transplant domestic content is relatively low and far less than that of the U.S. Big Three. Also, U.S. content using the EPA formula is substantially higher than the local content as measured by different formulas. Thus the measurements by the EPA as well as CAFE are always overestimated.

Alarmed by a U.S. Federal Trade Commission investigation (1990)[32] of the anticompetitive implications of the *keiretsu* method of buying among related auto companies, Japanese MITI urged Japanese transplant parts suppliers to buy more parts in the U.S. Robert Lawrence (1990)[33] believes that, by 1992, the average Japanese transplant will be purchasing about 60 percent of its components and materials in the U.S., the equivalent of 75 percent CAFE content. Transplants must produce drivetrains in the U.S. in order to meet CAFE content levels of 75 percent. Those transplant

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[32] *Automotive News*, April 30, 1990, p. 22.
[33] Robert Lawrence, *Foreign-Affiliated Automakers in the United States: An Appraisal*, Study for the Automobile Importer of America (Washington, D.C.; The Brookings Institution, 1990).

Table 10 Comparison of Transplants' Local Content

	Honda Accord			Joint Venture Product		
Contents ($/vehicle)	Total	U.S. Source	Japan Source	Total	U.S. Source	Japan Source
Imported Parts	3,820	0	3,820	5,216	0	5,216
Transplants Parts	2,625	850	1,775	2,699	874	1,825
U.S. Content	850	850	0	874	874	0
Japanese Content	1,775	0	1,775	1,825	0	1,825
U.S. Domestic Parts	1,585	1,585	0	1,229	1,229	0
Labor, Depreciation	2,000	1,369	631	2,671	1,945	726
Total Mfg. Cost	10,030	3,804	6,226	11,815	4,048	7,767
Assembly Profit	213	213	0	371	371	0
Ex-Factory Price	11,911	5,685	6,226	13,294	5,527	7,767
U.S. Content as %:						
Mfg. Cost	**38**			**34**		
Ex-Factory Cost	**39**			**32**		
CAFE	**48**			**42**		
EPA	**68**			**61**		

Source: Office for the Study of Automotive Transportation (Ann Arbor, MI; University of Michigan, 1994).

assemblers which plan only engine assembly in the U.S. are unlikely to purchase more than 50 percent of their parts in the U.S. Those with no plans for engine assembly will not achieve content levels above 50 percent. Based on the stated plans of transplants for drivetrain sourcing, Howes (1988)[34] estimates that on average, Japanese transplants will purchase only 50 percent of the needed components and materials in the U.S.

3.2.3.B. Employment

According to Howes (1993)[35], U.S. firms have lost over 2 million units of sales to Japanese firms during the last decade. While imports were 300,000 units higher, 1.54 million Japanese transplant-produced cars were sold in the U.S. in 1993. The U.S. had a bilateral auto trade deficit of over 34 billion dollars with Japan in 1994. Approximately 3 million U.S. jobs have been lost in the industry in the last 10 years. This implies that there is an annual net $6 billion transfer of U.S. job losers' income to the Japanese transplants.

The most significant and contentious aspect of the transplants is their impact on employment in the U.S. automotive industry. The impact of transplants on the net U.S. employment in automotive-related production depends on numerous assumptions including: the period of analysis, the extent to which Japanese transplants are being

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[34] Candace Howes, "Transplants and Job Loss: The UAW Response for the GAO," UAW Research Department, Detroit, MI: May 10, 1988.

[35] Candace Howes, *Japanese Auto Transplants and the U.S. Automobile Industry,* Economic Policy Institute Washington, D.C., 1993).

substituted for imports, and the extent to which U.S.-made parts are used in transplants vehicles. Lawrence (1990)[36] estimated that Japanese transplants would result in a net gain of 65,000 jobs by 1991.

But Howes and the UAW estimated that the transplants will result in a net loss as shown in Table 11. Lawrence's assumptions about ultimate transplant volume and displacement ratios[37] provide the conclusion that the equivalent of five Big Three assembly plants will close while 11 transplants will open. Howes' study finds that the equivalent of 13.5 Big Three assembly plants will close while 13.5 equivalent transplants will open. Under the assumption about domestic sourcing ratios Lawrence concludes that about 17,000 jobs are created by every Japanese transplant while Howes' study shows 2,800 more jobs per plant. By Howes' study, the aggregate net job loss to imports reached 179,000 jobs by 1986. Many of those imports have been displaced by transplants.

However, total Japanese sales are expected to rise by one million units, displacing the equivalent of traditional U.S. domestic assembly and numerous associated parts plants. By the ESI estimates, the traditional domestic firms lost 132,560 jobs while transplants gained 57,760 jobs, thus giving the net loss of 74,800 jobs by 1991. The estimated GNP loss for traditional domestic firms is $9.6 billion while the GNP gain for transplants is $4.1 billion resulting in a $5.5 billion net GNP loss. Since imports are

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[36] Robert Lawrence, *Foreign-Affiliated Automakers in the United States: An Appraisal*, Study for the Automobile Importers of America (Washington, D.C. ; The Brookings Institution, 1990).

[37] The displacement rate is the rate at which transplants displace imports from Japan.

Table 11 The Employment Impact of Japanese Transplants

	Lawrence	GAO[a]	UAW	Howes
Period of Analysis	1982-90	1985-90	1985-90	1982-93
Volume of Transplant, millions	2.23	1.8	1.8	2.7
Displacement Ratio (%)	45	85	85	100
Volume of Displacement, millions	-1	-1.53	-1.53	-2.07
Assembly Jobs per Plant	2,545	2,560	2,560	2,412
Parts Jobs per Plant	25,124	19,811	26,161	24,574
Total Employees per Plant	30,283	23,879	31,533	29,620
Domestic Sourcing Ratio for Japanese Transplants (%)	60	50	50	50
Domestic Sourcing Ratio for Big Three (%)	84	83	87	87
Annual Production Increase (%)	2	2	2	2
Total Transplant Jobs	196,463	112,190	140,767	198,437
Domestic Jobs per Plant[b]	17,620	12,466	15,640	14,699
Total Big Three Jobs[c]	-131,315	-156,911	-215,216	-356,743
Net Job Gain or Loss	65,148	-44,721	-74,449	-158,306

Notes: a= U.S. General Accounting Office

b= Sum of assembly jobs per plant plus domestic parts jobs per plant

c= Number of plants times total domestic jobs per plant.

Source: Complied by Kim from various sources expected to fall by 1 million units while transplant production rises by 2 million over the next few years, the two will offset one another.

Between 1986 and 1993, there was a small increase in the net employment of approximately 21,000 jobs. Approximately, $10 billion in gross compensation was lost in the industry. This is a redistribution from U.S. auto workers in the Big Three to the Japanese transplants. The ESI estimates that more than 300,000 high wage assembly and parts workers will have been displaced by imports and transplants while transplants create about 200,000 new jobs by the mid-1990s.

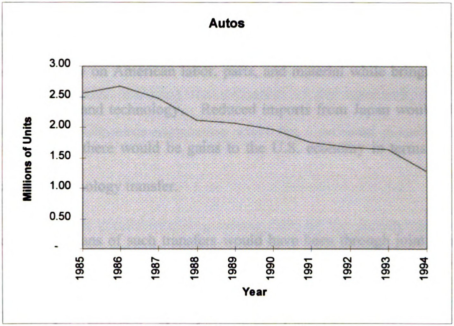
3.2.3.C. U.S. Domestic Parts Industry

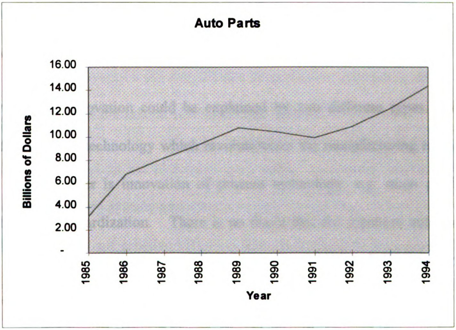
For the U.S. domestic auto parts and materials industry, the effect of both imports and the transplants is very important. The U.S. parts producers have suffered the erosion in Original Equipment Manufactures (OEM) sales volume from imports as the Big Three over the past two decades, since exports to Japan have been and remain quite small. This implies that every imported Japanese car bears a loss of potential U.S. parts sales at the OEM level. It is widely expected that the opening of the transplants would enable the U.S. parts and materials producers to make up part of this lost ground.

However, the rate of transplant displacement of imports has been much lower than expected. By the ESI estimates, the transplants source only about 20% of their parts and materials from the traditional U.S. domestic suppliers. Another 30% is sourced from transplant parts makers, but the U.S. content of these parts is only about 33%. The total U.S. portion of transplants is thus only about 30%. Japanese operations in the U.S. transplants are essentially assembly operations. On average about 50% of the value of parts used in transplants are imported from Japan on average according to Howes' study (1992). U.S.-sourced parts are purchased from outside suppliers or manufactured within the assembly plants. The majority of parts purchases from outside suppliers are purchased from U.S. subsidiaries of Japanese parts manufacturers. These suppliers for transplants are exclusively nonunion and compensation rates are about 44% of compensation rates in Big Three parts plants and 58% of compensation rates for the parts industry as a whole.

Auto parts represent about 60% of the manufacturing cost of an automobile on average. As a result while the U.S. auto trade deficit with Japan fell gradually, the deficit in auto parts increased rapidly since the mid-1980s. Figure 6 illustrates the changing pattern of U.S. imports of Japanese autos and auto parts during the last decade. The U.S. trade deficit with Japan in auto parts and materials has been rising steadily even as the deficit in complete auto trade has fallen. The decline of parts imports in 1990-91 is related both to recession and the subsequent sharp fall-off of auto sales as well as to the opening of a number of new transplants parts facilities. Japanese auto parts in 1994 accounted for $12.8 billion or about 20% of the U.S. $66 billion trade deficit with Japan. Japanese transplants have announced that an additional one million units of transplant capacity will come on line in the U.S. before the end of 1990s, and thus a more serious negative effect on the U.S. domestic parts industry is expected.

Figure 6 U.S. Imports of Japanese Autos and Auto Parts





Source: American Automobile Manufacturers Association, FT 990 (U.S. Bureau of the Census, Commerce Department, 1985-1994).

3.2.3.D. Technology Transfer

During the last decade, the number of vehicles produced by Japanese transplants has grown to 1.6 million units. The U.S. expected that the production at the transplants would be based primarily on American labor, parts, and material while bringing in new management techniques and technology. Reduced imports from Japan would alleviate payments deficits while there would be gains to the U.S. economy in terms of wages, R&D, new jobs and technology transfer.

One effective means of such transfers would have been through joint ventures[38] with the Big Three, as it would have minimized adjustments to the U.S. environment and revitalized old U.S. plants. However, only a few transplant facilities, such as the joint venture between Toyota and GM which used an old GM plant, were created in this way. Most others were completely new plants in new locations.

Technological innovation could be explained by two different types. One is innovation of production technology which revolutionizes the manufacturing methods of the product, and the other is innovation of process technology, e.g. mass production technology through standardization. There is no doubt that the Japanese auto industry has been the leading innovator in terms of both types of technological development over the past decades.

[38] This was the method adopted by the Japanese steel industry which entered into a series of joint ventures with U.S. steel makers in the 1980s.

All the Japanese manufacturers used much of their profits to automate plants, renew facilities and develop the standards of production technology. A huge investment was made into the research and the development of establishing the R&D system of technological innovation in the late 1980s. Japanese automakers pioneered many corporate innovations, including the utilization of the teamwork concept for product planning and simultaneous engineering, which has been noted globally since the 1980s.

Also, the Japanese product-planning system calls for the participation of parts makers from the early stages. Well-organized teamwork between the design department and other departments, such as production, sales and market research, work effectively in order to reduce unnecessary costs and time. The Japanese system has revealed the limits of productivity gains from the traditional U.S.-type of mass production of standardized products since this could overlook the significance of qualitative changes in development and process technologies of the automobile production system.

Japanese transplants in the U.S. also have helped to transfer Japanese quality control, just-in-time delivery system, and other innovative techniques to the U.S. On the plus side, this has had a net positive effect. But most Japanese transplants mainly assemble imported parts, and this clearly limits the potential of technology transfer. Much of the economic benefit with automobile production is derived from the engineering development work that must precede the launch of a new automobile.

The Big Three spend virtually all of the R&D funds for any given car project in the U.S. while Japanese transplants have relied on their traditional keiretsu in Japan. For example, in the case of the Honda plant in Ohio, approximately $85 million was spent in R&D for the vehicles produced, but all of the engineering work was done by the parent company's engineering development in Japan. This pattern can be observed in all other Japanese transplants in U.S. territory.

In the case of the Big Three, all of the most sophisticated and high value-added work is performed in the U.S. Although most Japanese transplants have announced the creation of technical, designing, and test centers in the U.S., the effects and efforts are relatively small so far. For the U.S. auto industry, it is important to learn about process technology. All workers should be part of quality control.

Howes (1993) provides considerable evidence to support the hypothesis that substantive technology transfer from Japanese transplants is not occurring in the U.S. Plant-level productivity data suggest that transplant assemblers are less productive than their Japanese counterpartners in the actual assembly process. However, firm and industry level data show that considerably more Japanese production and white-collar labor hours go into the average vehicle built in Japan, relative to the hours in the same vehicle assembled in the U.S. Both facts strongly suggest that crucial aspects of the Japanese system are not only not being transferred to the U.S., but also would not be in the future.

3.3. Implication of the U.S. Strategic Trade Policy toward Japanese Automobiles

The success of the U.S. strategic trade policy in automobiles depends in part on its impact on Japanese transplants in the U.S. Two issues have dominated the policy discussion of the relative costs and benefits of transplants. One is whether transplants will help reduce the trade deficit. The second issue is whether transplants create domestic jobs.

Proponents of FDI claim that Japanese investment will reduce the bilateral trade deficit with Japan. Thus far, no evidence supports that claim. The bilateral automotive trade deficit for 1990 was $31.1 billion. If transplant volume continues to expand and imports remain the same or fall only slightly, then it is expected the trade deficit will increase. Sean P. McAlinden, David Andrea, Michael S. Flynn, and Brett C. Smith (1991) have shown convincingly that the U.S. auto trade deficit with Japan can be expected to reach over $40 billion (in 1990 dollars) by 1996.

The impact of transplants on the net U.S. employment in automotive-related production was discussed earlier. Lawrence's study estimates that Japanese transplants would cost a net loss of 158,000 U.S. jobs between 1982 and 1993 when 2.7 million transplant vehicles with 50 percent U.S. content displaced as many traditional U.S.-assembled vehicles. When Japanese transplant production first began in 1982, the Japanese firms were selling 2.2 million imports in the U.S. market. By the mid-1980s, Japanese firms had announced plans to build over 1.8 million transplants in the U.S. by 1990.

Since there was no obvious economic incentive to shift capacity to the U.S. before 1986, it seemed likely that the Japanese firms' objective was to guarantee continued expanding access to the U.S. market. Between 1982 and 1986, while transplant sales volume grew to 500,000 units, Japanese import sales continued to rise from 2.2. million units to 3.3 million units; with imports growing at the same time, transplants were certainly displacing domestic vehicles. Between 1986 and 1991, imports fell by 1.3 million units while transplants rose by 1.5 million.

One would infer that while transplants had failed to displace imports at all until 1986 they are now displacing imports at a rate of almost one for one. But between 1982 and 1991, imports fell by only 200,000 units while transplants rose by 2.0 million units; transplants were displacing domestic vehicles at a rate of 90 percent.

The enormous growth of imports witnessed between 1982 and 1986 should be viewed partly as a strategy to reserve a share of the market for transplants which would come on-line several years later. It takes several years to build an auto plant but capacity in an existing plant can be expanded with overtime or an additional shift. Between 1986 and 1991, as another 1.4 million transplants were added to the U.S. market, imports were cut back. It would have been imprudent for any Japanese firm to add 250,000 transplant units to the U.S. market without reducing imports. Based on Japanese plans as of 1988, they planned to sell nearly five million units by the mid-1990s, including 2.3 million imports and 2.7 million transplants.

When Honda, Nissan, and Toyota had started operations in the U.S., all firms knew there would be unrestrained expansion and that they had better secure a place. Therefore, as the minimum permissible level of imports was expanded under the VER in 1984 and again in 1985, firms immediately increased imports, many of them knowing that for political reasons they might replace imports with transplants in the long run, but that they would be unable to gain a market share if they delayed expansion until the U.S. plants were built.

As political opposition to the large Japanese presence in the U.S. market has increased during the prolonged U.S. recession, Japanese firms have recently made a commitment to reduce car imports into the U.S. market. The recent revision of the minimum permissible level of car imports to 1.85 million units under the VER will not greatly affect the level of car imports currently at 2 million units.

From the standpoint of the U.S. as a whole, the new foreign investments often are simply additions to current overcapacity[39]. Local state assistance and subsidies to new Japanese plants have resulted in strengthening the competitiveness of Japanese transplants and consequently weakening the U.S. domestic plants as well as parts suppliers. Thus, heavily subsidized Japanese operations tend to block existing U.S. parts suppliers' access to the transplant assemblers, as well as win away many of those suppliers' existing contracts with the Big Three.

[39] By the ESI estimates, capacity utilization in the U.S. was 62 percent versus 95 percent in Japan.

One of the strategic mistakes that the U.S. has made over the last few decades may have been in not aggressively selling U.S. cars in the Japanese market[40]. The Big Three automakers are now desperate to penetrate the Japanese car market. There are about 41 million passenger vehicles on the road in Japan. However, only 1.4% of them are U.S. made cars. The Japanese have spent billions of dollars studying American tastes and building plants in the U.S. to manufacture cars that suit them. The Big Three had generally confined their efforts in Japan to exporting the same cars and trucks they manufacture in the U.S. Most of them do not have the tiny engines that Japanese prefer, and few are equipped for driving on the left-hand side of the road.

Over decades, the U.S. car companies have made investments overseas comparable to what the Japanese have made in the U.S. The U.S. companies control almost 25% of the European market. To counter the U.S. administration's criticism, the Japanese companies point to the success of European auto makers in penetrating the Japanese market[41]. The fundamental point is that, although the Japanese market has been historically closed, this does not explain why Germany and Great Britain export more cars to Japan than the Big Three, and France and Sweden nearly as many.

Furthermore, sustained exchange rate realignments would further augment the U.S. competitive advantage in relation to Japan. Automobile trade closely tracks the yen-dollar exchange rate as we examined in the empirical work. The maintenance of a

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[40] In 1993, U.S. exported only 54,493 passenger cars to Japan, while Japan exported 1,454,553 passenger cars to the U.S.

[41] European manufacturers combined had 2.8% of the market in Japan in 1994. In the U.S., all the European manufacturers combined have 3.1% of the market in the same year.

strong yen would boast the relative competitiveness of both U.S. assembly plants and U.S. based parts producers. Policy actions to widen the Japanese assemblers' supplier networks to include U.S. firms, and boosting parts exports to Japan would make the Japanese assembly plants in the U.S. even more competitive. The Japanese automobile firms also need to meet the challenge of becoming truly global firms. This will involve the difficult task of genuinely incorporating foreign nationals in management and foreign firms in supplier networks.

CHAPTER IV

EMPIRICAL EVALUATION OF THE JAPANESE VER AND PRICE TRENDS IN THE U.S. AUTOMOBILE MARKET

4.1. Modeling of a VER: Hedonic Equation

A major issue regarding price indices centers around their adjustment to quality change. For standardized products, the physical specifications and characteristics typically remain unchanged over long periods of time and quality change usually does not present a problem. However, for some products like automobiles whose specifications and characteristics evolve rapidly over time, accounting properly for quality change becomes important. It is thus important to use regression methods to construct quality-adjusted price indexes.

Regression analysis, particularly involving dummy variables, can help considerably in dealing with quality adjustment of price indexes over time. This type of regression analysis is known as hedonic price analysis. In this analysis, transaction prices are regressed on a number of explanatory variables, each of which measures an important aspect of product quality. This method can also be extended into the intertemporal domain by showing how multivariate regression analysis can be used to measure the extent to which prices have changed over time, adjusting for quality by holding its level fixed. This procedure incorporates the dichotomous independent variables into the regression.

Andrew T. Court (1938)[42] defined hedonic price comparisons as "those which recognize the potential contribution of any commodity, a motor car in this instance, to the welfare and happiness of its purchasers and the community". Following Court, one may argue that automobiles produce a number of services that consumers enjoy. It would be desirable to measure directly the amount of happiness and increased welfare provided by automobile services, but such quantification would be impossible.

It might be reasonable, however, to relate the enjoyment consumers receive from automobiles to physical design and operating characteristics, such as power, speed, safety devices, and air conditioning. He then argued that in the case of passenger cars, if the relative importance to the customer of horsepower, braking capacity, window area, seat width, tire size, etc., could be established, the data reflecting these characteristics could be combined into an index of usefulness and desirability. Prices per vehicle divided by this index of hedonic content would yield comparisons in the face of changing specifications.

[42] Andrew T. Court of the Automobile Manufactures' Association first devised the Hedonic Pricing Method to investigate the effects of auto price changes on the total volume of auto sales in 1938.

The hedonic technique thus converts the "quality problem" into a quantity measure. Court's methodological contribution to the construction of quality-adjusted price indexes was therefore a most important and significant one. Much recent work concerning empirical evaluation of automobiles was based on the framework established by Court. Court's hedonic multiple regression approach to the construction of price indexes was revived by Zvi Griliches. Unlike Court's, Griliches' work immediately stimulated a substantial and very influential body of new research, both theoretical and empirical. Unlike Court, who focused on the demand side, the post-Griliches research typically envisages hedonic prices as the outcome of shifting the supply and demand curve for various characteristics.

Feenstra (1984, 1988) employs hedonic regressions, where the logarithm of the automobile retail price is a function of its quality. Using data from 1979-1985, he showed that some of the observed price increases in Japanese cars could be accounted for by corresponding increases in quality. Feenstra's documentation of quality upgrading due to the VER has remained an important fact in most discussions of the effects of the VER, while recent empirical work has moved well beyond the simple hedonic regression approach.

Dixit (1988) constructed a simple simulation model of the U.S. automobile industry in which there were two types of products, U.S. and Japanese. Dixit computed an optimal strategic trade policy and estimated the welfare gains. He found that the gains from the strategic trade policy would have been very small.

Dinopoulos and Kreinin (1988) introduced European cars into the calculus. They draw on Feenstra to investigate the effect of the U.S.-Japan Auto VER on the behavior of European producers. Their study shows that European producers raised prices by nearly one third. The U.S. welfare loss due to the rise in European prices exceeded the U.S. loss to Japan and the consumers' welfare loss within the U.S.

Goldberg (1993) used a structural oligopoly model of the U.S. automobile industry. Her estimates indicate that the main effect of the VER came immediately after it was imposed and that the policy had little or nearly no effect in later years.

In this chapter, the empirical work uses time series and cross section data to examine the effect of quality attributes and macroeconomic variables on car prices. Theoretically, imposing a VER will result in an increase in car prices and, consequently, in consumers' welfare loss. Also, it is expected that a VER will be accompanied by quality upgrading. From the consumers' viewpoint, the costs of imposing trade restraints are substantially affected by quality upgrading. Thus, the increase in the import price under a VER overstates consumer cost, since part of this increase results from quality upgrading. It is important to control for quality upgrading, so that we can isolate changes in the mark-ups from the overall variation in price.

Using a three-country comparative analysis, this empirical work examines how the price trend in real terms changed in the U.S. car market after imposing the Japanese VER. Further, this work investigates the effect of quality upgrading, as well as macroeconomic effects on the price trend in the U.S. car market. Finally, this work controls for quality upgrading and macroeconomic effects to determine and evaluate the mark-ups.

4.2. Data and Estimation

The general specification of this estimation parallels that of Feenstra (1988), however, there are three major differences. First, I use more recent data covering the 1981-1994 period. Second, the model specification is different from that of Feenstra. For example, I add macroeconomic variables, such as the U.S.-Japanese exchange rate and the U.S. average prime rate, which may have significant explanatory power. Third, I add time trend variables to incorporate macroeconomic effects into the discussion.

The primary data source for estimation is the *Automotive News: Market Data Books* for 1981-1994. The sample consists of the base versions of the four door sedans sold in the U.S. but produced by car companies in the U.S., Japan or Europe. When the four door is not available, I use the two door coupe in order to keep the number of products computationally manageable. Data were obtained on the retail price of car, volume sold and various quality measures such as car length, weight, horse power (HP), and the presence of air conditioning (Air), or an anti-lock brake system (ABS)[43]. The macroeconomic data on exchange rates (ER), the consumer price index (CPI), and the average prime interest rate (APR) are obtained from the *Survey of Current Business.*

Table 12 shows the means for all observations by country since the imposition of Japanese VER. As one would expect, the average U.S. car is bigger, heavier, more powerful and better equipped than the average Japanese car. Alternatively, the average European car ranked highest in terms of HP, Air, ABS, and the average price over the period.

Table 13 provides the market average for key variables including the number of models, the average retail price, the sales volume and other attributes. The number of available models climbed steadily until 1991, while the sales volume per model declined through the early 1990s. The deflated price of automobiles has risen steadily, although noticeably larger-than-average spikes appear in 1982 and 1991.

Overall, these tables suggest that the increase in price that coincides with the imposition of the Japanese VER may not be due to higher mark-ups, but rather may reflect quality upgrading, as Feenstra found. The average car in the 1990s is better equipped than previous models. This is proxied by the inclusion of air

[43] It was 1986 when the ABS system was first available in the U.S. market for U.S. and European cars. Japanese cars began to install this equipment in 1987 in the U.S. market.

conditioning as standard equipment and more emphasis on safety devices such as the anti-lock brake system. An important message to take from Table 13 is that most of the quality variables exhibit enhancement, and we should take account for this phenomenon in the empirical work.

Table 14 focuses more narrowly on the trend of each producing country in the U.S. The first three columns present the average retail price by year. Coinciding with the imposition of the VER, the average U.S. car price increased, and continued to increase steadily for the rest of the period. The average Japanese price, on the other hand, shows a fairly steady climb through the whole period, while the average European price exhibits an increasing but fluctuating trend with a hump in the late-1980s. In the last six columns, the average sales volume and market share of each country is presented. Only the U.S. market share increased over time. Both the Japanese and the European market shares decreased, showing unstable trends. The average sales volume per model declined through the early 1990s, while the number of models increased steadily.

Figure 7 illustrates the price trend of each producing country based on the data in Table 14. This comparison depicts clearly how the average price of each country' car changed during the period. Taken together, Table 14 and Figure 7 suggest that there was a simultaneous change in the real price of cars in the U.S. car market over the period.

Table 15 shows the definitions and the means of each variable used in the regression. The regressors include the five vehicle attributes such as length, weight, horse power, air conditioning, the anti-lock brake system and three macroeconomic variables which include the current and the lagged exchange rate of U.S. dollar with respect to Japanese yen and the U.S. average prime rate. In addition, the regressors include the year-specific dummy variables and the time trend and trend-squared variables which take account of the trend in the U.S. automobile market.

Each of the following equations is estimated for each of the three types of cars sold in the U.S. market: U.S.-produced, Japanese-produced, and European-made cars.

- **Regression for Real Trend after Controlling for Quality Upgrading** (using year-specific dummy variables):

  (I) $\text{lprice} = b_0 + b_1X + b_2D + e$

- **Regression for Estimated Trend after Controlling for Quality Upgrading** (using nonlinear time trend and trend squared variables):

  (II) $\text{lprice} = b_0 + b_1X + b_2Yr + b_3Yrsq + e$

- **Regression for Estimated Trend after Controlling for Quality Upgrading and Macroeconomic Effects** (using nonlinear time trend and trend squared variables):

  (III) $\text{lprice} = b_0 + b_1X + b_2M + b_3Yr + b_4Yrsq + e,$

where lprice is logarithm of car price, and D is a set of year-specific dummy variables covering thirteen years. The inclusion of these variables effectively controls for variation in price due to inflation, productivity or other unobserved factors. X denotes seven quality variables (length, weight, horse power, air-conditioning, anti-lock brake system, and dummy variables for small and large size cars). M refers to the three macroeconomic variables (the current exchange rate of the U.S. dollar with respect to Japanese yen, the one year lagged exchange rate of U.S.-Japan, and the U.S. average prime rate).

The nonlinear time trend variables, Yr and Yrsq incorporate macroeconomic effects into the equations. The linear specification could lead to a rough inference concerning the trend. The trend has a value of zero for the first year (Y_{1981} = 0) and increases by one for each subsequent year (Y= 0,1,2...., 13). The trend squared has a value of zero for the first year and increases by the square for each subsequent year. The estimated regression has 1,775 observations[44]. The coefficients on the year-specific dummy variables address the key question of evaluating the VER effect on prices.

[44] Some of the observations in which any attribute or part of data are not available from the original data sources, and those with the price range over $50,000 are truncated. Thus, total sales volume or total number of models and average means of variables except macro data may be different from official statistics.

4.3. Results and Interpretation

Table 16 reports estimates of the conventional hedonic equation for each country. These are computed from the regression of the log price on a set of individual characteristics and the year-specific dummy variables. Because regression (1) uses year-specific dummy variables, the annually-observed macroeconomic data are not included in the equation because of multicollinearity. Each estimated coefficient can be interpreted as the percentage change in price caused by a unit change in that characteristic. Most of the coefficients for car attributes are positive and significant as expected. Large or luxury cars (luxury cars are included in the category of large cars) are sold at a higher premium than other cars.

The coefficients on the set of year-specific dummy variables for the U.S. cars are positive and significant over the 1982-1993 period. There was an upward trend until the 1986-87 period, suggesting a persistent increase in the average price of the U.S. cars even after controlling for quality effects. In the Japanese case, however, most coefficients are insignificant; this implies that the increase in the average retail price of Japanese cars in the U.S. market was absorbed by quality upgrading of Japanese cars, rather than by the mark-ups due to the VER.

The coefficients on the year-specific variables for the European cars are mostly negative and insignificant throughout the 1980s, but become negative and significant during the 1990s. This result suggests that the increase in the retail price of European cars during the 1980's was captured by quality enhancement as in the Japanese case. The sudden fall in the adjusted price in 1989-1990 continues for the rest of the period, possibly reflecting the fact that it was at approximately the same time that Japanese luxury cars became competitive in the U.S. market[45].

Figure 8, like Table 16, illustrates the time trend for each producing country after controlling for quality effects. Table 16 and Figure 8 suggest a VER effect on the price of the U.S. cars during 1981-1986, while the cars from other countries show no mark-ups through the period except the Japanese cars for 1985-1987.

In the next two regressions, I omit the year-specific dummy variables from the equation. Instead, I use a nonlinear time trend variable and a time trend squared variable. This results in a smoothed time trend by fitting the estimated coefficients to each year. Tables 17 and 18 report the results of regression (2), which still excludes the macroeconomic variables, and (3), which includes the macroeconomic variables. The main purpose of these regressions is to identify the macroeconomic effects from the variation in price. The magnitude of the trend differentials in regressions (2) and (3), are the main subjects discussed in this section. I turn to regression (3) in Table 18 and examine the trend differentials while adding in the macroeconomic variables.

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[45] In 1986, Honda introduced the Acura Legend, the first of the Japanese luxury division, into the U.S. Toyota followed with the Lexus ES 280 and the Lexus LS 400 in 1989, while Nissan introduced the Infiniti M 30 and the Infinity Q 45 in 1990.

In Table 18, the coefficient on the APR is -1.8% for the U.S. cars, and -1.6% for the Japanese cars, implying a slightly negative relationship between the APR and the price of the U.S. cars, as well as the Japanese cars. This result reflects the fact that the U.S. consumers, on average, buy new cars with monthly payments, and they are concerned about the interest rate they should pay over the period. When the interest rate goes up, the U.S. new car buyers seem to be negatively affected on their purchasing new cars, but not so much. This result appears to apply to the U.S. and Japanese cars, but not European cars in the U.S. market according to the findings.

However, the coefficients on the ER and the lagged ER are insignificant for the U.S. cars. This is somewhat surprising since it suggests that the U.S.-Japanese exchange rate did not play a role in explaining the variation in the price of the U.S. cars. It seems that after controlling for quality improvement, the variation in price of the U.S. cars is due to the APR or other non-observed factors, including mark-ups. In the Japanese case, the coefficient on the ER is -29.1% and it is statistically significant, although the coefficient on the lagged ER is insignificant. This result implies that the change in the price of Japanese cars is significantly affected by the U.S.-Japanese current exchange rate, after controlling for quality upgrading. When Japanese yen is depreciated with respect to U.S. dollars, Japanese cars have a comparative advantage in terms of price. Since they become more competitive, Japanese producers could lower the price to a certain level, and still achieve higher profits due to the exchange rate differential. This also suggests that Japanese car buyers in the U.S. are more sensitive to the price of Japanese cars than to U.S. or European cars. Consequently, the pricing of Japanese cars in the U.S. market has a significant negative correlation with the U.S.-Japanese exchange rate.

The coefficients on the macroeconomic variables for European cars are insignificant, suggesting that the pricing of European cars sold in the U.S. is independent of the U.S.-Japanese exchange rate and the U.S. APR. The coefficients on the lagged ER for all countries are negative but insignificant, suggesting that there is no correlation between the lagged ER and the price of cars sold in the U.S.

Figures 9 and 10 are presented to explore the specific pattern of the trend by fitting the estimated time trend to each year, yielding smoothed trends. Figure 9 provides comparative trends for each producing country after controlling for quality upgrading only, while Figure 10 shows these trends after controlling for both quality upgrading and the macroeconomic effects. The important message from both figures is that there seems prominent mark-ups resulting from imposing the Japanese VER for the U.S. cars during the early 1980s, even after controlling for both quality upgrading and macroeconomic effects.

European cars exhibit a slight increase in adjusted price for a short while, then decline steadily for the rest of period. These results suggest that the primary price impact of the VER on the U.S. and European cars came immediately after it was imposed, and that the policy had little or no effect in later years as Goldberg (1993) found. The individual trend for each producing country indicates that the adjusted price actually fell steadily after the mid-1980s, suggesting that the U.S. consumers benefited from the decline in adjusted price during the last decade.

In contrast, Japanese cars did not show mark-ups through the period. The increase in the retail price of Japanese cars in the U.S. was entirely explained by quality upgrading, and thus the predicted U.S. consumers' welfare loss caused by the rise in the price of Japanese cars did not occur. In Figure 10, the Japanese trend after controlling for quality upgrading and macroeconomic effects exhibits a persistent decreasing pattern, implying that U.S. consumers enjoyed the Japanese quality improvement at a low cost relative to the U.S. or European cars over the period.

Finally, Figures 11, 12, and 13 are rearranged from Figures 9 and 10 so as to compare the different trends with and without controlling for macroeconomic effects by the producing country. Each figure demonstrates how macroeconomic variables affect the trend within each producing country in the U.S., showing a symmetric pattern of increasing influence on the price. One thing to be mentioned is that all the trends after the mid-1980s show persistent declines in the adjusted price after controlling for both effects on the price, again suggesting that the U.S. consumers' social costs due to higher retail price were partially compensated for by the quality improvement for the rest of the period.

In concluding, first, I examined the time trend in real terms, which shows a simultaneous upward trend in the price of the U.S., Japanese, and European cars in the U.S. Then, I investigated the effects of quality attributes on the price of cars sold in the U.S., yielding evidence of substantial quality upgrading of imported cars and a positive relationship with the variation in price after imposing the Japanese VER.

Second, I found that only the price of Japanese cars was significantly affected by the U.S.-Japanese exchange rate. The U.S. and Japanese prices were slightly affected by the U.S. APR. In the European case, the price was not affected by either the U.S.-Japan exchange rate or by the U.S. APR.

Third, I found that U.S. produced cars showed an increase in the adjusted price during the early 1980s, even after controlling for both quality upgrading and macroeconomic effects. This implies monopolistic pricing with higher percentage mark-ups in the U.S. auto industry during the period. European cars also displayed a slight increase in the adjusted price for a short while. However, the quality-adjusted price of Japanese cars continued to decline steadily through the period, suggesting that the increase in the retail price of Japanese cars in the U.S. was not a mark-up, but rather reflected quality upgrading. This result is similar to Feenstra's (1988).

Fourth, I found that the U.S. consumers' loss due to mark-ups during the earliest VER period was caused mainly by the increase in the adjusted price of the

U.S. cars, but not by the Japanese cars. The benefits from quality upgrading of Japanese cars exceeded the increase in retail price that the U.S. consumers paid. Furthermore, all the cars exhibit a persistent decline in the adjusted price after the mid-1980s when controlling for both quality effects and macroeconomic effects. This result reinforces prior findings that the U.S. new car buyers benefited from quality upgrading, even though they were confronted with higher retail prices during the last decade.

Fifth, it seems reasonable to expect that U.S. interest rate and the current exchange rate have played an important role in the U.S. automobile market. In particular, the U.S. exchange rate with respect to the Japanese yen has been crucial in the pricing of Japanese cars when considering the significant negative correlation between the U.S.-Japanese exchange rate and the price of Japanese cars in the U.S. , as discussed earlier.

Finally, these empirical results may support the hypothesis that the VER has contributed to quality upgrading. Japanese and European cars had substantial quality upgrading effects over the whole period, while the U.S. cars initially showed a relatively slower pattern of quality upgrading when compared to other countries. However, this work does not support the hypothesis that imposing the Japanese VER merely led to higher imported car prices. Rather, quality increased dramatically which partially offset the negative impact of the higher prices.

In the analysis, it seems that the main effect of the Japanese VER after controlling for both quality upgrading and macroeconomic effects, occurred immediately after it was levied, and lasted only a limited time. Specifically, it seems that the VER affected U.S. cars for 1981-1984, and European cars for 1981-1982. Japanese cars, however, did not show any mark-ups during the entire period, suggesting that the increase in the retail price of Japanese cars was completely transferred to quality improvement. Overall, these results suggest that the U.S. consumers' welfare loss during the VER period was mainly due to the mark-ups in the domestic cars, but not imported cars according to the findings. This is a drastic departure from the theory's expectation.

Table 12 Variable Means by Producing Country

	Overall	U.S.	Japan	Europe
Observations	1,775	859	603	313
Price ($)	11,950	11,095	10,587	15,774
Sales (unit)	62,599	89,608	49,859	13,417
Length (in×10)	1,819.94	1,907.65	1,723.19	1,777.23
Weight (lb.)	2,809.27	3,015.34	2,540.61	2,767.15
HP	121.67	119.39	114.26	121.75
Air*	.377	.345	.224	.760
ABS*	.156	.123	.133	.284
Car Size**	1.774	1.984	1.390	1.936
Small (%)	.465	.341	.713	.339
Medium (%)	.296	.334	.184	.406
Large (%)	.239	.325	.103	.265

1. Variables denoted with * are binary dummy variables equal to 1 if the condition holds and 0 otherwise.
2. Variables denoted with ** is dummy variable equals to 1 if the car size is small, 2 if medium, and 3 if large of luxury.

Table 13 Some Descriptive Statistics by Year

Yr.	Obs.	Price	Sales	Length	Weight	HP	Air	ABS
81	98	9,190	75,230	1,851.37	2,786.64	93.83	.245	0
82	102	9,931	66,283	1,852.89	2,779.26	94.50	.304	0
83	112	10,056	72,787	1,850.05	2,774.47	96.59	.250	0
84	101	10,159	89,123	1,837.74	2,762.93	102.02	.248	0
85	118	10,477	85,471	1,821.36	2,744.03	103.00	.305	0
86	128	10,972	80,045	1,805.41	2,711.82	107.24	.320	.023
87	130	11,558	66,994	1,798.42	2,715.64	110.13	.354	.069
88	137	11,870	67,196	1,804.00	2,743.72	116.46	.401	.876
89	137	12,067	64,179	1,809.34	2,746.50	119.31	.387	.109
90	144	11,640	63,804	1,801.41	2,824.72	124.31	.396	.167
91	155	12,378	54,756	1,803.67	2,827.65	130.45	.439	.232
92	138	13,082	53,767	1,819.17	2,901.33	136.18	.442	.348
93	133	13,531	57,776	1,838.81	2,939.13	140.45	.496	.414

1. Statistics for 1994 are not shown here because the data for sales volume in that year was not available at the time this study was undergone.

Table 14 Comparison of Prices and Quantities by Producing Country

Year	Average U.S. Price($)	Average Japanese Price($)	Average European Price($)	Average U.S. Sales	Average Japanese Sales	Average European Sales	U.S. Market Share(%)	Japanese Market Share(%)	European Market Share(%)
1981	8,807	7,712	12,107	100,592	64,303	13,706	56.322	36.004	7.674
1982	9,561	8,332	12,861	79,399	74,293	18,379	46.143	43.176	10.097
1983	9,929	8,321	13,047	92,419	63,699	19,016	52.770	36.372	10.858
1984	10,137	8,136	14,306	112,403	67,962	20,416	55.983	33.849	10.168
1985	10,108	8,411	14,687	114,017	67,489	22,299	55.944	33.114	10.942
1986	10,922	8,883	14,418	110,730	63,869	21,274	56.532	32.607	10.861
1987	11,228	9,565	15,502	93,642	58,908	15,175	57.131	35.940	6.929
1988	11,464	9,738	16,002	98,574	57,294	12,971	58.383	33.934	7.682
1989	11,612	9,631	17,735	100,698	50,386	12,297	61.634	30.840	7.527
1990	11,595	10,051	15,599	92,347	54,063	13,611	57.709	33.785	8.506
1991	12,106	10,857	16,219	84,002	49,082	8,556	59.307	34.653	6.040
1992	12,648	11,957	17,474	84,361	41,190	6,658	63.809	31.155	5.036
1993	12,510	12,914	19,144	88,528	43,048	8,250	63.313	30.787	5.900

Figure 7 Comparison of Real Trends

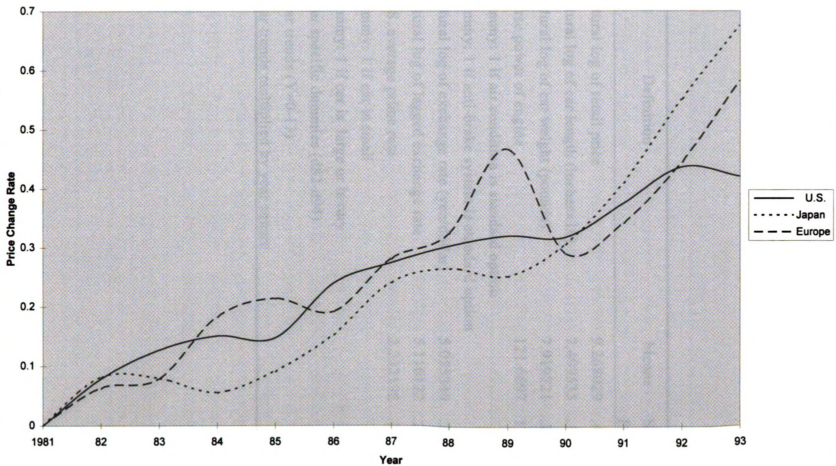


Table 15 Definitions, Means, and Standard Deviations of Variables

Variable	Definition	Means	Standard Deviation
ln(Price)	natural log of retail price	9.268029	.4494934
ln(Length)	natural log of car length (inches×10)	7.499535	.1989406
ln(Weight)	natural log of car weight (pounds)	7.919721	.2143010
HP	horse power of engine	121.6697	114.8219
Air	dummy: 1 if air condition is standard option		
ABS	dummy: 1 if anti-brake system is standard option		
ln(ER)	natural log of exchange rate (yen/dollar)	5.055349	.2933063
ln(ERP)	natural log of lagged exchange rate	5.116122	.2801853
APR	U.S. average prime rate	2.232192	.2883095
Small	dummy: 1 if car is small		
Large	dummy: 1 if car is large or luxury		
dYr	year specific dummies (d82-d94)		
Yr	year trends (Y=0-13)		
Yrsq	year trends multiplied by year square		

Table 16 OLS Hedonic Equation after controlling for Quality Upgrading (I)
(Using Year-Specific Dummy Variables)
$lprice = b_0 + b_1X + b_2dYr + e$

Independent Variables	U.S. Coef.	U.S. Std. Err.	Japan Coef.	Japan Std. Err.	Europe Coef.	Europe Std. Err.
ln(Length)	.3173367**	.1485479	.7857960	.2003932	.1818383	.3368971
ln(Weight)	.1436211**	.0453136	.4721024***	.1105241	1.109675***	.2162202
HP	.0027368***	.0003436	.0051969***	.0004265	.0028945***	.0006070
Air	.2775336***	.0212239	.0849870***	.0292901	.1984835***	.0412712
ABS	.1104824***	.0258647	.0818826***	.0381111	.1012137**	.0438261
Small	-.1092968***	.0208972	-.0559149**	.0261270	-.0528269	.0416918
Large	.1181106***	.0229421	.0609370*	.0418569	.2001203***	.0411267
d82	.1018493***	.0342414	-.0096758	.0565810	-.0515105	.0693486
d83	.1558638***	.0335093	-.0072954	.0540035	-.0383991	.0702096
d84	.1589341***	.0342200	-.0278925	.0549664	-.0382140	.0788030
d85	.1519319***	.0337975	-.0027546	.0528361	-.0588281	.0695653
d86	.1901623***	.0343756	.0141411	.0507688	-.0959149	.0673930
d87	.1893754***	.0349706	.0572783	.0501584	-.0415328	.0666909
d88	.1463340***	.0353764	.0415826	.0496963	-.0387865	.0656351
d89	.1349772***	.0366671	.0078370	.0484458	.0109041	.0668520
d90	.0964236***	.0365965	-.1319461**	.0481113	-.1424052**	.0696716
d91	.0899918***	.0370489	-.0861432*	.0476314	-.1474535**	.0674720
d92	.1084813***	.0374004	-.1027003**	.0482861	-.2041299***	.0754466
d93	.0753331**	.0375933	-.0769445*	.0489040	-.2590170***	.0809184
d94	.0063258	.0391985	.0229005	.0494622	-.2369039***	.0789698
No. of Obs.	859		603		313	
R-squared	0.7830		0.8134		0.7893	
Adj R-squ	0.7778		0.8070		0.7749	

* significant at 10 % level, ** significant at 5% level, *** significant at 1% level.

Figure 8 Comparison of Real Trends after Controlling for Quality Upgrading (I)

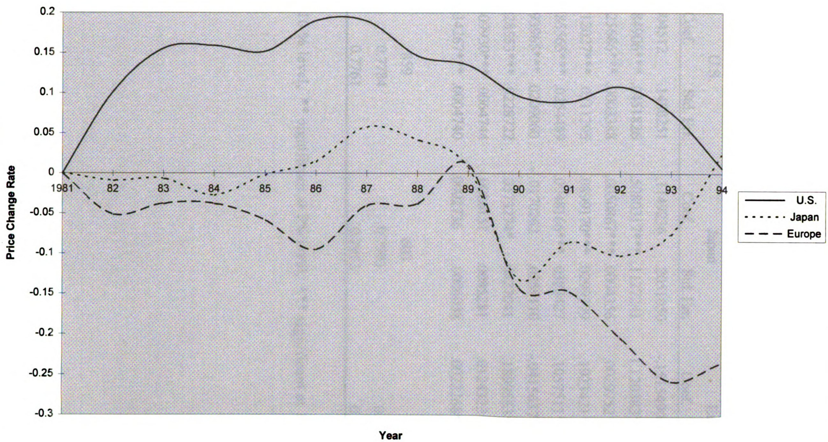


Table 17 OLS Hedonic Equation after controlling for Quality Upgrading (II)

(Using Nonlinear Time Trend Variables)

$lprice = b_0 + b_1X + b_2Yr + b_3\ Yrsq + e$

Independent	U.S.		Japan		Europe	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
ln(Length)	.3404512	.1480251	.1149236	.2051050	-.1515490	.3344875
ln(Weight)	.1484906***	.0451826	.5080317***	.1127241	1.120383***	.2120844
HP	.0025686***	.0003388	.0050867***	.0004356	.0029752***	.0006021
Air	.2712027***	.0211295	.0899170***	.0299379	.1923421***	.0406195
ABS	.1285565***	.0254489	.0948166***	.0387427	.1057511***	.0434889
Small	-.1093965***	.0209060	- .0170262	.0259110	-.0415637	.0408902
Large	.1228553***	.0228722	.0573274*	.0427041	.1899553***	.0404683
Yr	.0409930***	.0064744	-.0086151	.0085281	.0124323	.0118057
Yrsq	-.0034267***	.0004740	.0002736	.0006038	.0022268***	.0009047
No. of Obs.	859		603		313	
R-squared	0.7784		0.7983		0.7816	
Adj R-squ	0.7761		0.7953		0.7751	

* significant at 10 % level, ** significant at 5% level, *** significant at 1% level.

Figure 9 Comparison of Estimated Trends after Controlling for Quality Upgrading (II)

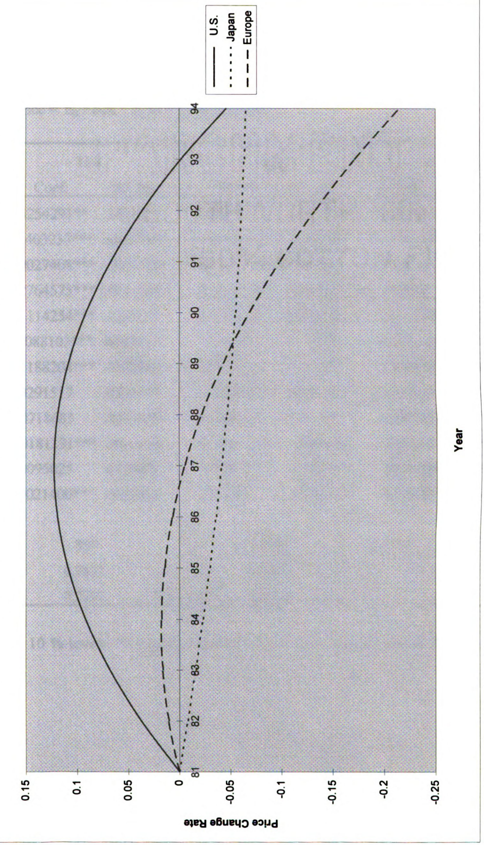


Table 18 OLS Hedonic Equation after Controlling for Quality Upgrading and Macroeconomic Effects (III)

(Using Nonlinear Time Trend Variables)

$$lprice = b_0 + b_1X + b_2M + b_3Yr + b_4Yrsq + e$$

Independent	U.S.		Japan		Europe	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
ln(Length)	.3254291**	.1474072	.0967087	.2022190	-.1935012	.3327858
In(Weight)	.1403237***	.0449704	.4894825***	.1115838	1.147988***	.2112001
HP	.0027408***	.0003396	.0051587***	.0004306	.0028727***	.0006000
Air	.2764575***	.0211040	.0865170***	.0384501	.2005292***	.0404880
ABS	.1114254***	.0257035	.0920052*	.0384501	.0970364	.0433421
Small	-.1088103***	.0207837	-.0370102	.0259376	-.0450094	.0408397
Large	.1188204***	.0227848	.0507305	.0421697	.1966858	.0403649
In(ER)	.0291517	.0701959	-.2914163***	.1013313	-.0199224	.1398483
ln(ERP)	-.0718683	.9372920	-.1207649	.1301068	-.2157737	.1797768
APR	-.0181331***	.0059188	-.0158451**	.0080550	.0040357	.0114388
Yr	.0095025	.0138000	-.0598671***	.0172037	.0048460	.0258576
Yrsq	-.0021400***	.0005960	.0012288	.0006911	-.0025937**	.0011183
No. of Obs.	859		603		313	
R-squared	0.7822		0.8054		0.7865	
Adj R-squ	0.7791		0.8015		0.7780	

* significant at 10 % level, ** significant at 5% level, *** significant at 1% level.

Figure 10 Comparison of Estimated Trends after Controlling Quality Upgrading and Macroeconomic Effects (III)

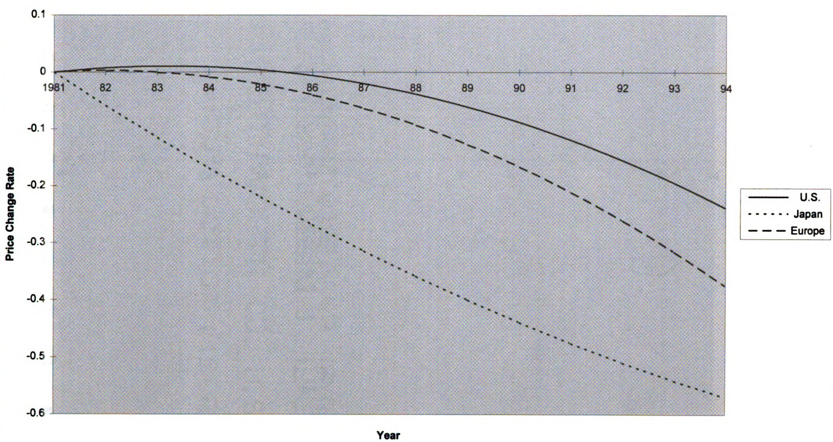


Figure 11 Comparison of Estimated Trends with and without Macroeconomic Effects after Controlling for Quality Upgrading in U.S. Cars

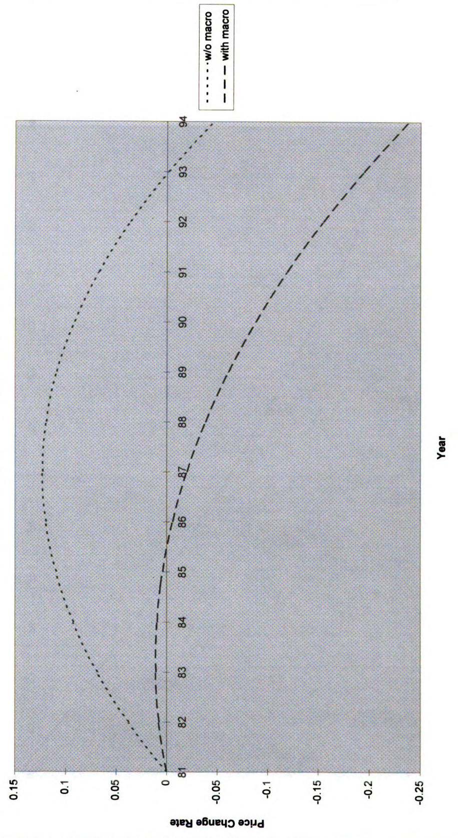


Figure 12 Comparison of Estmated Trends with or without Macroeconomic Effects after Controlling for Quality Upgrading in Japanese Cars

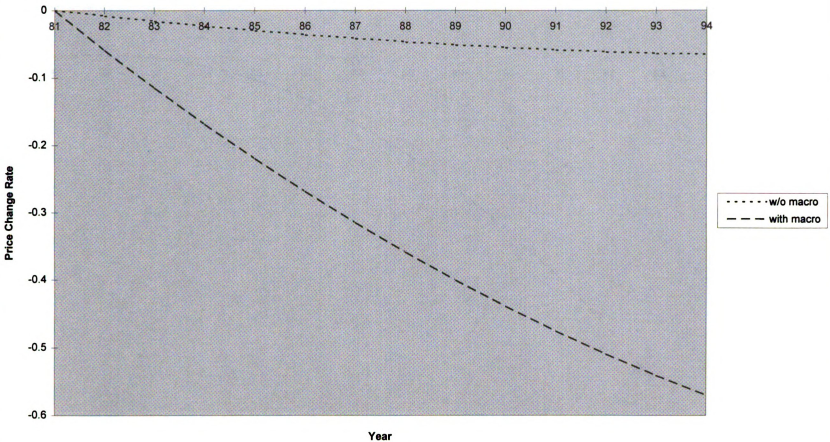
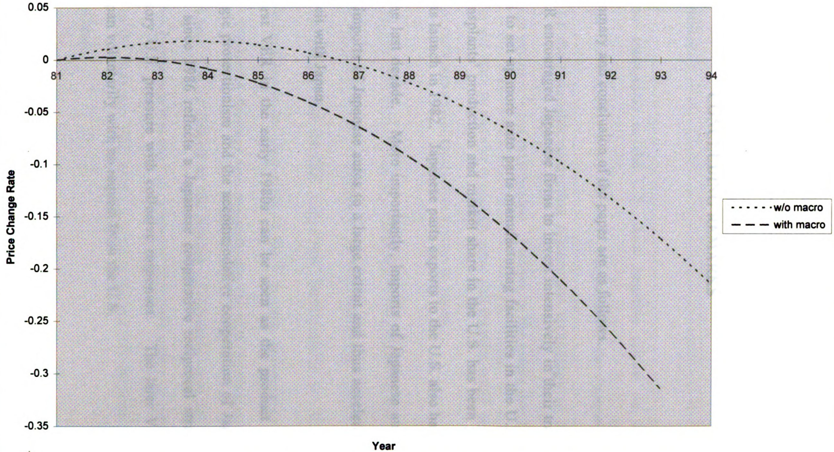


Figure 13 Comparison of Estimated Trends with or without Macroeconomic Effects after Controlling for Quality Upgrading in European Cars



CHAPTER V

CONCLUDING REMARKS

The summary and conclusion of the paper are as follows.

The VER encouraged Japanese firms to invest intensively in their transplant production and to set up more auto parts manufacturing facilities in the U.S. The capacity of transplants' production and market share in the U.S. has been growing quickly since its launch in 1982. Japanese parts exports to the U.S. also have risen rapidly over the last decade. More importantly, imports of Japanese auto parts have replaced imports of Japanese autos to a large extent and thus accelerated the U.S. trade deficit with Japan.

The first VER in the early 1980s can be seen as the product of U.S. coercive strategic protectionism and the accommodative cooperation of Japan, but the later VER since 1986 reflects a Japanese cooperative reciprocal strategy to deflect retaliatory U.S. pressure with collusive responses. The later VER was renewed by Japan voluntarily with no request from the U.S.

Production in the U.S. by the Japanese automobile manufactures circumvented the long-run impact of VER. Although shipments of Japanese cars to the U.S. were below agreed-upon levels, the scale of U.S. manufacturing operations led to an increase in the actual availability of Japanese automobiles in the U.S. auto market.

Japanese transplants in the U.S. show negative effects on the U.S. employment and the domestic parts industry. Furthermore, the Japanese firms failed to transfer their superior production system and technology to the U.S., because to a large extent it is not transferable. Further, to the extent that there is a transfer, they do not want to transfer it enough since full transfer could undermine the conditions of their successful productive system in Japan.

Empirical evaluation of the VER effect generally supports the theory's expectation that the VERs are accompanied by quality upgrading. However, the regression results suggest that the U.S. consumers' losses due to the VER were mainly from the increase in the pure price of the U.S. cars, rather than from the Japanese cars. Empirical findings also suggests that the U.S. exchange rate with respect to Japanese Yen is crucial to the pricing of Japanese cars in the U.S. market. Finally, I conclude that the U.S. bilateral auto trade policy of quantitative restraint such as the Japanese VER could not solve the chronic disputes over the U.S.-Japan auto trade.

These findings contrast with the adverse reaction to the import of Japanese automobiles and the U.S. push for VER limits. Naturally, Japanese firms capitalized on the opportunity provided by higher U.S. prices to move into the higher quality U.S. market and to export intermediate components for manufacture in the U.S. As a result, their hostility to VERs, and U.S. enthusiasm for the same diminished. These illustrate the point that government policies do not necessarily reflect national welfare but pressures from powerful interest groups, especially articulate, select constituencies. While the benefits are broadly distributed, the burdens are not. Macro gains must be weighed against sector specific consequences, which I have indicated briefly. But the overall balance is not tackled nor the determination of a Paretian optimum which must contend with the difficulties of interpersonal utility comparisons. In the case of automobiles, intangible nationalistic considerations also confound the issue. It is for these reasons that automobile trade policy conflicts will continue to be a divisive element in U.S.-Japanese relations. My findings are still relevant to these trade policy differences and the debate even though I have not analyzed these complexities of political economy in detail.

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