



Demand estimation for the Iranian automobile industry[☆]

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ABSTRACT

The main contribution of this paper is a simple theoretical framework and empirical estimations explaining the behavior of the manufacturers. The paper focuses on the frequently used methods of demand estimation for discrete choice models to analyze the Iranian automobile market. It shows how both major companies in Iran choose to produce lower quality products and why they still collusively charge high markups. Empirical estimations are based on Berry, Levinsohn, and Pakes (1995) to predict marginal costs and markups. Estimation results also support the hypothesis that manufacturers are charging high markups. In addition, the counterfactual analysis carried out supports the view that both duopolist firms prefer to operate at lower quality rather than at higher quality production levels. They also collusively price their products. Furthermore, analyses are performed using the Multinomial Logit methodology to better understand the Iranian automobile market. Tastes of people with different genders and ages for some specific cars are explained, and the effects of population changes on auto demand are predicted.

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1. Introduction

The Iranian auto market is supplied by two major companies, I.K.Co. (Iran Khodro Company) and Saipa-Yadak, and other relatively small producers and importers. In particular, the two largest companies account for more than 98% of the total market share, however, their products are often viewed as low quality. Interestingly, these companies sell their products with relatively high markups which is commonly observed in monopoly markets. To explain these observations, this paper provides a simple theoretical framework to present the conditions under which both firms choose to produce low quality products with high prices. Moreover, empirical estimations based on discrete choice models are used to test theoretical results by estimating marginal costs and markups and more importantly to conduct counterfactual experiments. Interestingly, the results provide evidence for significant markups and optimal decisions of the firms to produce low quality products in the market.

The methods used in this paper, particularly discrete choice models, are common in the applied Industrial Organization literature. In discrete choice models, individuals choose from a set of mutually exclusive options to gain the highest possible utility. In these models, the utilities of alternatives for individuals depend both on the consumers' attributes and the characteristics of the alternatives. However, utilities cannot be measured directly when some of the attributes that influence the utilities are unobservable. In addition, demographics are used as a proxy for consumer heterogeneity in such models. The Multinomial Logit model, as in [Guadagni and Little. \(1983\)](#), the Nested Logit model, as in [Goldberg \(1995\)](#), and the Random Coefficients model used by [Berry \(1994\)](#) are among the most common models utilized in the literature.

As previously mentioned, the Multinomial Logit model is frequently used to estimate random utility maximization problems. Under the assumptions of this model, the probabilities of choosing different alternatives are computed as functions of the attributes of the customers. Various authors have applied the Multinomial Logit model to their papers. For example, [Guadagni and Little. \(1983\)](#) apply the Multinomial Logit model in the coffee market and study the repeat purchasing behavior of the shoppers. They allow for an additional marginal utility for future consumption of the already-consumed products to explain the positive correlation among sales patterns. In an earlier application, [Domencich and McFadden. \(1975\)](#) used the model in the context of transportation planning to explain the decision for alternative transportation modes (car, bus or etc.). Structurally, the Multinomial Logit model

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implies that substitution patterns are proportional when the choice probabilities of alternatives depend only on their own characteristics and are independent of the characteristics of other present choices. As a result, the Multinomial Logit model fails to give a reasonable explanation for substitution patterns between different choices in models where utilities are described as functions of the attributes of the choices or the consumers. However, this model provides a framework to investigate some counterfactual analyses such as the effects of population attributes on demands.

To allow for more realistic substitution patterns between alternatives with fewer cross-price elasticities of demand, Berry (1994) and Berry, Levinsohn, and Pakes (1995) introduced more flexible characteristic-based utilities. In particular, market-level demand functions are obtained from aggregating over customer-level demand functions, where utility functions relate market equilibrium prices to the market shares of goods. In their framework, the interaction between supply and demand on the consumer level determines the equilibrium prices and develops new methods to estimate costs as well as the demand parameters. The method has been developed and implemented by many authors for other differentiated markets. In an interesting application, Nevo (2000, 2001) used this method for the US ready-to-eat cereal market and conducted experiments to evaluate mergers in this market. Similarly, Petrin (2002) considered extra moments derived from micro data to identify more precise parameters for the US auto industry.

The present paper benefits from the aforementioned estimation methodologies to give a deeper understanding of the Iranian automobile market. The presence of high markups are supported by the estimations as a sign of collusive pricing by the companies. Also, estimated marginal costs implied by the BLP method are used in a counterfactual analysis to show that firms are reluctant to produce higher quality goods, a claim supported by the simple theoretical framework, as well.

The organization of the paper is as follows. Section 2 provides a theoretical model to explain why firms are manufacturing lower quality products. Section 3 explains the data used in empirical estimations. Empirical frameworks, the basic Multinomial Logit model and the BLP method, are described in Section 4. Section 5 provides three sets of empirical results. First, the results of estimations using the Multinomial Logit model are provided to explore the characteristics of the market. Second, the results of the BLP method illustrate the presence of higher markups for lower quality products in the Iranian auto industry. And third, based on the estimated parameters of the BLP model, a counterfactual analysis is performed to show that producing lower quality products is the dominant strategy for both firms in the Iranian auto market. Finally, Section 6 concludes and outlines questions for future research.

2. Theoretical model

This section provides a theoretical framework to study the Iranian auto market. A static game is used to obtain and to illustrate under what conditions both firms in a duopoly market choose to produce low quality products rather than highly differentiated cars. Based on the model, we conduct a simple counterfactual empirical experiment in Section 5 to support the idea that it is profitable for neither company to deviate to any other outcome or under any conduct, either collusive or oligopolistic. To build a proper model to best fit the Iranian auto market we need to make few of assumptions.

Assumption 2.1. The game consists of two stages. In the first period, each firm chooses to produce either a high or a low quality product, and in stage two, each firm strategically chooses the price to maximize its profit.

Assumption 2.2. Firms may collude in prices given their production portfolios.

The assumption states that after a firm chooses to produce a quality, either low or high, it is possible to collude with the other firm on pricing without breaking any laws. For simplicity, we assume that the firms choose to produce either a low or a high quality rather than a quality from a continuous state space. In addition, the assumption that firms can collude with no cost is reasonable since there is no antitrust law in Iran, i.e., no question of legality for colluding firms. Such a market leads to collusive equilibria in which firms charge high prices that approach the monopoly markups. Additionally, empirical estimates of markups in Section 5 verify that the companies exercise high markups in the market.

In addition to the fact that firms charge high markups, the Iranian auto market is widely known as a closed or a domestic market. In 2005, over 98% of the cars in the market were manufactured by domestic firms and less than 2% of the cars were imported to Iran by foreign producers.¹ As a result, we claim that imported cars have almost no effect on the quality choice of the major domestic producers, and for now we ignore their effects. Besides these assumptions, lack of dynamic panel data prevents us from studying the dynamic strategic behaviors of the firms. Therefore, we restrict ourselves to a static framework.

As mentioned, our benchmark model consists of two periods. In period one, the firms choose the quality of the product from a list of qualities, either high or low. Pricing decisions together with the decision of whether or not to collude are made in the second period. To find the subgame perfect equilibrium of the game, the method of backward induction suggests that the firms choose to collude on pricing in the second period regardless of their quality choice in the first period. We denote the qualities of the higher product and the lower product by q^h and q^l , respectively, where $q^h > q^l$. Furthermore, the fixed cost of producing a high quality product is c^h which is greater than the corresponding fixed cost of producing a low quality one denoted by c^l . Our model focuses on a vertical differentiation structure where the consumers' choices vary with their taste parameters. The taste parameter of the individuals are assumed to be drawn independently from a uniform distribution with support $[\theta^l, \theta^h]$. Consumers have utility function of the form $u((p^i, q^i), \theta) = \theta q^i - p^i$, as in Tirole (1988) where $i \in \{l, h\}$. Given these prices, it is straightforward to show that there exists a consumer with taste $\theta^* = (p^h - p^l)/(q^h - q^l)$ who is indifferent to consuming the low or high quality product. In addition, we assume that an outside option yields zero utility for consumers. It is clear that the agents with tastes lower than $\theta_* = p^l/q^l$ never consume any product and end up with an outside option and its zero utility. Obviously, for the existence of an equilibrium, it is necessary that both θ^* and θ_* belong to $[\theta^l, \theta^h]$. In all, we can state that:

Theorem 2.1. When both high and low quality products are present in the market, given prices p^l and p^h , customers with tastes belonging to $[\theta^*, \theta^h]$ purchase the high quality product, customers with tastes $[\theta_*, \theta^*]$ purchase the low quality product and all other consumers with tastes $[\theta^l, \theta_*]$ don't buy anything and end up consuming an outside option and getting zero utility.

Theorem 2.2. When only one product quality is present in the market, i.e., both firms produce the same quality good, given quality q and price p of the good, customers with tastes $[(p/q), \theta^h]$ purchase the product and all other consumers $[\theta^l, (p/q)]$ don't purchase anything and obtain zero utility as long as $(p/q) \geq \theta^l$.

¹ Any car assembled outside the country is called an imported car, otherwise they are called domestic. Imported automobiles are distinguished by asterisks in Table 8.

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