THE PINHAS SAPIR CENTER FOR DEVELOPMENT

Tel-Aviv University

Tel-Aviv, Israel

THE EFFECT OF THE ARAB BOYCOTT ON ISRAEL: THE AUTOMOBILE MARKET

Chaim Fershtman Neil Gandal

Discussion Paper No. 3-95

November 1995

The Effect of the Arab Boycott on Israel: The Automobile Market

Chaim Fershtman
and
Neil Gandal

Eitan Berglas School of Economics
Tel Aviv University

Abstract

Recent progress towards a comprehensive peace in the Middle East has led to a relaxation of the enforcement of the Arab economic boycott of Israel. This in turn has led to the entry of all the major Japanese and Korean automobile manufacturers into the Israeli market. In this paper, we examine the effect of the Arab economic boycott on this market. Using recent advances in estimating discrete-choice models of product differentiation, we estimate that had the boycott continued, the welfare loss per purchaser would have been approximately $790 in 1994. This benefit can be interpreted as a *peace dividend.* Since approximately 113,000 new automobiles were sold in 1994, the welfare gain to consumers was more than $89 million that year.

Keywords: Economic Sanctions, Boycott

We are grateful to the Pinhas Sapir Center for Development for financial support and to Sarit Markovich for outstanding research assistance. We thank seminar participants at the University of Maryland, the University of Michigan, Stanford University, and Tel Aviv University for helpful comments and also thank Steve Berry, Jim Levinsohn, and Ariel Pakes for provision of data on product characteristics of automobiles sold in the U.S.

1 Introduction

The Arab economic boycott of Israel is probably one of the most enduring and comprehensive cases of the use of economic sanctions.[1,2] In 1922, the Fifth Palestine Arab Congress passed a resolution calling on Arabs to boycott Jewish businesses in Palestine. The boycott was institutionalized with the establishment of the Arab League in 1945. Following the establishment of Israel, the Arab League banned all commercial and financial transactions between Israel and the Arab states. In 1951, the Arab League set up a central boycott office (CBO) in Dasmacus, Syria with branches in member states to administer the boycott. The formation of the CBO institutionalized two additional aspects of the boycott:

- The *secondary boycott*, in which foreign firms were prohibited from operating in Arab countries if they had trade or commercial dealings with Israel. The CBO maintains and updates a *blacklist* of firms that are banned from the Arab World.

- The *tertiary* boycott, which prohibits foreign firms from acquiring technology from, and establishing partnerships or joint ventures with blacklisted foreign companies. Boycott resolutions also contain a provision banning the purchase of components that exceed 10 percent of the total cost of production from blacklisted firms.

Although the boycott officially continues to this day, recent progress toward peace in the Middle East has led to a relaxation of the enforcement of the Arab economic boycott of Israel.[3] The ending of the Arab Boycott (and the resulting economic benefits) is viewed

[1]Sarna (1986) provides a thorough historical account of the Arab boycott against Israel, qualitatively assesses its impact on Israel, and discusses countermeasures undertaken by third party governments. In the 1970s, the U.S., for example, enacted legislation prohibiting compliance with the boycott. In order to downplay the boycott's effect, Israel did not enact anti-boycott legislation. For work on Israel's anti-boycott policies, see Rolef (1989).

[2]There is a fairly large literature on the use of international economic sanctions. See for example, Leyton-Brown (1987), a conference volume consisting of fifteen papers on the use of economic sanctions as a policy instrument, and Hufbauer, Schott, and Elliot (1990), a detailed case study of the use of economic sanctions in this century.

[3]According to the Far Eastern Economic Review, (Trofimoc, Yaroslav, "Peace Dividend," *Far Eastern Economic Review," 157, 46: p.74,* Persian gulf countries stopped enforcing the boycott following the Middle

by the Israeli public as one of the important *peace dividends*. While no one doubts that the boycott has caused significant damage to the Israeli economy, structural economic models have not been employed to estimate its magnitude. Recently some numbers were thrown into the public debate, but they were not based on any formal analysis.[4] The public debate has so far focused on the effect of the boycott on foreign investment, and on the closure of export markets.

The *secondary* and *tertiary* boycotts also had a significant effect on local product markets. The dearth of product variety and the pattern of competition within Israel during the long period in which the boycott was enforced may have resulted in significant welfare losses. The purpose of this paper is to examine one particular market, the automobile market, and to estimate the welfare loss due to the economic boycott. In principal, the boycott likely affected the equilibrium price of the cars sold in Israel, the variety of cars available, the type of cars that were purchased, as well as the total number of cars purchased. All these factors affect consumer welfare.[5]

In the automobile market, the boycott was quite successful in insuring that the leading Japanese automobile manufacturers (Toyota, Honda, Nissan, Mazda, and Mitsubishi) and all the Korean automobile manufacturers stayed out of the Israeli market. The first major Japanese manufacturer (Mitsubishi) entered in late 1988, while the remaining Japanese manufacturers waited until the peace process began; the Korean manufacturers followed the Japanese and only entered the Israeli market in 1994.

The effect of the Arab economic boycott was not limited to the Middle East; compliance with the boycott often went beyond agreeing not to sell automobiles in Israel. In 1981, for example, Toyota announced plans to a undertake a joint venture with the *blacklisted* Ford

East Peace Talks in Madrid in 1991. On October 1, 1994, the Gulf Cooperation Council officially announced that it would no longer enforce the *secondary* and *tertiary* boycotts.

[4]In a recent article ("Boycott Close-Up," *Chemical Business*, 11 18-19 Nov 1993,) Danny Gillerman, president of the Israeli Chambers of Commerce and Danny Lipkin, an economic analyst estimate the financial loss to Israel as a result of the Arab boycott at somewhere between $45 and $49 billion since 1950.

[5]There has never been any significant domestic automobile production in Israel.

Motor Company;[6] The venture was to produce cars at Ford's unused plants in the U.S. Saudi Arabia's Minister of Commerce warned that his country would ban all Toyota automobiles if the deal with Ford went through.[7] Indeed, following the warning, the joint venture was canceled.

In our analysis, we employ recent advances in estimating discrete-choice models of product differentiation. These techniques, developed by Berry (1994) and Berry, Levinsohn, and Pakes (BLP) (1995), enable structural estimation of both the demand and oligopoly pricing aspects that characterize differentiated product markets. The techniques yield estimates of own and cross price elasticities as well as estimates of cost-side parameters. BLP (1995) employ their model in order to estimate equilibrium in the U.S. automobile market. The automobile industry is especially attractive to study because (1) important characteristics are identifiable and easy to measure and (2) because product level data (quantities, prices and product characteristics) are readily available to the researcher. Verboven (1995) extended the model developed in Berry (1994) to multiproduct firms and to markets in which import quotas exist.[8] Verboven then employed the model in order to examine international price discrimination in European automobile markets.[9,10]

[6]Ford Motor Company was blacklisted in 1966 for licensing an Israeli firm to assemble Ford trucks and tractors. Ford continued doing business with Israel and was banned from selling its automobiles in all Arab countries.

[7]Sarna, p.170, notes that in 1980, Toyota sold 256,000 cars in the Middle East; approximately fifty percent of these were sold in Saudi Arabia.

[8]A multiproduct firm takes into account how the price of one product affects the demand for the other products that it sells.

[9]Other important contributions to this literature include Bresnahan (1987) and Goldberg (1995). Bresnahan (1987) was the first to employ a structural model to estimate both the demand and oligopoly pricing aspects that characterize differentiated product markets. He employed a vertical differentiation model to examine whether U.S. automobile manufacturers colluded in the mid 1950s. Goldberg (1995) used both micro (individual household) and market level data in her study of the automobile industry. See BLP (1995) and Verboven (1995) for detailed reviews of the rich literature on the automobile industry.

[10]Dinopoulos and Kreinin (1988) employ "hedonic" price regressions to empirically estimate the effect of Japanese automobile voluntary export restrictions (VERs) on automobile prices and welfare in the U.S. Our approach differs from theirs in that we employ a structural (rather than an reduced form) model.

Estimating the economic effects of the Arab boycott poses some inherent difficulties. One strategy would be to estimate a dynamic model using a period that covers both "boycott" and "post boycott" equilibria and assess the gains over time. Although such an approach is appealing, there were many significant changes in Israel (such as rapid income growth and major reforms in automobile taxation policies) over the last few years that make it virtually impossible to isolate the effect of the boycott or its removal. An alternative strategy is to evaluate or simulate the equilibrium that would have obtained in the market had the boycott not existed, given the information on the market equilibrium when the boycott existed. Given the available data we conduct a similar exercise, but in the opposite direction. Using data for 1994, we estimate the market equilibrium in the Israeli automobile market and then simulate the equilibrium that would have existed had the boycott continued. We chose 1994 because by then all the major Japanese and Korean firms had entered the Israeli market.[11] The simulation reveals that had the boycott continued, the market would have been approximately 12 percent smaller in 1994 and that there would have been a leftward shift in the distribution to smaller (less expensive) vehicles.

The main finding of this paper is that had the boycott continued, the welfare loss would have been on the order of $790 per purchaser in 1994. This benefit, primarily from increased variety, can be interpreted as a *peace dividend*. Since the average (sales-weighted) price of a new car in Israel was approximately $ 21,000 in 1994,[12] the welfare gain is approximately 3.7 percent of the price of a new car. Since 113,000 private automobiles were sold in the Israeli market in 1994, had the boycott continued, the cost to consumers would have been more than $89 million in that year.

[11] We also chose 1994 (the latest year for which data were available) in order to avoid measuring "pent up" demand for the new varieties.

[12] Consumers paid 128 percent in taxes on automobiles sold in Israel in 1994.

2 The Boycott and the Automobile Industry

Sarna (1986) writes that among the leading economic powers, Japan had the "most consistent record of compliance with the discriminatory and restrictive trade practices of the Arab boycott of Israel."[13] The boycott was especially successful in the Japanese automobile industry. In particular, the five major Japanese automobile manufacturers (Toyota, Honda, Nissan, Mazda, and Mitsubishi) fully complied with the Arab boycott.[14]

In 1968, the three largest Japanese automobile manufacturers, Toyota, Honda, and Nissan, were explicitly warned by boycott officials not to sell their products in Israel. The firms complied. Indeed, requests by potential Israeli importers to sell Toyota, Honda, Nissan, Mitsubishi, and Mazda automobiles were continually rejected. The manufacturers claimed that there was a "shortage of production."[15]

In contrast to the "big five," in 1968, Subaru (Fuji Heavy Industries) did not sell any automobiles outside of Japan. Given that there were no Japanese automobiles in Israel at the time, in 1969 Subaru selected Israel as its initial export market. Without competition from other Japanese manufacturers, Subaru succeeded far beyond its expectations. Subaru accounted for slightly more than 27 percent of the new automobiles sold in Israel during the 1986-1990 period. Until late 1988, the only Japanese competition to Subaru in Israel came from other small Japanese manufacturers: Daihatsu, which entered in 1983 and Suzuki, which entered in 1985.

In 1988, Mitsubishi granted the "Kolomotor" agency in Israel the rights to sell Mitsubishi automobiles. Saudi Arabia and other Arab states put pressure on the Japanese company (there was even a meeting between the Saudi and Japanese economic liasons in Washington)

[13] Sarna, p. 165. He denotes a whole chapter to what he calls "the surrender of Japan." Reingold and Lansing (1994) examine the reasons behind Japan's strict compliance with the Boycott.

[14] See Chart 1 for detailed information on world production and market shares of Japanese automobile manufacturers.

[15] Sarna, p.172.

but Mitsubishi automobiles arrived in Israel in late 1988 (model year 1989).[16]

Shortly after the peace process began, the other major Japanese automobile manufacturers (Honda, Mazda, Toyota, and Nissan) began to sell in Israel.[17] No action has been taken by the Central Boycott Office or any individual Arab state.

According to the Israeli Ministry of Finance (see footnote 16), the Koreans were even more subservient to the Central Boycott Office than the Japanese. Indeed there were no Korean automobiles in Israel until 1994. In that year, Daewoo and Hyundai entered the Israeli market and immediately attained a combined 14 percent market. The other major Korean manufacturer (Kia) began selling its products in Israel in 1995.

The threat of *blacklisting* had less success with European and American automobile firms. Renault was blacklisted in 1955, and in 1959 it stopped selling its products in Israel. When the expected sales to the Arab world did not materialize, Renault returned to the Israeli market. In 1966, General Motors was warned not to open an assembly plant in Israel; G.M. continued to trade with Israel, but did not open an assembly plant. By 1969, all European and American automobile manufacturers were selling their products in Israel.[18]

3 The Model

We model the automobile industry as an oligopolistic market in which firms compete through prices. There are n firms, many of which sell several types of cars. N represents the number

[16]We thank Moshe Kobi, a senior member of the group in charge of Boycott affairs at the Israeli Ministry of Finance, for these details.

[17]Honda entered the Israeli shortly before the peace process began. In the early 1980s, Honda began producing automobiles in America. By the late 1980s, there was pressure by Jewish groups to export Hondas produced in America to Japan. (U.S. law prohibits cooperation with the boycott). In 1990, Honda opened a dealership in Israel. Until 1993, the Hondas sold in Israel were all produced in the U.S.

[18]This information is from the Israeli Central Bureau of Statistics. The Japanese dependence on Middle East oil likely made it more susceptible to the boycott. Nevertheless, the enforcement of the boycott was uneven and did not solely depend in which country the firm was located. It is likely that the optimal strategy of the CBO was not to punish all firms that were blacklisted. It is possible that some firms were punished to insure that the threat of *blacklisting* was credible.

of car models available. Our model of the automobile market closely follows Berry (1994); the multiproduct aspect is as in Verboven (1995).

3.1 Demand

The utility of product j to consumer i, denoted u_{ij}, depends on both product and consumer characteristics. Following Berry, we employ a random utility model of the form

$$u_{ij} = x_j\beta - \alpha p_j + \xi_j + \epsilon_{ij} + x_j(\beta_i - \beta), \tag{1}$$

where the first two terms are the mean valuations of product j's observed characteristics; x_j is a vector of observable product characteristics (such as engine size, weight, etc.) and p_j is the observed price of automobile j. The parameters α and β represent the mean valuations of the observable characteristics. The final three terms are the decomposition of the error term:[19]

- ξ_j represents the average value of product j's unobserved characteristics;
- ϵ_{ij} is the deviation of buyer preferences around this mean;
- $x_j(\beta_i - \beta)$ captures buyer heterogeneity in the valuation of the observable characteristics; β_i is buyer $i's$ valuation for the observable characteristics.

The final two error terms introduce heterogeneity and the distribution of these terms determines the substitution patterns among products. The multinomial logit model assumes that there is no buyer heterogeneity: in particular, the logit assumes that (1) $\beta_i = \beta$ for all i, and that (2) ϵ_{ij} are identically and independently distributed across consumers and choices with the extreme value (Weibull) distribution function.

[19]This decomposition and discussion follows both Berry (1994) and Bresnahan, Stern, and Trajtenberg (1995).

Given the discrete choice set, under these two assumptions, it can be shown that the probability of choosing product j, (the market share of product j) is

$$s_j = \frac{e^{\delta_j}}{(\sum_k e^{\delta_k})}, \tag{2}$$

where

$$\delta_j = x_j\beta - \alpha p_j + \xi_j, \tag{3}$$

is the mean utility level from product j. Despite its unrealistic substitution patterns among products, the logit distribution is popular because of the closed form solution (equation (2)).

In order to overcome the implausible substitution patterns among products, many authors employ the "nested" multinomial logit model. In this model, products fall into certain (predetermined) classes. This yields a much more reasonable pattern of substitution among products.[20] For example, if automobiles are nested according to class, the introduction of a new compact car will reduce demand for other compacts by more than for cars in other classes. Using the nested multinomial logit model, the probability of choosing product product j belonging to group g is

$$s_j = \frac{e^{\delta_j/(1-\sigma)}}{D_g^{\sigma}(\sum_g D_g^{1-\sigma})}, \tag{4}$$

where $D_g = \sum_{[j \in G_g]} e^{\delta_j/(1-\sigma)}$, G_g denotes the set of automobiles of type g, and $0 \leq \sigma < 1$ measures the degree of substitution among the products in the classes or groups. If $\sigma = 0$, the cross elasticities among products do not depend on the particular classification of the products; in such a case, the simple (non-nested) multinomial logit model is appropriate. In the case in which σ approaches one, the cross elasticity between any two products that belong to different groups is zero.

[20] It is assumed that there is a separate class that contains only the outside good, with a mean utility normalized to zero.

We use the nested (multinomial) logit model to estimate the equilibrium in the Israeli automobile market. As Berry notes, this model is appropriate when the substitution effects between products primarily depend on pre-determined classes of products. This assumption seems quite reasonable in the case of automobiles; indeed industry groups employ a standard classification system (small, compact, medium, large, luxury/sport).[21] Berry showed that by inverting the market share equation (4), one obtains[22]

$$ln(s_j/s_0) = x_j\beta - \alpha p_j + \sigma ln(\bar{s}_{j/g}) + \xi_j, \tag{5}$$

where $\bar{s}_{j/g}$ is the share of product j in group g (the within-group share), and s_0 is the proportion of consumers that choose the outside good, that is, choose not to purchase a new car. Since prices and group shares are endogenous, estimates of the parameters (α, β, and σ) can be obtained by an instrumental variable regression on (5).[23]

3.2 Multiproduct Oligopoly Pricing

Following the literature, we assume that the marginal cost of producing each product is independent of the output levels and linear in a vector of cost characteristics.[24] Since there is no domestic production, the assumption of constant marginal cost is quite realistic in the case of the Israeli automobile market. Thus the marginal cost of good j is

[21] Goldberg (1995) and Verboven (1995) also employ variants of the nested logit model in their studies of the automobile industry. Bresnahan, Stern, and Trajtenberg (1995) note that if there is more than one level of nesting, the order of the nesting gives rise to undesirable patterns of substitution. In our setting there is a single (natural) nesting.

[22] The details are in Berry (1994).

[23] Since the proportion of consumers choosing the outside good (s_0) appears on the left hand side of (5), this number must be estimated or assumed. For example, Greenstein (1994) estimates the share of the outside good. Following Verboven (1995) and Berry, Levinsohn, and Pakes (1995), we assume that the size of the potential market is known. Extensive experimentation reveals that only the estimate of the constant β_0 changes when we change the size of the potential market. This is intuitive; a larger potential market means that more consumers chose the outside good than one of the available automobiles. This reduces the mean utility of all inside goods relative to the mean utility of the outside good.

[24] The model was also estimated using marginal costs that were log-linear in the vector of cost characteristics and there were no qualitative changes.

$$mc_j = w_j\gamma + v_j, \tag{6}$$

where w_j is a vector of observable characteristics, v_j is an unobserved cost characteristic and γ is a vector of unknown parameters. The profits of a multiproduct firm f selling F products are

$$\pi_f = \sum_{k=1}^{F}(p_k/(1+t) - mc_k)q_k, \tag{7}$$

where p_k is the retail price of product k, q_k is the corresponding quantity sold, t is the tax rate, and mc_k is the marginal cost of producing automobile k. Assuming that the firms compete on prices and that they only take into account the cross elasticities among their products within a group, we have the following first order condition for product j:[25]

$$\frac{p_j}{(1+t)} + \sum_{k\in f_g}(p_k/(1+t) - mc_k)\eta_{kj}\frac{q_k}{q_j} = 0, \tag{8}$$

where f_g represents the set of products that firm f is selling in group g, and η_{kj} is the cross price elasticity between products k and j. Transformation of the first order conditions (8) and substitution of (6) yields the following pricing equation for product j:[26]

$$p_j/(1+t) = w_j\gamma + \frac{(1-\sigma)}{\alpha(1+t)[1 - \sigma\sum_{k\in f_g} q_k/Q_g - (1-\sigma)\sum_{k\in f_g} q_k/M]} + v_j, \tag{9}$$

where Q_g is the total number of sales in group g, and $M = \sum_{i=0}^{N} q_i$. Instruments are also needed in order to estimate the pricing equation, since the last term on the right hand side is endogenous.

[25]This useful representation is from Bresnahan, Stern, and Trajtenberg (1995). Using a relatively general demand model, Caplin and Nalebuff (1991) have established the existence of a pure strategy Nash equilibrium in the case of single product firms. For the nested logit model of demand, Anderson and de Palma (1992) have established that a pure strategy Nash equilibrium exists in the case of multiproduct firms.

[26]The derivation is tedious. For the details, see Verboven (1995). Note that our model is a special case of his, in which there is a single classification (or nest) and that the mean utility is *linear* in prices.

4 Estimation

The two equation system to be estimated consists of the demand (5) and pricing (9) equations. It is likely that ξ_j (unobserved demand characteristics) and v_j (unobserved cost characteristics) are correlated.[27] Additionally, two parameters (α and σ) appear in both equations. Finally, some of the parameters appear non-linearly. This suggests that the appropriate method of estimating the full system is via the general method of moments (GMM). We use the GMM software package.[28]

4.1 Instruments

In order to identify our two equation system, we need to find instruments for within-group shares ($\bar{s}_{j/g} \equiv q_j/Q_g$) and firm shares within a group ($\sum_{k \in C_g} q_k/Q_g$), in addition to prices. It is clear that some, or all, of the product characteristics (x_j) will be included in the vector of the cost characteristics (w_j); hence we do not try to identify the system via cost shifters. Rather we follow the literature and use the characteristics of other models as instruments.

First consider instruments for the within-group shares. As Bresnahan, Stern and Trajtenberg (1995) note, within-group share is negatively correlated with the number of other products in a group. Similarly, as the sum of the characteristics of the other products in the group increases, the other products become much stronger competitors and the within-group share of product j falls.

Now consider instruments for firm shares within a group. Clearly the firms' share in a particular group is increasing in the number of other products it sells in the group and decreasing in the number of products sold by competitors. Further, firms' shares in the group are increasing in the sum of the characteristics of the other products it sells in the group and decreasing in the sum of the characteristics of products sold by competitors in

[27] A characteristic that might be contained in both error terms is style.

[28] The software was written by Lars P. Hansen, John C. Heaton, and Masao Ogaki. See Hansen and Singleton (1982) for the theoretical foundations.

the group.

Finally consider instruments for price. From the first order condition (8), the number of other products that a firm sells within the group and the sum of the characteristics of the other products sold by the firm in the group will be positively correlated with price.[29]

4.2 Data

In 1994, approximately 113,000 private automobiles were sold in the following four classes: small, compact, medium, and large.[30] Despite the relatively small size of the Israeli market, there were more than 170 different products available.[31] Many of these brands had only a few sales. We restricted the sample to brands that had more than 80 sales. This left a sample of 101 brands; these brands accounted for 111,192 or more than 98 percent of the total market in 1994.[32]

In Israel, all import licenses are exclusive. For example, the "Kolomotor" agency has the exclusive rights to import Mitsubishi automobiles, etc. Prices are set centrally by the exclusive dealer and retail price maintenance is strictly enforced. Hence, our prices are transaction rather than list prices. Our price data comes from the Yitzhak Levi pricebook (May 1994), which provides comprehensive coverage of the Israeli car market. The retail price includes a 128 percent tax. The prices are in New Israeli Shekels.[33]

Since Israel is a small market, for each model available, many premium features are either included as standard equipment or not available. For example, dual airbags were standard equipment on all Honda Accords sold in Israel. In the case of GM, only the top of the line automobiles are imported to Israel; automatic transmission, air conditioning, power steering

[29] All of the instruments that we have discussed are included in the set of "optimal" instruments suggested by Pakes (1995) and discussed by BLP (1995).

[30] In the case of the Israeli market, the luxury/sport class is extremely small, and hence only the first four classes are employed.

[31] Models with different engine sizes are considered to be different products.

[32] Chart 2 shows how the Israeli Market has grown over time.

[33] The exchange rate in May 1994 was 2.95 New Israeli Shekels = $ 1.00.

and ABS braking systems were included as standard equipment in these automobiles. In addition to the prices, the Levi pricebook includes the car features described above; hence for each price observation, we know what additional features were available.[34] We now describe the other data.

The variable ENGINE is the engine size in liters.[35] The dummy variables SMALL, COMPACT, MEDIUM, and LARGE each take on the value one if the automobile falls into one of these predetermined classes. Similarly, the dummy variables JAPAN, KOREA, USA, WESTERN EUROPE, and EASTERN EUROPE take on the value one if the automobile is produced in that country or region.[36]

The dummy variable AIRCONDITION (AUTOMATIC) takes on the value one if the model has air conditioning (automatic transmission) and zero otherwise. The variable AIR-BRAKE takes on the value two if the model has both airbags and ABS (non-locking) brakes. If the model has only one of the features, the variable takes on the value one. If the model has none of the features, the variable takes on the value zero.[37]

Table (4) (in the appendix) contains descriptive statistics on the available data. The three models with the greatest sales per model (the Mitsubishi Lancer (11447), the Daewoo Racer (10658) and the Subaru Grand Leone (Impreza) (6834) were all in the compact class. Together those three models account for more than 25 percent of our sample. Table (1) shows the sales of automobiles according to group.

[34] In the case in which options are available, the Levi pricebook will list the price with and without the options. In such a case, we took the observation with the fewest options.

[35] We also have data on size (length and width), horsepower and weight. There is a high degree of correlation between these characteristics and for that reason we only included one of these characteristics in our model. Data on these physical characteristics were obtained from three sources: Katalog Der Automobil Review (1994), Hallwag Publishers, Berne, Switzerland (this source has data on all automobiles sold in Europe) , Automotive News Market Data Book (1994) (this source has data on all automobiles sold in the U.S.), and in some cases the importers themselves. This is because some of the automobiles sold in Israel are not sold in the U.S. or in European markets.

[36] Similar to other authors, we include Hondas produced in America as Japanese automobiles.

[37] Since most of the models that have one of these features also have the other feature, it seemed best to define the variable in this fashion.

	Small	Compact	Medium	Large	Total
Total Sales	25026	58075	19004	9087	111192
Models	19	37	20	25	101
J & K Sales	3733	36773	13031	1579	55116
J & K Models	5	11	10	6	32

Table 1: Automobile Sales by Group.

4.3 GMM Estimation

Our preferred model includes engine size, and whether the car has air conditioning, automatic transmission, ABS brakes and Airbags; these features appear both in x_j and w_j. In addition, we have included a dummy variable in the x_j (demand side characteristic) vector for Japanese and Korean ($J\&K$) compact automobiles.

The results of the general method of moments estimation using our preferred model are shown in Table (2).[38] The model fits the data reasonably well. Indeed, the estimates of the marginal cost of air conditioning and automatic transmission are in line with the option prices that are occasionally listed separately in the Levi pricebook.[39]

The correlation between actual and predicted prices is approximately .95 regardless of whether we employ the preferred model or a model with the demand side dummy variable for Japanese and Korean compact vehicles removed. There is a significant difference, however,

[38]Although a regression of within-group shares on the set of instruments yields the expected signs, the instruments are not highly correlated with within-group shares. Hence we add the following set of variables that are positively correlated with within-group shares to the list of instruments: a dummy variable which is the product of WESTERN EUROPE and SMALL, a dummy variable which is the product of (JAPAN+KOREA) and COMPACT, a dummy variable which is the product of JAPAN and MEDIUM and a dummy variable which is the product of USA and LARGE to the list of instruments. The other instruments are the sum of the engine sizes of the other products in the group, the number of other products in the group, and the number of other products that a firm sells in the group. Residual regressions show that all the instruments are exogenous.

[39]AIRBRAKE likely is a proxy for other premium features such as power locks, power windows and metallic paint; hence its estimated marginal cost is quite high.

in the correlation between actual and predicted sales. In the case of the preferred model, the correlation is a relatively reasonable .40, while in the alternative model without a dummy variable for Japan and Korean compact cars, the correlation between these two measures falls to .17. Further, in the case of the alternative model, there is a significant positive correlation between the estimated error term of the demand equation and the dummy variable for Japan and Korean compact cars.

The estimated model predicts that there is a significant degree of competition in the Israeli automobile market. In particular, our estimates yield relatively high price elasticities and relatively low price-cost margins. The mean (sales weighted) price-cost margin is close to five percent. This corresponds to the conventional wisdom. A recent article in a local daily newspaper[40] commented on the fact that there is not a great deal of brand loyalty in the Israeli market. This makes sense, given that there are no local players in the market. A dramatic example is the case of Subaru. In 1994, Subaru's share of the market was seven percent, a far cry from the 27 percent of the market that it held during the 1986-1990 period.

[40]Salel, Ya'acov, "The Pie Shrinks and Changes," *Ha'aretz*, 7/27/95, section B p.4.

	Both Equations:			
Variable	Coefficient	Standard Error		
$1/\alpha$	12718	3581		
σ	0.62	0.83		

	Demand Equation:		Pricing Equation:	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
CONSTANT	−2.66	0.50	−478	2135
ENGINE	1.97	0.75	13536	1696
AIRBRAKE	1.31	0.51	9768	1098
AUTOMATIC	0.80	0.28	3538	1188
AIRCONDITION	0.37	0.31	2451	1778
Jap/Kor COMPACT	0.61	0.20		
GMM OBJ	3.78			

Table 2: GMM Results: Preferred Model

5 Simulation: The Effect of the Boycott

In order to conduct our experiment, we now compare two simulated oligopoly equilibria: (1) the full choice set or "post boycott equilibrium" and (2) the reduced choice set or "boycott equilibrium." In the case of the "post boycott" equilibrium, this amounts to solving two hundred and two non-linear equations, i.e., (the demand (5) and pricing (9) equations for each model without the error terms).[41] In the case of the "boycott" equilibrium, this amounts to solving the 78 demand and pricing equations for each model that would have been available had the boycott continued. In this simulation, we include the Subaru, Daihatsu, and Suzuki models, since these firms did not participate in the boycott.

A comparison of the two simulations yields the following results:

[41] This system was solved using the GAUSS non-linear simultaneous equations subroutine.

- The new car market in israel would have been approximately 12 percent smaller in 1994 had the boycott continued.

- Had the boycott continued, there would have been a leftward shift in the distribution to smaller (less expensive) vehicles. Table (3) shows the "predicted" distribution of new car sales according to group for the "post boycott" and the "boycott" equilibria.

	Small	Compact	Medium	Large	Total
Post Boycott Equilibrium (101 models)	0.25	0.43	0.20	0.12	1.00
Boycott Equilibrium (78 models)	0.29	0.38	0.20	0.13	1.00

Table 3: Distribution of Automobile Sales by Group.

- A comparison of the predicted prices reveals that prices would not be much higher had the boycott continued in 1994. This is due to the fact that the Israeli market is relatively competitive and that close substitutes exist for nearly every model in the market.

5.1 Welfare

Trajtenberg (1989,1990) recently developed a methodology for measuring the gains from product innovation; he used the methodology to estimate the benefits associated with Computed Tomography Scanners. We employ his methodology to estimate the benefits associated with the entry of the Japanese and Korean automobiles into the Israeli market.

The equations in (4) are a system of probabilistic demand functions for individual i. Trajtenberg shows that the demand system exhibits all the properties of deterministic demand functions; therefore consumer surplus can be calculated. In the case of the nested logit model, Trajtenberg (1989) shows that consumer surplus (per consumer) up to a constant is

given by

$$W = \frac{log[\sum_g D_g^{(1-\sigma)}]}{\alpha} + C, \tag{10}$$

where C is the constant of integration. It can easily be verified that indeed $-\frac{\partial W}{\partial p_j}$ equals the expression for market share (demand) in (4) above. Hence using Roy's identity, $s_j = \frac{-\partial W}{\partial p_j} / \frac{\partial W}{y}$, we see that $C \equiv y$, where y is income. Our measure of the welfare gain from the end of the enforcement of the boycott is simply

$$W(101) - W(78), \tag{11}$$

where $W(101)$ is the per person consumer surplus associated with the "post boycott equilibrium" (equation (10)), and $W(78)$ is the per person surplus associated with the "boycott equilibrium." In order to compute these welfare measures, we need equilibrium prices for the "boycott" and "post boycott" equilibria. We employ the prices from our simulations.

The calculations reveal that the welfare gain associated with the end of the Arab economic boycott amounted to $790 per purchaser in 1994. The simulations predict that the prices would not have increased significantly had the boycott continued; nearly 90 percent of the welfare gain comes in the form of increased variety. Recall that the (sales weighted) average price of an automobile sold in Israel in 1994 was approximately $21,000; hence the associated welfare gains are approximately 3.7 percent of the price of the average car. Since there were approximately 113,000 automobile purchases in 1994, the welfare gain to consumers totaled more than $89 million.

In order to examine whether these results were robust to the assumption that the firms sell multiple products and only take into account the cross elasticities among their products in the same class, we re-estimated the model under the alternative assumption that each firm sold a single product. Under this assumption, equation (9) becomes

$$p_j/(1+t) = w_j\gamma + \frac{(1-\sigma)}{\alpha(1+t)[1-\sigma q_j/Q_g - (1-\sigma)q_j/M]} + v_j. \tag{12}$$

The estimates using this model are qualitatively similar and the estimated welfare gain is of a similar magnitude. In the case of single product pricing, we estimate the welfare gain associated with the end of the Arab economic boycott to be $870 per purchaser in 1994. Thus our results are not dependent on the assumption of multiproduct pricing.

6 Concluding Remarks: The Effectiveness of the Boycott

The boycott clearly was effective in that the major Japanese and all of the Korean firms stayed out of the Israeli market during the period in which the secondary and tertiary boycotts were strictly enforced. Our analysis suggests that consumer welfare loss due to the boycott was not insignificant.

On the other hand, the effectiveness of the boycott was mitigated by the incentive that it created for small Japanese firms to enter the Israeli market. In the case of Subaru, Daihatsu and Suzuki, the choice was between becoming small players in the large Arab automobile markets and being very large players in the small Israeli market. We estimate that had none of these Japanese firms entered the Israeli market, the size of the"boycott" market would have been 20 percent smaller than the size of the "post boycott" market; further we estimate that the gain in consumer surplus from the end of the Arab boycott would have been approximately seventy percent larger, that is on the order of magnitude of $1280 per purchaser in 1994. Since there will typically be incentives for some firms to enter markets that others are boycotting, the effectiveness of boycotts will to a large extent depend on the ability of the sponsors of the sanctions to enforce the prohibition on trade.

References

ANDERSON, SIMON, AND ANDRE DE PALMA "Multiproduct Firms: A Nested Logit Approach," The Journal of Industrial Economics, XL: 261-276, 1992.

BERRY, STEVEN "Estimating Discrete-Choice Models of Product Differentiation,"

RAND Journal of Economics, 25: 334-347, 1994.

BERRY, STEVEN, JAMES LEVINSOHN, AND ARIEL PAKES "Automobile Prices in Market Equilibrium," Econometrica, 63: 841-890, 1995.

BRESNAHAN, TIMOTHY "Competition and Collusion in the American Auto Industry: The 1955 Price War," Journal of Industrial Economics, 35: 457-482, 1987.

BRESNAHAN, TIMOTHY, SCOTT STERN, AND MANUEL TRAJTENBERG "Market Segmentation and the Sources of Rents from Innovation: Personal Computers in the late 1980s, mimeo, 1995.

CAPLIN, ANDREW AND BARRY NALEBUFF, "Aggregation and Imperfect Competition: On the Existence of Equilibrium," Econometrica, 59: 26-61, 1991.

DINOPOULOS, ELIAS AND MORDECHAI KREININ, "Effects of the U.S.-Japan Auto VER on European Prices and on U.S. Welfare," Review of Economics and Statistics, 70: 484-491, 1988.

GOLDBERG, PINELOPI "Product Differentiation and Oligopoly in International Markets: the Case of the U.S. Automobile Industry," Econometrica, 63: 891-952, 1995.

GREENSTEIN, SHANE "From Super-Minis to Super-Computers: Estimating Surplus in the Computing Market," NBER working paper 4899, 1994.

HANSEN, LARS AND KEN SINGLETON "Generalized Instrumental Variable Estimation of Nonlinear Rational Expectations Models," Econometrica, 50: 1269-1286, 1982.

HUFBAUER, GARY, SCHOTT, JEFFREY, AND KIMBERLY ELLIOT "Economic Sanctions reconsidered: History and Current Policy 2nd edition," Institute for International Economics, Washington, D.C., 1990.

LEYTON-BROWN, DAVID editor, "The Utility of International Economic Sanctions," St. Martin's Press, New York, 1987.

PAKES "Dynamic Structural Models, Problems and Prospects: Mixed Continuous Discrete Controls and Market Interactions," in *Advances in Econometrics: The Sixth World congress of the Econometric Society, Vol II*, ed. Jean-Jacques Laffont and Chris Sims, Cambridge University Press, New York, 1995.

REINGOLD, RUTH AND PAUL LANSING "An Ethical Analysis of Japan's Response to the Arab Boycott of Israel," Business Ethics Quarterly, 4: 335-353, 1994.

ROLEF, SUSAN HATTIS "Israeli Anti Boycott Policy," Davis Institute of Policy Studies (Hebrew University) Working Paper 28-1989.

SARNA, AARON "Boycott and Blacklist," Roman & Littlefield Publishers, New Jersey, 1986.

TRAJTENBERG, MANUEL "The Welfare Analysis of Product Innovations, with an Application to Computed Tomography Scanners," Journal of Political Economy, 94: 444-479, 1989.

TRAJTENBERG, MANUEL "Economic Analysis of Product Innovation: The Case of CT Scanners," Harvard University Press, Cambridge, MA., 1990.

VERBOVEN, FRANK "International Price Discrimination in the European Car Market," forthcoming, RAND Journal of Economics.

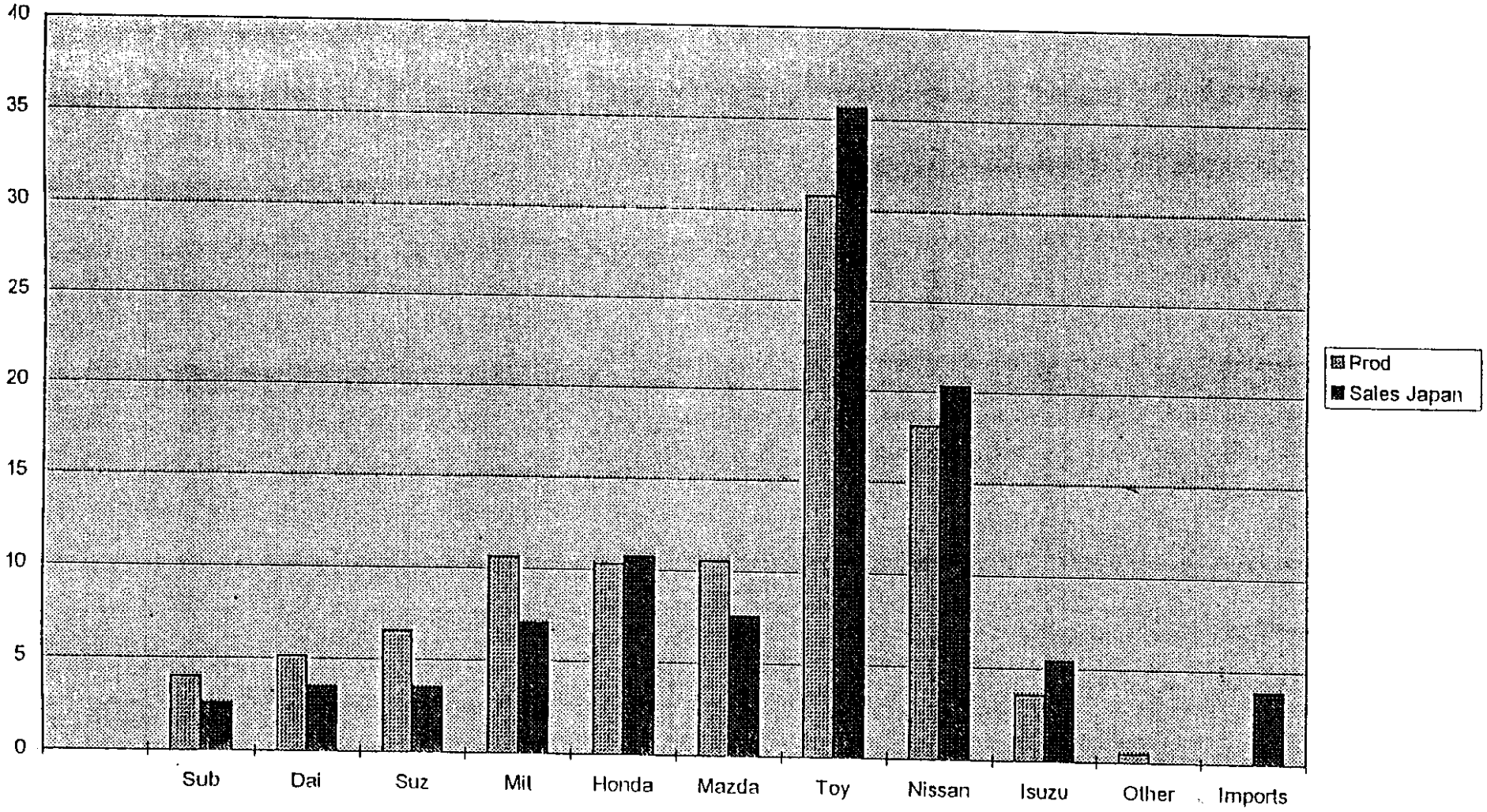
Appendix[42]

Variable	Mean	Maximum	Minimum
PRICE	62962	176700	29999
QUANTITY	1101	11447	83
ENGINE	1.60	3.8	1.00
AIRCONDITION	0.87	1.00	0.00
AUTOMATIC	0.12	1.00	0.00
AIRBAGS	0.08	1.00	0.00
ABS BRAKES	0.07	1.00	0.00
SMALL	0.23	1.00	0.00
COMPACT	0.52	1.00	0.00
MEDIUM	0.17	1.00	0.00
LARGE	0.08	1.00	0.00
WESTERN EUROPE	0.42	1.00	0.00
JAPAN	0.36	1.00	0.00
KOREA	0.13	1.00	0.00
USA	0.05	1.00	0.00
E. EUROPE	0.04	1.00	0.00

Table 4: Descriptive Statistics

[42]Except for the variable quantity, the mean values in Table (4) are weighted by sales. Recall that in the case of options (air conditioning, automatic transmission), we took the model with the fewest features. Hence the associated means are not the percentage of new automobiles with these features.

Percent of Total Japanese Production (1991) and Percent of Sales in Japanese Market (1991)



Total Production by Japanese Manufacturers (1991): 13.1 Million
Total Sales in Japan (1991): 4.8 Million

Sources: Production: Automative News (May 27, 1992)
as Reported in Market Share Reporter (1993).

Sales: Tokyo Business Today (September 1992)
as Reported in Market Share Reporter (1994)

Chart 2: Automobile Sales
Israel 1990-1994