A descriptive analysis of the Spanish automobile market in the 1990's

Xosé-Luís Varela-Irimia, Universitat Rovira i Virgili
A descriptive analysis of the Spanish automobile market in the 90’s

X. Luis Varela-Irimia *

Universidad Carlos III de Madrid

August 28, 2007

*PhD student. Departamento de Economía. Universidad Carlos III. Calle Madrid, 126. 28903 Getafe, Madrid. http://www.eco.uc3m.es/jvarela . E-mail: jvarela@eco.uc3m.es
1 Introduction

This chapter provides an overview of the automobile market in Spain during the 90’s. The focus is on descriptive analysis based on my dataset and other sources. I look at product turnover and at changes in characteristics and prices along time. The chapter is organized as follows: Section 2 describes the database, which is used to make a report on the entry and exit patterns in section 3 and the evolution of prices and characteristics in section 4. Section 5 presents some evidence from specialized magazines. Section 6 looks at other European markets. Section 7 concludes.

2 Data description

I use a unique dataset of monthly registrations of new cars in Spain from January 1990 to December 2000. The dataset includes information on listed nominal and real prices and characteristics such as size of the car (length, width, weight, luggage capacity), power (cubic centimeters and horse power of the engine, number of cylinders, maximum speed), fuel consumption, and equipment (dummies for air conditioning, ABS, airbags, central door locking, electric windows). It also has information on the geographical origin of the brand producing the model. The unit of observation is a car model in a given month and the definition of model is taken as the commercial name. Models are classified in segments and segment definition is taken as granted from industry sources. The dataset excludes super-luxe models, such as Ferrari or Rolls Royce, however the dataset accounts for more than 99.9% of car registrations.

3 Entry and exit

From 1990 to 2000 the Spanish market witnesses a dramatic increase in the number of models: from an initial number of 77 models we end up with 159 by December 2000. The number of models increases constantly during the whole period even though the total number of passenger cars registrations and the real GDP per capita remain constant (and
even decline) in the first half of the sample period (Figure 1). Therefore, increases in market size or purchasing power improvements are not enough to explain such proliferation.

Figure 1:

According to industry sources\(^1\), the market for passenger cars in Spain can be segmented in 8 groups: Small-Mini, Small, Compact, Intermediate, High-Intermediate, Luxury, Sport, and Minivan. From the Small-Mini to the Luxury, the differences are mainly vertical, i.e. the cars of upper segments are better. The Sport segment has some horizontal differentiation component with respect to High-Intermediate and Luxury. Minivans are horizontally differentiated with respect to all other segments. The relative weight of each of them has varied along time (Figure 2). The Small cars lost market share against compact. High-Intermediate and Minivans also increase their shares while Intermediate follow an irregular pattern and Small-Mini decrease.

\(^1\)National Association of Automobile and Truck Manufacturers (ANFAC) Annual Report (2006), page 57. Accessible online at http://www.anfac.es. During the 90’s the Minivan segment was still marginal in Spain, for that reason it was grouped in a unique category that nowadays has split in two, following the consolidation of the segment.
During the sample period we observe that the increasing trend for the number of products applies to all groups (Figure 3).

Looking more carefully at the entry and exit process we see that the net increase in the stock of models is mainly driven by the entries with exits keeping stable along the
sample period. The most remarkable fact is the wave of entries in 1996-98 with its peak in 1997.

Figure 4:

There are two important factors that justify this intense process of product entry: model replacement and product proliferation. The first responds to the behaviour of incumbent firms that periodically renew their portfolio of products. The reason is simply the competition from other’s new products and the need for being able to attract demand. The new product is introduced and it competes for a while with the old product to be replaced. This is done segment-by-segment and the duration of the overlapping varies from case to case depending of the relative success between the new and the old product. Figure 5 depicts the whole range of products commercialized by Peugeot between 1990 and 2000 and their life spans. The replacement is almost perfect for segments (in brackets) Compact (3), High-Intermediate (5), and Luxury (6). Within the Small (2) segment we observe longer overlaps due perhaps to the succeed of the 106. This kind of behavior is common to many incumbent firms.
The second factor is a consequence of the entry of new firms in the market. These firms usually start with one or two models and as they consolidate they introduce more and more products to offer the widest range of models possible. In practice this implies firms having at least one product in a number of different segments. Product proliferation is also caused by the incumbent firms entering in new segments. In the example above, Peugeot does not enter the Minivan segment (8) until the mid of the decade.

Tables 1 and 2 show more clearly these two factors. Almost all the incumbent increase the number of segments where they are present, meaning they make an effort to expand their range of products. But at the same time the total number of models commercialized in the period reflects an important product turnover in all segments. The proliferation effect is larger for new entrants because they try to fill the gap with incumbents as soon as they can. Nevertheless, some of them catch up faster than other. In any case, product proliferation seems to be driving the large increase of car models in the decade.
Table 1: Product entry and exit by incumbents

<table>
<thead>
<tr>
<th>Brand</th>
<th>Initial number of: Models</th>
<th>Segments</th>
<th>Final number of: Models</th>
<th>Segments</th>
<th>Total number of: Entries</th>
<th>Exits</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citroen</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Fiat</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>12</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Ford</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Mazda</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Opel</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Peugeot</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Renault</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Rover</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>13</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Seat</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Toyota</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 2: Product entry and exit by new entrants

<table>
<thead>
<tr>
<th>Brand</th>
<th>Date of entry</th>
<th>Initial number of: Models</th>
<th>Segments</th>
<th>Final number of: Models</th>
<th>Segments</th>
<th>Total number of: Entries</th>
<th>Exits</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrysler</td>
<td>Feb. 1992</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Daewoo</td>
<td>Mar. 1995</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Galloper</td>
<td>Nov. 1998</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Hyundai</td>
<td>Jan. 1992</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Kia</td>
<td>Jan. 1997</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>Jan. 1990</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Subaru</td>
<td>Jan. 1991</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Suzuki</td>
<td>Jan. 1990</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2 shows that a large part of the product proliferation effect is due to Asian manufacturers. Indeed, their market share steadily increases over time face to European
and, more significantly, to American manufacturers (Figure 6).

Figure 6:

![Evolution of the market share by origin](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>Spanish</th>
<th>European</th>
<th>Asian</th>
<th>American</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 Prices and characteristics

Average real prices tend to increase after an initial period of decline due to the economic crisis in the first half of the decade (Figure 7).
However, the average quality of cars increases also in the period such that quality adjusted real prices remain constant or even fall during the decade. Appendix 1 collects some figures depicting the increase of some selected, representative car characteristics leading the quality change. If we look at averages per segment we see that the size and weight increase over time leading to "better" cars (for the sport segment the feeling is usually the opposite: "good" sport cars are small, fast and powerful). The maximum speed and the power of the engine have also increased over time, although not so steadily. Also the proportion of cars having air conditioned, anti-lock braking system (ABS), and driver airbag have increased for during the whole period. This characteristics have been considered as proxies for quality or "luxury" degree of car (e.g. air conditioned in Berry, Levinsohn, and Pakes (1995) ) and they clearly show that the quality of all segments have increased, although it increased sooner in the higher-quality segments, as one could expect.

The changes in average characteristics for the Small-Mini and Minivan segments are affected in part by the small number of models, which makes new entries to have large
influence on the averages. In the rest of segments the number of models is larger and the averages show a smoother pattern.

In the second part of the appendix I report the change in car size, horse power, and maximum speed for some selected models. I pick those three characteristics to keep the exposition simple but the results apply in general to all the characteristics mentioned in the by-segment analysis. I have selected the models from the set of most popular cars in the sample, trying to balance the brands, segments, and brand-origin representation. The main conclusion that can be drawn from those pictures is that quality is also changing along time for specific models. Firms seem to adjust from time to time some characteristics of their products. The rationale for that is to keep track of consumer needs and also to respond to competitors entry and exit decisions, which affect the average quality of a given model’s competitors. Changes are usually small, as we could expect, because if the change needed were very large the most likely best response would be the introduction of a new model. Finally, the frequency of changes varies from one model to another with no particular pattern by firm or segment: some models change frequently while other do not change at all (at least during the sample period).

5 Evidence from specialized automobile magazines

This section summarizes the casual evidence obtained from automobile magazines on the issue of changes in characteristics. It is based mainly on news taken from the online car magazine of the Spanish newspaper "El Mundo". I have reviewed several editions during 2006 and 2007. Although this two years lay out of my sample period, it does not seem difficult to assume that the same kind of behaviour may have happen in the past.

Firstly, there is strong evidence of segmentation on the market. When a new models arrives it is immediately associated with a set of competitors and this becomes public information for both consumers and producers. This fact gives support to particular

\footnote{Available at: http://www.elmundo.es/elmundomotor/index.html. pdf copies of the news and reports used for this section are also available from the author. I can provide a translation into English for those which are in Spanish.}

\footnote{For example, the introduction of the new Renault Laguna taken June 4, 2007:}
demand modelling strategies such as Nested Logit.

Secondly, it is easy to find news related to variation of characteristics. In general terms, firms tend to modify either the design of the car, or technical characteristics or both. Usually those changes in characteristics are small but relevant. They are also advertised and diffused and they imply some costs of adjustment of production. Many brands behave like that. I have collected evidence for several models and among them: Ford Mondeo, Volkswagen Golf, Renault Twingo, Skoda Fabia, Volvo V70, Toyota Avensis, and Opel Astra. Therefore, there is evidence on the changes in quality of cars along time which is intended to attract demand and to relaunch the profitability of an existing model (e.g. the new Renault Twingo).

Finally, we can also find some evidence regarding the level at which some decisions are made. The development of new models is decided at the global industry level. However, the decisions of introduction of those new products seem to be made at the regional market level, which in Europe basically coincides with a country. Therefore, conditions of local demand influence product entry and exit decisions, but also the modification of the existing products. For example, it is reported that the Volvo V70 was first introduced in the Scandinavian market and then it would be progressively introduced in the remaining European countries.

6 Evidence from European car markets

This part looks at the evolution of characteristics in five different countries (Belgium, France, Germany, Italy, and UK) using a dataset available at Frank Verboven’s website\(^4\). Verboven’s dataset is less detailed than mine in terms of characteristics. Therefore I only look at Horse Power (HP), Length (Le), and Fuel efficiency (Li1). The definition of model is also different and hence I cannot compare descriptives from my data with his.

The set of graphs presented in Appendix 2 give a glance at what is going on. The first two graphs (Figures 18 and 19) depict the entry and exit process for a number of

\(^{http://www.elmundo.es/elmundomotor/2007/06/04/coches/1180975643.html}\)

\(^{4http://www.econ.kuleuven.be/public/NDBAD83/frank/cars.htm}\)
models in each of the five countries. For each car model the years of entry in each of the five countries are marked in the vertical axis. Figures 20 to 22 show the dispersion of each selected characteristic in each country for each model. These graphs must be read as follows: on the x-axis there is the model id, on the y-axis is the characteristic. Take one model and look at the vertical line passing through it, if there is more than one dot over the line this means that this characteristic has changed at least once. I add a version of these graphs (Figures 23 to 25), restricted to only the first 30 models coded in the database, to give a clearer view. If characteristics did not change at all then there would be a graph of a dotted curve.

Figures 26 to 28 plot the evolution over time of each selected characteristic for some particular car models. I have selected a sample of cars representing different brands, segments, and representative of the different patterns of changes in characteristics across countries. These graphs are read as follows: the x-axis is year and the y-axis is the characteristic. Take one year and look at the vertical line passing through it, if there is more than one dot this means that this characteristic in that year for that car model is different in at least one country, i.e., the characteristics of cars are different across countries even for the same model. If characteristics did not change over time and across countries there would be a single horizontal line. If characteristics did not change over time, but did change across countries, there would be several horizontal lines.

The graphs suggest the following:

- Entry is usually not simultaneous in all countries. Gaps of two or three years across countries in the moment of entry are frequent, specially for non european producers. Those gaps are wider and even more frequent for exit decisions. These two facts suggest that entry and exit are influenced by national market conditions.

- Characteristics change for a large proportion of models in all countries. Notice that if characteristics did not change at all we would have a graph of a curve, instead of a cloud. Computations from the database induce to think that there is a rate of change of 50% of the observations overall (not so different from my data).
The change is not always the same in all countries and evolution by country do not overlap.

The amount of the change in characteristics is not large.

I can capture changes in observed characteristics (engine, size, etc.) but I cannot capture changes in design. The important thing is that changes are almost always in both observed and unobserved characteristics.

7 Conclusion

From the descriptive analysis above we can conclude that the Spanish automobile market shows a dramatic increase in the number of products that corresponds mainly with firms product proliferation strategies, although there is some influence of product replacement behavior. Firms introduce new products, apparently to keep track of consumer needs, but they also try to increase the life span of current product by modifying their characteristics. The empirical evidence suggests that those decisions are made in a regional / national level basis, rather than being made at the global market level. Therefore, the main question to be solved is to explain how and why firms find profitable to expand their range of products by estimating product entry costs.
References


Appendix 1: Evolution of automobile characteristics.

By segment

Figure 8:
Figure 9:

Average Weight per segment

Kgs.

Year

Average Weight per segment

Figure 10:

Average Horse Power per segment

Horse Power

Year

Average Horse Power per segment
Figure 13:

Proportion of cars with ABS per segment

Year

Proportion of cars with ABS

1990 1995 2000

Small-Mini  Small  Compact  Intermediate

Proportion of cars with driver airbag

Year

Average proportions of cars with driver airbag per segment

1990 1995 2000

Small-Mini  Small  Compact  Intermediate

Figure 14:
Selected models

Figure 15:

Car size for selected models

- Chrysler Voyager
- Ford Mondeo
- Renault Laguna
- Audi A4
- Toyota Corolla
- VW Golf
- Citroen ZX
- Opel Corsa


Squared meters: 6, 7, 8, 9
Appendix 2: Figures for European car markets

Figure 18:

(Interpretation: Model code is on the horizontal axis. The vertical line passing through a given model code contains the years of entry of that model in each of the five markets. The dots for 1970 correspond to the beginning of the sample, and not to proper entries.)
Figure 19:

![Year of exit for selected models](image)

(Interpretation: Model code is on the horizontal axis. The vertical line passing through a given model code contains the years of exit of that model in each of the five markets. The dots for 1999 correspond to the end of the sample, and not to proper exits.)

Figure 20:

![Dispersion of Horse Power by country](image)

(Interpretation: For each country the model code is on the horizontal axis and horse power in the vertical axis. The vertical line crossing a given model code contains all the observations of horse power for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)
Figure 21:

Dispersion of Length by country

(Interpretation: For each country the model code is on the horizontal axis and length in the vertical axis. The vertical line crossing a given model code contains all the observations of length for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)

Figure 22:

Dispersion of Fuel Efficiency by country

(Interpretation: For each country the model code is on the horizontal axis and fuel consumption in the vertical axis. The vertical line crossing a given model code contains all the observations of fuel consumption for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)
Figure 23:

Dispersion of Horse Power by country

Selected models

(Interpretation: For each country the model code is on the horizontal axis and horse power in the vertical axis. The vertical line crossing a given model code contains all the observations of horse power for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)

Figure 24:

Dispersion of Length by country

Selected models

(Interpretation: For each country the model code is on the horizontal axis and length in the vertical axis. The vertical line crossing a given model code contains all the observations of length for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)
Figure 25:

Dispersion of Fuel Efficiency by country
Selected models

(Interpretation: For each country the model code is on the horizontal axis and fuel consumption in the vertical axis. The vertical line crossing a given model code contains all the observations of fuel consumption for that model in that country along time. If the vertical line contains only one dot it means that the characteristic did not vary at all for that model. Several dots over the vertical line mean that the characteristic has changed along time.)

Figure 26:

Evolution of Horse Power for selected models

(Interpretation: For each model, the observations of horse power in each of the five countries in a given year are on the vertical line over that year. A single dot for one year means that horse power was the same in all countries in that year. Two or more dots mean that the characteristic varied across some countries.)
Evolution of Length for selected models

Interpretation: For each model, the observations of length in each of the five countries in a given year are on the vertical line over that year. A single dot for one year means that length was the same in all countries in that year. Two or more dots mean that the characteristic varied across some countries.

Evolution of Fuel Efficiency for selected models

Interpretation: For each model, the observations of fuel efficiency in each of the five countries in a given year are on the vertical line over that year. A single dot for one year means that fuel efficiency was the same in all countries in that year. Two or more dots mean that the characteristic varied across some countries.