The impact of mergers on prices and variety and evaluating merger simulations: evidence from the UK car industry

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First of all I would like to thank Prof. Christos Genakos for his invaluable guidance and support. His role as my supervisor was catalytic for the completion of my thesis.

I would also like to thank Prof. James T. Walker (University of Reading Business School) for sharing his data of the UK automobile market with me.

Last but not least, I would like to thank my family for their tremendous support.

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Abstract

In my thesis I examine how prices and variety are affected from mergers, analyzing the effect of six mergers in the UK car market. These mergers are those of: Seat by VAG in 1986, Jaguar by FORD in 1990, Saab by GM in 1990, Skoda by VAG in 1991, Rover by BMW in 1994 and Mazda by FORD in 1996. In the first chapter, I use a difference-in-differences methodology to examine how mergers affected prices; only the results of the Mazda–Ford and Saab-GM mergers are robust enough to conclude that they have an effect on prices. The first seems to increase prices while the second one decreases them. In the second chapter I examine the effect on variety. From my results it seems that mergers certainly affect variety but not necessarily in a negative manner since the mergers of Skoda – VAG and Rover – BMW led to greater variety. In the third chapter I use merger simulation techniques to simulate the effect on prices from the Mazda-Ford merger and then discuss its predicting power, comparing them with the difference-in-difference methodology.

Chapter 1: The impact of mergers on prices

1.1. Introduction

Mergers are a significant worldwide phenomenon that is greatly puzzling both antitrust agencies and empirical economists. Merger activity has witnessed an unprecedented increase over the last three decades, both in terms of monetary value and number of deals involved. The number of mergers reviewed by antitrust regulators in 2015, for example, was 46,977 (compared to 36,204 in 2005 and 20,666 in 1995) with a total merger value that exceeded $4.5 trillion.[2] Examples of large mergers that caught the headlines abound: Pfizer merged with Warner-Lambert for $90 billion in 1999, Comcast merged with the broadband unit of AT&T for $60 billion in 2002, Procter & Gamble bought Gillette for $57 billion in 2004, Pfizer acquired Wyeth for $67 billion in 2009 and Anheuser-Busch Inbev bought SABMiller PLC for $109 billion in 2015.

My research is focused on how an horizontal merger affects market prices.Theory suggests that a merger between competitors increases firms' market power (both for the merged entity and its competitors), thereby leading to higher prices and lower output.[3] On the other hand, merging firms often claim that their union will result in large efficiency gains that may counterbalance the reduction in competition. These efficiencies may come from exploiting returns to scale, the diffusion of best practices and know-how, and greater incentives to innovate.[4]Antitrust authorities, therefore, actively seek to prevent mergers that could threaten competition. However, it is an empirical question whether a merger will lead to higher prices or not.

In this paper I am focusing on the automobile industry. During the previous decades there was an intensive change in the ownership structure of the automobile industry. I examine how the mergers of Seat by VAG in 1986, Jaguar by FORD in 1990, Saab by GM in 1990, Skoda by VAG in 1991, Rover by BMW in 1994 and Mazda by FORD in 1996 affected the prices in the UK market, using aggregate yearly data which includes prices, sales and a large number of

[2] IMAA https://imaa-institute.org/mergers-and-acquisitions-statistics
[3] For more look at Ivaldi, Juliet, Rey, Seabright and Tirole (2003)
[4] Expenditure on R&D is expected to be more profitable post-merger since there are fewer competitors in the market and spillover effects are also reduced.

characteristics of the new models sold between 1971 and 2002. According to the European Commission, their concentrations do not raise serious doubts as to their compatibility with the Common Market and the functioning of the EEA Agreement. Therefore the Commission had decided not to oppose the notified operations and to declare them compatible with the common market and with the functioning of the EEA Agreement[5]. In most cases my results are in correspondence with the Commision's decisions since they indicate that none of these mergers had any significant positive effect on prices except for the merger of Mazda-Ford where some results indicate an increase in prices.

One simple approach for measuring the impact of a merger is to find how prices have changed after the merger. However, prices can be affected for a numerous of reasons such as demand and productivity shocks. In order to control for those confounding factors that may have occurred during the examined time window, I use the difference-in-differences (diff-in-diff) methodology. The key idea behind the diff-in-diff methodology is to compare how prices change after the merger (treatment group) relative to similar products or markets which are not affected form the merger but face similar productivity and demand shocks (control group). The most similar studies to my research are the ones of Barton & Sherman (1984), Borenstein (1990), Hosken & Taylor (1997), Prager & Hannan (1998), Hastings (2004) and Ashenfelter & Hosken (2008).

The research of Barton & Sherman (1984) is one of the first papers that use this methodology to evaluate the effect of a merger. They examined the price effects of Xidex Corporation's acquisitions of the microfilm businesses of Scott Graphics and Kalvar Corporation. Scott Graphics produced the dublicating microfilm type "diazio" and Kalvar Corporation produced the "vesicular" type while Xidex produced both. As a result, Xidex had eliminated a major rival in each of its two main product lines. In order to isolate price effects of the acquisitions and control for the influence of general inflation and changes in the costs of inputs specific to the production of diazo and vesicular microfilm, instead of examining their price changes, they examined the changes on the price ratios of the two films. Because of the similarity in materials and processes, the vesicular-to-diazo price ratio should not be much affected by productivity shocks or general inflation. They found that both acquisitions led to higher prices for each of the involved films. Furthermore, these prices increases where sufficient to recover the cost of the acquisitions in about two years and led to higher profits for Xidax Corporation.

[5]This decision is adopted in application of Article 6(1)(b) of Council Regulation No 4064/89.

Borenstein (1990) examined the effects of the Northwest merger with Republic airlines and the acquisition of Trans World Airlines (TWA) by Ozark. Both acquisitions occurred in the fall of 1986 and involved airlines that carried large shares of the total enplanements from their major hubs. In his research, Borenstein examined the price changes before and after the merger of the eight largest domestic carriers relative to the industry average prices for routes of similar distance. He found that during that time, with the exception of Texas Air carrier, the two merging parties where the ones with the largest price increase. However, when he examined more analytically the average price changes on markets with specific characteristics, the results are mixed. He divided the market into four different categories where one, both or none of the merging carriers was active before the merger. Then, he divided each group depending the existence of at least one competitor or not. From that comparison, while he gets consistent results for the impact of Northwest - Republic merger, there is no evidence that TWA - Ozark merger had any impact on prices. On the other hand he found that after the completion of the two mergers there was an increase in the market shares of the merging parties and a decline on the capacity of the airports which would justify an increase on the fare prices.

Hosken & Taylor (1997) examine the effects of the Marathon/Ashland Petroleum (MAP) joint venture on retail and wholesale reformulated (RFG) gasoline prices. They examined the price effects on the cities that both Marathon and Ashland supplied RFG gasoline prior to the joint venture, i.e. Covington and Louisville of Kentucky and Fairfax and Richmond of Virginia. In order to identify the effect of the merger and control for demand or supply shocks they used a difference-in-difference methodology in which they measured the price changes following the merger in those cities relative to the ones in the respective control areas. Those control areas are the Chicago for the Kentucky cities, Norfolk and Baltimore for Virginia cities and Houston as an additional control area for all cities. They found that only the wholesale prices in Kentucky cities were increased but it passed only partially to the consumer prices in in Covington and it did not pass at all to the ones in Louisville. Furthermore, the control cities close to the affected cities yield very similar effects while the more distant regions yield divergent price effects. These results suggest that the use of multiple control groups is imperative when using a difference-in-difference approach to test the robustness of results.

Prager & Hannan (1998) analyze the effects of mergers in the U.S. banking industry on deposit account interest rates. In order to identify banking mergers, they examined the markets in

which the Herfindahl-Hirschman index(HHI)[6] increased by more than 100 points during a one-year period to a level exceeding 1400. Furthermore, if in comparing two years, a bank has disappeared from the market and this occurred because of a merger producing an increase in the market's HHI more than 200 points to the post-merger HHI of at least 1800, then that market is classified as one with a substantial horizontal merger. Then, they compared the changes in deposit rates offered by banks operating in those markets with the ones offered by banks operating in the rest marketsduring the same period. In their research, they examined three different types of deposit products: NOW accounts, personal money market deposit accounts (MMDAs) and small (less than $100,000) three-month certificates of deposit (3MOCDs).In their results, there was a decline on the deposit interest rates of found that interest rates fell by 18percent for NOW accounts and by 9 percent for MMDAs. However, there was no statistically significant effect for 3MOCDs. Moreover, they have found that mergers that had a less substantial impact on local market concentration did not lead to lower deposit interest rates.This supports their interpretation that the impact of substantial horizontal mergers is probably the result of the increased market power rather than reduced efficiency.

Hastings (2004) analyzed the price effects of the acquisition of Thrifty, a California gasoline retail chain selling unbranded gasoline, by Arco, a national branded and vertically integrated gasoline chain. After the merger, Arco re-branded the Thrifty stations with the Arco name and colors. Hastings studied how rivals' prices changed as a result of the merger. To do so, she compares the differences in price change, before and after the merger, between gas stations that were near a Thrifty station (the treatment group) and those that were not (the control group). The circumstances of the acquisition provide a reasonable basis to think that the merger can be considered as exogenous to the local market; namely, it seems unlikely to be correlated with any unobserved factors that would have changed prices in markets containing Thrifty stations differently from prices in markets without them. She finds that gas stations that were near a Thrifty station raised their prices after the merger more than those that were not, indicating that the merger caused prices to increase.

Another empirical example is the research of Ashenfelter and Hosken (2008) who evaluate

[6]The HHI is used as an indicator of the effects of a proposed bank merger on competition. The Justice Department will examine further the proposed merger if it results in an increase in the HHI of over 200 points in a given market to a level greater than 1800.

the effectiveness of U.S. horizontal merger policy, by examining five of the most problematic cases from the antitrust agencies' point of view. The cases under examination are Proctor and Gamble's purchase of Tambrands (feminine hygiene products), Aurora Foods' (Mrs. Butterworth) purchase of Kraft's Log Cabin breakfast syrup business, Pennzoil's purchase of Quaker State motor oil, General Mills' purchase of the branded cereal business of Ralcorp, and the merger of the distilled spirits businesses of Guinness and Grand Metropolitan. The first three mergers were apparently allowed to be consummated with no government action while the other two were modified by the FTC (Federal Trade Commission). Their empirical results indicate that four of the five mergers that they studied resulted in some increases in some consumer prices[7], typically between 3% and 7%, while the fifth merger had little effect on prices.However, in the four mergers where they find substantial evidence of a price increase, manufacturers did not increase all of their prices uniformly. Instead, the merged firm chose to increase the price of one of its products (or a set of products) while holding the other prices more or less fixed.

1.2. **Background information of the mergers**

In 1982, VAG initiated cooperation with the Spanish automobile producer SEAT S.A. (SEAT) concerning the production of the models VW Passat and VW Polo. The motive for this cooperation was that the management of VAG wanted to gain access to Spanish production plants in order to gain efficiency and reduce total production costs. This cooperation continued until 18 June 1986, when VAG acquired 51% of the shares in SEAT, thus becoming the majority shareholder of the Spanish firm, and increased its interest to 75% by the year's end. The reported motive for the final acquisition of SEAT, in addition to increased economic efficiency, was that VAG wanted to gain further access to the southern European automobile markets, and to incorporate another brand into the firm's "portfolio" of automobiles.[8]

In 1989, Ford Motor Company announced that it planned to buy Jaguar P.L.C. for a total cost of nearly $2.38 billion. The deal was completed in 1990 and reflects the continuing consolidation

[7] Short run

[8] Mergers and Economies of Scale: Volkswagen AG 1976 – 2000, Niklas Rudholm, Department of Business Administration and Economics, University of Gävle, Sweden ,October 2006

of the world's auto industry and the eagerness of big car makers to acquire prestigious brands. However Ford had very little idea of the problems that Jaguar was facing. The increased competition from the Japanese moving into the luxury-car sector, the high cost of developing new models, and a downturn in the crucial American market have made it increasingly difficult for smaller car makers like Jaguar to go it alone. Ford's offer may seem extraordinarily high for a company that made 51,939 cars in the year prior to the purchase and even then was barely breaking even. But Ford executives made it clear that they were paying a premium for the Jaguar name and would invest heavily to turn the British company into a much bigger producer.[9] After three years of plunging sales, the company was losing $1 million a day when Mr. Scheele arrived at Jaguar's Browns Lane plant outside Coventry in 1992.[10]

In 1989, the Saab car division of Saab-Scania was restructured into an independent company, Saab Automobile AB, headquartered in Sweden. At a press conference on 15 December 1989, GM announced that it was buying 50% of Saab's car operations.[11] In 1990, General Motors (GM) bought a 50% (controlling) share of the company for over £380 million. Saab benefitted from the supply chain, as well as by learning from the experience of a global dealer. For GM this was a chance to gain a position in the European luxury car market, after previous failed attempts.[12]

On March 28 1991, a joint-venture partnership agreement between Skoda and Volkswagen took place, marked by the transfer of a 30% share to the Volkswagen Group on April 16, 1991. The main motive behind this merger was the good access to the car markets of eastern-central and eastern Europe and the fact that their cooperation in production could lead to increased efficiency.[13]

Concerning the Rover – BMW merger, it all began with BMW's recognition that, like its rival, Mercedes-Benz, it needed to achieve greater economies of scale. As Mercedes expanded organically with additional models - the merger with the Chrysler Corporation came later - BMW decided on growth by acquisition. In 31 January 1994, British Aerospace announced the

[9] Ford to Buy Jaguar for $2.38 Billion
http://www.nytimes.com/1989/11/03/business/ford-to-buy-jaguar-for-2.38-billion.html
[10] Ford Puts British Automaker on the High Road : Jaguar Comes Roaring Back
http://www.nytimes.com/1999/03/24/business/worldbusiness/24iht-jag.2.t.html
[11] G.M. to Buy Half of Saab Car Unit
http://www.nytimes.com/1989/12/16/business/gm-to-buy-half-of-saab-car-unit.html
[12] The History of Saab, thecarbuyingservice.co.uk, 26 June 2015
https://www.thecarbuyingservice.co.uk/blog/the-history-of-saab
[13] Mergers and Economies of Scale: Volkswagen AG 1976 – 2000, Niklas Rudholm, Department of Business Administration and Economics, University of Gävle, Sweden, October 2006

sale of its 80% majority share of the Rover Group to BMW. BMW paid the equivalent of $1.35 billion for the Rover Group, and nearly doubled that figure in subsequent investment. However, what looked like a bargain (Ford paid $2.4 billion for the much smaller Jaguar company) was actually a liability. BMW completed its deal in only 10 days and did not look closely enough at the operation of the businesses within Rover. Had it done so, it may have had a much better view of Rover's problems, such as inaccurate sales data. It did not have profits or a strong balance sheet, and it had been starved of cash for decades. However, in terms of capitalization, it was a decent deal since Rover's production capacity was 700,000 cars while BMW's was only 500,000[14].

The Japanese car manufacturers managed to improve on productivity and quality far beyond what most North American firms had ever achieved in the small car market. Instead of competing head on with the Japanese, Ford preferred to acquire Mazda in order to learn and be able to compete in these market segments. In 1979 FORD and MAZDA entered into an agreement under which FORD acquired a 24.5% shareholding in Mazda with the two companies maintaining their autonomies. In 1996 Ford completed its merger with Mazda, increasing its shareholding to a 33,4% controlling stake of Mazda.[15] From their partnership, there was a great diffusion of know-how and new models arose after their merger. Soon thereafter, Henry Wallace was appointed President, and he set about restructuring Mazda and setting it on a new strategic direction. [16]

1.3. Empirical Methodology

The major issue faced by any attempt to estimate the effect of the merger on prices, as with any evaluation of an intervention using non-experimental data, is the method used to control for other confounding factors that may also have changed at the time of the event. Of

[14] How brash BMW ran Rover to catastrophe http://www.theguardian.com/business/2000/mar/26/rover.observerbusiness

[15] REGULATION (EEC) No 4064/89 MERGER PROCEDURE, Case No IV/M.741 - Ford / Mazda, Article 6(1)(b) NON-OPPOSITION Date: 24/05/1996, http://ec.europa.eu/competition/mergers/cases/decisions/m741_en.pdf

[16] Ford and Mazda: A lesson in cooperation, Automotive news, June 16, 2003 http://www.autonews.com/article/20030616/SUB/306160777/ford-and-mazda:-a-lesson-in-cooperation

special concern is the effect of possible changes in demand or costs on prices. The method I use to control for these factors is familiar from the literature on diff-on-diff estimation, focussing on the selection of a control group and the selection of a window of data surrounding the events we are studying. The former is important for dealing with permanent time-varying factors, while the latter can be very useful in dealing with transitory time-varying factors.

The key idea behind the diff-in-diff methodology is to compare prices before and after a merger. This comparison relies on three factors: (i) that the merger is an exogenous, unexpected event for all non-merging firms, (ii) an appropriate control group is selected to control for any other irrelevant factors affecting prices post-merger, and (iii) an appropriate time window around the merger is chosen. The main advantages of this methodology stem from the clear identification (conditional on the three previous factors) and the ease of estimation. In our case we can choose an appropriate treatment in order to find the effect on the close competitors of the merged firms (e.g. models of the same segment as the one sold by the merged brands), and the rest of the market as a control group. I also use different time windows: given that a merger is an exogenous event for the rest of the market and unexpected since its approval is not stated long before the time of the event, the diff-in-diff can be applied to our case. Its empirical credibility though comes at a cost: it is very difficult to generalize the results derived from one merger to future mergers in other industries or even the same industry.

I use the following empirical specification:

$$\log P_{it} = \alpha + \beta_1 X_{it} + \beta_2 \Psi_{it} + \beta_3[\text{Post Merger}]_{it} + \beta_4[\text{Post Merger}]_{it}[\text{Close Competitors}]_{it} + \beta_5[\text{Year}] + \beta_6[\text{Brand}] + \beta_7[\text{Location}] + \beta_8[\text{Segment}] + \beta_9[\text{Other Merger}]$$

where: a = constant

X_{it} = primary characteristics of product i in year t

Ψ_{it} = secondary characteristics of product i in year t

Year = year dummy

Brand = brand dummy

Location = location dummy

Segment = segment dummy

Other Merger = join other merger dummy

Pit is the price of the model i in the year t. The β_1 and β_2 capture the influence of the primary and secondary characteristics of cars respectively, where the secondary characteristics are bundles of similar characteristics of the car[17]. I include year, brand, location (equals 1 if the selected model is produced in that country), and segment dummies to control for seasonal, brand, location and segment pricing respectively. I also include "Other Merger" dummies to control for effects on prices of cars that are involved in other mergers.[18] The coefficient β4 measures the proportionate price increase of the merger's close competitor's product relative to products in the control group, while β3 measures the proportionate price increase that brings the event of the merger to all brands in the market. Since it is a log-level price index, a one-unit increase of variable, it will lead to a β_i*100% increase in prices.

I use six alternatives of the above hedonic price index for my regressions. The first one, which I call "basic", includes the "year", "brand", "location" and "segment" dummies. Then, to the previous specification I add the primary characteristics and name it "primary". The third one, named "all", includes all the previous variables plus the secondary characteristics. I also examine three more alternatives by adding the "Other merger" dummies in the previous specifications.

The ideal event window should be long enough to capture any changes in prices associated with the merger, but not too long in order to avoid noise from other changes in the market. I consider two different time windows: The first one is the "1 by 1" time window and includes data one year before and one year after the merger. This is the shortest time window that I use and should avoid any contaminating effects. The second one is the "2 by 2" time window and includes data two years before and two years after the merger. This time window is larger than the "1 by 1" in order to be more certain that it contains the moment that the merging firms start coordinating.

I consider three different cases of close competitors as the treatment group. The first consists of the car models manufactured in the same country, the second consists of the car models of the same segment and the third consists of the car models of the same segment which were

[17] For example, instead of using two different dummies for radiocassete and radiocd, we use the bundle of radio. This takes the price of 0, 1 or 2 when there is no radio, radiocassete or radiocd respectively.

[18] For instance, a car produced by Jaguar or from the brands owned by Ford will have its dummy "other_merg_jaguar_ford" equal to one, after the merger of Jaguar-Ford

manufactured by factories in the same country[19] as the merged ones respectively. All treatment groups are close competitors but without participating in the merging party. Thus for the treatment group, it is an exogenous unexpected event.

As a control group, I use the rest of the market. The primary advantage of using a control group is that it should control for shocks to both demand and cost that affect branded products. An increase in income, for example, may increase the demand for a new car, thus increasing the prices of our treatment group. The prices of the rest of the market will also increase, serving as a control for the relative demand shift. Similarly, a productivity shock such as an increase in the price of steel (material used for the production of cars) will increase production cost and lead to higher prices not only for the treatment group but also for the rest of the market. The disadvantage of using the rest of the market as a control group is that these products are likely to be close enough substitutes to the treatment groups' products and the merging party. Thus, their prices will also be affected by the merger. Nevertheless, it is likely that the effect on the prices of these competitors will be lower than that of the treatment group. Hence, while measuring price changes relative to our control group may understate any price increase due to the merger, the sign of the relative price increase should be correct.

I used two different hypotheses for the error term. The first one is clustering over brand. The other is the robust standard error. The reason behind using cluster errors is due to the fact that the models of the same brand are likely to be correlated. For instance, car engines not only are produced from the same production lines but different engine models are used in more than one car model of the brand. Hence, there would be some correlation between these cars and as a result, shocks due to the productivity costs of a particular car engine will affect all these models in a similar way.

[19] For example if one of the merged cars is a sports car manufactured in France, then I will include all sports cars manufactured in France in my treatment group

1.4. Data

The data is annual and includes unit sales, inflation-adjusted market prices to the year 2014 and the characteristics of all new car model variants sold in the United Kingdom over the period 1984–1998. The characteristics are categorized as primary and secondary, with 6 primary characteristics and 27 secondary characteristics. It also includes 8 market segments, 19 locations, 68 brands, 15 years and 6 other-merger dummy variables.

I used three different treatment groups. The first is cars manufactured in the same location, the second is cars of the same segment and the third is cars of the same segment manufactured in the same location as the merged ones. For convenience I call them "location", "segment" and "segment & location" respectively. These treatment groups, depending on how I specify the close competitor, are composed of different cars.

Tables 1.1.1 to 1.1.6 present the basic statistics of the variables included in the Primary Characteristics for the two time windows of the mergers of Seat - Vag, Saab - GM, Jaguar - Ford, Skoda - VAG, Rover – BMW and Mazda – Ford, respectively. The primary characteristics are power (brake horsepower divided by weight), economy (miles per pound at 56 mph in real 2014 prices), size (length multiplied by width), fuel injection, diesel engines and turbo (dummy variables) between 1984 and 1998.[20] Graphs 1.1.1.a to 1.1.1.d show the average price (weighted by their sales) of the merging party of Seat – Vag and that of the rest of the market, the cars manufactured in the same country, the cars that belong to the same segment and the cars of the same segment that are manufactured in the same country as the merged ones, respectively, in a time window of 5 years before and 5 years after. Graphs 1.1.1.e to 1.1.7.g show the average price of the cars that belong to the treatment groups: location, segment, and location & segment, respectively, and the rest of the market. Similarly, the graph sets 1.1.2.a -1.1.2.g to 1.1.7.a-1.1.7.g stand for the mergers of Saab - GM, Jaguar - Ford, Skoda - VAG, Rover - BMW, and Mazda – Ford.

[20] Details and statistics of all variables are presented in the Appendix

Seat (VAG) 1986

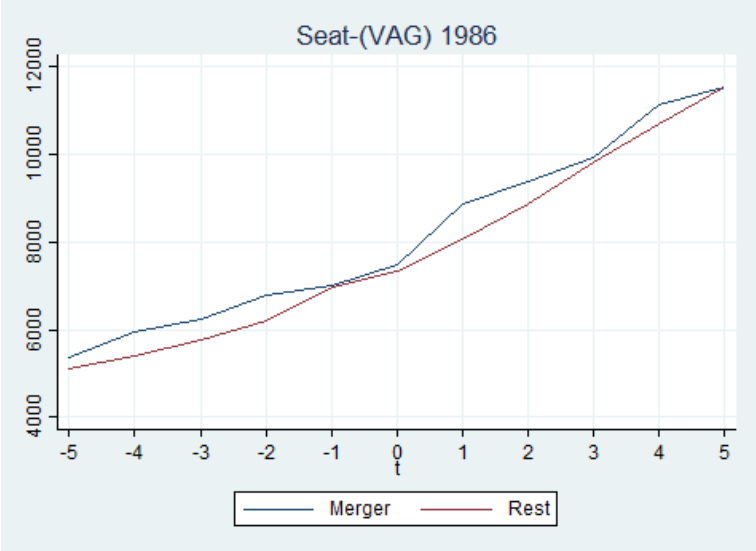
In the treatment group "location", I use cars manufactured in West Germany and Spain. In the treatment group "segment" I use the models of Mini/Super-mini, Small Family, Medium, Executive, and Sports. In "location & segment", the models that are included are from West Germany (Mini/Super-mini, Small Family, Medium, Executive, Sports) and Spain (Mini/Super-Mini, Small Family).

Table 1.1.1 Statistics of basic characteristics (Seat – VAG)

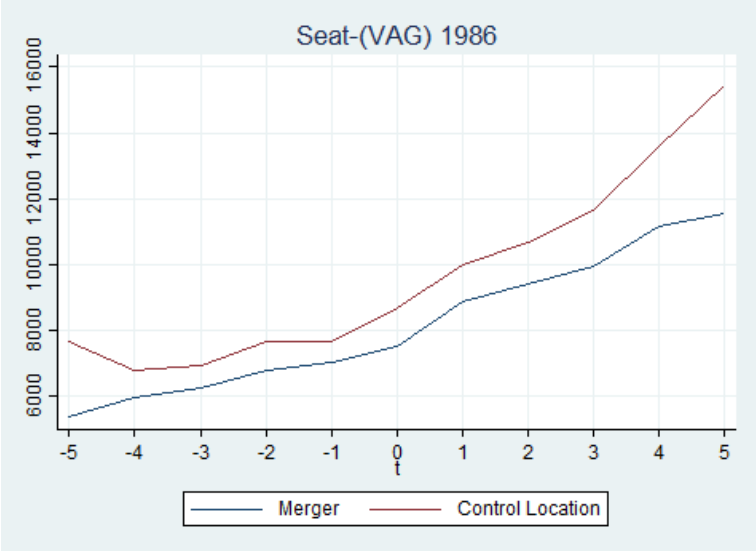
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	87561.4	31266.2	87894.6	31716.8
Size (=length* width)	73.3964	12.7313	73.4137	12.2839
Economy (= miles per pound)	44.7538	11.237	45.7205	12.0786
Fuel injection	0.27913	0.44884	0.27234	0.4453
Diesel fuel	0.10194	0.30276	0.10351	0.30472
Turbo	0.07646	0.26589	0.07702	0.2667
Post-merger	0.51699	0.50001	0.52557	0.4995
Post-merger * treat "location"	0.12015	0.32533	0.1183	0.32306
Post-merger * treat "segment"	0.46602	0.49915	0.47197	0.49937
Post-merger * treat "loc & seg"	0.10801	0.31058	0.10659	0.30869

From Graph 1.1.a the merging party seems to increase their average price one year after the acquisition of Seat, i.e. when t = 1. However, one year later, i.e. t = 2, their average price falls. When we compare it to the equivalent of their close competitors (Graphs 1.1.1.b to 1.1.1.d), only when we use "segment" as close competitors does there seem to be some mobility similar to that of the rest of the market. The close competitors' type of "location" and "location & segments" increase their prices relative to the rest of the market (Graph 1.1.1.e and 1.1.1.g). However, for the close competitors' type of "segment", the opposite holds true since they drop their relative price (Graph 1.1.1.f).

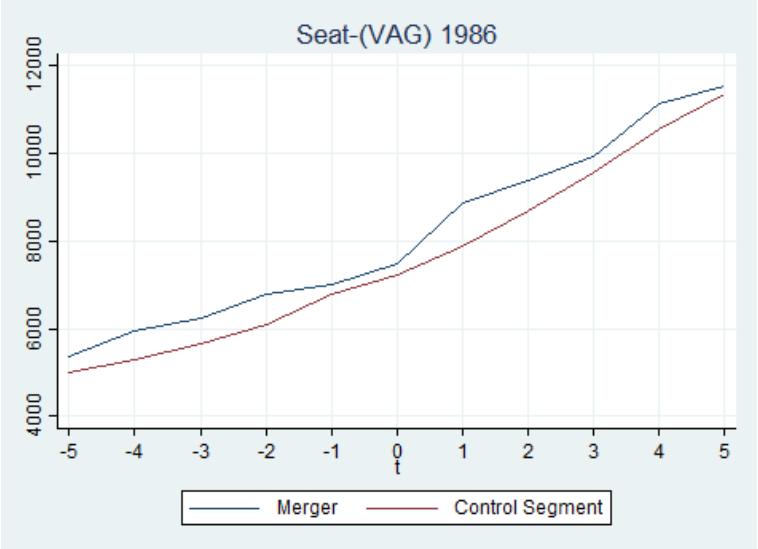
Graph 1.1.1.a Average price of Seat–Vag and the rest of the market



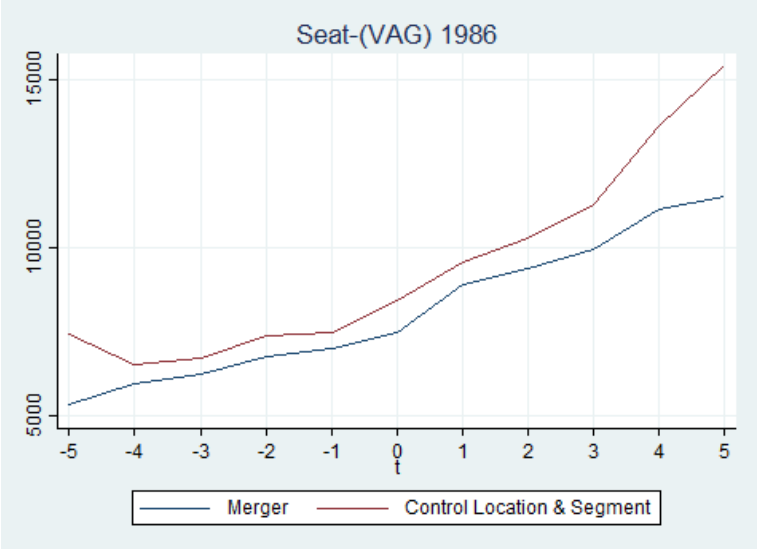
Graph 1.1.1.b Average price of Seat–Vag and competitors type "location"



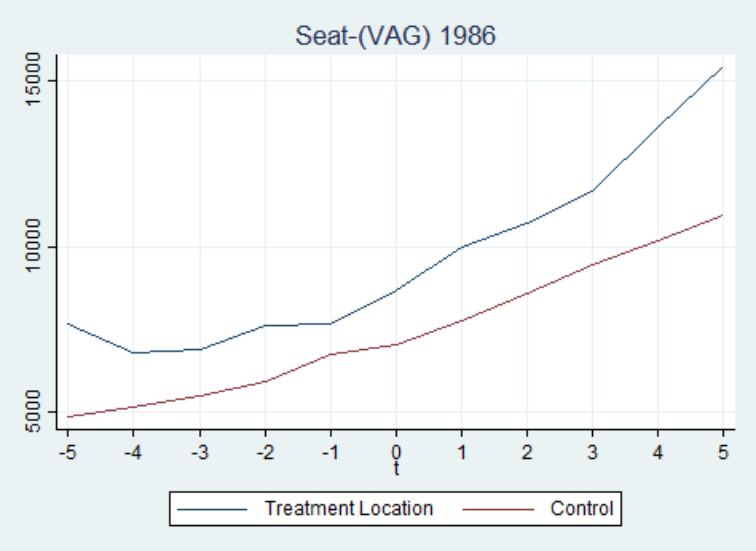
Graph 1.1.1.c Average price of Seat–Vag and competitors type "segment"



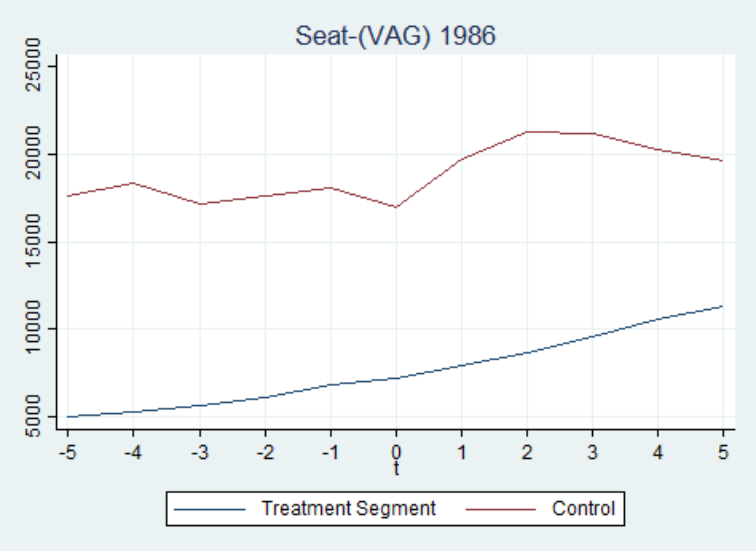
Graph 1.1.1.d Average price of Seat–Vag and competitors type "location & segment"



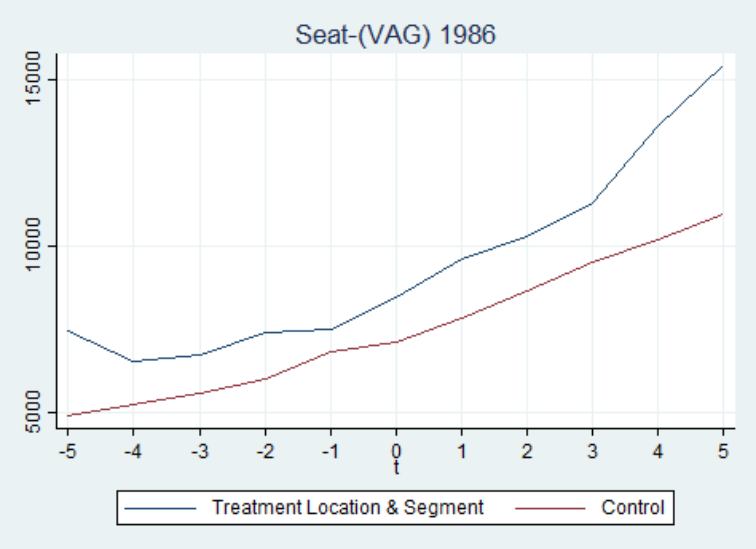
Graph 1.1.1.e Average price of competitors type “location" and the rest of the market



Graph 1.1.1.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.1.g Average price of competitors type “location & segment" and the rest of the market



Jaguar (FORD) 1990

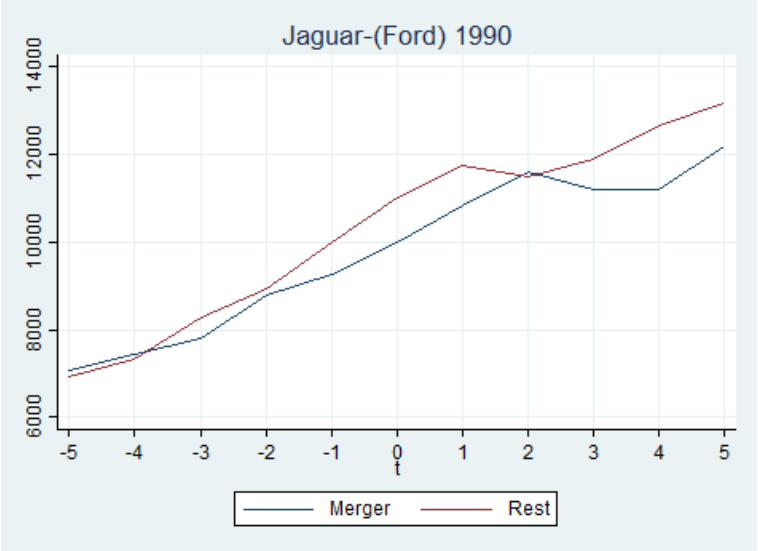
In the treatment group "location", I use cars that have been manufactured in the UK, Belgium, West Germany and Spain. In the treatment group "segment" I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury and Sports. In the "location & segment" group, the models that are included are from the UK (Mini/Super-mini, Small Family, Medium, Luxury, Sports), Belgium (Medium, Luxury), West Germany (Mini/Super-mini, Small Family, Executive), and Spain (Mini/Super-Mini, Small Family) .

Table 1.1.2 Statistics of basic characteristics (Jaguar – Ford)

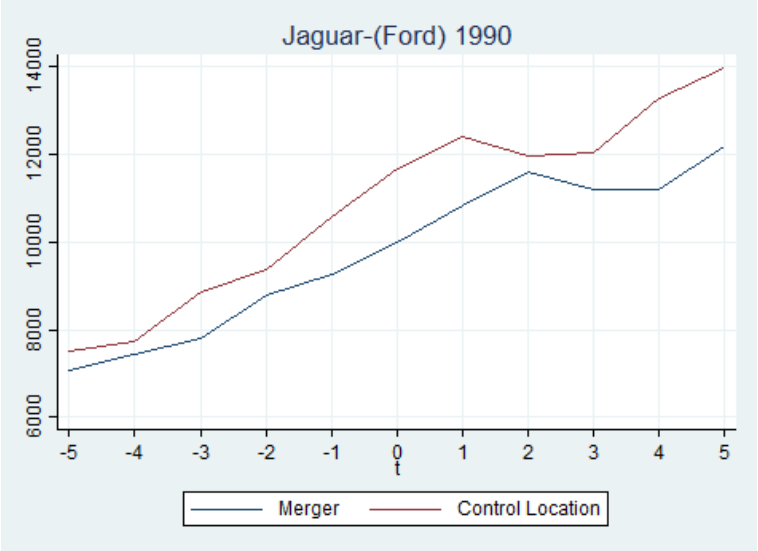
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	96219.1	31718.5	96441.4	32250.6
Size (= length* width)	75.1499	11.7152	75.2102	11.5564
Economy (= miles per pound)	51.6605	11.3118	52.1695	11.4544
Fuel injection	0.49087	0.50019	0.50645	0.50009
Diesel fuel	0.11493	0.31911	0.12043	0.32555
Turbo	0.11063	0.31385	0.11183	0.31524
Post-merger	0.52739	0.49952	0.54516	0.49809
Post-merger * treat "location"	0.24275	0.42898	0.25323	0.43498
Post-merger * treat "segment"	0.4855	0.50006	0.50161	0.50013
Post-merger * treat "loc & seg"	0.12782	0.33407	0.13602	0.3429

If we examine the price trends, two years after the merger, the merging party's average price seems to increase relative to the rest of the market and their close competitors (Graphs 1.1.2.a to 1.1.2.d). However for all the types of close competitors, there seems to be an opposite path being taken and they are reducing their prices relative to the rest of the market (Graphs 1.1.2.e to 1.1.2.g).

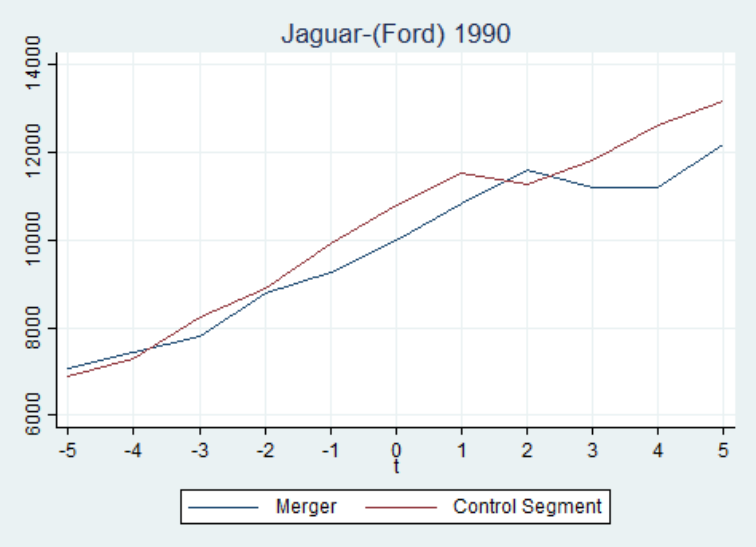
Graph 1.1.2.a Average price of Jaguar-Ford and the rest of the market



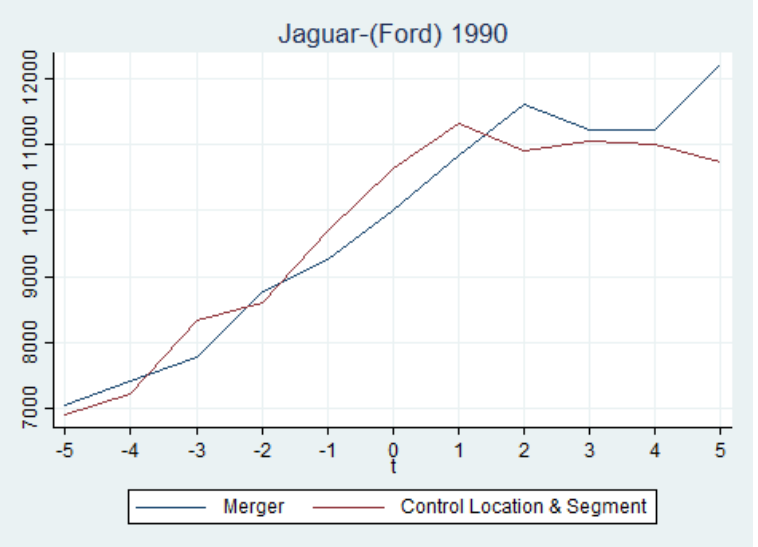
Graph 1.1.2.b Average price of Jaguar-Ford and competitors type "location"



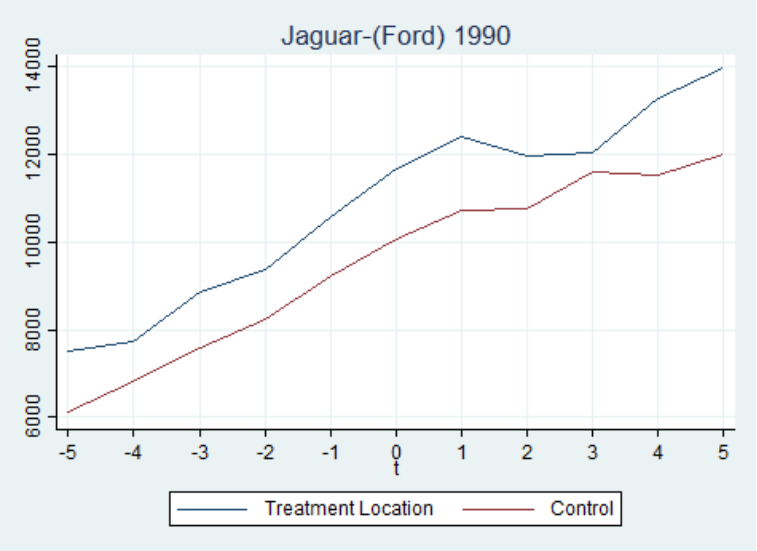
Graph 1.1.2.c Average price of Jaguar-Ford and competitors type "segment"



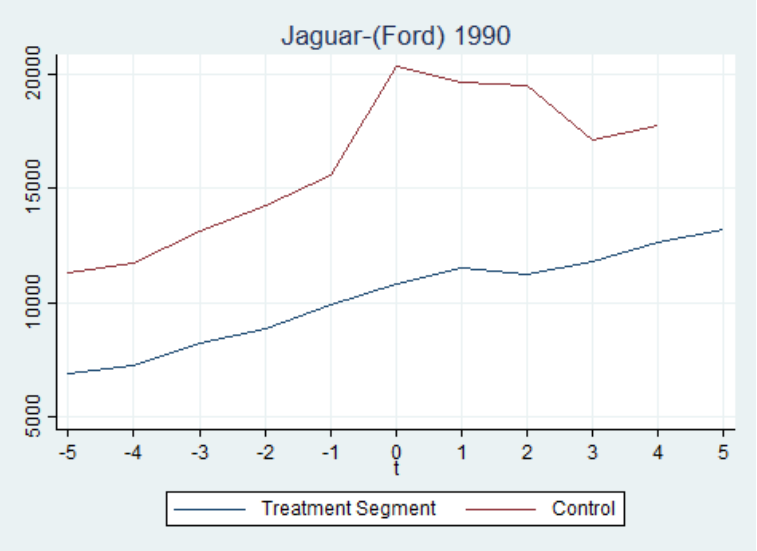
Graph 1.1.2.d Average price of Jaguar-Ford and competitors type "location & segment"



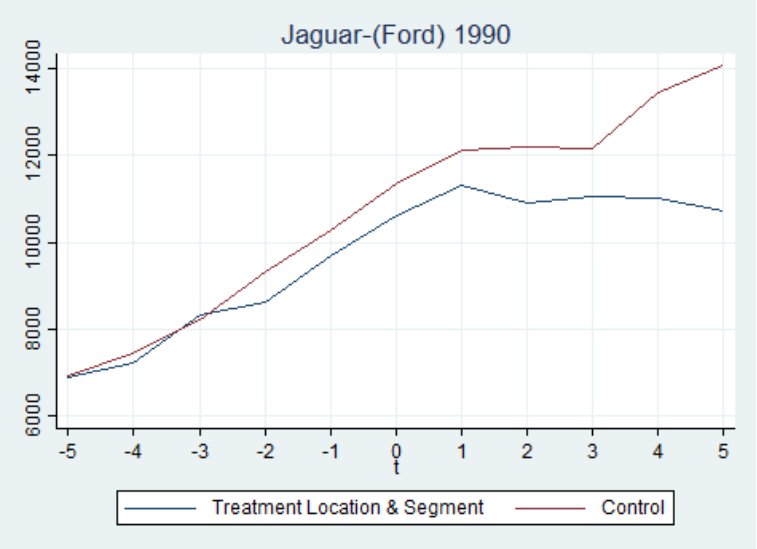
Graph 1.1.2.e Average price of competitors type “location" and the rest of the market



Graph 1.1.2.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.2.g Average price of competitors type “location & segment" and the rest of the market



Saab (GM) 1990

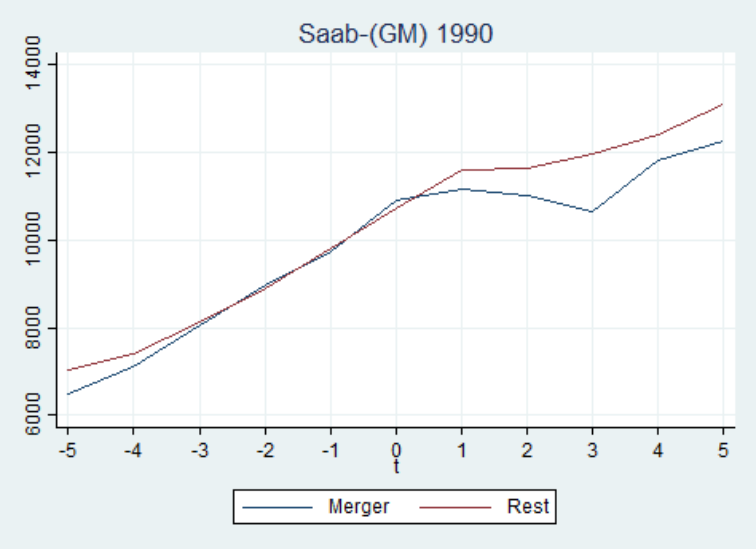
For the treatment group "location", I use cars manufactured in the UK, West Germany, Spain and Sweden. For the treatment group "segment", I use the models of Mini/Super-mini, Medium, Executive, Sports and 4by4. For the "location & segment" group, the models that are included are from the UK (Medium, 4by4), West Germany (Medium, Executive, Sports), Spain (Mini/Super-mini), and Sweden (Medium, Executive).

Table 1.1.3 Statistics of basic characteristics (Saab – GM)

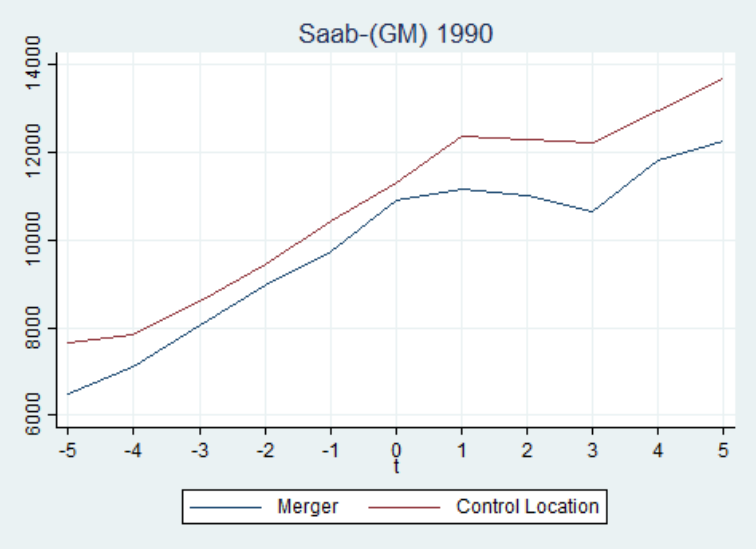
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	95418	32741.6	95686.1	32997.2
Size (=length* width)	75.5163	11.8603	75.523	11.7077
Economy (= miles per pound)	51.6777	11.7168	52.1217	11.8257
Fuel injection	0.44239	0.49693	0.46353	0.4988
Diesel fuel	0.11934	0.32436	0.12312	0.32867
Turbo	0.107	0.30927	0.1045	0.30599
Post-merger	0.51955	0.49988	0.53492	0.49891
Post-merger * treat "location"	0.25412	0.43559	0.26073	0.43915
Post-merger * treat "segment"	0.36728	0.48231	0.37817	0.48506
Post-merger * treat "loc & seg"	0.12757	0.33378	0.13192	0.33849

During the first three years after the merger, the merging party's average price falls in relation to the rest of the market and their close competitors (Graphs 1.1.3.a to 1.1.3.d). Concerning the impact on their close competitors' prices, two years after the merger, "location" drops its average price relative to the rest of the market (Graphs 1.1.3.e and 1.1.3.f). However, for the "segment", there is an increase in relative prices while for "location & segment", there is no notable impact on prices.

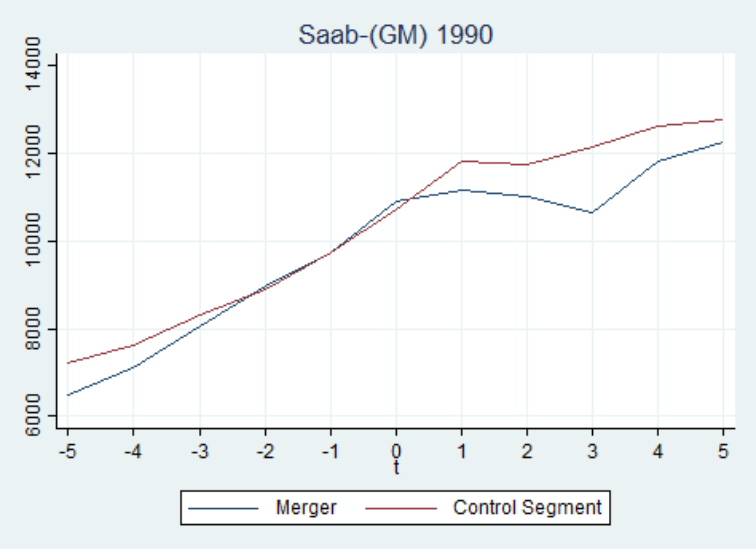
Graph 1.1.3.a Average price of Saab-GM and the rest of the market



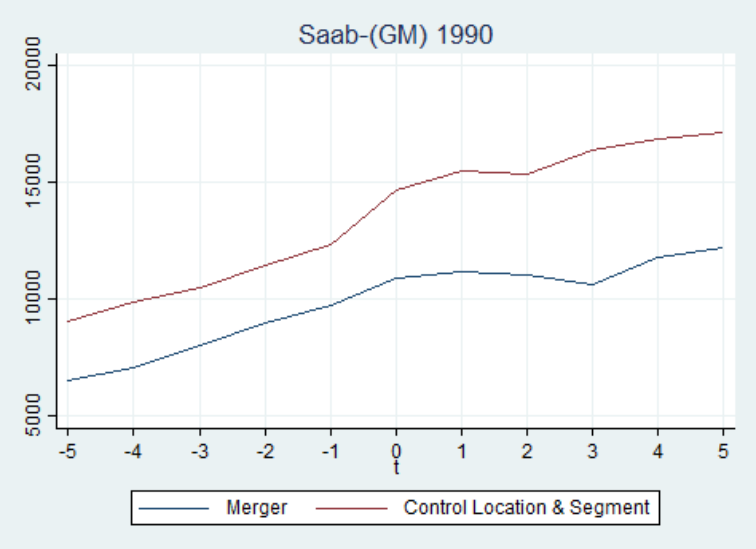
Graph 1.1.3.b Average price of Saab-GM and competitors type "location"



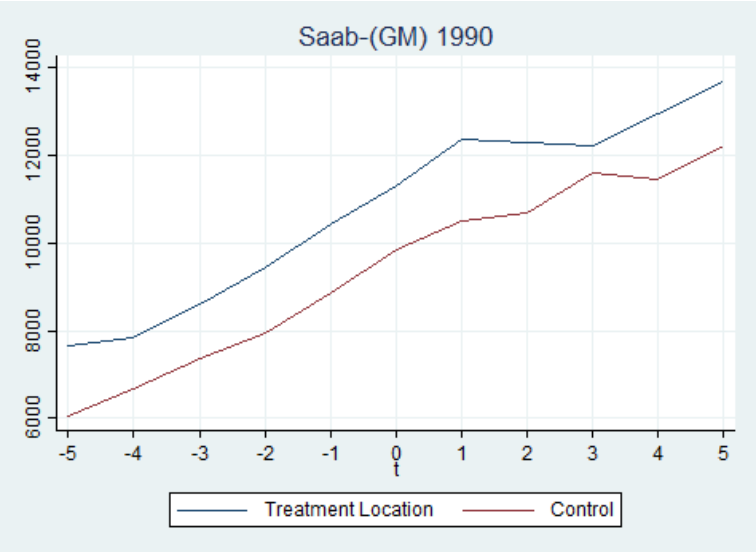
Graph 1.1.3.c Average price of Saab-GM and competitors type "segment"



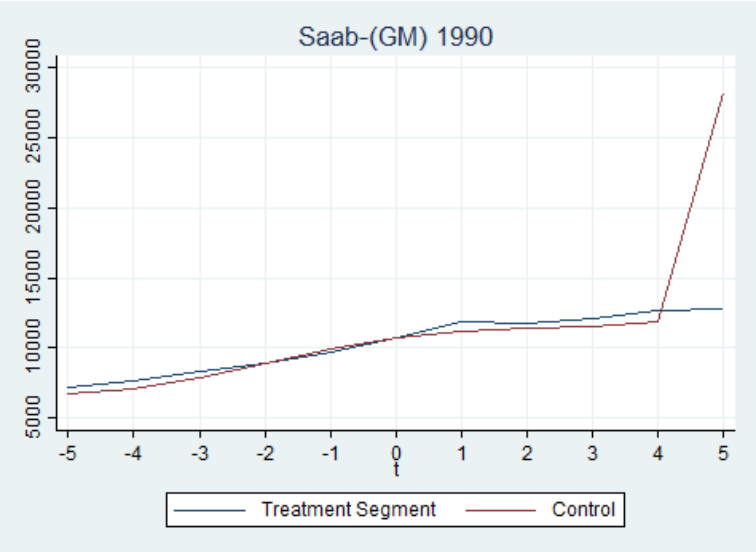
Graph 1.1.3.d Average price of Saab-GM and competitors type "location & segment"



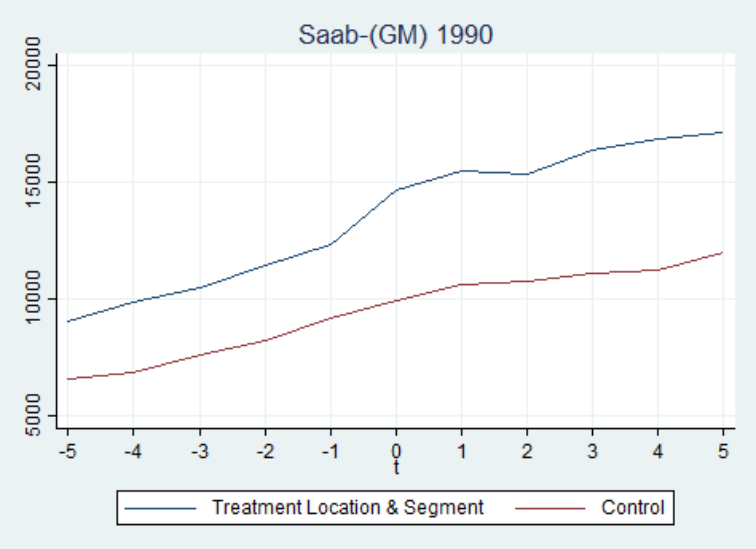
Graph 1.1.3.e Average price of competitors type “location" and the rest of the market



Graph 1.1.3.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.3.g Average price of competitors type “location & segment" and the rest of the market



Skoda (Vag) 1991

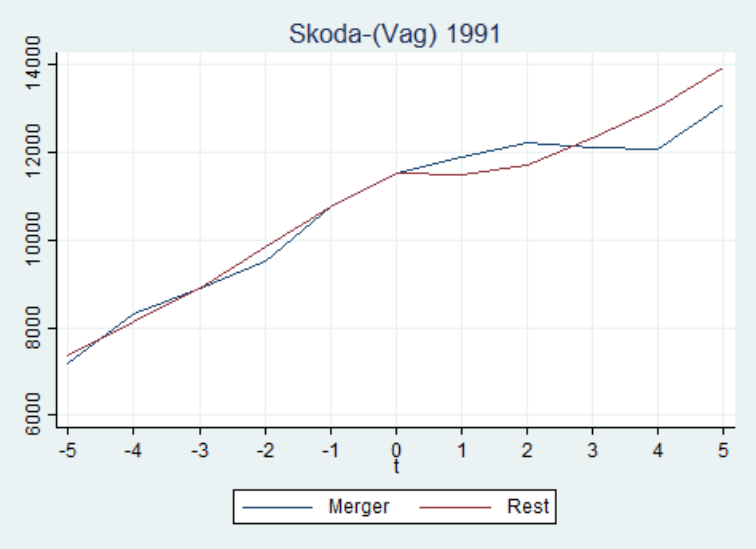
In the treatment group "location", I use cars that have been manufactured in West Germany, Spain, and the Czech Republic. In the treatment group "segment", I use the the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, and Sports. In the "location & segment" group, the models that are included are from West Germany (Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports), Spain (Mini/Super-mini, Medium), and the Czech Republic (Small Family).

Table 1.1.4 Statistics of basic characteristics (Skoda – VAG)

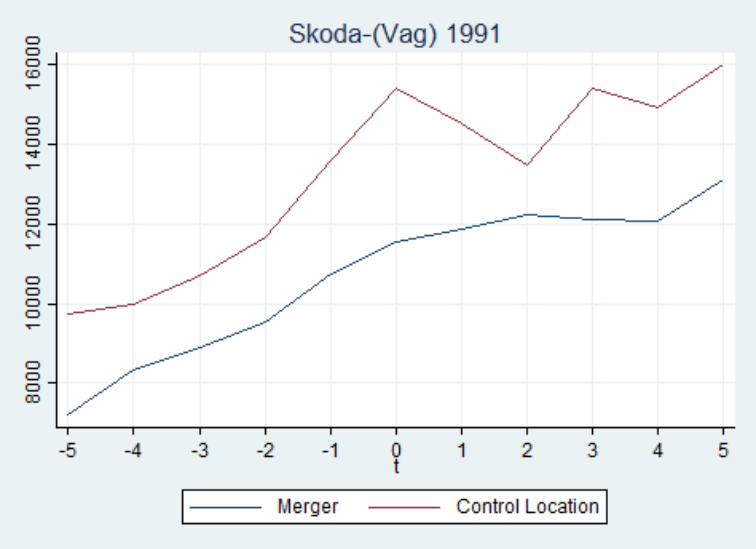
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	97443.8	33343.3	97434.1	33918.4
Size (=length* width)	76.6963	11.882	76.7473	11.8323
Economy (= miles per pound)	51.9133	11.9067	51.5293	12.0512
Fuel injection	0.5124	0.5001	0.51753	0.49982
Diesel fuel	0.125	0.33089	0.13605	0.34294
Turbo	0.10227	0.30316	0.10727	0.30954
Post-merger	0.52479	0.49964	0.52067	0.4997
Post-merger * treat "location"	0.1126	0.31627	0.11983	0.32485
Post-merger * treat "segment"	0.48141	0.49991	0.47514	0.49951
Post-merger * treat "loc & seg"	0.10434	0.30586	0.10832	0.31087

During the first two years after the merger, the merging party's average price increases relative to the rest of the market and their close competitors (Graphs 1.1.4.a to 1.1.4.d). However, their close competitors follow the opposite direction since for all types of close competitors, their average price reduces its difference with that of the rest of the market (Graphs 1.1.4.e to 1.1.4.g).

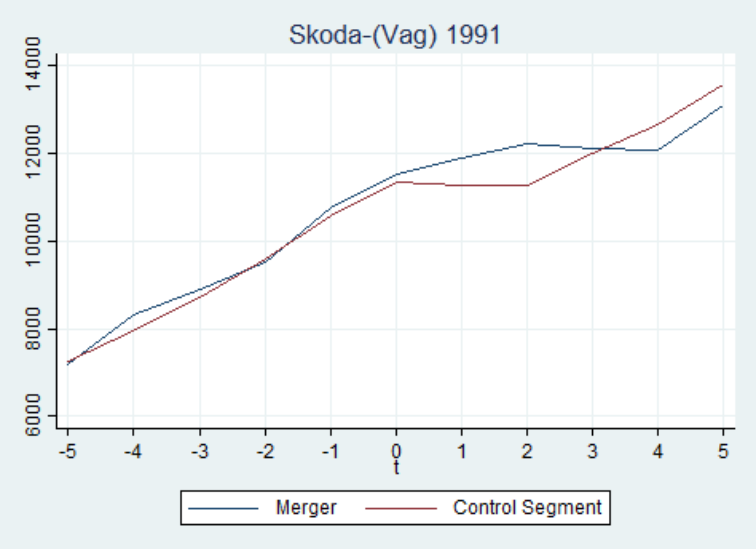
Graph 1.1.4.a Average price of Skoda-VAG and the rest of the market



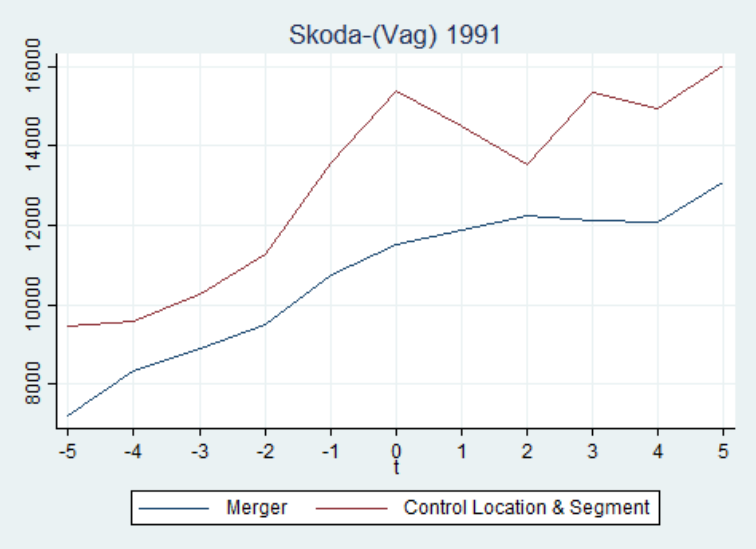
Graph 1.1.4.d Average price of Skoda-VAG and competitors type "location"



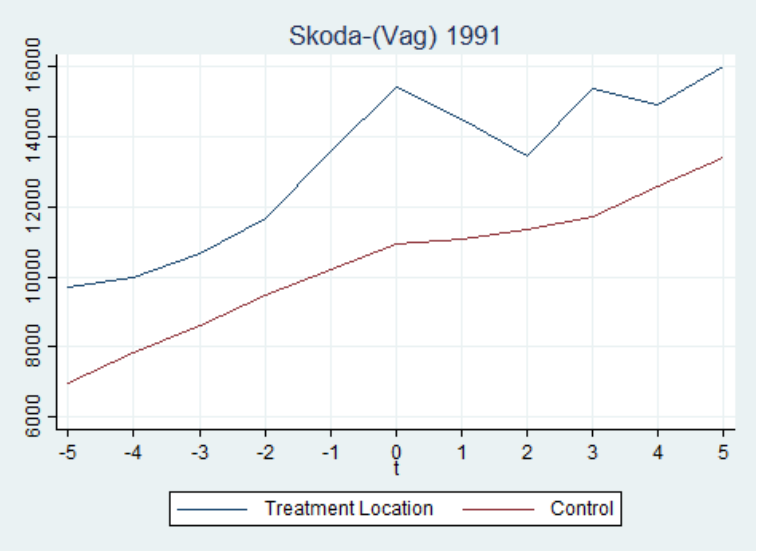
Graph 1.1.4.c Average price of Skoda-VAG and competitors type "segment"



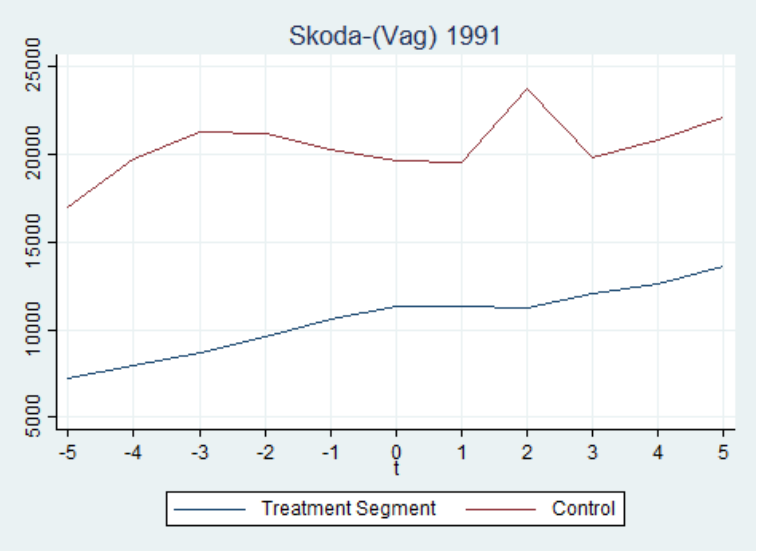
Graph 1.1.4.d Average price of Skoda-VAG and competitors type "location & segment"



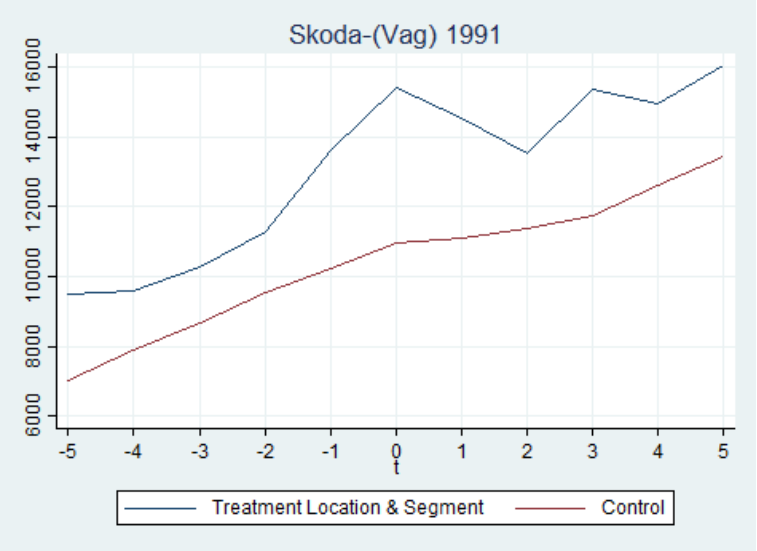
Graph 1.1.4.e Average price of competitors type “location" and the rest of the market



Graph 1.1.4.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.4.g Average price of competitors type “location & segment" and the rest of the market



Rover (BMW) 1994

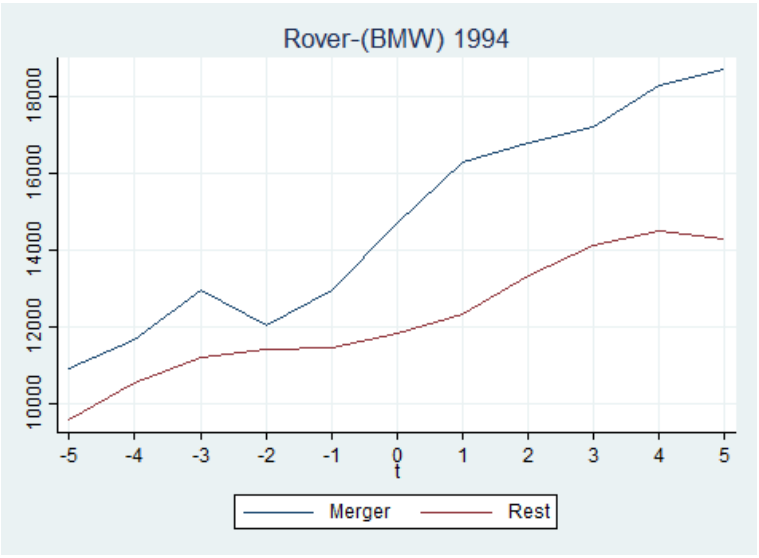
In the treatment group "location", I use cars manufactured in the UK and West Germany. In the treatment group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, and 4by4. In the "location & segment" group, the models that are included are from the UK (Mini/Super-Mini, Small Family, Medium, Executive, Sports, 4by4), and West Germany (Medium, Executive, Luxury, Sports).

Table 1.1.5 Statistics of basic characteristics (Rover – BMW)

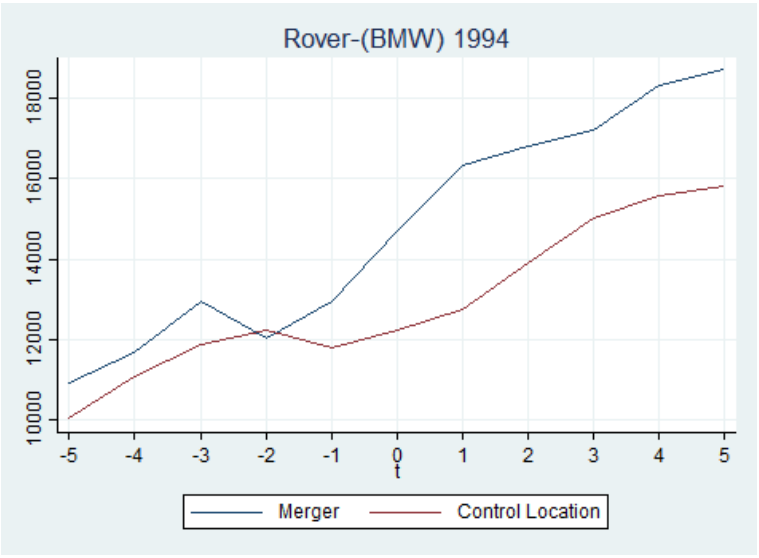
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	97773.2	32442.2	97772.9	32518.8
Size (=length* width)	78.287	11.1496	78.1005	11.0173
Economy (= miles per pound)	49.545	10.9356	49.683	11.0521
Fuel injection	0.6976	0.45952	0.67979	0.46667
Diesel fuel	0.16866	0.37464	0.16618	0.37233
Turbo	0.13273	0.33946	0.1346	0.34138
Post-merger	0.50998	0.50015	0.50826	0.50005
Post-merger * treat "location"	0.18762	0.39061	0.18465	0.3881
Post-merger * treat "segment"	0.48503	0.50003	0.48299	0.49983
Post-merger * treat "loc & seg"	0.1517	0.35891	0.14577	0.35296

One year after the merger, i.e. t = 1, the merging party's average price increases relative to the rest of the market and all types of close competitors (Graphs 1.1.5.a to 1.1.5.d). However, one year later, i.e. t =2, their difference seems to return to the initial levels. Regarding the impact on close competitors, for "location" and "location & segment", there seems to be an increase in prices two years after the merger, i.e. t = 2, relative to those of the rest of the market (Graphs 1.1.5.e and 1.1.5.g). For "segment", there is an even bigger effect on their average relative prices which increases a year after the merger and deteriorates in the next years (Graph 1.1.5.f).

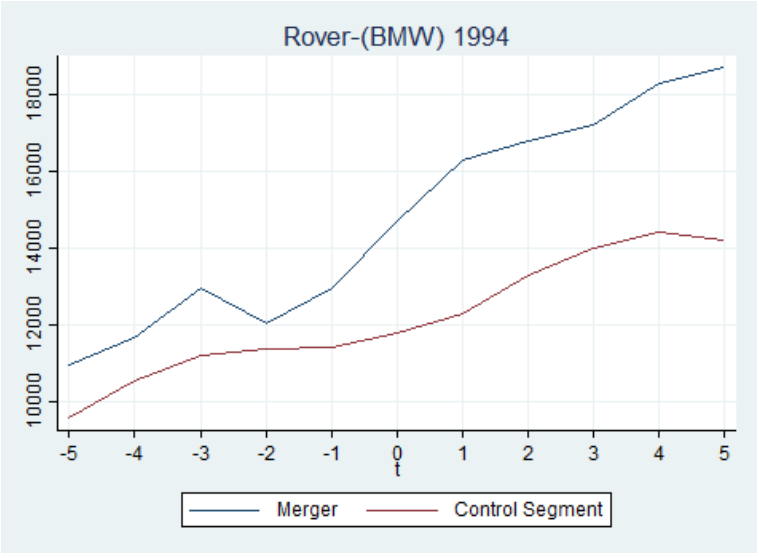
Graph 1.1.5.a Average price of Rover-BMW and the rest of the market



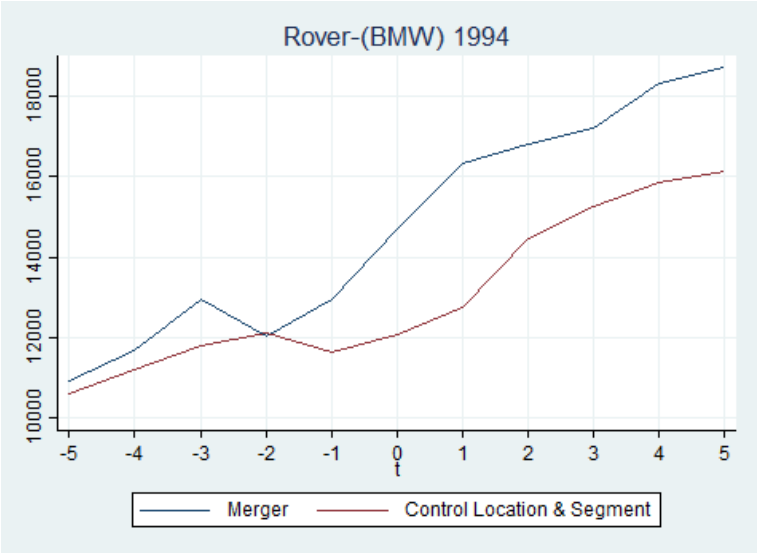
Graph 1.1.5.b Average price of Rover-BMW and competitors type "location"



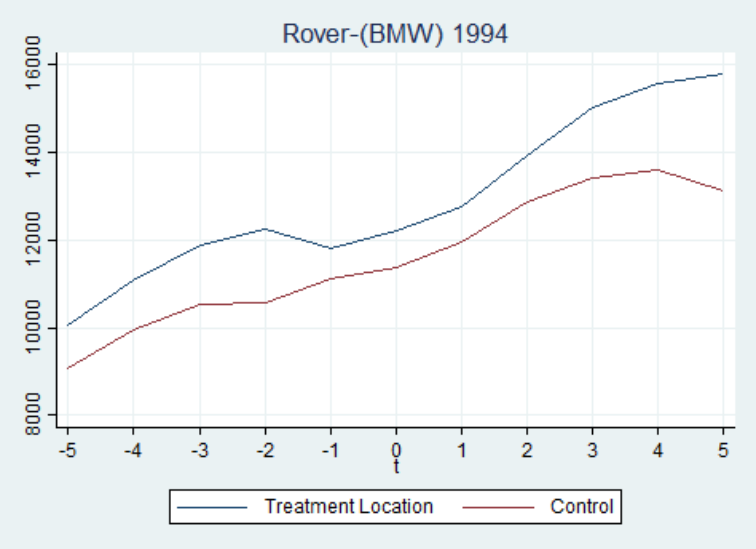
Graph 1.1.5.c Average price of Rover-BMW and competitors type "segment"



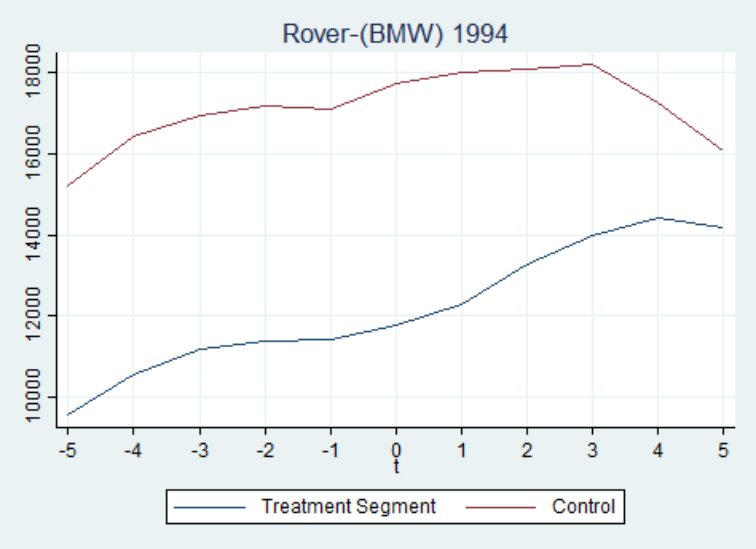
Graph 1.1.5.d Average price of Rover-BMW and competitors type "location & segment"



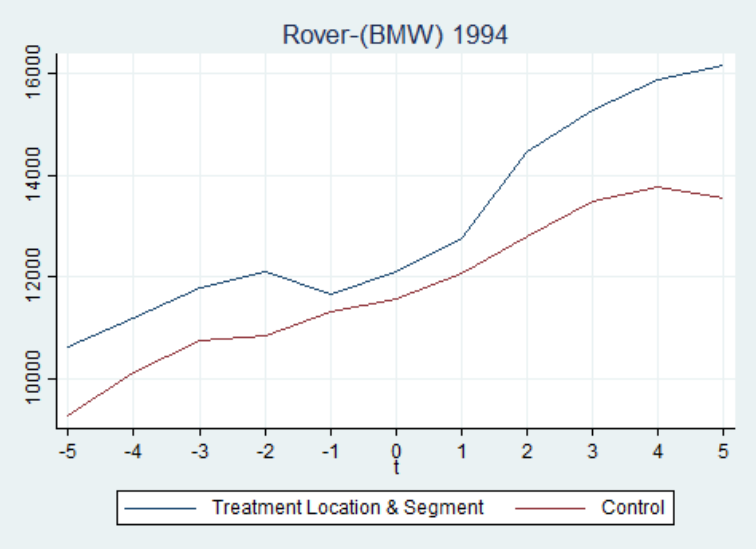
Graph 1.1.5.e Average price of competitors type “location" and the rest of the market



Graph 1.1.5.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.5.g Average price of competitors type “location & segment" and the rest of the market



Mazda (Ford) 1996

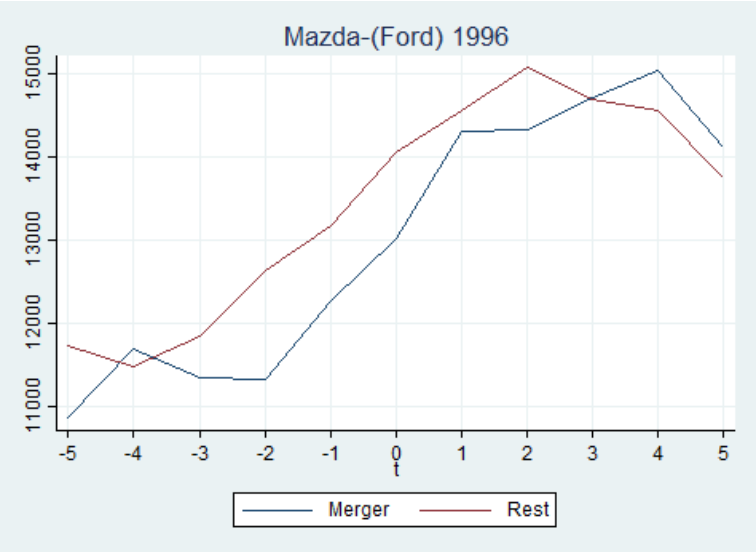
In the treatment group "location", I use cars that have been manufactured in the UK, Belgium, West Germany, Spain, USA and Japan. In the treatment group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, PC and 4by4. In the "location & segment" group, the models that are included are from the UK (Mini/Super-mini, Small Family, Luxury, Sports, PC), Belgium (Medium), West Germany (Small Family, Executive, Sports), Spain (Mini/Super-mini, 4by4), USA (Sports, 4by4), and Japan (Mini/Super-mini, Small Family, Medium, Executive, Sports).

Table 1.1.6 Statistics of basic characteristics (Mazda – FORD)

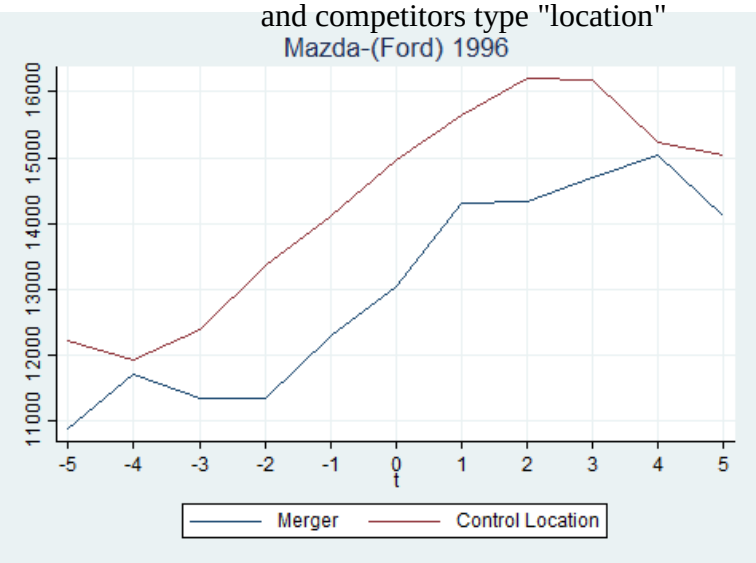
Time window	1 by 1		2 by 2	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	98699.8	33613.6	98850.6	34112.6
Size (=length* width)	79.9604	11.178	79.6061	11.4584
Economy (= miles per pound)	46.0718	10.5583	45.7533	10.8392
Fuel injection	0.73774	0.44007	0.73245	0.44279
Diesel fuel	0.19245	0.39441	0.19321	0.39491
Turbo	0.17736	0.38215	0.17669	0.38149
Post-merger	0.52547	0.49959	0.53786	0.49868
Post-merger * treat "location"	0.34623	0.47599	0.3575	0.47937
Post-merger * treat "segment"	0.52547	0.49959	0.53786	0.49868
Post-merger * treat "loc & seg"	0.1566	0.3636	0.16154	0.36811

One year after the merger, i.e. t = 1, the merging party's average price increases relative to that of the rest of the market and drops a year later, i.e t =2 (Graph 1.1.6.a). Similar results hold when we compare it with all the different types of close competitors, except for the "location & segment" group where the merger's average price decreases relative to them (Graphs 1.1.6.b to 1.1.6.d). Regarding the impact on close competitors, for "location & segment", there is an increase in average price compared to the rest of the market (Graph 1.1.6.g). For the "location", there is no notable impact on prices, while for "segment", we cannot proceed to a comparison since Ford produces cars of all segments from 1994 and after (Graphs 1.1.6.e and 1.1.6.f).

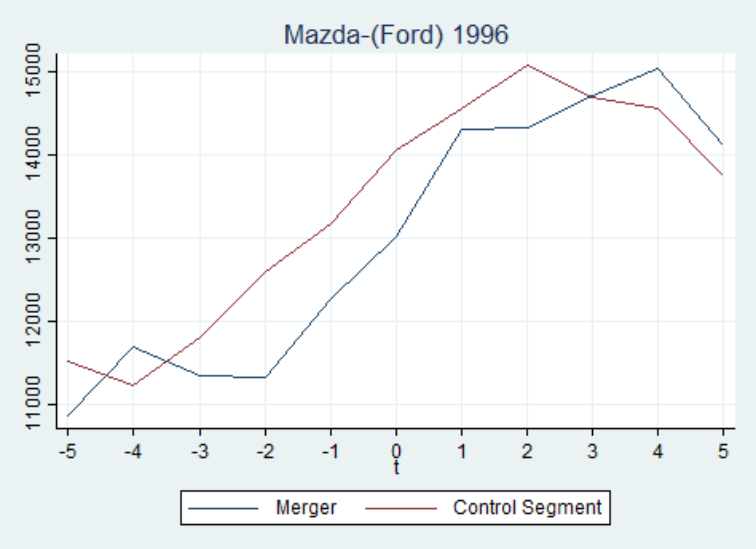
Graph 1.1.6.a Average price of Mazda-Ford and the rest of the market



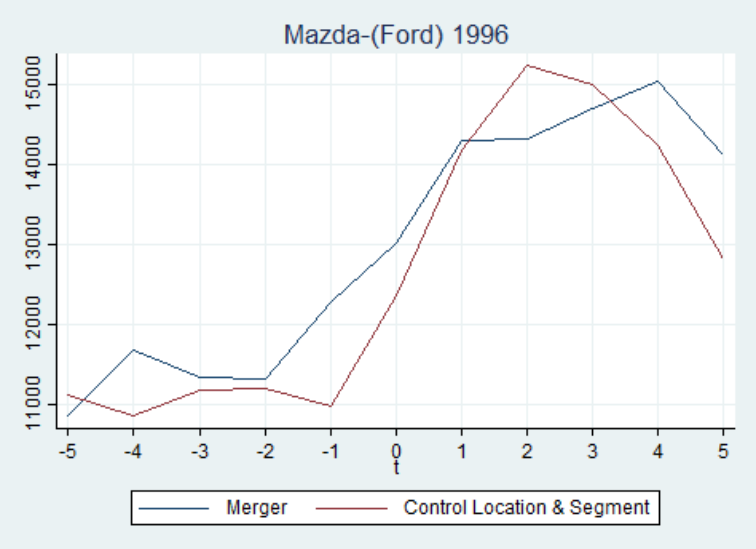
Graph 1.1.6.b Average price of Mazda-Ford and competitors type "location"



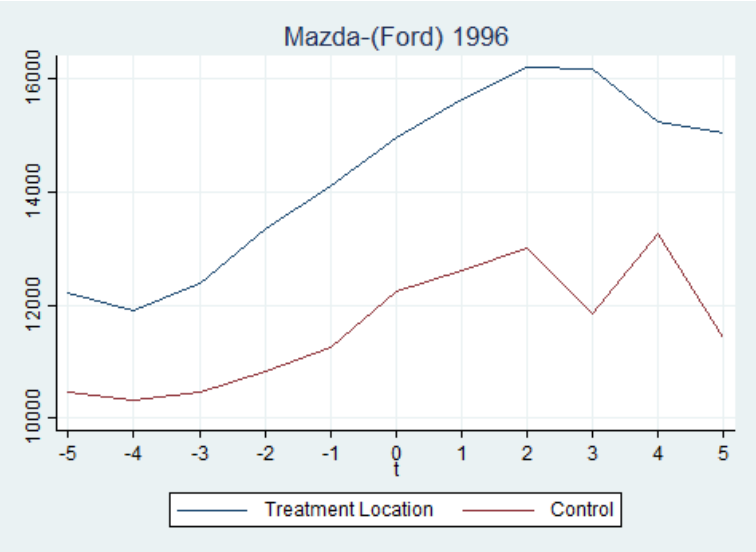
Graph 1.1.6.c Average price of Mazda-Ford and competitors type "segment"



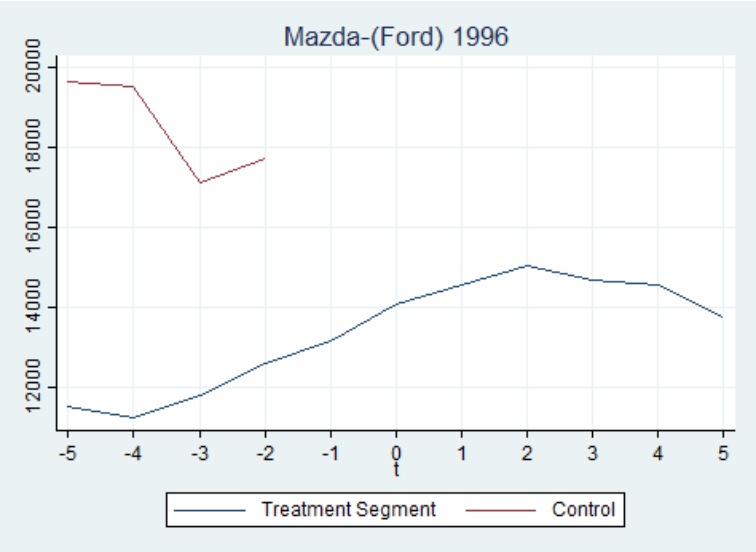
Graph 1.1.6.d Average price of Mazda-Ford and competitors type "location & segment"



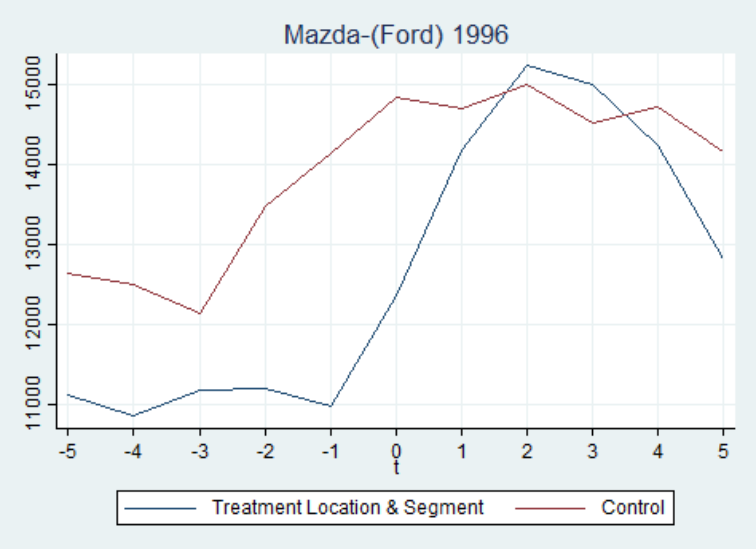
Graph 1.1.6.e Average price of competitors type “location" and the rest of the market



Graph 1.1.6.f Average price of competitors type “segment" and the rest of the market



Graph 1.1.6.g Average price of competitors type “location & segment" and the rest of the market



1.5. Results

In Tables 1.2.1 to 1.2.8, I summarize all the results of the post-merger and treatment groups with a robust standard error. Tables 1.2.1 to 1.2.4 stand for regressions without the "other merger" dummies and the rest are those with "other merger" dummies. Tables 1.2.1, 1.2.2., 1.2.5 and 1.2.6 show results using the "1 by 1" time window while the rest show "2 by 2". The odd-numbered tables stand for the effect on prices of the whole market (coefficient of "post-merger") and the even ones for the effect on the close competitors, relative to the rest of the competitors (coefficient of "post-merger"*"close competitor"). In some regressions the post-merger variable was dropped since its effect was absorbed by the year dummies. For Mazda-Ford, when we use segment as the treatment group, we have no results to report since the treatment group contains cars from all the available segments. Thus, the variable is dropped from the regression.

The merger of Saab-GM seems to negatively affect the prices of its close competitors for "segment" and "location & segment". When we use the time window "1 by 1" without the "other merger" dummies, in all regressions of the treatment groups "segment" and "location & segment", we have significant negative effects on prices (Table 1.2.2). The merger brings a decrease in the prices of cars of the same "segment" or of the same "location & segment", around 4% to 5%. For the "basic" regressions of both "segment" and "location & segment", the results are statistically significant for a critical value of 10%. This is also true for the "primary" regression of the "segment" while the rest are statistically significant for 5%. When we use the wider "2 by 2" time window, the effect of the merger on the prices of these cars becomes even more intense. It brings a decrease in the prices of cars from the same "segment" or of the same "location & segment", around 5% to 7%, and these figures are statistically significant for even lower critical values, i.e. 1%, for all regressions (Table 1.2.4).

However, if we add the "other merger" dummies, we have fewer regressions which give a statistically significant effect. For the "1 by 1" time window, we have a significant negative effect, around 4% to 6%, on prices for all alternatives of the treatment "location & segment", and 3.9% for cars of the same "segment" in the "all" regression for the critical value of 10% (Table 1.2.6). Again, if we use the wider "2 by 2" time window we get a more intense effect. The merger brings a decrease in the prices of these cars, around 4% to 7%, and is statistically

significant for the even lower critical value of 1% except for the "primary" regression of the "segment" treatment which is statististically significant for the critical value of 5% (Table 1.2.8). Moreover, if we change the hypothesis about the standard error and do clustering over brand then we have a significant negative effect for all regressions of both time windows of both types of competitors, whether we add the "other merger" dummies or not (Tables 1.2.10 to 1.2.16).

For the Jaguar-Ford merger, there are some results, which are not very robust, that indicate a significant positive effect for the close competitors type "segment" and "location & segment". The merger brings an increase of 5.9% to cars of the same "segment" and around 2% on the prices of cars of the same "location & segment" according to the results of the "primary" regressions of the "segment", and the "primary" and "all" regressions of "location & segment", respectively, for a time window of "2 by 2" (Table 1.2.4). These results are statistically significant for the critical value of 10%. However, if we add the "other merger" dummies, we have a statistically significant effect only for the "primary" regression of "segment" for a "2 by 2" time window which is equal to 5.95% and significant for a critical value of 10% (Table 1.2.8). No other regression results in a statistically significant effect and if we change the hypothesis about the standard error and do a clustering over brand, then there are no regressions with statistically significant effects on prices (Tables 1.2.10 to 1.2.16). Thus, it is quite possible that the merger did not affect the prices of its close competitors.

For the Skoda–VAG merger, we have a significant positive effect only for the "basic" regression of "location & segment" for the "2 by 2" time window with or without the "other merger" dummies (Tables 1.2.4 and 1.2.8). These are equal to around 4.9% and significant for a critical value of 10%. If we change our hypothesis about the standard error and do clustering over brand, then these results become statistically significant for even the lower critical value of 5%, plus we have a statistically positive effect equal to 4.3% for the "basic" regression of "location & segment" for the "2 by 2" time window with other merger dummies. However, no other regression gives a statistically significant effect for the merger on the prices of any type of close competitor. Hence, the merger probably did not affect the prices of its close competitors.

For the merger of Mazda–Ford, there are also some results that indicate a significant positive effect on close competitors for "location & segment". The merger brings an increase in the prices of these cars, around 5.2% to 5.5%, according to the result of "basic" regression of the "1 by 1" time window, with or without the merger dummies which are statistically significant for a 5%

critical value (Tables 1.2.2 and 1.2.5). When we use the wider time window, all the results are statistically significant for a critical value of 1% and equal to around 2.3% to 5.5% (Tables 1.2.4 and 1.2.8), except for the results of the "all" regression which is statistically significant for a critical value of 5%. If we change the hypothesis about the standard error and do clustering over brand, we have even more regressions with a significant positive effect on the same regressions where the "primary regression" of "location & segment" of the "1 by 1" time window with or without other merger dummies results in a statistically positive effect, around 2.3%, and is statistically significant for a 10% critical value (Tables 1.2.10 and 1.2.14). However the results for the "all" regression are now statistically significant for the less restrictive critical value of 10%. Hence, the merger seems to have led to an increase in the prices of its close competitors for "location & segment".

For the other mergers, we do not have any regressions with a significant effect on prices.

All without other mergers, robust s.e.

1 by 1

Table 1.2.1. Effect of merger on the market prices, time window "1 by 1", robust s.e.

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.106***	0.116***	0.0976***	0.134**	0.0983**	0.108***	0.114***	0.121***	0.0995***
Saab - (GM)	-0.0104	-0.0502***	-0.0608***	0.0322	-0.0194	-0.0278	0.00739	-0.0372***	-0.0490***
Jaguar - (Ford)	-0.0160	-0.0512***	-0.0579***	0	-0.0869**	-0.0894**	-0.00749	-0.0521***	-0.0612***
Skoda - (VAG)	0.00118	0	0	0	0	0	0.000118	0	0
Rover - (BMW)	-0.00174	-0.0153	-0.0204	0.0316	-0.0133	0	-0.00834	-0.0210*	-0.0251**
Mazda - (Ford)	0.0518***	-0.0249*	-0.0201	0.0344***	-0.0238**	-0.0266***	0.0181	-0.0305***	-0.0308***

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.2. Effect of merger on the close competitors' prices, time window "1 by 1", robust s.e.

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.0259	0.0275	0.0222	-0.0240	0.0270	-0.00593	-0.0113	0.00956	0.0159
Saab - (GM)	0.00784	0.00366	0.00412	-0.0543*	-0.0406*	-0.0432**	-0.0563*	-0.0447**	-0.0389**
Jaguar - (Ford)	0.0249	0.00909	0.00514	0.00815	0.0431	0.0366	0.0113	0.0212	0.0227
Skoda - (VAG)	0.0335	0.0130	0.00892	0.0465	0.0931	0.0935	0.0409	0.0169	0.0149
Rover - (BMW)	0.00204	-0.00160	-0.00371	-0.0335	-0.00273	0.00712	0.0236	0.0160	0.0111
Mazda - (Ford)	-0.0261	0.00166	-0.00950	0	0	0	0.0547**	0.0235	0.0146

*** p<0.01, ** p<0.05, * p<0.1

2 by 2

Table 1.2.3. Effect of merger on the market prices, time window "2 by 2", robust s.e.

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.138***	0	0	0.132***	0	0	0.144***	0	0
Saab - (GM)	0.0132	-0.0719***	-0.0975***	0.0708***	-0.0319**	-0.0595***	0.0352**	-0.0527***	-0.0819***
Jaguar - (Ford)	-0.0109	-0.0681***	-0.0818***	0	-0.115***	-0.116***	-0.00168	-0.0672***	-0.0865***
Skoda - (VAG)	-0.00377	-0.0567***	-0.0683***	0.00184	-0.0856*	-0.0958*	-0.00636	-0.0578***	-0.0706***
Rover - BMW)	0.0420**	0.00521	0.00270	-0.0359	-0.0423	-0.0741	0.0333**	-0.00100	-0.00450
Mazda - (Ford)	0.0432***	-0.0266**	0	0.0348***	-0.0226**	0	0.0186	-0.0340***	0

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.4. Effect of merger on the close competitors' prices, time window "2 by 2", robust s.e.

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.0179	0.0220	0.0178	0.0108	0.0419	0.0219	-0.0136	0.00546	0.0116
Saab - (GM)	0.0142	0.0122	0.00789	-0.0732***	-0.0488***	-0.0486***	-0.0648***	-0.0557***	-0.0507***
Jaguar - (Ford)	0.0252	0.0159	0.00224	0.0223	0.0590*	0.0386	0.00903	0.0251*	0.0218*
Skoda - (VAG)	0.0329	0.0103	0.00486	0.00145	0.0338	0.0313	0.0480*	0.0163	0.0172
Rover - (BMW)	-0.0241	-0.0161	-0.0213*	0.0708	0.0269	0.0531	-0.00140	0.000224	-0.00240
Mazda - (Ford)	-0.0126	0.00585	-0.0112	0	0	0	0.0547***	0.0390***	0.0245**

*** p<0.01, ** p<0.05, * p<0.1

All with other mergers, robust s.e.

1 by 1

Table 1.2.5. Effect of merger on the market prices, time window "1 by 1" controlling for other mergers' effect, robust s.e.

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.0108	-0.0513***	-0.0614***	0.0292	-0.0261	-0.0320	0.00170	-0.0440***	-0.0540***
Jaguar - (Ford)	-0.0155	-0.0518***	-0.0589***	0	-0.0890**	-0.0919**	-0.00620	-0.0529***	-0.0624***
Skoda - (VAG)	0.000691	0	0	0	0	0	-0.000465	0	0
Rover - (BMW)	-0.00172	-0.0153	-0.0204	0.0313	-0.0134	0	-0.00833	-0.0210*	-0.0251**
Mazda - (Ford)	0.0520***	-0.0245*	-0.0196	0.0335**	-0.0239**	-0.0266***	0.0182	-0.0303***	-0.0305***

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.6. Effect of merger on the close competitors' prices, time window "1 by 1" controlling for other mergers' effect, robust s.e.

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.00767	-0.00167	0.00222	-0.0519	-0.0354	-0.0394*	-0.0615*	-0.0465**	-0.0398*
Jaguar - (Ford)	0.0375	0.00484	-0.00278	0.00959	0.0428	0.0358	0.00963	0.0147	0.0158
Skoda - (VAG)	0.0343	0.0128	0.00882	0.0453	0.0936	0.0938	0.0421	0.0167	0.0147
Rover - (BMW)	0.000959	-0.00241	-0.00377	-0.0337	-0.00288	0.00712	0.0230	0.0156	0.0115
Mazda - (Ford)	-0.0278	0.000946	-0.0101	0	0	0	0.0519**	0.0226	0.0137

*** p<0.01, ** p<0.05, * p<0.1

2 by 2

Table 1.2.7. Effect of merger on the market prices, time window "2 by 2", controlling for other mergers' effect, robust s.e.

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.0117	-0.0739***	-0.0992***	0.0638***	-0.0407**	-0.0644***	0.0264	-0.0608***	-0.0870***
Jaguar - (Ford)	-0.0111	-0.0696***	-0.0831***	0	-0.118***	-0.118***	-0.00162	-0.0679***	-0.0850***
Skoda - (VAG)	-0.00431	-0.0623***	-0.0708***	0.000755	-0.0896*	-0.0974**	-0.00628	-0.0631***	-0.0727***
Rover - (BMW)	0.0463***	0.00772	0.00462	-0.0328	-0.0393	-0.0720	0.0381**	0.00240	-0.00182
Mazda - (Ford)	0.0426***	-0.0264**	0	0.0342***	-0.0226**	0	0.0186	-0.0337***	0

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.8. Effect of merger on the close competitors' prices, time window "2 by 2", controlling for other mergers' effect, robust s.e.

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.00950	0.0109	0.0131	-0.0692***	-0.0416**	-0.0423***	-0.0705***	-0.0554***	-0.0467***
Jaguar - (Ford)	0.0355	0.0177	0.00687	0.0229	0.0595*	0.0415	0.00761	0.0204	0.0207
Skoda - (VAG)	0.0335	0.00631	0.00355	0.000531	0.0313	0.0301	0.0498*	0.0125	0.0166
Rover - (BMW)	-0.0245	-0.0136	-0.0194	0.0728	0.0278	0.0542	-0.00116	0.00191	-0.000668
Mazda - (Ford)	-0.0126	0.00546	-0.0120	0	0	0	0.0530***	0.0379***	0.0226**

*** p<0.01, ** p<0.05, * p<0.1

All without other mergers, cluster brand

1 by 1

Table 1.2.9. Effect of merger on the market prices, time window "1 by 1", cluster brand

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.106***	0.116***	0.0976***	0.134**	0.0983**	0.108***	0.114***	0.121***	0.0995***
Saab - (GM)	-0.0104	-0.0502***	-0.0608***	0.0322**	-0.0194	-0.0278**	0.00739	-0.0372***	-0.0490***
Jaguar - (Ford)	-0.0160	-0.0512***	-0.0579***	0	-0.0869**	-0.0894**	-0.00749	-0.0521***	-0.0612***
Skoda - (VAG)	0.00118	0	0	0	0	0	0.000118	0	0
Rover - (BMW)	-0.00174	-0.0153	-0.0204**	0.0316	-0.0133	0	-0.00834	-0.0210**	-0.0251***
Mazda - (Ford)	0.0518**	-0.0249	-0.0201	0.0344**	-0.0238*	-0.0266*	0.0181	-0.0305**	-0.0308**

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.10. Effect of merger on the close competitors' prices, time window "1 by 1", cluster brand

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.0259	0.0275	0.0222	-0.0240	0.0270	-0.00593	-0.0113	0.00956	0.0159
Saab - (GM)	0.00784	0.00366	0.00412	-0.0543***	-0.0406***	-0.0432***	-0.0563**	-0.0447**	-0.0389**
Jaguar - (Ford)	0.0249	0.00909	0.00514	0.00815	0.0431	0.0366	0.0113	0.0212	0.0227
Skoda - (VAG)	0.0335	0.0130	0.00892	0.0465	0.0931	0.0935	0.0409	0.0169	0.0149
Rover - (BMW)	0.00204	-0.00160	-0.00371	-0.0335	-0.00273	0.00712	0.0236	0.0160	0.0111
Mazda - (Ford)	-0.0261	0.00166	-0.00950	0	0	0	0.0547**	0.0235*	0.0146

*** p<0.01, ** p<0.05, * p<0.1

2 by 2

Table 1.2.11. Effect of merger on the market prices, time window "2 by 2", cluster brand

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.138***	0	0	0.132***	0	0	0.144***	0	0
Saab - (GM)	0.0132	-0.0719***	-0.0975***	0.0708***	-0.0319	-0.0595***	0.0352**	-0.0527***	-0.0819***
Jaguar - (Ford)	-0.0109	-0.0681***	-0.0818***	0	-0.115***	-0.116***	-0.00168	-0.0672***	-0.0865***
Skoda - (VAG)	-0.00377	-0.0567***	-0.0683***	0.00184	-0.0856***	-0.0958***	-0.00636	-0.0578***	-0.0706***
Rover - BMW)	0.0420***	0.00521	0.00270	-0.0359	-0.0423	-0.0741	0.0333***	-0.00100	-0.00450
Mazda - (Ford)	0.0432*	-0.0266*	0	0.0348**	-0.0226*	0	0.0186	-0.0340**	0

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.12. Effect of merger on the close competitors' prices, time window "2 by 2", cluster brand

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	0.0179	0.0220	0.0178	0.0108	0.0419	0.0219	-0.0136	0.00546	0.0116
Saab - (GM)	0.0142	0.0122	0.00789	-0.0732***	-0.0488***	-0.0486***	-0.0648**	-0.0557**	-0.0507***
Jaguar - (Ford)	0.0252	0.0159	0.00224	0.0223	0.0590	0.0386	0.00903	0.0251	0.0218
Skoda - (VAG)	0.0329	0.0103	0.00486	0.00145	0.0338	0.0313	0.0480**	0.0163	0.0172
Rover - (BMW)	-0.0241	-0.0161	-0.0213	0.0708	0.0269	0.0531	-0.00140	0.000224	-0.00240
Mazda - (Ford)	-0.0126	0.00585	-0.0112	0	0	0	0.0547***	0.0390***	0.0245*

*** p<0.01, ** p<0.05, * p<0.1

All with other mergers, cluster brand

1 by 1

Table 1.2.13. Effect of merger on the market prices, time window "1 by 1", controlling for other mergers' effect, cluster brand

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.0108	-0.0513***	-0.0614***	0.0292**	-0.0261*	-0.0320***	0.00170	-0.0440***	-0.0540***
Jaguar - (Ford)	-0.0155	-0.0518***	-0.0589***	0	-0.0890**	-0.0919**	-0.00620	-0.0529***	-0.0624***
Skoda - (VAG)	0.000691	0	0	0	0	0	-0.000465	0	0
Rover - (BMW)	-0.00172	-0.0153	-0.0204**	0.0313	-0.0134	0	-0.00833	-0.0210**	-0.0251***
Mazda - (Ford)	0.0520**	-0.0245	-0.0196	0.0335**	-0.0239*	-0.0266*	0.0182	-0.0303**	-0.0305**

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.14. Effect of merger on the close competitors' prices, time window "1 by 1", controlling for other mergers' effect, cluster brand

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.00767	-0.00167	0.00222	-0.0519***	-0.0354**	-0.0394***	-0.0615*	-0.0465*	-0.0398**
Jaguar - (Ford)	0.0375	0.00484	-0.00278	0.00959	0.0428	0.0358	0.00963	0.0147	0.0158
Skoda - (VAG)	0.0343	0.0128	0.00882	0.0453	0.0936	0.0938	0.0421*	0.0167	0.0147
Rover - (BMW)	0.000959	-0.00241	-0.00377	-0.0337	-0.00288	0.00712	0.0230	0.0156	0.0115
Mazda - (Ford)	-0.0278	0.000946	-0.0101	0	0	0	0.0519**	0.0226*	0.0137

*** p<0.01, ** p<0.05, * p<0.1

2 by 2

Table 1.2.15. Effect of merger on the market prices, time window "2 by 2", controlling for other mergers' effect, cluster brand

Coefficient of	Post Merger								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.0117	-0.0739***	-0.0992***	0.0638***	-0.0407*	-0.0644***	0.0264	-0.0608***	-0.0870***
Jaguar - (Ford)	-0.0111	-0.0696***	-0.0831***	0	-0.118***	-0.118***	-0.00162	-0.0679***	-0.0850***
Skoda - (VAG)	-0.00431	-0.0623***	-0.0708***	0.000755	-0.0896***	-0.0974***	-0.00628	-0.0631***	-0.0727***
Rover - (BMW)	0.0463***	0.00772	0.00462	-0.0328	-0.0393	-0.0720	0.0381***	0.00240	-0.00182
Mazda - (Ford)	0.0426*	-0.0264*	0	0.0342**	-0.0226*	0	0.0186	-0.0337**	0

*** p<0.01, ** p<0.05, * p<0.1

Table 1.2.16. Effect of merger on the close competitors' prices, time window "2 by 2", controlling for other mergers' effect, cluster brand

Coefficient of:	Post Merger * Close Competitor								
Treatment:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	0.00950	0.0109	0.0131	-0.0692***	-0.0416**	-0.0423**	-0.0705**	-0.0554**	-0.0467**
Jaguar - (Ford)	0.0355	0.0177	0.00687	0.0229	0.0595	0.0415	0.00761	0.0204	0.0207
Skoda - (VAG)	0.0335	0.00631	0.00355	0.000531	0.0313	0.0301	0.0498**	0.0125	0.0166
Rover - (BMW)	-0.0245	-0.0136	-0.0194	0.0728	0.0278	0.0542	-0.00116	0.00191	-0.000668
Mazda - (Ford)	-0.0126	0.00546	-0.0120	0	0	0	0.0530***	0.0379**	0.0226*

*** p<0.01, ** p<0.05, * p<0.1

1.6. Conclusion

In my research I examined how the mergers of Seat-VAG, Jaguar-FORD, Saab-GM, Skoda-VAG, Rover-BMW and Mazda-FORD affected the prices in the UK market. From the prices trends, it seems that the merging firms of Jaguar-Ford, Skoda-VAG and Mazd-Ford increased their prices relative to the ones of the rest of the market and their close competitors. However, with the exception of the close competitor type "location & segment" of Mazda-Ford, their close competitors'relative prices do not seem to be affected by the mergers. On the other hand, while the firms of the other three mergers did not increase their relative price, yet there was an intensive mobility on the prices of their close competitors. The close competitors of Seat-VAG and Rover-BMW increased their prices while the mobility on the ones of Saab-GM is mixed. Close competitors type "location" drops its average price relative to the rest of the market. However, for the close competitor type "segment", there is an increase in the relative prices while for "location & segment", there is no notable impact on them.

Literature in mergers & acquisition has shown that in most cases the mergers increase prices. However, that was not the case for the mergers that I examined. From my results, most of the examined mergers had no statistically significant negative effect on the close competitors' prices. In order to ensure that these results are consistent I used three alternatives for my hedonic price, two different time windows, two different hypothesis for the error term and three different types of close competitors, i.e. car models manufactured in the same country, car models of the same segment and car models of the same segment which were manufactured by factories in the same country as the merged ones. Furthermore, I examined how my results are affected when I control for the effects of other mergers that were close to the merging year. Nevertheless, it did not have any significant effect on the results of most of the mergers.

Two of the six mergers, i.e. Seat-VAG and Rover-BMW, had no results with a statistically significant effect at all. The other four had some results with a statistically significant effect. The Mazda–Ford, Jaguar-Ford and Skoda-VAG mergers had some significant positive effects while Saab–GM showed a significant negative one. However, only the results of Mazda–Ford and Saab-GM are robust enough to conclude that these mergers had an effect on the prices of its close competitors and, in fact, the most robust result comes from the Saab–GM merger which was a negative one. Moreover, the results of the regressions that showed a significant

positive effect on prices were smaller (around 2% to 6%) than those of Saab–GM, which showed a negative effect (around 4% to 7%). Thus, even if the merger of Mazda-Ford led to higher prices, overall the six mergers did not harm consumers.

The results of this research are a clear indication that a merger not only may be harmless for the market but it could be beneficial for it, which is quite surprising for advocates against mergers. A possible explanation is that the efficiency gains seem to overcome the unwanted effects from the decreased competiveness of the market, and the prices are not affected - or even drop - after the merger. Hence, leaving aside the case of Mazda–Ford, where there is some indication that it might have led to higher prices, the antitrust authorities' decision to allow these mergers was correct and in the case of the Saab-GM merger, the consumers benefited from it with lower prices.

We may not be able to generalize the results for future mergers; however they show that theory alone cannot predict the outcome of a merger and it constitutes an empirical question. Therefore, further research should be conducted in order to have a better picture of how a merger affects the market prices.

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Chapter 2: The impact of mergers on variety

2.1 Introduction

Mergers are a significant worldwide phenomenon that is greatly puzzling both antitrust agencies and empirical economists. Merger activity has witnessed an unprecedented increase over the last three decades, both in terms of monetary value and number of deals involved. The number of mergers reviewed by antitrust regulators in 2015, for example, was 46,977 (compared to 36,204 in 2005 and 20,666 in 1995) with a total merger value that exceeded $4.5 trillion.[21] Examples of large mergers that caught the headlines abound: Pfizer merged with Warner-Lambert for $90 billion in 1999, Comcast merged with the broadband unit of AT&T for $60 billion in 2002, Procter & Gamble bought Gillette for $57 billion in 2004, Pfizer acquired Wyeth for $67 billion in 2009 and Anheuser-Busch Inbev bought SABMiller PLC for $109 billion in 2015.

My research is focused on how horizontal mergers affect product variety. Theory suggests that merging firms may spread apart similar products in order to reduce competition among their products. However, if relocation costs are too high then these firms may prefer to withdraw them from the market and decrease variety. Moreover, the merging party may crowd products together in order to preempt entry which can either increase variety or result in too many products and too few varieties. Furthermore, the diffusion of know-how and combination of the merged firms' production line allow them to offer additional products, something which tends to increase variety. Thus the effect of mergers on variety is an empirical question and it is important to understand how mergers, which are allowed or prohibited by antitrust policy, affect the market.

In this paper I am focusing on the automobile industry. During the previous decades there was an intensive change in the ownership structure of the automobile industry. I examine how the mergers of Seat by VAG in 1986, Jaguar by FORD in 1990, Saab by GM in 1990, Skoda by VAG in 1991, Rover by BMW in 1994 and Mazda by FORD in 1996 affected the prices in the UK market, using aggregate yearly data which includes prices, sales and a large number of characteristics of the new models sold between 1971 and 2002. According to the European

[21] IMAA https://imaa-institute.org/mergers-and-acquisitions-statistics

Commission, their concentrations do not raise serious doubts as to their compatibility with the Common Market and the functioning of the EEA Agreement. Therefore the Commission had decided not to oppose the notified operations and to declare them compatible with the common market and with the functioning of the EEA Agreement[22]. However, even if the Commision's decisions were correct, nothing has been said about their effect on product variety.

The very first model in which firms compete not only on prices but also on their product characteristics is the one of Hotelling (1929). In his model he examined how firms compete with products that are located on one dimensional space and a large number of small buyers that are uniformly distributed in that space. He uses a two-stage game in which firms firstly select their products' location and then they compete in prices. Each buyer's location is assumed to be his preferred type of product whose distance from the product location is his transition cost for that product. Thus, his total cost is the price of the product plus the transportation cost. As a result, in a duopoly, despite the fact that they will face a higher competition, firms will locate their products as close as possible and near the center in order to acquire the highest possible share. If there are more than one firms, each firm eventually compete only with its closest ones (the closest from the left and from the right). As a result, regardless of the number of the brands, each one will behave as an oligopolist. This model implies that there may be two different outcomes from a merger. On the one hand, mergers soften price competition so there are less incentives for differentiation in the market. On the other hand a merger may prefer to reduce competition through repositioning products away. However, in Hoteling's model a merger, which lead to a monopoly, does not really need different products since he can acquire the full market with just a single product. As a result he may prefer to keep only one product in the market. As a result, a merger will prefer to reduce the profit cannibalization of its firms which can be achieved either by higher differentiation or by dropping some products. Hence, the effect of a merger on product variety cannot be easily predicted.

Despite the very intuitive work of Hotelling, d'Aspremont, Gabszewicz, and Thisse (1979) showed that for locations that are not far enough from each other there is no pure strategy price equilibrium. In order to avoid the non-existence of equilibrium, they proposed a slightly modified version of Hotelling's in which the transportation costs are quadratic with respect to the distance which solved the problem.

[22]This decision is adopted in application of Article 6(1)(b) of Council Regulation No 4064/89.

Another interesting variant of the Hotelling's model is the one of Salop's (1979) circular city model. In this model he examined large market without boundary effects since firms are located in a circle instead of a line and there is also an outside good. The existence of the outside good implies that consumers are not obliged to buy any of the competing products. In contrast to the original model of Hotelling, here a symmetric equilibrium exists. However, his findings are very similar to the ones of Hotelling in which there are two opposite incentives for the firms. On the one hand firms prefer to locate as far as possible to reduce completion. On the other hand there is an incentive to locate at the centre (among the other firms) in order to increase their market share by reaching out to the greatest amount of customers. Thus, there are two opposite effects where the first one will increase differentiation and variety while the second one will reduce it.

However how realistic is to assume that products differ in a single characteristic? How generalizable are the conclusions from models in which products are located in a single dimensional space? Lancaster (firstly at 1966 and later at 1976 and 1979) has developed a more realistic model in terms of substitutability. These are the so called "Lancastrian models" which instead of using a single dimensional space they use a virtual space of their characteristics. Each good has the same characteristics but in different proportions. Thus, each good is defined by the bundle of its (measurable) characteristics. Similar to the Hotelling model, each consumer has its preferred bundle of characteristics and he chooses either one of the goods in the market or the outside good. The benefits from this model is that "wood will not be a close substitute for bread, since characteristics are dissimilar" while in the Hotelling model it is just a matter of taste.

So far I have presented models of two-stage game where firms select locations and then compete on prices. In theoretical literature there are also examples in which firms select simultaneously both location and price like in the research of Eaton and Lipsey (1978) and Novshek (1980). However a more recent and interesting research is the one of Gandhi, Froeb, Tschaunz and Werden (2008). They used an one-dimension location game in which both locations and prices are chosen simultaneously to analyze the effects of a merger in product variety. A merger internalizes the competition between products combined by the merger. As a result, in a price competition model it will lead to higher prices for the merging firms. However in their price-location model the results may be different. They assumed that the merging firms can instantaneously and costlessly reposition their products. They found that the higher the substitutability of their products the stronger the incentive to relocate them. Thus merging firms

prefer to increase the distances of their products which reduces the incentive to raise prices. Furthermore, consumers will be benefited in the case of repositioning from two aspects. On the one hand the increase in variety will have a direct positive effect on the consumer surplus, and on the other hand price increase will be significantly less than in the price-competition model. However, they note that product repositioning in the real world can be quite expensive and time consuming. As a result mergers may have no effect on product positioning in the short run.

From an empirical point of view, one indication about how the variety will be affected from the merger is the firms' concentration. Alexander's empirical research (1997) examined the relation between product variety of the hit songs and ownership market structure in the music recording industry. The advantage of examining the music industry is that the products-songs contain quantifiable information (i.e. time and meter, accent, harmonic structure, melody, and form) which can be used to compute product variety. He used annual sample from 1955 to 1988 during which the industry transformed from a highly competitive market structure to an oligopoly one. In order to identify the market structure he used two different measures; the Hirschman-Herdindahl index and the four-firm concentration ratio. In his model, variety is a function of structure, the square of structure and a time index to capture any time trends that may be present in the data. His results suggest that the relationship is non-monotonic as the maximum variety is promoted more by a moderately concentrated structure rather than high and low levels of concentration which result in lessened variety.

Probably the most influential empirical research regarding the relation between ownership concentration and product variety is the one of Berry and Waldfogel (2001). They document the effect of mergers on variety in the Radio Broadcasting market by examining the effect of the relaxed ownership restrictions by the 1996 Telecommunications Act. Before 1996, there was the "radio contour overlap rule" which limited the number of jointly owned stations in a local market to no more than three or four stations, depending on the size of the market. This was the key to their research since the relaxation of that rule allowed concentration to increase in different levels in different markets. This exogenous consolidation change provided them the needed instrumental variables for measuring the effect of concentration on variety. They used the "policy bands" dummies according to the number of stations in 1993 in order to instrument for the change in ownership concentration. Furthermore, they used the population to measure the market size. They found that consolidation reduced station entry without reducing variety and

increased the amount of programming variety relative to the number of stations. Furthermore, they found some evidence that consolidation increases the amount of programming variety per station and raises overall variety.

Goetz and Gufler (2006) shows that if the exit costs are not high enough, then a merger in a spatially differentiated economy will probably lead to reduced product variety. Their findings are based on data from the Austrian retail gasoline market and they measure the number of gasoline stations per region as the product variety of the market since it is less subject to endogeneity. They used as explanatory variables the population density, the Herfindahl index or alternatively the four-firm concentration measure and an interaction term of Herfindahl index with population. They found a statistically negative effect of concentration in variety which becomes even more intensive for higher population. Thus, the higher the population the larger the exit-inducing effects of increasing concentration. Furthermore, the more populated areas usually have higher property prices which means better outside opportunities for the station owner. This implies that in areas where fixed costs are higher relative to the exit costs, a reduction of variety by the merger is more possible. Moreover, they also estimated a 2sls regression where they instrumented the Herfindahl index and its interaction term. The results remain similar but with the coefficient of the interaction term been even more negative than in the corresponding OLS regression. They concluded that while concentration seems to affect variety negatively, the fixed entry and exit costs are the key determinants whether variety would be affected or not.

George (2007) suggested that multi-product firms will internalize the business stealing and as a result mergers may encourage firms to reposition products which would lead to higher variety. In order to prove her claims, she examined the effect of ownership concentration on product positioning and product variety in the market for US daily newspapers. At the beginning of 1993, acquisitions increased markedly where the number of papers changing hands jumped from an average 40 per year to about 100 per year. This intensive acquisition activity dropped in 2001 and return to the usual 40 acquisitions per year. George exploited that intensive change on the acquisition rate and used data from that period to examine how concentrations affect variety. As a measure of variety of the papers she used the number of different topics covered by the reporters in the market. In order to estimate the effects of concentration in the variety, she examined how variety differed during the period of intensive merger activity. She found that reducing the number of owners of daily papers in a city caused an increase in variety without

reductions in the per capita newspaper sales.

One more example of empirical study which uses data from the radio industry to examine how mergers affect product variety is the one of Sweeting (2010). He used micro-level data on the programming of individual radio stations to look directly at variation in stations' play lists following consolidation. He examined whether a common owner tends to differentiate the playlists of his stations relative to the ones of the independent stations. He found that differentiation increases six months after a merger. Moreover, he tested whether a common owner will position his stations closer to his competitors using a fixed effects specification. His findings indicate that a common owner tends to locate at least one of his stations closer to a competitor. Furthermore he examined the changes in market shares and found that in fact there is an increase in the common owners' market share. However, these market gains seem to be from the competitors and not from new listeners since there is no significant increase for stations that do not face any competition. In his results he found that there is a statistically significant decline in the number of competitors. To sum up his findings, despite the fact that mergers differentiate their stations, they simply reposition closer to the competitors. As a result, mergers did not increase variety when competitors were present and did not increase the number of listeners.

In my research, in order to determine the effect of a merger, I use a difference-in-differences (diff-in-diff) methodology. The key idea behind the diff-in-diff methodology is to compare variety before and after a merger. This comparison relies on three factors: (i) that the merger is an exogenous, unexpected event for all non-merging firms[23], (ii) an appropriate control group is selected to control for any other irrelevant factors affecting prices post-merger, and (iii) an appropriate time window around the merger is chosen. I use as a treatment group the merged firms and as a control group, I use their close competitors. The main advantages of this methodology stem from the clear identification (conditional on the three previous factors) and the ease of estimation. Its empirical credibility though comes at a cost: it is very difficult to generalize the results derived from one merger to future mergers in other industries, or even the same industry.

The research of Hastings (2004) is a good example of research which used the diff-in-diff methodology to evaluate the effect of a merger on the market. She analyzed the price effects of

[23]For the merged firms, it will not be an unexpected event. However we expect that it did not affect their production before the merger due to the time-consuming and high costs of repositioning their products.

the acquisition of Thrifty, a California gasoline retail chain selling unbranded gasoline, by Arco, a national branded and vertically integrated gasoline chain. After the merger, Arco re-branded the Thrifty stations with the Arco name and colors. Hastings studies how rivals' prices changed as a result of the merger. To do so, she compares the differences in price change, before and after the merger, between gas stations that were near a Thrifty station (the treatment group) and those that were not (the control group). The circumstances of the acquisition provide a reasonable basis to think that the merger can be considered as exogenous to the local market; that is, it seems unlikely to be correlated with any unobserved factors that would have changed prices in markets containing Thrifty stations differently from prices in markets without them. She finds that gas stations that were near a Thrifty station raised their prices after the merger more than those that were not, indicating that the merger caused prices to increase.

Another empirical example is the research of Ashenfelter and Hosken (2008) who evaluate the effectiveness of U.S. horizontal merger policy, by examining five of the most problematic cases from the antitrust agencies' point of view. The cases under examination are Proctor and Gamble's purchase of Tambrands (feminine hygiene products), Aurora Foods' (Mrs. Butterworth) purchase of Kraft's Log Cabin breakfast syrup business, Pennzoil's purchase of Quaker State motor oil, General Mills' purchase of the branded cereal business of Ralcorp and the merger of the distilled spirits businesses of Guinness and Grand Metropolitan. The first three mergers were apparently allowed to be consummated with no government inteference while the other two were modified by the FTC (Federal Trade Commission). Their empirical results indicate that four of the five mergers that they studied resulted in some increases in some consumer prices[24], typically between 3% and 7%, while the fifth merger had little effect on prices. However, in the four mergers where they found substantial evidence of a price increase, manufacturers did not increase all of their prices uniformly. Instead, the merged firm chose to increase the price of one of its products (or a set of products) while holding the other prices more or less fixed.

[24] Short run

2.2. Background information of the mergers

In 1982, VAG initiated cooperation with the Spanish automobile producer SEAT S.A. (SEAT) concerning the production of the models VW Passat and VW Polo. The motive for this cooperation was that the management of VAG wanted to gain access to Spanish production plants in order to gain efficiency and reduce total production costs. This cooperation continued until 18 June 1986, when VAG acquired 51% of the shares in SEAT, thus becoming the majority shareholder of the Spanish firm, and increased its interest to 75% by the year's end. The reported motive for the final acquisition of SEAT, in addition to increased economic efficiency, was that VAG wanted to gain further access to the southern European automobile markets, and to incorporate another brand into the firm's "portfolio" of automobiles.[25]

In 1989, Ford Motor Company announced that it planned to buy Jaguar P.L.C. for a total cost of nearly $2.38 billion. The deal was completed in 1990 and reflects the continuing consolidation of the world's auto industry and the eagerness of big car makers to acquire prestigious brands. However Ford had very little idea of the problems that Jaguar was facing. The increased competition from the Japanese moving into the luxury-car sector, the high cost of developing new models, and a downturn in the crucial American market have made it increasingly difficult for smaller car makers like Jaguar to go it alone. Ford's offer may seem extraordinarily high for a company that made 51,939 cars in the year prior to the acquisition and even then was barely breaking even. But Ford executives made it clear that they were paying a premium for the Jaguar name and would invest heavily to turn the British company into a much bigger producer.[26] After three years of plunging sales, the company was losing $1 million a day when Mr. Scheele arrived at Jaguar's Browns Lane plant outside Coventry in 1992.[27]

In 1989, the Saab car division of Saab-Scania was restructured into an independent company, Saab Automobile AB, headquartered in Sweden. At a press conference on 15 December 1989,

[25] Mergers and Economies of Scale: Volkswagen AG 1976 – 2000, Niklas Rudholm, Department of Business Administration and Economics, University of Gävle, Sweden ,October 2006
[26] Ford to Buy Jaguar for $2.38 Billion
http://www.nytimes.com/1989/11/03/business/ford-to-buy-jaguar-for-2.38-billion.html
[27] Ford Puts British Automaker on the High Road : Jaguar Comes Roaring Back
http://www.nytimes.com/1999/03/24/business/worldbusiness/24iht-jag.2.t.html

GM announced that it was buying 50% of Saab's car operations.[28] In 1990, General Motors (GM) bought a 50% (controlling) share of the company for over £380 million. Saab benefitted from the supply chain, as well as by learning from the experience of a global dealer. For GM this was a chance to gain a position in the European luxury car market, after previous failed attempts.[29]

On March 28 1991, a joint-venture partnership agreement between Skoda and Volkswagen took place, marked by the transfer of a 30% share to the Volkswagen Group on April 16, 1991. The main motive behind this merger was the good access to the car markets of eastern-central and eastern Europe and the fact that their cooperation in production could lead to increased efficiency.[30]

Concerning the Rover – BMW merger, it all began with BMW's recognition that, like its rival, Mercedes-Benz, it needed to achieve greater economies of scale. As Mercedes expanded organically with additional models - the merger with the Chrysler Corporation came later - BMW decided on growth by acquisition. In 31 January 1994, British Aerospace announced the sale of its 80% majority share of the Rover Group to BMW. BMW paid the equivalent of $1.35 billion for the Rover Group, and nearly doubled that figure in subsequent investment. However, what looked like a bargain (Ford paid $2.4 billion for the much smaller Jaguar company) was actually a liability. BMW completed its deal in only 10 days and did not look closely enough at the operation of the businesses within Rover. Had it done so, it may have had a much better view of Rover's problems, such as inaccurate sales data. It did not have profits or a strong balance sheet, and it had been starved of cash for decades. However, in terms of capitalization, it was a decent deal since Rover's production capacity was 700,000 cars while BMW's was only 500,000.[31]

The Japanese car manufacturers managed to improve on productivity and quality far beyond what most North American firms had ever achieved in the small car market. Instead of competing head on with the Japanese, Ford preferred to acquire Mazda in order to learn and be able to compete in these market segments. In 1979 FORD and MAZDA entered into an

[28] G.M. to Buy Half of Saab Car Unit
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[31] How brash BMW ran Rover to catastrophe
http://www.theguardian.com/business/2000/mar/26/rover.observerbusiness

agreement under which FORD acquired a 24.5% shareholding in Mazda with the two companies maintaining their autonomies. In 1996 Ford completed its merger with Mazda, increasing its shareholding to a 33,4% controlling stake of Mazda.[32] From their partnership, there was a great diffusion of know-how and new models arose after their merger. Soon thereafter, Henry Wallace was appointed President, and he set about restructuring Mazda and setting it on a new strategic direction. [33]

2.3. Empirical Methodology

The major issue faced by any attempt to estimate the effect of the merger on product variety, as with any evaluation of an intervention using non-experimental data, is the method used to control for other confounding factors that may also have changed at the time of the event. Of special concern is the effect of possible changes in demand, automobile regulation or costs on variety.[34] The method I use to control for these factors is familiar from the literature on diff-in-diff estimation, focussing on the selection of a control group and the selection of a window of data surrounding the events I am studying. The former is important for dealing with permanent time-varying factors while the latter can be very useful in dealing with transitory time-varying factors.

The key idea behind the diff-in-diff methodology is to compare prices before and after a merger. This comparison relies on three factors: (i) that the merger is an exogenous, unexpected event for all non-merging firms, (ii) an appropriate control group is selected to control for any other irrelevant factors affecting prices post-merger, and (iii) an appropriate time window around the merger is chosen. The main advantages of this methodology stem from the clear identification (conditional on the three previous factors) and the ease of estimation. In our case we can choose an appropriate treatment in order to find the effect on the close competitors of the merged firms (e.g. models of the same segment as the one sold by the merged brands), and the

[32] REGULATION (EEC) No 4064/89 MERGER PROCEDURE, Case No IV/M.741 - Ford / Mazda, Article 6(1)(b) NON-OPPOSITION Date: 24/05/1996, http://ec.europa.eu/competition/mergers/cases/decisions/m741_en.pdf
[33] Ford and Mazda: A lesson in cooperation, Automotive news, June 16, 2003 http://www.autonews.com/article/20030616/SUB/306160777/ford-and-mazda:-a-lesson-in-cooperation
[34] For instance, an increase on fuels' price due to regulation or oil crisis will probably lead to lower demand on high fuel consumption cars like sports cars. As a result the manufacturer may drop some of their sports cars and lead to lower variety on this segment.

rest of the market as a control group. I also use different time windows: given that a merger is an exogenous event for the rest of the market and unexpected since its approval is not stated long before the time of the event, the diff-in-diff can be applied to our case. Its empirical credibility though comes at a cost: it is very difficult to generalize the results derived from one merger to future mergers in other industries or even the same industry

I use the following empirical specification:

$$\log(Models_{it}) = \alpha + \beta_1 X_{it} + \beta_2 \Psi_{it} + \beta_3 [\text{Post Merger}]_{it} + \beta_4 [\text{Post Merger}]_{it} [\text{Merging Party}]_{it} + \beta_5 [\text{Year}] + \beta_6 [\text{Brand}] + \beta_7 [\text{Location}] + \beta_8 [\text{Segment}] + \beta_9 [\text{Other Mergers}] + \beta_{10} [\text{Rest Aqcuisition Brand}] + \beta_{11} [\text{Rest Aqcuisition Party}]$$

where: a = constant

X_{it} = primary characteristics of product i in year t

Ψ_{it} = secondary characteristics of product i in year t

Year = year dummies

Brand = brand dummies

Location = location dummies

Segment = segment dummies

Other Mergers = join other merger dummies

Rest Aqcuisition Brand = join the examined merger group dummies

Rest Aqcuisition Party = examined merging party acquire other brand dummies

$Models_{it}$ is the number of models of product i's brand in year t. I count as one model the cars that have the same model name, cc (cubic centimeter of engine) and bhp (horse power), and examine two different cases. The β_1 and β_2 capture tendencies of different levels of variety given different primary and secondary characteristics of cars respectively, where the secondary characteristics are bundles of similar characteristics of the car[35]. I include year, brand, location (equals 1 if the selected model is produced in that country), and segment dummies to control for seasonal, brand, location and segment effect on variety, respectively. I also include the "Other Mergers" dummy

[35] For example, instead of using two different dummies for radiocassete and radiocd, we use the bundle of radio. This takes the price of 0, 1 or 2 when there is no radio, radiocassete or radiocd respectively.

to control for effects on product variety that are involved in other mergers.[36] Similarly, I include the "Rest Acquisition Brand" and "Rest Acquisition Party" dummies (for simplicity, we call them the "Rest Merger" dummies) in order to control for the possible effect on product variety that was involved from other acquisitions of the merger under examination. The "Rest Aqcuisition Brand" dummy equals one if car's i brand has completed its acquisition from the merging party under examination. The "Rest Acquisition Party" equals one for all cars of the merging party a year after the acquisition. The coefficient β4 measures the proportionate variety increase/decrease of the merged firms relative to those in the control group, while β3 measures the proportionate variety increase/decrease that the event of the merger brings to all brands in the market. Since it is a log-level function, a one-unit increase of variable i will lead to a β_i*100% increase on variety.

I use six alternatives of the above function for my regressions. The first one, which I call "basic", includes the "Year", "Brand", "Location" and "Segment" dummies. Then, in the previous specification I add the primary characteristics and I name this "primary". The third one, named "All", includes all the previous variables plus the secondary characteristics. I also examine three more alternatives by adding the "Other merger" dummies in the previous specifications. Similarly, I examine six more alternatives to the previous specifications by adding the "Rest Merger" dummies.

The ideal event window should be long enough to capture any changes in variety associated with the merger, but not too long in order to avoid noise from other changes in the market. I consider three different time windows. The first one is the "1 by 1" which includes data one year before and one year after the merger. This window is very short and should avoid any contaminating effects. The second one is the "3 by 3", which is larger, in order to be more certain that it captures the full effect of the merger and includes data three years before and three years after the merger. The third one is the "5 by 5" which contains data five years before and five years after the merger. This is the widest time window, which captures most of the effects of the merger but also suffers the most from uncontrolled contaminating effects.

[36] For instance, suppose that we examine the acquisition of Seat by VAG. A car by Saab or by the brands owned by GM will have its dummy "other_merg_saab_gm" equal to one after the merger of Saab - GM, i.e. after 1990. Similarly, a car by Skoda or by the brands owned by VAG will have its dummy "rest_merg_seat_gm" equal to one after the merger of Saab - GM, i.e. after 1990.

As a treatment group, I use the merging firms and I consider three different cases of close competitors as control groups. The first consists of the car models manufactured in the same country, the second consists of the car models of the same segment and the third consists of the car models of the same segment which were manufactured by factories in the same country[37] as the merged ones respectively. All control groups are close competitors but without participating in the merging party. Thus for the control group it is an exogenous unexpected event.

The primary advantage of using a control group is that it should control for shocks to both demand and cost that may affect variety. An increase in fuel prices, for example, may increase the demand for a small or more fuel-efficient car which may lead to higher variety for these segments of the treatment group and/or reduced variety for the other segments. The variety of the same segments of their close competitors will be affected in a similar way, serving as a control for the relative variety shift. Similarly, a productivity shock such as an increase in the price of steel (material used for the production of cars) will lead to a reallocation of their products' characteristics, e.g. cars with more plastic parts, and lead to higher or lower variety (depending on whether they drop the more steel oriented cars, or introduce cars with more plastic parts) not only for the treatment group but also for the rest of the market. The disadvantage of using the close competitors as a control group is that these products are likely to be close enough substitutes to the merging party. Thus, their variety will also be affected by the merger. Nevertheless, it is likely that the effect on the variety of these competitors will be lower than that of the merging party. Hence, while measuring variety changes relative to our control group may understate any variety decrease due to the merger, the sign of the relative variety decrease should be correct.

I use two alternatives for the dependent variable "models". In the first specification, named "specific variety", I count the number of each firm's models that are close substitutes to those of the merging firms. In the second case, named "total variety", given that a firm is a close competitor producing a close substitute, I count the total number of models produced by that firm. The former will avoid more noise from unexpected effects in the close competitors' product variety while the latter should control better for any concequent repositioning from the competitors.

[37] For example if one of the merged cars is a sports car manufactured in France, then I will include in my control group all sports cars manufactured in France

I used two different hypotheses for the error term. The first one is clustering over model name. The other is the robust standard error. The reason behind using cluster errors is due to the fact that the variations of the same model are likely to be correlated. For instance, car bodies are not only produced from the same production lines, but most variations of the model use the same car body. Moreover, variants of the same model share similar characteristics and as a result will be affected similarly by shocks on consumers' preferences. Hence, there would be some correlation between these cars and as a result shocks of productivity costs or demand will affect the variety of these models in a similar way.

2.4. Data

The data is annual and includes the unit sales, inflation-adjusted market prices to the year 2014 and characteristics of all new car model variants sold in the United Kingdom over the period 1981–2001. The characteristics are categorized into primary and secondary characteristics, with 6 primary characteristics and 27 secondary characteristics. It also includes 8 market segments, 19 locations, 68 brands, 21 years, 6 other-merger and 4 pairs of rest-merger dummy variables.

I used three different control groups. The first is cars manufactured in the same location, the second is cars of the same segment and the third is cars of the same segment manufactured in the same location as the merged ones. For convenience, I call them "location", "segment" and "location & segment" respectively. These control groups, depending on how I specify the close competitor, are composed of different cars.

Tables 2.1.1 to 2.1.6 present the basic statistics of the variables included in Primary Characteristics for the two time windows of the mergers of Seat - Vag, Saab - GM, Jaguar - Ford, Skoda - VAG, Rover – BMW and Mazda – Ford respectively. The primary characteristics are power (brake horsepower divided by weight), economy (miles per pound at 56 mph in real 2014 prices), size (length multiplied by width), fuel injection, diesel engines and turbo (dummy variables) between 1981 and 2001.[38] Graphs 2.1.1.a to 2.1.1.d show the total product variety of the merging party of Seat – Vag and that of the rest of the market, the cars

[38] Details and statistics of all variables are presented in the Appendix

manufactured in the same country, the cars that belong to the same segment and the cars of the same segment, which are manufactured in the same country as the merged ones, respectively, in a time window of 5 years before and 5 years after. Similarly, graph sets 2.1.2.a -2.1.2.d to 2.1.6.a-2.1.6.d stand for the mergers of Saab - GM, Jaguar - Ford, Skoda - VAG, Rover - BMW, and Mazda – Ford respectively.

Seat (VAG) 1986

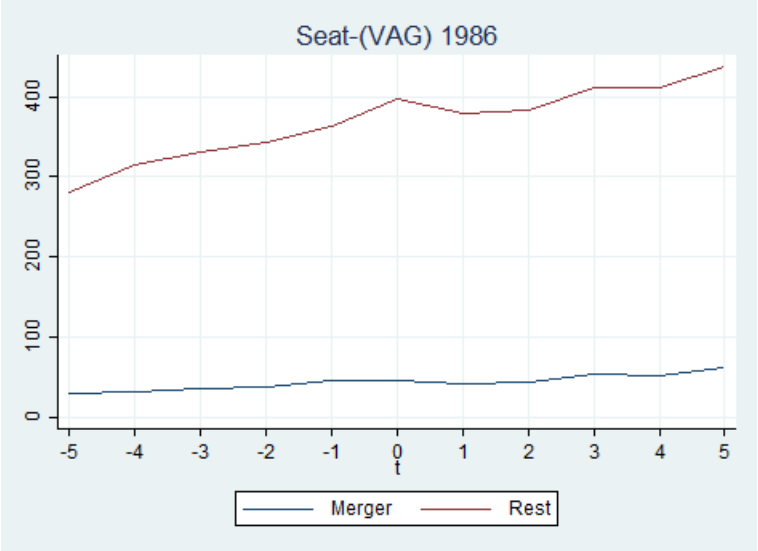
When I use the "location" control group, I use cars manufactured in West Germany, Spain and the Czech Republic. When I use the "segment" control group, I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury and Sports. When I use the "location & segment" control group, the models that are included are from West Germany (Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports), Spain (Mini/Super-Mini, Small Family, Medium) and the Czech Republic (Small Family, Sports).

Table 2.1.1 Statistics of basic characteristics (Seat – VAG)

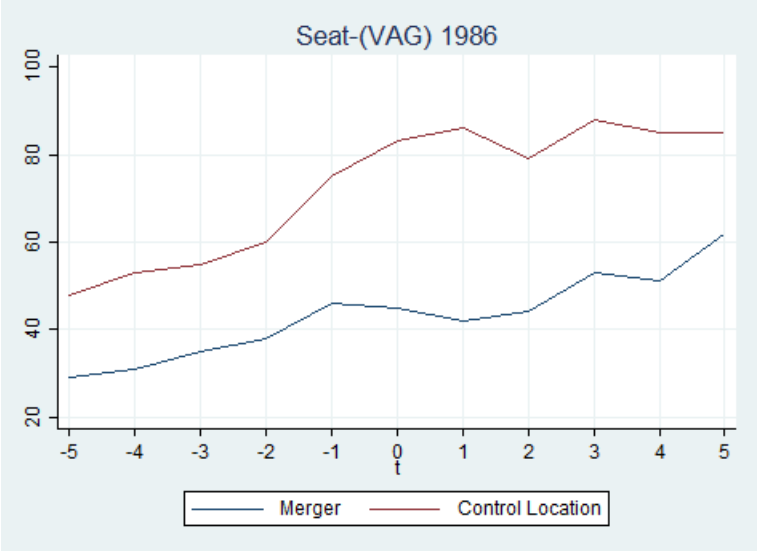
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	87804.2	30522.8	88332.5	31270.7	89564.2	31784.9
Size (=length* width)	72.8081	11.9213	72.8533	11.6328	73.2508	11.7872
Economy (= miles per pound)	45.7054	10.7608	46.78	12.1411	46.5236	12.2601
Fuel injection	0.28121	0.44985	0.2787	0.44845	0.30217	0.45925
Diesel fuel	0.09918	0.29908	0.0967	0.2956	0.09112	0.28782
Turbo	0.08168	0.27404	0.07822	0.26858	0.07365	0.26124
Post-merger	0.50992	0.50019	0.53066	0.49916	0.55855	0.49662
Post-merger * merging party	0.05134	0.22082	0.05818	0.23412	0.06492	0.24641

From Graph 2.1.1.a the merging party seems to have increased their variety one year after the acquisition of Seat, i.e. when t = 1, relative to that of the rest of the market. However, one year later and for the following years, i.e. after t = 2, their relative variety falls. When we compare it to the equivalent of their close competitors (Graphs 2.1.1.b to 2.1.1.d), only when we use "segment" as close competitors does there seem to be some mobility similar to that of the rest of the market.

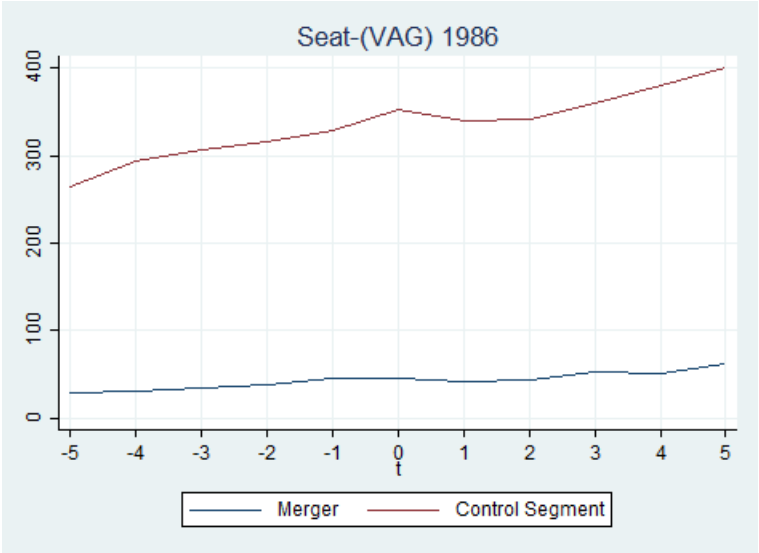
Graph 2.1.1.a Total variety of Seat-Vag and the rest of the market



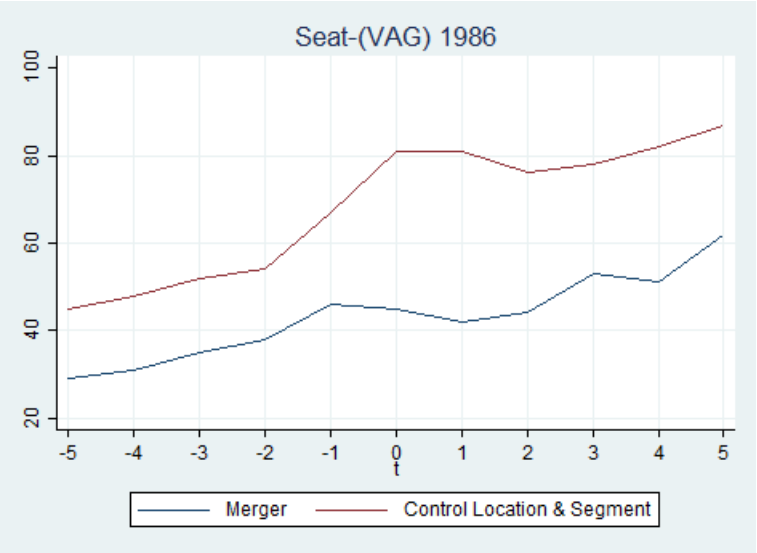
Graph 2.1.1.b Total variety of Seat-Vag and competitors type "location"



Graph 2.1.1.c Total variety of Seat-Vag and competitors type "segment"



Graph 2.1.1.d Total variety of Seat-Vag and competitors type "location & segment"



Jaguar (FORD) 1990

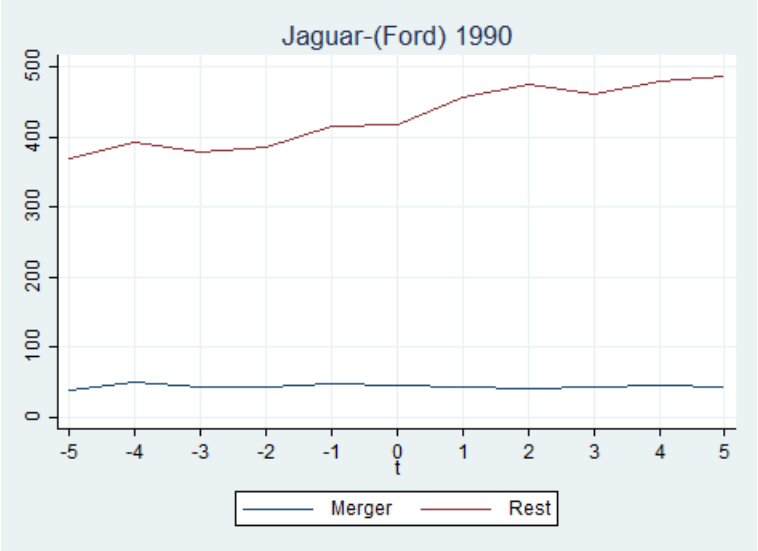
When I use the control group "location", I use cars that have been manufactured in the UK, Belgium, West Germany, Spain and USA. When I use the control group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, 4 by 4 and PC. When I use the control group "location & segment", the models that are included are from the UK (Mini/Super-mini, Small Family, Medium, Luxury, Sports, PC), Belgium (Medium, Luxury), West Germany (Mini/Super-mini, Small Family, Medium, Executive), Spain (Mini/Super-Mini, Small Family, 4 by 4), and USA (Sports).

Table 2.1.2 Statistics of basic characteristics (Jaguar – FORD)

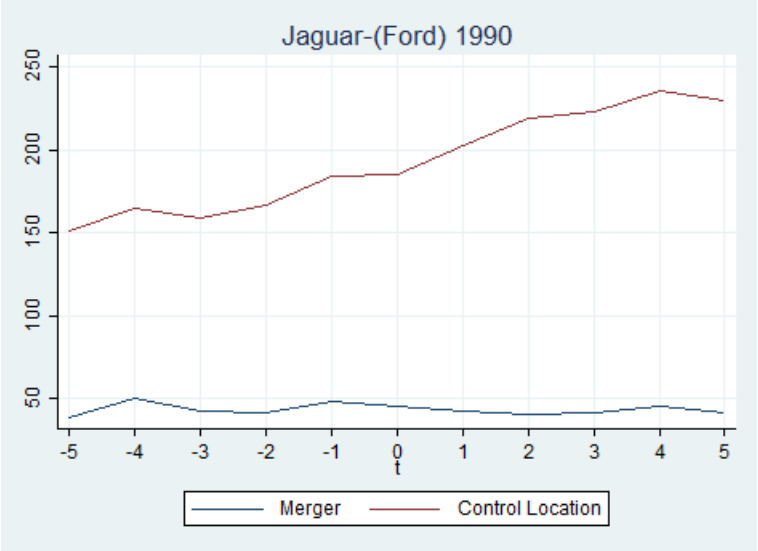
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	95966	32234.2	96082	32644.6	95169.3	32742.3
Size (=length* width)	75.7129	11.9079	75.9727	11.8721	76.1779	11.9992
Economy (= miles per pound)	52.6424	11.6751	52.0923	11.5887	49.9662	11.5985
Fuel injection	0.45357	0.49808	0.48699	0.49991	0.49892	0.50005
Diesel fuel	0.11632	0.32077	0.12356	0.32913	0.1314	0.33787
Turbo	0.09677	0.29579	0.09951	0.29939	0.10512	0.30674
Post-merger	0.51711	0.49995	0.53806	0.49863	0.54717	0.49782
Post-merger * merging party	0.06158	0.24052	0.05832	0.23439	0.05825	0.23423

From Graph 2.1.1.a after the merger, i.e. from t =1 and afterwards, the merging party seems to decrease their variety relative to the rest of the market. When we compare it to the equivalent of their close competitors (Graphs 2.1.1.b to 2.1.1.d), we see similar mobility except for the "location & segment" which seems to decrease their variety at t =3 relative to that of the merging party.

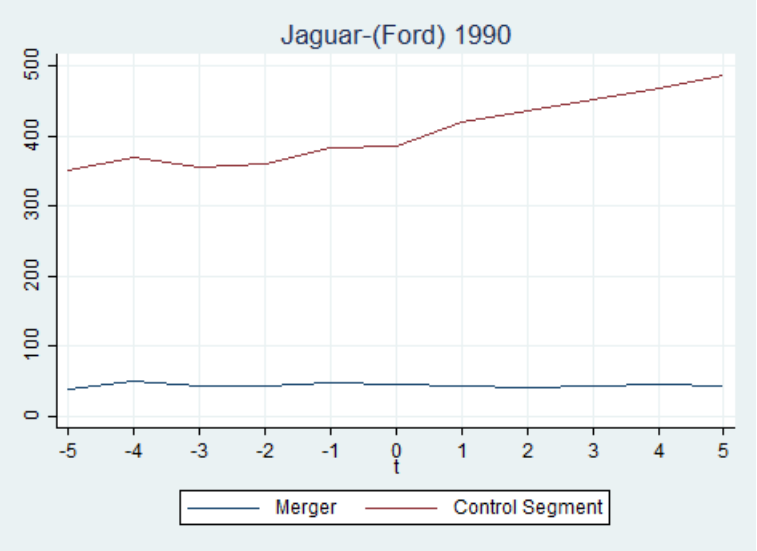
Graph 2.1.2.a Total variety of Jaguar-Ford and the rest of the market



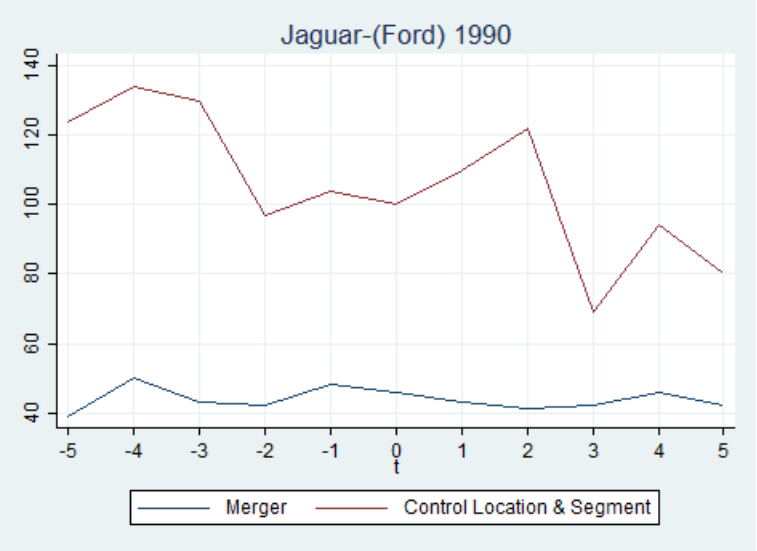
Graph 2.1.2.b Total variety of Jaguar-Ford and competitors type "location"



Graph 2.1.2.c Total variety of Jaguar-Ford and competitors type "segment"



Graph 2.1.2.d Total variety of Jaguar-Ford and competitors type "location & segment"



Saab (GM) 1990

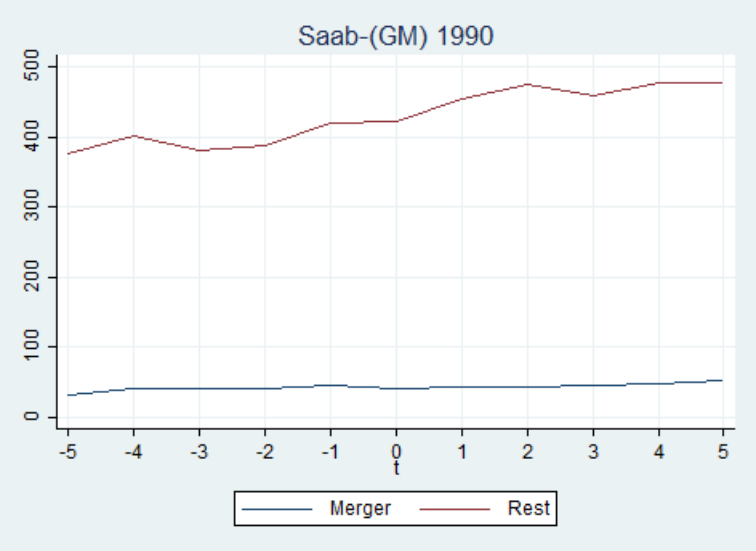
When I use the control group "location", I use cars manufactured in the UK, West Germany, Spain, Sweden and Republic of Korea. When I use the control group "segment" I use the models of Mini/Super-mini, Small Family, Medium, Executive, Sports and 4by4. When I use the control group "location & segment", the models that are included are from the UK (Medium, 4by4), West Germany (Mini/Super Mini, Medium, Executive, Sports), Spain (Mini/Super-mini, Sports), Sweden (Medium, Executive) and Republic of Korea (Small Family, Medium).

Table 2.1.3 Statistics of basic characteristics (Saab – GM)

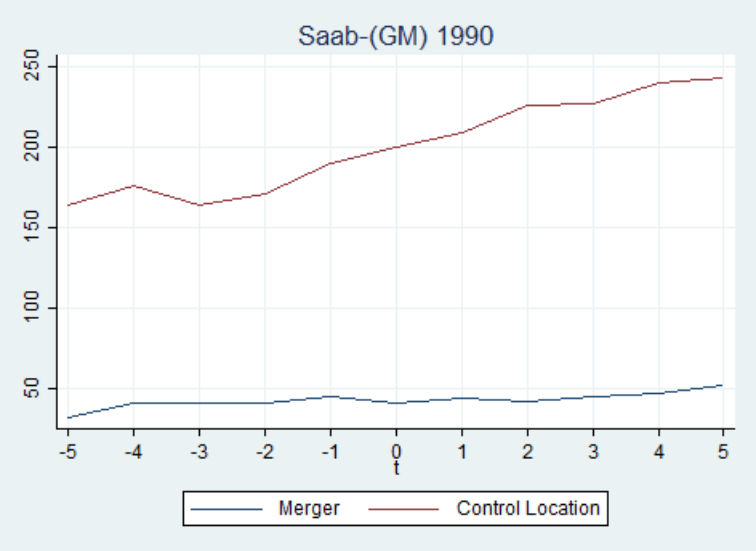
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	95742.8	32806.4	96450.5	33039.7	96010.1	33130.5
Size (=length* width)	76.5287	12.123	76.8666	12.0404	77.1011	12.1206
Economy (= miles per pound)	52.1718	12.1306	51.5227	11.934	49.5655	11.8712
Fuel injection	0.47092	0.49943	0.50487	0.50007	0.52123	0.4996
Diesel fuel	0.12864	0.33498	0.12996	0.33633	0.13736	0.34427
Turbo	0.09843	0.29807	0.1	0.30006	0.10625	0.30819
Post-merger	0.53579	0.499	0.55356	0.49722	0.56924	0.49524
Post-merger * merging party	0.05481	0.22774	0.05693	0.23175	0.05979	0.23713

After the merger, the merging party's variety seems to fall relative to the rest of the market and their close competitors (Graphs 2.1.3.a to 2.1.3.d).

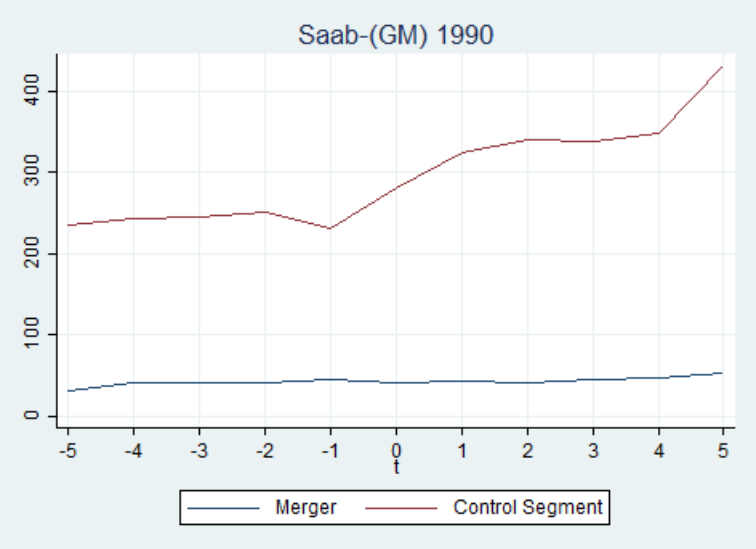
Graph 2.1.3.a Total variety of Saab-GM and the rest of the market



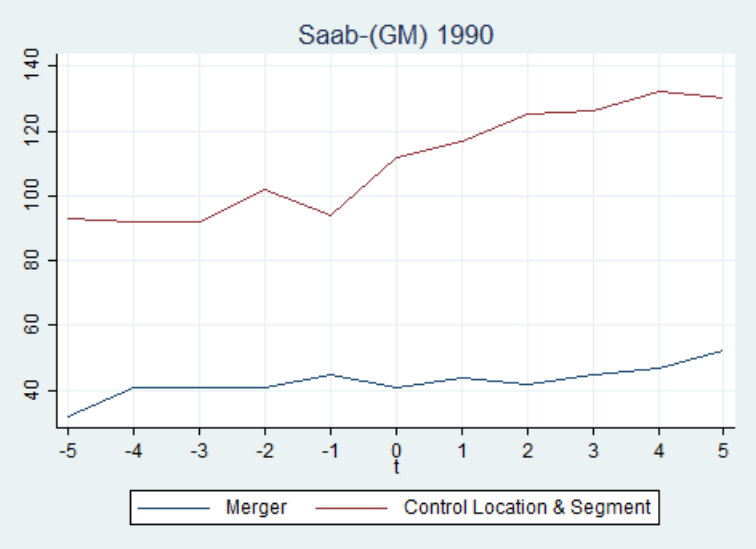
Graph 2.1.3.b Total variety of Saab-GM and competitors type "location"



Graph 2.1.3.c Total variety of Saab-GM and competitors type "segment"



Graph 2.1.3.d Total variety of Saab-GM and competitors type "location & segment"



Skoda (Vag) 1991

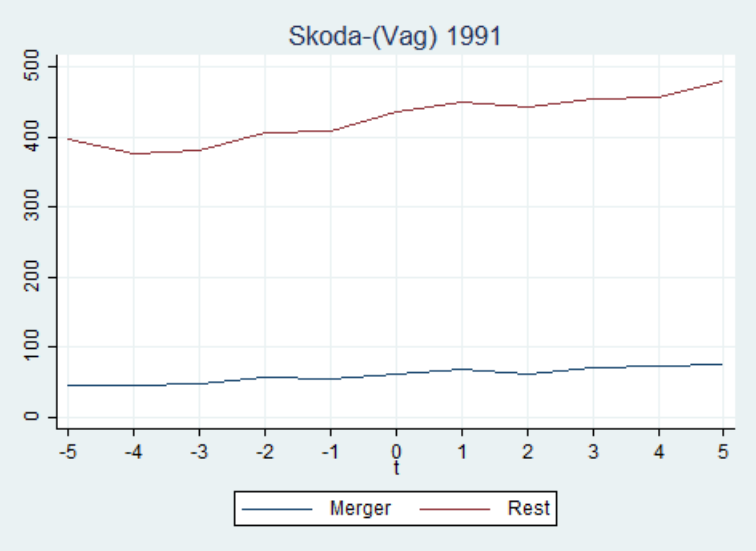
When I use the control group "location", I use cars that have been manufactured in West Germany, Spain, and the Czech Republic. When I use the control group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports and PC. When I use the control group "location & segment", the models that are included are from West Germany (Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, PC), Spain (Mini/Super-mini, Small Family, Medium, PC), and Czech Republic (Mini/Super-mini, Small Family, Sports).

Table 2.1.4 Statistics of basic characteristics (Skoda – VAG)

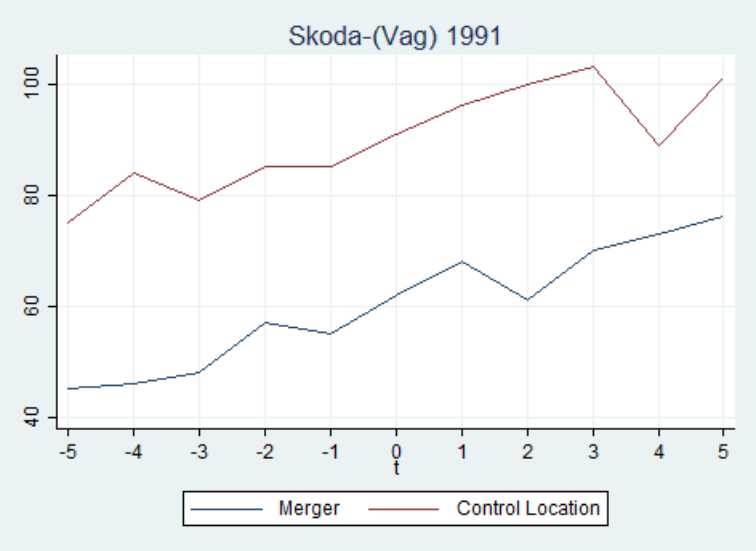
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	98400.6	32835.2	97602.9	33195.1	96544	33257.1
Size (=length* width)	76.2902	11.76	76.1953	11.5126	76.3943	11.6431
Economy (= miles per pound)	53.0862	11.37	52.6051	11.3274	51.2816	10.922
Fuel injection	0.53417	0.49907	0.53867	0.49859	0.53797	0.49861
Diesel fuel	0.11261	0.31627	0.13043	0.33684	0.13654	0.34339
Turbo	0.09336	0.29108	0.10123	0.30168	0.10863	0.31121
Post-merger	0.52551	0.49959	0.53336	0.49897	0.54096	0.49837
Post-merger * merging party	0.07122	0.25732	0.07202	0.25857	0.07594	0.26493

The merging party's variety seems to decrease relative to the rest of the market (Graphs 2.1.4.a). Similar mobility seems to appear when we compare the merging party's variety with that of the "segment" (graph 2.1.4.c). However, for the remaining types of close competitors, there does not seem to be any significant change in variety. While the merging party's relative variety reduces at t=2, the difference becomes narrower after t=3 (Graphs 2.1.4.b to 2.1.4.d).

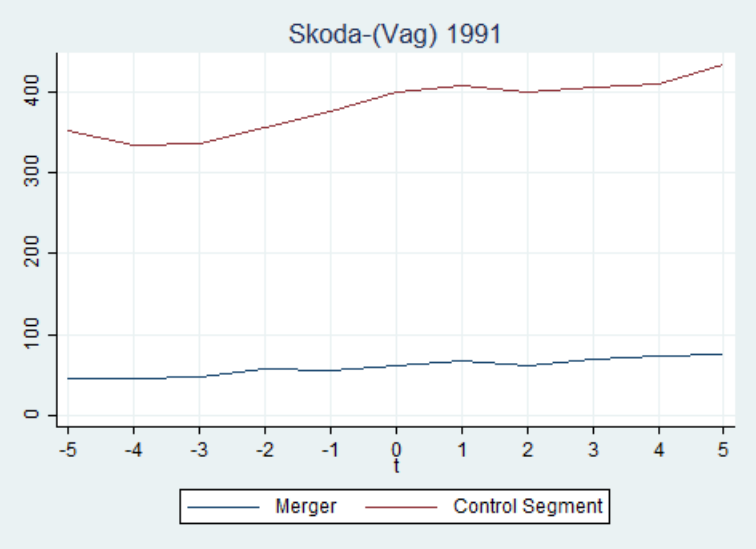
Graph 2.1.4.a Total variety of Skoda-VAG and the rest of the market



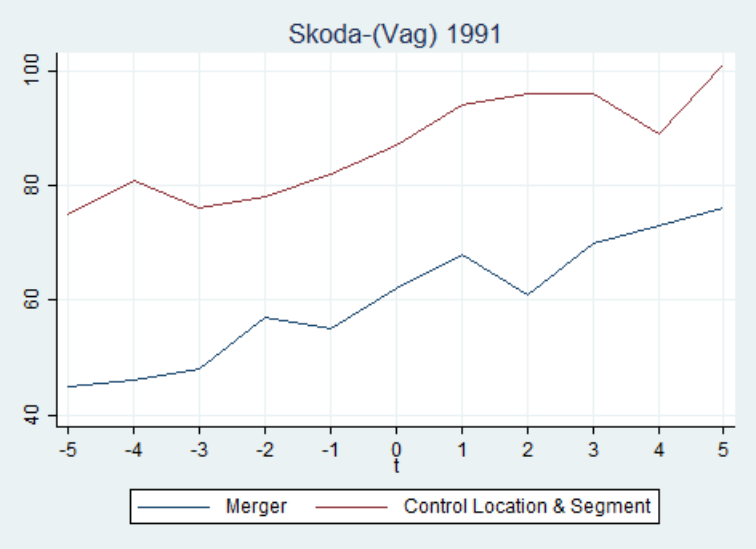
Graph 2.1.4.b Total variety of Skoda-VAG and competitors type "location"



Graph 2.1.4.c Total variety of Skoda-VAG and competitors type "segment"



Graph 2.1.4.d Total variety of Skoda-VAG and competitors type "location & segment"



Rover (BMW) 1994

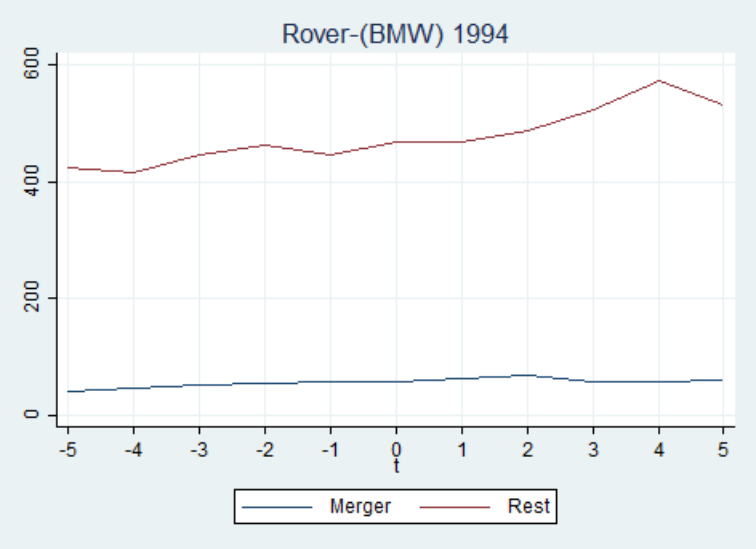
When I use the control group "location", I use cars manufactured in the UK and West Germany. When I use the control group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports and 4by4. When I use the "location & segment" control group, the models that are included are from the UK (Mini/Super-Mini, Small Family, Medium, Executive, Sports, 4by4), and West Germany (Medium, Executive, Luxury, Sports).

Table 2.1.5 Statistics of basic characteristics (Rover – BMW)

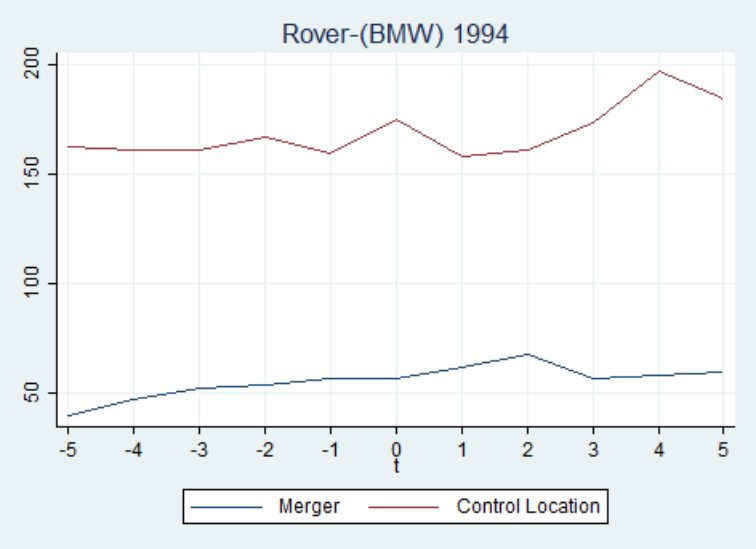
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	99516.6	34217.1	98814.4	33437	98399.3	33771.4
Size (=length* width)	78.7645	11.3129	78.4592	11.4359	78.1811	11.6828
Economy (= miles per pound)	49.5891	11.1927	49.0121	11.2477	48.0292	11.7024
Fuel injection	0.69782	0.45941	0.6651	0.47202	0.63913	0.4803
Diesel fuel	0.16969	0.37553	0.16246	0.36893	0.16294	0.36934
Turbo	0.13158	0.33819	0.13636	0.34322	0.14321	0.35032
Post-merger	0.50635	0.50019	0.51232	0.49992	0.52292	0.49952
Post-merger * merging party	0.06171	0.24073	0.06041	0.23828	0.05828	0.23429

The merging party's variety seems to decrease relative to the rest of the market at t=2 and afterwards (Graphs 2.1.5.a). Similar mobility seems to be the case when we compare the merging party's variety with that of the close competitors type "segment" (graph 2.1.5.c). However, when we compare the merging party's variety with the remaining types of close competitors, their variety increases in the first two years after the merger and at t=3 it decreases (Graphs 2.1.5.b to 2.1.5.d).

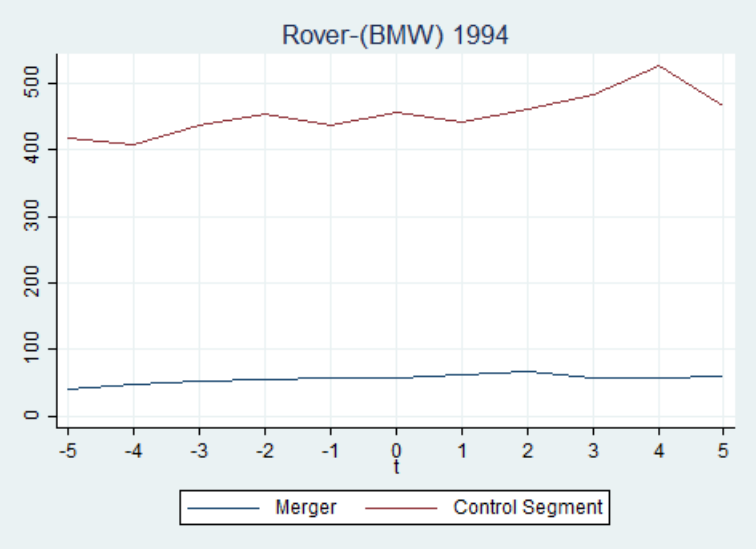
Graph 2.1.5.a Total variety of Rover-BMW and the rest of the market



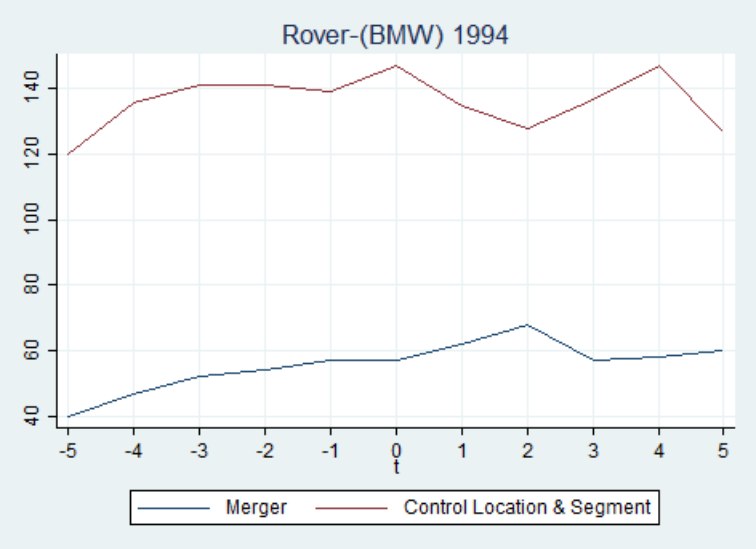
Graph 2.1.5.b Total variety of Rover-BMW and competitors type "location"



Graph 2.1.5.c Total variety of Rover-BMW and competitors type "segment"



Graph 2.1.5.d Total variety of Rover-BMW and competitors type "location & segment"



Mazda (Ford) 1996

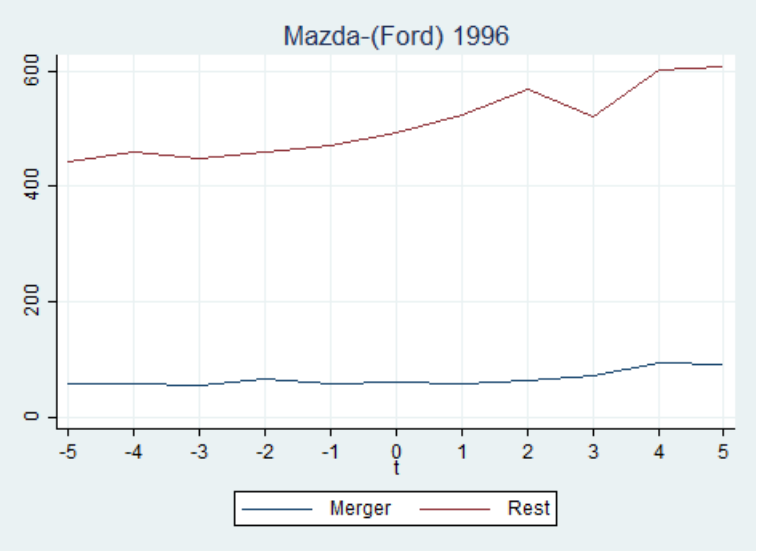
When I use the control group "location", I use cars manufactured in the UK, Belgium, West Germany, Holland, Spain, Sweden, USA and Japan. In the treatment group "segment", I use the models of Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, PC and 4by4. When I use the control group "location & segment", the models that are included are from the UK (Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, 4by4, PC), Belgium (Medium, Luxury), West Germany (Mini/Super-mini, Small Family, Executive, Sports), Holland (Medium), Spain (Mini/Super-mini, Small Family, 4by4), Sweden (Executive, Sports), USA (Sports, 4by4), and Japan (Mini/Super-mini, Small Family, Medium, Executive, Luxury, Sports, and PC).

Table 2.1.6 Statistics of basic characteristics (Mazda – FORD)

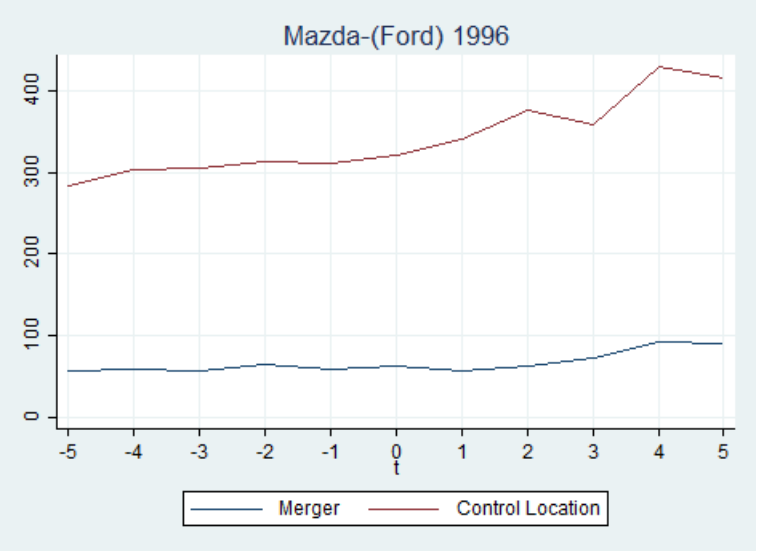
Time window	1 by 1		3 by 3		5 by 5	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Power (= horse power / weight)	98100.8	33307.9	98906.4	33998.3	99280.6	34035.8
Size (=length* width)	79.8345	11.068	79.4403	11.502	79.1987	19.685
Economy (= miles per pound)	46.2142	10.4928	45.4697	11.036	44.9024	11.661
Fuel injection	0.73361	0.44225	0.72496	0.4466	0.70737	0.45501
Diesel fuel	0.19004	0.3925	0.18843	0.39111	0.18253	0.38631
Turbo	0.16846	0.37443	0.1663	0.3724	0.16369	0.37002
Post-merger	0.52033	0.49979	0.52712	0.49933	0.53946	0.49848
Post-merger * merging party	0.05726	0.23244	0.05838	0.2345	0.06463	0.24589

One year after the merger, i.e. t = 1, the merging party's variety decreases relative to that of the rest of the market (graph 2.1.6.a). Similar results hold when we compare the merging's party variety with their close competitors' "location" and "location & segment" (Graphs 2.1.6.b to 2.1.6.d). However their difference seems to be smaller in comparison with "location & segment. I do not comment on the merging party's variety in comparison with "segment" since Ford is producing cars from all segments from 1994 and after (Graphs 2.1.6.c) and as a result it is actually the whole market.

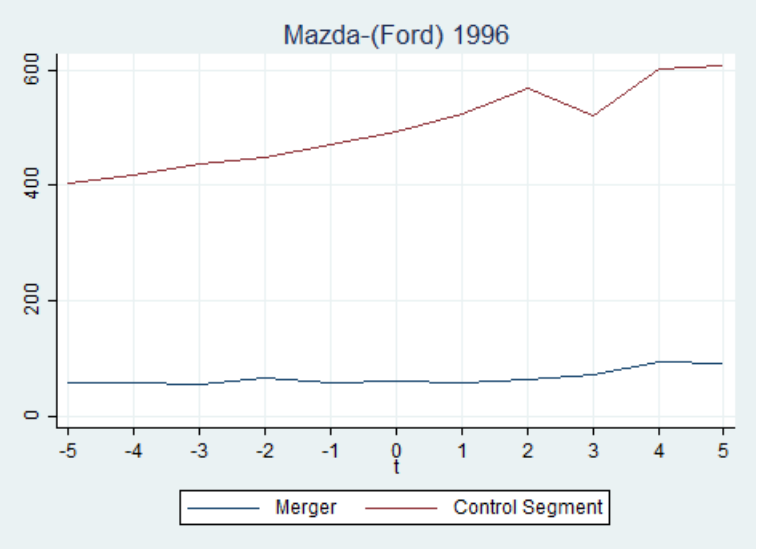
Graph 2.1.6.a Total variety of Mazda-Ford and the rest of the market



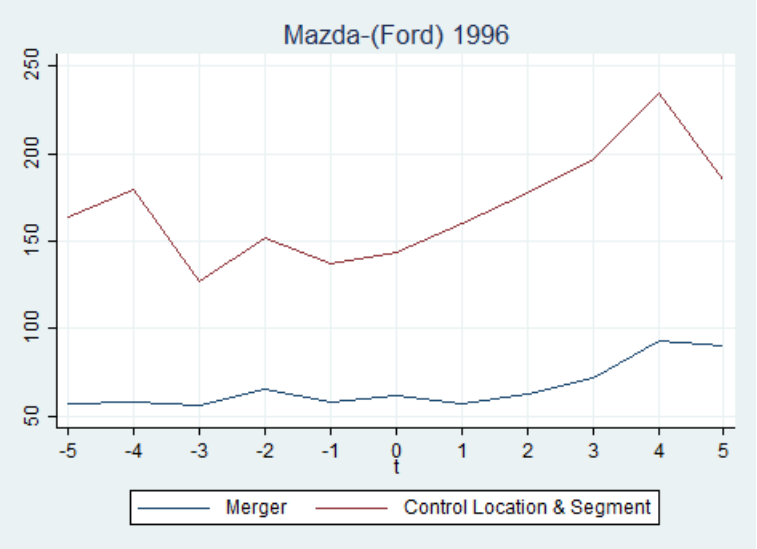
Graph 2.1.6.b Total variety of Mazda-Ford and competitors type "location"



Graph 2.1.6.c Total variety of Mazda-Ford and competitors type "segment"



Graph 2.1.6.d Total variety of Mazda-Ford and competitors type "location & segment"



2.5. Results

In Tables 2.2.1.1. to 2.2.1.8, I summarize the results from all the specifications for my treatment groups where I count, as a dependent variable, the total number of models produced by product i's brand (total variety), and use the robust standard error. Tables 2.2.1.1 to 2.2.1.4 stand for regressions without the "other merger" dummies while the rest are those with "other merger" dummies. Tables 2.2.1.1 and 2.2.1.5 summarize the results using a "5 by 5" time window. Tables 2.2.1.2 and 2.2.1.6 summarize the results using a "3 by 3" time window. Tables 2.2.1.3 and 2.2.1.7 are the respective tables when using a "1 by 1" time window. Tables 2.2.1.4 and 2.2.1.8 summarize the results from all three time windows when using the "rest merger" dummies in my regressions. Similarly 2.2.2.1. to 2.2.2.8 are the respective tables when I use the number of models that are close competitors and produced by product i' s brand (specific variety) as a dependent variable.

The merger of Seat-VAG seems to negatively affect the variety of the merging party. We have a statistically negative effect for a critical value of 1% in all alternative specifications[39]. When we use the "location & segment" group as the control, we have a more intense effect, which is around a 19% to 29% decrease on product variety (Tables 2.2.1.1 to 2.2.2.8). A less intense effect is given when we use "location" as a control, around 10% to 13%. In all cases, we have a bigger effect when we examine the "total variety" (Tables 2.2.1.1 to 2.2.1.8) than in the case of the "specific variety" (Tables 2.2.2.1 to 2.2.8). When we control for the other merger effects, we have an even more intense effect (Tables 2.2.1.5 to 2.2.1.8 and 2.2.5 to 2.2.2.8). However, when we use the "segment" control group and include the "rest merger" dummies (Tables 2.2.1.4, 2.2.1.8, 2.2.2.4 and 2.2.2.8), i.e. we control for the effect of the other acquisition of Skoda by VAG, the effect is reduced but remains statistically significant for the critical value of 1%. Thus, since we have very robust results we conclude that the acquisition of Seat from VAG led to lower variety.

Similarly, the merger of Saab-GM has pretty robust results that suggest that their merger also decreased variety. When we examine the "total variety", we have a statistically insignificant effect for the "basic" and "primary" specifications of the "5 by 5" time window with the

[39] Only when we use cluster errors do we have some insignificant results. These results come when we use the "location" control group with the "other mergers" dummies and only for the specifications "basic" and "primary".

"segment" group and without the "other merger" dummies (Table 2.2.2.5). When we use the "segment" control group, the "all" specification without "other merger" dummies of the "5 by 5" time window and the "basic" and "primary" specifications with "other merger" dummies of the "5 by 5" time window, the results are statistically negative for a critical value of 10% (Tables 2.2.1.1 and 2.2.1.5 respectively). Similarly, when we use the "location & segment" group without "other merger" dummies, we have again a statistically negative effect for a critical value of 10% at the "all" specification with the "3 by 3" time window (Table 2.2.1.2).

For the "all" specification of the "5 by 5" time window, when we use the "location" group without other merger dummies and the "segment" control group with the "other merger", we have a statistically negative effect for a critical value of 5% (Tables 2.2.1.1 and 2.2.1.5). The remaining regressions give a statistically negative effect for a critical value of 1% (Tables 2.2.1.1 to 2.2.1.7). However, when we examine the "specific variety", the results are a little different. When we use the "location & segment" control group with "other merger" dummies of the "5 by 5" time window, we have an insignificant effect for the "basic" and "primary" specifications (Table 2.2.2.5). Similarly, with the same control group, we also have an insignificant effect for all three specifications of the "3 by 3" time window with or without the "other merger" dummies (Tables 2.2.2.2 and 2.2.2.6 respectively). Nevertheless, the remaining regressions give a statistically negative effect for a critical value of 1%. Moreover, the smaller the time window we use, the more intense the effect we have for both "total variety" and "specific variety" and it becomes even greater when we control for "other mergers". Thus, we conclude that the merger of Saab – GM led to reduced product variety.

The merger of Jaguar - FORD also seems to decrease variety. When we examine the "total variety", all results are negative and statistically significant for a critical value of 1% (Tables 2.2.1.1 to 2.2.1.7). A more intense effect is reported when we use the "location & segment" control group (around 28% to 40%) while it is lower when we use "segment" (around 25% to 35%). However, when we examine the "specific variety" with the "location & segment" control group using a "3 by 3" time window, we have statistically insignificant results for all three specifications without the "other merger" dummies (Table 2.2.2.2), and the "all" specification with "other merger" dummies (Table 2.2.2.6). Nevertheless, the remaining results are statistically significant for a critical value of 1%. Thus, we have pretty robust results which indicate a decrease in variety. Furthermore, it is quite an interesting fact that in the "specific variety" we

get more intense results when using the "location" as a control group, around 29% to 42%, with lower results when we use the "location & segment" group, around 4% to 13% (except for the "1 by 1" time window with the "other mergers" group, which is around 29% to 45%), which is the opposite case compared with the "total variety".

The merger of Skoda - VAG is more interesting since the results suggest that it led to higher variety. When we do not control for the "other mergers" and irrespective of the inclusion of the "rest mergers" dummies, all results for both "total variety" and "specific variety" are positive and statistically significant for a critical value of 1%, at around 11% to 18% and 12% to 21%, respectively (Tables 2.2.1.1 to 2.2.1.4 and 2.2.2.1 to 2.2.2.4). However, when we add the "other merger" dummies we have some statistically insignificant results. Specifically, when we examine the "total variety" using the "3 by 3" time window, all results are statistically insignificant except for those of the "segment" group and the "all" specification of "location & segment", which remain statistically significant for a critical value of 1% and 10% respectively (Table 2.2.1.6). Nevertheless, when we add the "rest merger" dummies, the results from the "all" specification of both these control groups and the same time window are, again, positive and statistically significant results for a critical value of 1% (Table 2.2.2.8). For the "specific variety", irrespective of the use of the "rest merger" dummies or not, when we add the "other merger" dummies and use the "location & segment" group, we have statistically insignificant results for the "basic" and "primary" specifications of the "5 by 5" and "3 by 3" time windows (Tables 2.2.2.5 to 2.2.2.8). Similarly, when using the "location" group, we have statistically insignificant results for the same specifications of the "3 by 3" time window (Table 2.2.2.6 and 2.2.2.8). However, the remaining results remain statistically significant for the same critical value of 1%. Thus, the results indicate that the merger has probably led to increased variety.

Similarly, the merger of Rover-(BMW) seems to have led to increased variety. All results for both "total variety" and " precise variety" are positive and statistically significant for a critical value of 1% and only when we do clustering do we have some statistically insignificant results. Furthermore, it seems that as we shorten our time window, our results indicate a less intense effect on variety. For "total variety" we get similar results when we use "location" or "location & segment" as control groups, at around 14% to 24%, while we get a smaller effect when we use the "segment" control group which is around 7% to 15% (Tables 2.2.1.1 to 2.2.1.7). However, for "specific variety" we have a more intense effect when we use "location & segment" as a

control group, which is 16% to 34%, than when we use the “location” or “segment” control group, at around 10% to 25% (Tables 2.2.2.1 to 2.2.2.7).

The results from Mazda - FORD suggest that their merger led to lower variety. All results from “total variety” are negative and statistically significant for a critical value of 1%, irrespective of whether we include the “rest merger” and “other merger” dummies (Tables 2.2.1.1 to 2.2.1.8). The most intense effect is reported when we use the “segment” control group, which is around 10% to 21%, and the least intense when we use the “location & segment” control group, which is around 6% to 17%. Moreover, the greater the time window, the higher the effect; if we control for the “other mergers”, we get an even more intense effect on the merging party’s variety. However, when we control for the “rest mergers”, the effect seems to be reduced. Similarly, all results from “specific variety” are negative and statistically significant for the same critical value of 1%, except when we use the “location & segment” control group and the “1 by 1” time window, where all specifications without the “other merger” dummies and the “all” specification with the “other merger” dummies are statistically significant for a critical value of 5% (Tables 2.2.2.1 to 2.2.2.8). However, these results are more robust, at around 8% to 19% irrespective of the specification, the control group or whether we control for the “rest mergers” or not. Moreover, when we control for the “other mergers”, the results are higher, at around 10% to 25%. In all cases, the wider the time window, the more intense the effect on the merging party’s variety becomes. Thus, there is no doubt that the merger of Mazda-Ford led to reduced variety.

Total variety without "other merger" dummies

Table 2.2.1.1 Effect of merger on the merging firms' variety, time window "5 by 5".

Coefficient of:	Post Merger * Merging party								
Control:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.239***	-0.240***	-0.247***	-0.130***	-0.133***	-0.126***	-0.240***	-0.240***	-0.249***
Saab - (GM)	-0.0556***	-0.0536***	-0.0497**	-0.0287	-0.0274	-0.0381*	-0.0687***	-0.0684***	-0.0721***
Jaguar - (Ford)	-0.288***	-0.288***	-0.304***	-0.257***	-0.257***	-0.256***	-0.322***	-0.320***	-0.338***
Skoda - (VAG)	0.164***	0.161***	0.166***	0.143***	0.140***	0.148***	0.168***	0.162***	0.179***
Rover - (BMW)	0.225***	0.226***	0.248***	0.147***	0.145***	0.150***	0.227***	0.226***	0.245***
Mazda - (Ford)	-0.142***	-0.139***	-0.132***	-0.158***	-0.158***	-0.158***	-0.136***	-0.136***	-0.131***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.2 Effect of merger on the merging firms' variety, time window "3 by 3"

Coefficient of:	Post Merger * Merging Party								
Control:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.275***	-0.276***	-0.279***	-0.121***	-0.123***	-0.116***	-0.286***	-0.287***	-0.291***
Saab - (GM)	-0.0978***	-0.0988***	-0.0832***	-0.0910***	-0.0913***	-0.0930***	-0.107***	-0.106***	-0.100***
Jaguar - (Ford)	-0.264***	-0.262***	-0.268***	-0.250***	-0.250***	-0.249***	-0.285***	-0.281***	-0.287***
Skoda - (VAG)	0.116***	0.110***	0.116***	0.116***	0.115***	0.119***	0.120***	0.114***	0.130***
Rover - (BMW)	0.200***	0.202***	0.202***	0.118***	0.117***	0.116***	0.213***	0.212***	0.213***
Mazda - (Ford)	-0.122***	-0.119***	-0.112***	-0.149***	-0.147***	-0.143***	-0.0965***	-0.0974***	-0.0933***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.3 Effect of merger on the merging firms' variety, time window "1 by 1"

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.280***	-0.282***	-0.280***	-0.131***	-0.130***	-0.130***	-0.294***	-0.295***	-0.290***
Saab - (GM)	-0.158***	-0.160***	-0.162***	-0.190***	-0.190***	-0.195***	-0.171***	-0.173***	-0.176***
Jaguar - (Ford)	-0.303***	-0.301***	-0.302***	-0.316***	-0.316***	-0.316***	-0.345***	-0.342***	-0.337***
Skoda - (VAG)	0.140***	0.137***	0.147***	0.131***	0.131***	0.130***	0.130***	0.127***	0.136***
Rover - (BMW)	0.147***	0.146***	0.137***	0.0717***	0.0708***	0.0679***	0.153***	0.153***	0.142***
Mazda - (Ford)	-0.0957***	-0.0938***	-0.0839***	-0.109***	-0.109***	-0.103***	-0.0737***	-0.0730***	-0.0639***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.4 Effect of merger on the merging firms' variety, controlling for "rest mergers"

Coefficient of		Post Merger * Merging Party								
Control:		Location			Segment			Location & segment		
Window	Regression:	basic	primary	all	basic	primary	all	basic	primary	all
5 by 5	Seat-(VAG)	-0.239***	-0.240***	-0.247***	-0.117***	-0.120***	-0.126***	-0.240***	-0.240***	-0.249***
	Skoda-(VAG)	0.185***	0.181***	0.166***	0.146***	0.143***	0.148***	0.187***	0.180***	0.179***
	Mazda-(FORD)	-0.115***	-0.112***	-0.132***	-0.132***	-0.132***	-0.158***	-0.0888***	-0.0892***	-0.131***
3 by 3	Skoda-(VAG)	0.116***	0.110***	0.116***	0.116***	0.115***	0.119***	0.120***	0.114***	0.130***
	Mazda-(FORD)	-0.122***	-0.119***	-0.112***	-0.149***	-0.147***	-0.143***	-0.0965***	-0.0974***	-0.0933***
1 by 1	Skoda-(VAG)	0.140***	0.137***	0.147***	0.131***	0.131***	0.130***	0.130***	0.127***	0.136***

*** p<0.01, ** p<0.05, * p<0.1

Total variety with "other merger" dummies

Table 2.2.1.5 Effect of merger on merging firms' variety, time window "5 by 5", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.268***	-0.270***	-0.279***	-0.140***	-0.144***	-0.137***	-0.273***	-0.274***	-0.285***
Saab - (GM)	-0.119***	-0.119***	-0.107***	-0.0343*	-0.0343*	-0.0417**	-0.0699***	-0.0685***	-0.0614***
Jaguar - (Ford)	-0.296***	-0.300***	-0.308***	-0.250***	-0.251***	-0.249***	-0.342***	-0.342***	-0.342***
Skoda - (VAG)	0.123***	0.118***	0.125***	0.125***	0.122***	0.132***	0.121***	0.115***	0.137***
Rover - (BMW)	0.193***	0.196***	0.222***	0.135***	0.134***	0.141***	0.205***	0.205***	0.229***
Mazda - (Ford)	-0.200***	-0.197***	-0.182***	-0.214***	-0.215***	-0.204***	-0.174***	-0.174***	-0.166***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.6 Effect of merger on the merging firms' variety, time window "3 by 3", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.161***	-0.161***	-0.142***	-0.108***	-0.110***	-0.111***	-0.119***	-0.118***	-0.110***
Jaguar - (Ford)	-0.291***	-0.290***	-0.289***	-0.258***	-0.259***	-0.256***	-0.312***	-0.307***	-0.301***
Skoda - (VAG)	0.0545	0.0459	0.0536	0.0951***	0.0946***	0.0994***	0.0551	0.0466	0.0655*
Rover - (BMW)	0.196***	0.197***	0.197***	0.113***	0.112***	0.112***	0.216***	0.215***	0.216***
Mazda - (Ford)	-0.167***	-0.166***	-0.157***	-0.196***	-0.196***	-0.186***	-0.148***	-0.149***	-0.143***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.7 Effect of merger on the merging firms' variety, time window "1 by 1", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.268***	-0.270***	-0.276***	-0.240***	-0.240***	-0.245***	-0.271***	-0.272***	-0.276***
Jaguar - (Ford)	-0.365***	-0.364***	-0.368***	-0.352***	-0.352***	-0.352***	-0.411***	-0.410***	-0.401***
Skoda - (VAG)	0.140***	0.137***	0.147***	0.131***	0.131***	0.130***	0.130***	0.127***	0.136***
Rover - (BMW)	0.141***	0.140***	0.132***	0.0685***	0.0674***	0.0656***	0.146***	0.145***	0.136***
Mazda - (Ford)	-0.159***	-0.157***	-0.148***	-0.172***	-0.172***	-0.166***	-0.137***	-0.137***	-0.128***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.1.8 Effect of merger on the merging firms' variety, controlling for other & rest mergers

Coefficient of		Post Merger * Merging Party								
Control:		Location			Segment			Location & segment		
Window	Regression:	basic	primary	all	basic	primary	all	basic	primary	all
5 by 5	Seat-(VAG)	-0.268***	-0.270***	-0.247***	-0.128***	-0.131***	-0.126***	-0.273***	-0.274***	-0.249***
	Skoda-(VAG)	0.145***	0.139***	0.166***	0.130***	0.128***	0.148***	0.141***	0.135***	0.179***
	Mazda-(FORD)	-0.141***	-0.139***	-0.132***	-0.161***	-0.162***	-0.158***	-0.127***	-0.128***	-0.131***
3 by 3	Skoda-(VAG)	0.0545	0.0459	0.116***	0.0951***	0.0946***	0.119***	0.0551	0.0466	0.130***
	Mazda-(FORD)	-0.167***	-0.166***	-0.112***	-0.195***	-0.195***	-0.143***	-0.148***	-0.149***	-0.0933***
1 by 1	Skoda-(VAG)	0.140***	0.137***	0.147***	0.131***	0.131***	0.130***	0.130***	0.127***	0.136***

*** p<0.01, ** p<0.05, * p<0.1

Specific variety, without "other merger" dummies

Table 2.2.2.1 Effect of merger on the merging firms' variety, time window "5 by 5"

Coefficient of:	Post Merger * Merging party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.120***	-0.120***	-0.136***	-0.119***	-0.123***	-0.117***	-0.187***	-0.186***	-0.197***
Saab - (GM)	-0.0682***	-0.0657***	-0.0618***	-0.130***	-0.127***	-0.123***	0.0760***	0.0805***	0.0732***
Jaguar - (Ford)	-0.328***	-0.329***	-0.344***	-0.271***	-0.272***	-0.270***	0.0779***	0.0787***	0.0449*
Skoda - (VAG)	0.202***	0.201***	0.211***	0.134***	0.132***	0.138***	0.179***	0.173***	0.200***
Rover - (BMW)	0.246***	0.244***	0.266***	0.210***	0.205***	0.209***	0.324***	0.323***	0.340***
Mazda - (Ford)	-0.132***	-0.129***	-0.121***	-0.187***	-0.188***	-0.187***	-0.119***	-0.116***	-0.0996***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.2 Effect of merger on the merging firms' variety, time window "3 by 3"

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.150***	-0.150***	-0.160***	-0.103***	-0.105***	-0.0969***	-0.182***	-0.182***	-0.193***
Saab - (GM)	-0.106***	-0.107***	-0.0913***	-0.121***	-0.121***	-0.117***	0.0233	0.0244	0.0391
Jaguar - (Ford)	-0.294***	-0.292***	-0.296***	-0.251***	-0.251***	-0.250***	-0.0302	-0.0301	-0.0432
Skoda - (VAG)	0.140***	0.136***	0.151***	0.114***	0.113***	0.118***	0.113***	0.107***	0.130***
Rover - (BMW)	0.215***	0.214***	0.215***	0.163***	0.161***	0.160***	0.293***	0.291***	0.294***
Mazda - (Ford)	-0.113***	-0.110***	-0.103***	-0.163***	-0.161***	-0.156***	-0.169***	-0.171***	-0.160***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.3 Effect of merger on the merging firms' variety, time window "1 by 1"

Coefficient of:	Post Merger * Merging Party								
Control:	Location			Segment			Location & segment		
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.231***	-0.233***	-0.231***	-0.128***	-0.127***	-0.127***	-0.250***	-0.252***	-0.248***
Saab - (GM)	-0.195***	-0.197***	-0.201***	-0.249***	-0.250***	-0.259***	-0.126***	-0.131***	-0.130***
Jaguar - (Ford)	-0.330***	-0.328***	-0.331***	-0.304***	-0.305***	-0.304***	-0.291***	-0.289***	-0.287***
Skoda - (VAG)	0.143***	0.140***	0.149***	0.147***	0.147***	0.146***	0.124***	0.122***	0.132***
Rover - (BMW)	0.120***	0.119***	0.110***	0.102***	0.101***	0.0982***	0.172***	0.172***	0.163***
Mazda - (Ford)	-0.0895***	-0.0876***	-0.0778***	-0.109***	-0.109***	-0.103***	-0.125**	-0.124**	-0.116**

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.4 Effect of merger on the merging firms' variety, controlling for "rest mergers"

Coefficient of		Post Merger * Merging Party								
Control:		Location			Segment			Location & segment		
Window	Regression:	basic	primary	all	basic	primary	all	basic	primary	all
5 by 5	Seat-(VAG)	-0.120***	-0.120***	-0.136***	-0.106***	-0.110***	-0.117***	-0.187***	-0.186***	-0.197***
	Skoda-(VAG)	0.214***	0.212***	0.211***	0.137***	0.135***	0.138***	0.196***	0.189***	0.200***
	Mazda-(FORD)	-0.105***	-0.103***	-0.121***	-0.165***	-0.166***	-0.187***	-0.0852***	-0.0831***	-0.0996***
3 by 3	Skoda-(VAG)	0.140***	0.136***	0.151***	0.114***	0.113***	0.118***	0.113***	0.107***	0.130***
	Mazda-(FORD)	-0.113***	-0.110***	-0.103***	-0.163***	-0.161***	-0.156***	-0.169***	-0.171***	-0.160***
1 by 1	Skoda-(VAG)	0.143***	0.140***	0.149***	0.147***	0.147***	0.146***	0.124***	0.122***	0.132***

*** p<0.01, ** p<0.05, * p<0.1

Specific variety with "other merger" dummies

Table 2.2.2.5 Effect of merger on merging firms' variety, time window "5 by 5", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging Party								
Control:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Seat - (Vag)	-0.143***	-0.142***	-0.136***	-0.126***	-0.130***	-0.117***	-0.244***	-0.242***	-0.197***
Saab - (GM)	-0.145***	-0.144***	-0.0618***	-0.167***	-0.166***	-0.123***	0.0317	0.0340	0.0732***
Jaguar - (Ford)	-0.354***	-0.359***	-0.344***	-0.273***	-0.275***	-0.270***	-0.0949**	-0.0926**	0.0449*
Skoda - (VAG)	0.120***	0.116***	0.211***	0.117***	0.115***	0.138***	-0.00204	-0.00434	0.200***
Rover - (BMW)	0.197***	0.199***	0.266***	0.199***	0.195***	0.209***	0.279***	0.279***	0.340***
Mazda - (Ford)	-0.190***	-0.187***	-0.121***	-0.250***	-0.251***	-0.187***	-0.159***	-0.157***	-0.0996***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.6 Effect of merger on the merging firms' variety, time window "3 by 3", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging party								
Control:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.175***	-0.175***	-0.0913***	-0.169***	-0.170***	-0.117***	-0.0359	-0.0352	0.0391
Jaguar - (Ford)	-0.328***	-0.328***	-0.296***	-0.264***	-0.266***	-0.250***	-0.153***	-0.152***	-0.0432
Skoda - (VAG)	0.0530	0.0458	0.151***	0.0963***	0.0961***	0.118***	-0.0288	-0.0353	0.130***
Rover - (BMW)	0.198***	0.198***	0.215***	0.158***	0.156***	0.160***	0.285***	0.284***	0.294***
Mazda - (Ford)	-0.158***	-0.156***	-0.103***	-0.210***	-0.211***	-0.156***	-0.224***	-0.225***	-0.160***

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.7 Effect of merger on the merging firms' variety, time window "1 by 1", controlling for "other mergers" effect

Coefficient of:	Post Merger * Merging party								
Control:		Location			Segment			Location & segment	
Regression:	basic	primary	all	basic	primary	all	basic	primary	all
Saab - (GM)	-0.329***	-0.332***	-0.201***	-0.330***	-0.330***	-0.259***	-0.262***	-0.266***	-0.130***
Jaguar - (Ford)	-0.421***	-0.420***	-0.331***	-0.346***	-0.346***	-0.304***	-0.453***	-0.452***	-0.287***
Skoda - (VAG)	0.143***	0.140***	0.149***	0.146***	0.147***	0.146***	0.124***	0.122***	0.132***
Rover - (BMW)	0.114***	0.113***	0.110***	0.0994***	0.0982***	0.0982***	0.166***	0.166***	0.163***
Mazda - (Ford)	-0.152***	-0.151***	-0.0778***	-0.172***	-0.172***	-0.103***	-0.192***	-0.193***	-0.116**

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2.8 Effect of merger on the merging firms' variety, controlling for other & rest mergers

Coefficient of		Post Merger * Merging party								
Control:			Location			Segment			Location & segment	
Window	Regression:	basic	primary	all	basic	primary	all	basic	primary	all
5 by 5	Seat-(VAG)	-0.143***	-0.142***	-0.136***	-0.113***	-0.117***	-0.117***	-0.244***	-0.242***	-0.197***
	Skoda-(VAG)	0.137***	0.133***	0.211***	0.123***	0.120***	0.138***	0.0245	0.0219	0.200***
	Mazda-(FORD)	-0.131***	-0.129***	-0.121***	-0.198***	-0.199***	-0.187***	-0.126***	-0.126***	-0.0996***
3 by 3	Skoda-(VAG)	0.0530	0.0458	0.151***	0.0963***	0.0961***	0.118***	-0.0288	-0.0353	0.130***
	Mazda-(FORD)	-0.158***	-0.156***	-0.103***	-0.210***	-0.210***	-0.156***	-0.224***	-0.225***	-0.160***
1 by 1	Skoda-(VAG)	0.143***	0.140***	0.149***	0.146***	0.147***	0.146***	0.124***	0.122***	0.132***

*** p<0.01, ** p<0.05, * p<0.1

2.6. Conclusion

In my research I examined how the mergers of Seat-VAG, Jaguar-FORD, Saab-GM, Skoda-VAG, Rover-BMW and Mazda-FORD affected their variety in the UK market. From the variety trends (graphs 2.1.1.a to 2.1.6.d) mergers seem to decrease variety. Irrespective of the comparison group that I used in my graphs, Saab-GM and Mazda-Ford reduced variety. This is also true for the other mergers when we compare them with the rest of the market but not when we compare them with their close competitors. Depending on the type of close competitor that we compare with, while in some cases we still get lower variety, we also get either no notable differences or even higher variety in the case of Jaguar-Ford and close competitors type "location & segment". On the other hand, the merger of Seat-VAG did not seem to change their variety.

Literature in mergers & acquisition has shown that in most cases the mergers tend to decrease variety. From our very robust results, all of the examined mergers had a strong impact on variety but not necessarily in a negative manner. While most of the examined mergers seem to be consistent with theory and led to reduced variety, two of the six mergers: Skoda – Vag and Rover – BMW, not only did not decrease their variety, but it seems that they increased it. In order to ensure that these results are consistent I used three alternatives for my variety function, two different dependent variables, three different time windows, two different hypothesis for the error term and three different types of close competitors, i.e. car models manufactured in the same country, car models of the same segment and car models of the same segment which were manufactured by factories in the same country as the merged ones. Furthermore, I examined how my results are affected when I control for the effects of other mergers and other acquisitions of the merging party that were close to the year of the acquisition. Nevertheless, these results are very robust, irrespective of the control group, the way we count variety, the type of error or whether we control for the rest & other mergers or not.

From the results of this research, we can reach two conclusions. The first is that a merger does indeed affect the product variety. The second and more interesting one is that a merger is not always harmfull for product variety. In fact, a merger could actually lead to higher variety. A possible explanation is the pass-through of know-how which gives greater possibilities for varied

products and that the merging party may prefer to reposition rather than withdraw their products. Hence, a merger could be beneficial for product variety.

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Chapter 3: Predicting the impact of a merger on prices and evaluating the consistency of merger simulation

3.1 Introduction

Mergers are a significant worldwide phenomenon that is greatly puzzling both antitrust agencies and empirical economists. Merger activity has witnessed an unprecedented increase over the last three decades, both in terms of monetary value and number of deals involved. The number of mergers reviewed by antitrust regulators in 2015, for example, was 46,977 (compared to 36,204 in 2005 and 20,666 in 1995) with a total merger value that exceeded $4.5 trillion.[40] Examples of large mergers that caught the headlines abound: Pfizer merged with Warner-Lambert for $90 billion in 1999, Comcast merged with the broadband unit of AT&T for $60 billion in 2002, Procter & Gamble bought Gillette for $57 billion in 2004, Pfizer acquired Wyeth for $67 billion in 2009 and Anheuser-Busch Inbev bought SABMiller PLC for $109 billion in 2015.

My research is focused on evaluating and predicting the price effects of horizontal mergers. Theory suggests that a merger between competitors increases firms' market power (both for the merged entity and its competitors) thereby leading to higher prices and lower output.[41] On the other hand, merging firms often claim that their union will result in large efficiency gains that may counterbalance the reduction in competition. These efficiencies may come from exploiting returns to scale, the diffusion of best practices and know-how, and greater incentives to innovate.[42] Antitrust authorities, therefore, actively seek to prevent mergers that could threaten competition. However, it is an empirical question whether a merger will lead to higher prices or not.

In this chapter I am focusing on a single merger of the automobile industry. During the

[40] IMAA https://imaa-institute.org/mergers-and-acquisitions-statistics

[41] For more look at Ivaldi, Juliet, Rey, Seabright and Tirole (2003)

[42] Expenditure on R&D is expected to be more profitable post-merger since there are fewer competitors in the market and spillover effects are also reduced.

previous decades there was an intensive change in the ownership structure of the automobile industry. I examine if we can predict through merger simulation the effect of the acquisition of Mazda by FORD in 1996 on the prices in the UK market using aggregate yearly data which includes prices, sales and a large number of characteristics of the new models sold between 1971 and 2002. According to the European Commission the market share of passenger cars in the European Community was 11.9% for Ford and 1.4% for Mazda while the remaining important competitors were the VAG Group (16.4%), GM Group (13%), PSA Group (12%) and Renault and Fiat with around 10% each. Furthermore, the reported market shares in the market of the commercial vehicles were 14.9% for Ford and just 0.5% for Mazda. As a result the Commission had decided not to oppose the notified operation and to declare them compatible with the common market and with the functioning of the EEA Agreement[43]. However, from the results in Chapter 1, the merger seems to have a positive effect on prices.

In order to predict the effect of a merger I use a structural method. The key idea is to estimate and model the demand and supply functions using historical data. These estimates are used to simulate the post-merger equilibrium merger by altering the ownership structure of the industry. Then, I compare the simulated price effects with the actual ones in order to evaluate its effectiveness. In order to model the demand function I use a discrete choice model similar to the one used in McFadden (1973), Berry (1994), Berry, Levinsohn and Pakes (1995), Verboven (1996) and Nevo (2000).

McFadden's research (1973) was one of the most influential papers for the discrete choice models. In his research he outlined a general procedure for formulating econometric models of population choice behavior based on product and market characteristics. The formulated logit model is the one in which most later literature bases its demand estimations.

Berry (1994) considers the problem of "supply-demand" analysis on a cross-section of oligopoly markets with differentiated products. He assumed that demand follows a discrete-choice model, similar to that of McFadden, and allows for the possibility that prices are correlated with unobserved demand factors in the cross-section of markets. The unobserved product characteristics are expected to be correlated with the prices; thus the prices are endogenous since they are correlated with the unobservables. Since the unobserved product characteristics enter in a nonlinear fashion in his model he proposed a transformation of the

[43] This decision is adopted in application of Article 6(1)(b) of Council Regulation No 4064/89.

market share equation which allows the application of the instrumental variables methods. Then he demonstrated his methodology with Monte Carlo experiments.

Berry, Levinsohn and Pakes (1995) further analyse the work of Berry (1994). They noted a serious problem of the logit model, i.e. elasticities driven from market shares and endogeneity of prices, and suggested some alternatives as instruments which according to their research are the most suitable to deal with the endogeinety of prices. Finally, they applied their techniques to analyze the equilibrium in the U.S. automobile industry.

Verboven (1996) analyzed whether international price discrimination is the reason behind the differences in car prices across the European countries. To do so, he constructed and estimated an oligopoly model similar to that of Berry, Levinshon and Pakes (1995) considering three sources of international price discrimination: price elasticities, import quota constraints and collusion. He found that there were lower price elasticities in France, Germany, UK and Italy while there were binding import quotas of Japanese cars in France and Italy. Furthermore he noted a possible collusion in Germany and UK.

Nevo (2000) suggested the use of a demand estimation and a model of post-merger conduct to simulate the competitive effects of a merger. He estimated a brand-level demand system for ready-to-eat cereal using supermarket scanner data. The approach is used to examine five mergers in the ready-to-eat cereal industry: two actual mergers (Post and Nabisco, General Mills and Chex), one attempted (General Mills and Nabisco) that was later withdrawn, and two hypothetical (Kellogg and Quaker Oats, General Mills and Quaker Oats). His results demonstrate that mergers do indeed have an impact both on prices and total welfare. Then he proceeded to a more informal analysis where he compares the predicted outcomes of the actual mergers with the actual ones.

In order to evaluate the predictability of merger simulation I compare those results with the actual price change. However, any coincidental irrelevant factors or the time needed for the merging firms to start coordination may misguide us regarding the actual effect the merger. Thus, I also compare the predicted price change with the results of difference-in-differences from Chapter 1 which should avoid those problems.

Note that the ex-post evaluation of merger simulation is a very recent topic in literature. The very first related research is that of Peters (2006) who compared the simulated prices with the actual ones. Specifically, he used merger simulations to predict the post-merger prices for five

airline mergers and compared those predicted prices with the observed post-merger prices. From his research he concluded that merger simulation does not generally provide an accurate forecast.

Another example is the work of Weinberg (2011) where he examined the acquisition of Tambrand by Proctor & Gamble and compared the predicted prices with the actual ones. To do so, he used both direct and different estimates and concluded that the merger simulation gives much smaller price increases.

The research of Weinberg and Hosken (2013) is another example of the evaluation of merger simulation. They examined two different cases of merger. The first was the merger of the Pennzoil and Quaker Statebrands of passenger car motor oil and the second was the acqusition of Log Cabin breakfast syrup by the owner of the Mrs. Butterworth brand. They examined the price increase of the merging firms and their competing rivals. To do so, they used different models for their simulations and found that some of the simulated price effects were very close to the directly estimated price effects. However, the merger simulations underpredicted the price effects on the merging firms' brands for the motor oil merger and overpredicted the price effects for the syrup merger. Some explanations for those discrepancies are discussed but without being able to identify the source of this bias.

Björnerstedt and Verboven (2015) analyzed the merger between AstraZeneca Tica (AZT) and GlaxoSmithKline (GSK) in the Swedish market for analgesics. They computed the actual price changes and then compared them with the predicted ones from merger simulation models. For their demand models they used the constant expenditures specification where price enters logarithmically instead of linearly and market shares are in values instead of volumes. Their models seem to work well as they adequately predicted the merging firms' price increase. However, at a more detailed level there are several discrepancies since they predicted a larger price increase for the smaller firm of the merging party, which was not the case in practice, and they underpredicted the outsiders' responses. In order to explain these differences, they examined and modified their model allowing for a plausible cost increase due to the coincided reduction in the package size after the merger and the possibility of partial collusion. These modifications seem to partly explain these price differences and resulted in price changes that are closer to the actual ones.

3.2 Background information of the merger

Ford became interested in Mazda (or Toyo Koyo as the company was called before 1984) in the 1960's, when Mazda was the third largest automobile company in Japan with a reputation for engineering excellence. Ford began its co-operation with Mazda by buying parts for Ford cars sold in the Asia-Pacific region and by letting Mazda become a supplier for pick-up trucks for the US and Canadian markets. By the end of the 60's they were working together on a number of projects in the Asia-Pacific region. Mazda was basically the supplier of unassembled automotive parts and components, which Ford assembled and sold with Ford badges in various Pacific-rim countries.

In the 70's there was 'turbulence' in the operations of both firms, mainly caused by the oil crisis, a fact that affected their relations. The oil crisis of 1973 turned the demand to the smaller, lower fuel-consuming cars. By that moment, the Japanese car manufacturers managed to improve on productivity and quality far beyond what most North American firms had ever achieved in the small car market. Instead of competing head on with the Japanese, Ford preferred to acquire Mazda in order to learn and be able to compete in these market segments. In 1979, after some prior unsuccessful attempts[44], Ford completed a $135 million deal by which Ford attained a 24.5% shareholding in Mazda with the two companies maintaining their autonomies. As a result, Ford has been in a partnership with Mazda since 1979 when Ford Motor Company began negotiations to acquire a large stake in Mazda hoping to merge it with its own Japanese subsidiary, Ford Industries.

The merger paved the way for several new joint ventures between Ford and Mazda, in which the Japanese company built small cars and trucks under the Ford nameplate and distributed Ford products in Japan. They have been increasing their stakes each year since then. But it was not until 1996 that Ford purchased 33.4% of the company, the legal line in Japan for a controlling interest, by putting up $481 million in cash. [45] By that time Ford had already merged with Aston Martin and Jaguar.

Soon thereafter, Henry Wallace was appointed President, and he set about restructuring

[44] Initial attempts made by Ford were fought by Mazda and the later cries for economic help made by Mazda were ignored by Ford.

[45] REGULATION (EEC) No 4064/89 MERGER PROCEDURE, Case No IV/M.741 - Ford / Mazda, Article 6(1)(b) NON-OPPOSITION Date: 24/05/1996, http://ec.europa.eu/competition/mergers/cases/decisions/m741_en.pdf

Mazda and setting it on a new strategic direction.[46] Wallace and his team introduced some Western management practices. They tightened Mazda's financial controls and improved marketing. They sold assets, trimmed Mazda's bloated lineup of low-volume models, and consolidated the five sales channels into two. Slowly, the restructuring worked. In 1999, Mazda posted its first consolidated profit in six years, and has been profitable each year after 2000.

In 2002 Ford gained an extra 5% financial stake and in 2008 it sold 20% and lost its controlling stakes. From their partnership there was a great diffusion of know-how and new models arose after their merger. Furthermore, Mazda used its alliance with Ford as a means to access new markets, to learn more about Ford's cost-control practices and to explore the process of launching a major manufacturing facility in a foreign country.

3.3 Empirical Methodology

In order to simulate the effect of a merger we need to estimate the structural parameters that compose the demand and supply side. The first step is to estimate the demand function and use the estimated elasticities in order to recover marginal costs from the supply model. In order to estimate the demand function I use historical data before the merger. Then, based on these estimates, I can simulate the effect of a merger by altering the ownership structure in the car industry.

Demand

The simplest approach to model the demand function is to posit a functional form where the demanded quantity of car i is a function of the prices of all cars. Thus, one example of this would be:

$$\ln(q_i) = a_i + \sum_k [\eta_{ik} \ln(p_k)] + \varepsilon_i \qquad (1)$$

where q_i is the demand of product i, p stands for price and η_{ik} is the elasticity of good i with respect to the prices of good k. However such a function would be extremely difficult to estimate since a system of N products gives N^2 elasticities to estimate. For example, if the market consists

[46] Ford and Mazda: A lesson in cooperation, Automotive news, June 16, 2003
http://www.autonews.com/article/20030616/SUB/306160777/ford-and-mazda:-a-lesson-in-cooperation

of 100 products, then we need to estimate 10,000 parameters.

Berry (1994) solves the dimensionality curse by using a discrete choice model similar to that of McFadden (1973). In his model the demand is a function of the characteristics. To derive the demand function he assumed a utility function of the representative consumer and then aggregated these utility functions to construct the demand function. The advantage of this model is that product characteristics are much fewer than the cross-elasticities. Thus, the estimation of the demand function is now feasible.

Suppose the utility function of consumer i is given by:

$$u_{ij} = x_j\beta + \xi_j - \alpha p_j + \varepsilon_{ij} \equiv \delta + \varepsilon_{ij} \qquad (2)$$

where

$$\delta \equiv x_j\beta - \alpha p_j + \xi_j ,$$

$$i = 1,..., I , \quad j = 1,\ldots, J ,$$

x_j is a K-dimensional vector of the observed product characteristics, ξ_j stands for the mean of consumers' valuation of the unobserved by the econometricians' product characteristics and ε_{ij} is a mean-zero stochastic term.

Some of the observed product characteristics are the size of the car, the miles per litre and the power (horse power divided by the weight of the car). Some of the unobserved characteristics may be the popularity of a model from advertising or magazine reviews. We may not be able to observe ξ_j; however both firms and consumers observe and take them into consideration when they make decisions.

A consumer purchases one unit of good that will maximize his utility. Thus, consumer i chooses product j if and only if:

$$u_i(x_j, p_j, \xi_j; \theta) > u_i(x_r, p_r, \xi_r; \theta) \quad \text{for r = 0, 1,…, J} \qquad (3)$$

where product 0 stands for the outside good and θ is a vector that includes all parameters to the model. Note that discrete choice model assumes that a consumer will always select a product to consume. Therefore, I used an outside good in my specification in order to allow consumers not to buy any cars.

For simplicity, I assume that the utility from the outside good equals zero.

Hence, for a given θ the set that leads to a choice of good j is

$$A_j(x, p, \xi;\ \theta) = \{\zeta : u_{ij} \geq u_{ir}\} \qquad \text{for r = 0, 1,…, J} \qquad (4)$$

where A_j is the set of values for ζ that induces the choice of good j. If f(ζ) is the distribution of preferences in the population, then the market share of good j is:

$$s_j(x, p; \theta) = \int_{\zeta \in A_j(\theta)} f(\zeta)\, d\zeta \qquad (5)$$

So by equating the actual market shares with the above function we can estimate our demand parameters. However it should be noted that with the outside good our observations of the N products are not enough to calculate the N+1 products. Nevertheless, if the total market size M is directly observed then we can easily compute the market shares as $s_i = q_i / M$ and $s_0 = (M - \Sigma q_k)/ M$. I will follow Berry, Levinshon and Pakes (1993) who set the market size equal to the households in the economy.

I assume that ε_{ij} is identically and independently distributed across products and consumers with the "extreme value" distribution function $e^{-e^{-\varepsilon}}$. The market share of product i is given by the logit formula:

$$s_j(\delta) = {e^{\delta_j}}\Big/{\sum_{k=0}^{N} e^{\delta_k}} \qquad (6)$$

From (6) we can get the following for the own- and cross-elasticities:

$$\eta_{jk} = \begin{cases} -ap_j(1 - s_j) & \text{if j = k} \\ ap_k s_k & \text{otherwise} \end{cases} \qquad (7)$$

Now we face two problems. The first is related to the own elasticity. Since in most cases the market shares are small, the factor $a(1\text{-}s_j)$ is almost equal for all products. As a result, the lower the price, the lower will be the own elasticity. But this would imply higher mark ups for the lower-priced brands[47] . This may be true for some products if they have lower ratios of marginal costs to price than the more expensive ones. However, in general we will expect that the higher priced cars (like thse of Aston Martin, Jaguar, Mercedes etc.) will have higher mark ups.

The second one concerns cross-elasticity. The cross-elasticity of car j with respect to car k will

[47] $Mark\ up = \frac{-1}{own\ eleasticity}$

be equal to the product of the price and share of car k regardless of its characteristics. As a result there may be cases where a luxury car may have the same cross-elasticity among cars of different segments if the product of prices and share is the same among them. Furthermore, there would be cases where cars of the same segment may have lower cross-elasticities than cars of other segments.

A solution to the second problem would be to allow ε_{ij} to be correlated across products of similar characteristics rather than independently distributed. So instead of the simple logit, I would use a nested logit model where cars are grouped into different nests that are expected to be closer substitutes[48]. In order to group the cars I use the segment of the car that it belongs to, such as mini, family, sports etc. So now, instead of using just ε_{ij}, I use the function $v_{ij}(\sigma)+(1-\sigma)\varepsilon_{ij}$ where ε_{ij} is an iid extreme value random variable and v_{ij} has a (unique) distribution such that $v_{ij}(\sigma)+(1-\sigma)\varepsilon_{ij}$ is also an extreme value random variable.

Then the utility function will be:

$$u_{ij} = \delta_j + v_{ij}(\sigma) + (1-\sigma)\varepsilon_{ij} \qquad (8)$$

which results in the market share of good i given by

$$s_j(\delta) = \frac{e^{\delta_j/(1-\sigma)}}{I_g}\frac{{I_g}^{1-\sigma}}{\sum_g({I_g}^{1-\sigma})} \qquad (9)$$

where: $I_g = \sum_{j\in g} e^{\delta_j/(1-\sigma)}$

since the utility of the outside good is zero, then δ_0 and I_0 are equal to zero and one respectively. The elasticities now are given by:

$$\eta_{jj} = ap_j s_j - ap_j\left(\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma} MS_{j|g}\right) \qquad (10)$$

$$\eta_{jk} = \begin{cases} ap_k s_\kappa & \text{if k } \notin \text{g}, j \in g \\ ap_k s_k\left(\frac{\sigma}{1-\sigma}\frac{MS_{k|g}}{s_k} + 1\right) & if \;\; k, j \in g \end{cases}$$

[48] For more detailed information, see McFadden (1978) and Berry (1994)

where $MS_{j|g}$ is the observed market share of product j within its market segment g. As shown by McFadden (1978), the nested logit model is consistent for $0 \leq \sigma \leq 1$. The higher the σ, the higher the correlation of preferences in each group. If σ equals zero, then an individual's preferences are uncorrelated across all cars sold in the market, resulting in the simple logit model.

Notice that the nested logit allows for more flexible substitution patterns but it does not help for the own elasticity. A solution to this was suggested by Brenckers & Verboven (2006) who used a more flexible specification where the segmentation parameters were allowed to vary among groups. Hence a more flexible version will be:

$$s_j(\delta) = \frac{e^{\delta_j/(1-\sigma_g)}}{I_g} \frac{{I_g}^{1-\sigma_g}}{\sum_g ({I_g}^{1-\sigma_g})} \qquad (9a)$$

where $I_g = \sum_{j \in g} e^{\delta_j/(1-\sigma_g)}$

$$\eta_{jj} = ap_j s_j - ap_j \left(\frac{1}{1-\sigma_g} - \frac{\sigma_g}{1-\sigma_g} MS_{j|g}\right) \qquad (10a)$$

$$\eta_{jk} = \begin{cases} ap_k s_k & \text{if k} \notin \text{g}, j \in g \\ ap_k s_k \left(\frac{\sigma_g}{1-\sigma_g} \frac{MS_{k|g}}{s_k} + 1\right) & if \;\; k, j \in g \end{cases}$$

In order to be able to estimate the parameters of the demand function I am going to use the suggested convenient transformation of Berry (1994). So now our demand function for the restricted segmentation is:

$$\ln(s_j) - \ln(s_0) = x_j - ap_j + \sigma ln MS_{j|g} + \xi_j \qquad (11)$$

and for the flexible:

$$\ln(s_j) - \ln(s_0) = x_j - ap_j + \sigma_g ln MS_{j|g} + \xi_j \qquad (11a)$$

The above transformation makes it econometrically easy to calculate the above function and ξ_j

will be the residuals of the regression. However, before I proceed to the econometric estimation of the demand, notice that ξ may be unobserved to us but it is observed by the firms and they will take this into consideration in their pricing. As a result, p and $MS_{j|g}$ are no longer orthogonal to our error term and a simple OLS is no longer plausible and we need to use instruments for prices which are going to be discussed in later.

Supply

In the next section I will construct my supply model. Suppose that there are F groups of brands which produce some subset F_f of the j =1,..,J different cars. Each group is controlled under the same administration and they maximize their total profits. The profits of group f are given by:

$$\Pi_f = \sum_{j \in F_f} (p_j - mc_j) s_j(p) M - FC_j \quad (12)$$

where $s_j(p)$ is a function of prices of all cars that give the market share of car j, M is the size of the market, i.e. the number of households, mc_j is the marginal cost and FC_j the fixed cost of car j respectively. The pure-strategy Bertrand-Nash equilibrium for strictly positive prices is given by the first-order condition:

$$s_j(p) + \sum_{k \in F_f} (p_k - mc_k) \frac{\partial s_k(p)}{\partial p_j} = 0 \quad (13)$$

Let Θ be the ownership matrix of JJ rows and vectors, where

$$\Theta_{jr}^{pre} = \begin{cases} 1 & if\ j,r\ \ produced\ by\ firms\ of\ the\ same\ group \\ 0 & otherwise \end{cases} \quad (14)$$

and:

$$\Omega_{jr}^{pre}(p) = \frac{\partial s_r(p)}{\partial p_j} \Theta_{jr}^{pre} \quad (15)$$

Then, in vector notation, the first-order conditions are:

$$s(p) - \Omega^{pre}(p)(p - mc) = 0 \quad (16)$$

In order to derive the mc I will use my estimates from demand and the observed shares in equation (16). Hence the estimated $\widehat{mc}$ is:

$$\widehat{mc} = p - \Omega^{pre}(p)^{-1} s(p) \quad (17)$$

In order to estimate the post-merger equilibrium I use a new ownership matrix Θ^{post} and consequently Ω^{post} in response to the post-merger structure of the industry. Hence, from (16) the predicted post-merger equilibrium price p^* is given by:

$$p^* = \widehat{mc} + \Omega^{post}(p^*)^{-1}s(p^*) \quad (18)$$

Unfortunately there are two non-trivial assumptions. Firstly, the use of the same mc as before the merger is a non-trivial assumption. The new equilibrium does not leave space for any efficiency gains on the productivity costs. However, depending on the magnitude of the changes on prices we can question later if the predicted increase in prices is a plausible outcome. Secondly, the assumption of the size of Θ and Ω does not take into account the possibility of the drop or the introduction of new cars which eventually can affect the outcome. For instance, the acquired firm may reduce its competiveness to the rest of the group, not by increasing prices necessarily, but by producing cars that are not so close in substitution.[49]

3.4 Data & Estimation

The data is annual and includes the unit sales, inflation-adjusted market prices to the year 2014 and the characteristics of all new car model variants sold in the United Kingdom over the period 1980–1999. Data from 1980 to 1995 is used for the estimation of the demand and the rest is used to compare the simulated with the actual outcome. I use the following empirical specification for my regression:

$$\ln(s_j) - \ln(s_0) = \beta_c + \beta_1 X_j + \beta_2 Year + \beta_3 Brand + \beta_4 Home + \beta_5 Segment - ap_j + \sigma ln MS_{j|g} + \xi_j \quad (19)$$

where: s_j = share of product j, i.e q_j/M

s_0 = the outside good , i.e. $(M - \sum_{k \in J} q_k)/M$

$MS_{j|g}$ = share of product j within its segment g

[49] For more information, see Chapter 2.

β_c = constant

X_j = primary characteristics of product j

Year = year dummy

Brand = brand dummy

Home = domestic dummy

Segment = segment dummy

ξ_j = value of unobserved product characteristics

The characteristics x from equation (11) are now divided into primary and control dummies in (19). The primary characteristics X_j are power (= horse power/weight), size, economy (miles per pound), clima (equals 1, 2 or 0 if equipped with air conditioning, climate control or none) and whether it is equipped with a fuel injection system, turbo and/or diesel engine. The control dummies are dummy variables of 16 years, 68 brands and 5 market segments. I include "Year" and "Brand" dummies, the location dummy "Home" (equals 1 if the selected model is produced in the UK), and the "Segment" dummy to control for seasonal, brand, domestic and segment demand preferences or shocks, respectively. The β_1 to β_5 capture the influence of the primary characteristics, year, brand, location of manufacture and segment of the car, respectively, and α captures the influence of price. Since it is a log-level demand model, a one-unit increase in variable i will lead to a β_i*100% increase in the market share.

Cars are nested across their market segments which are mini/super-mini, small family, medium, executive, luxury, sports, 4-by-4 and polymorphic. However, since luxury and polymorphic cars are small segments, in order to have a less strict degree of freedom, I merge them with sport and executive respectively, which are very close in characteristics (prices size, fuel economy, etc). Furthermore, I drop the 4-by-4 segment which is also a small segment but its characteristics do not allow us to merge to any other segment.[50]

I use three alternatives for the above model. The first one is a simple logit version named "simple logit" where $\sigma = 0$ in equation (19). The second one is a nested logit with the same σ across all segments, named "fixed nested logit", and the third one, named "flexible nested logit", is a nested logit where σ is allowed to vary across segments.

[50] Details on how I decided to merge those segments are in the Appendix

Estimation & instruments

As I noted in the empirical methodology, the mean consumers' valuation of the unobserved product characteristics ξ will be the residuals of our regression. Since ξ is correlated with the consumers' preferences, we expect that it will affect pricing and the segment shares $MS_{j|g}$. As a result, both p and $MS_{j|g}$ are not orthogonal to the error term and a simple OLS is no longer plausible. In order to estimate the parameters of the model, we need to exploit a population moment condition that is a product of instrumental variables and the error term ξ to form a GMM estimator.[51]

I assume that the product characteristics are predetermined and uncorrelated with the error term ξ. Since the pricing equation holds for all cars simultaneously, constituting a Nash equilibrium, a firm's pricing policy for car j does not only depend on its own characteristics, but also on the characteristics of the other products owned by the same firm and on the characteristics of the competing products. As a result, Berry, Levinsohn and Pakes (1995) proposed the use of functions of the competitors characteristics as instruments. Since I used a similar specification to Vervoben & Breckens (2006) where the segmentation parameters were allowed to vary among groups, I follow a very similar method to construct my needed instruments.

The instruments that I use for the simple logit are: (i) the cars' own observed characteristics x_j, (ii) the number of cars and the sums of the characteristics of the rest of the cars produced by the same firm, and (iii) the number of cars and the sums of the characteristics of competing cars. Note that for (ii) and (iii), the characteristics that I choose to build those instruments need to be as variant as possible in order to be able to be correlated enough with the endogenous variables. Since a dummy variable is not a very good candidate for our instruments, I concluded in using the variables of power, size and economy for my instruments.

In a similar manner, the instruments that I use for the restricted nested logit are: (i) the cars' own observed characteristics x_j, (ii) the number of cars and the sums of characteristics of other cars of the same firm belonging to the same segment, (iii) the number of cars and the sums of the characteristics of the remaining segments of the firm, (iv) the number of cars and the sums of the characteristics of competing cars belonging to the same segment, and (v) the number of cars and the sums of the characteristics of all competing cars. For the flexible nested logit, I

[51] For more details, see Berry, Levinsohn, and Pakes (1995) or Nevo (2000).

use the same instruments as in the fixed, the difference being that I interact (ii) to (v) with the set of segment dummy variables.

Price trends & statistics in the UK

In 1995 the Ford group had the highest market share of 24% in the UK and Mazda a 0.7%. The remaining highest market shares are those of the GM group with 16.5%, BMW with 15.3% and the PSA group with 11.1%. Thus, the joint market share of Ford and Mazda, i.e. around 25%, is much higher than their total share in the European Community which was reported to be 13.3% by the European Commission.

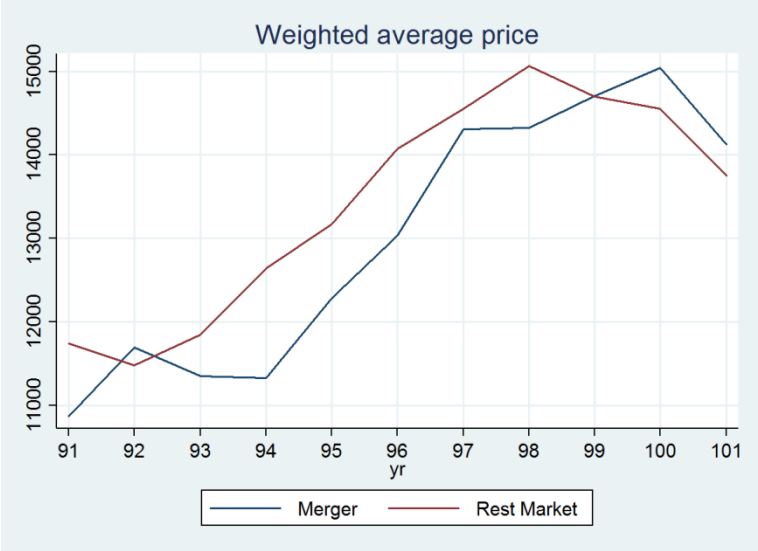
The following graphs (3.1.1.a to 3.1.4.b) show the trends in prices of the merging firms relative to the rest of the market and its close competitors. I consider three different cases of close competitors. The first consists of the car models manufactured in the same country, the second consists of the car models of same segment and the third consists of the car models of the same segment which were manufactured by factories in the same country[52] as the merged ones, respectively. Graphs 3.1.a to 3.4.a shows the average price (weighted by their sales) of Mazda and Ford in comparison with that of the rest of the market, the cars manufactured in the same country, the cars that belong to the same segment and the cars of the same segment that are manufactured in the same country as the merged ones, respectively, in a time window of 5 years before and 5 years after the merger. Graphs 3.1.b to 3.4.b are the respective ones where instead of two separate trends for Ford and Mazda, I use one with the average price of the whole merging party. Table 3.1 presents the basic statistics of the variables included in our regression for the period 1980 to 1995.

From Graph 1.a comparing to the rest of the market's average price, Mazda drops its average price after the acquisition while the Ford group increases it. Of course the market share of Mazda is very small relative to the Ford group and as a result their joint average price would be higher after the merger when we compare it to the rest of the market (Graph 3.1.b). Furthermore, we have similar results when we compare it with its close competitors (Graphs 3.2.a to 3.4.b). Hence the merger seems to lead to higher prices in the UK.

[52] For example if one of the merged cars is a sports car manufactured in France, then I will include in my treatment group all sports cars manufactured in France

Graph 3.1.a Average price of Mazda, Ford and the rest of the market

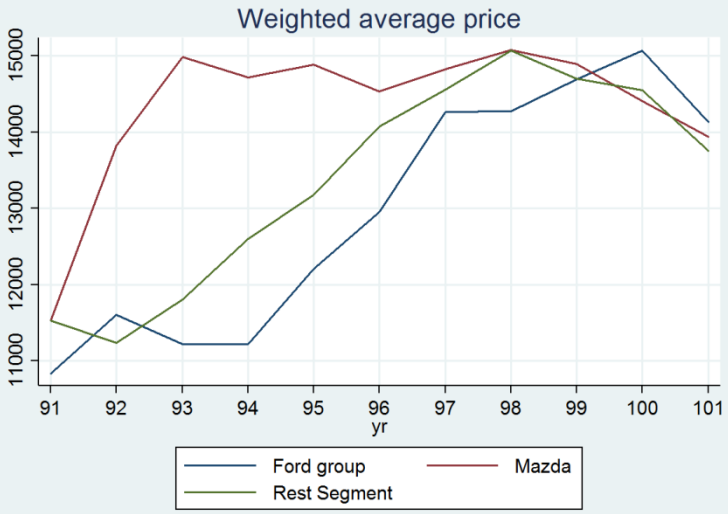
Graph 3.1.b Average price of the merging party and the rest of the market



Graph 3.2.a Average price of Mazda, Ford and competitors type "location"

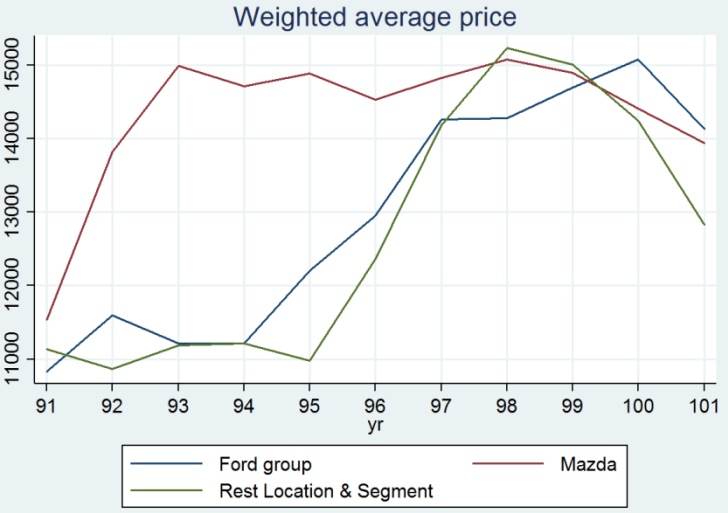
Graph 3.2.b Average price of the merging party and competitors type "location"

Graph 3.3.a Average price of Mazda, Ford and competitors type "segment"



Graph 3.3.b Average price of the merging party and competitors type "segment"

Graph 3.4.a Average price of Mazda, Ford and competitors type "location & segment"



Graph 3.4.b Average price of the merging party and competitors type "location & segment"

Table 3.1 Statistics of basic variables

Variable	Mean	Std. Dev.
Market share of each car	0.000204	0.000398
Market share of outside good	0.906668	0.00956
Real price	28334.2	24139.45
Power (= horse power / weight)	92950.89	32898.94
Size (=length* width)	74.8444	12.06135
Economy (= miles per pound)	47.47266	11.88724
Fuel injection	0.410824	0.492017
Diesel fuel	0.102911	0.303863
Turbo	0.084461	0.278097
Clima	0.094164	0.292077

3.5 Parameter estimates, elasticities and marginal cost

In Table 3.2, I summarize the results of the regressions for the primary characteristics of the treatment groups with robust standard error. The results from the first column stand for those with a simple OLS. The second and third columns, i.e. simple 1 and 2, are the estimates from a simple logit model with instrument set 1 and 2 respectively. The third and fourth, i.e. fix 1 and fix 2, are the respective ones for the nested logit with restricted segmentation while the fifth and sixth, i.e. flex 1 and flex 2, are the ones for the nested logit with flexible segmentation. Instrument set 1 are instruments produced by the number of models, variable power and variable size of the cars, while instrument set 2 are those produced by the number of models, variable power and variable economy.

In all cases the price (coefficient α) is statistically significant and negative for a critical value of 1% except for the simple logit where both instruments sets result in a price coefficient statistically significant for a critical value of 5%. In all alternatives of the nested logit the parameters σ from the groups are statistically significant for a critical value of 1% and between 0 and 1. Simple logit seems to have the less statistically significant results for the remaining primary characteristics where only size and diesel are statistically significant (critical value 5%) for instrument set 1, and size (1%), fuel injection (10%) and diesel (1%) for instrument set 2,

respectively. The variable turbo has statistically significant results (1%) only when we use flexible segmentation while variable power has statistically significant results (1% at set 1 and 10% at set 2) only at the restricted segmentation. The variable size is statistically significant for a critical value of 1% at both regressions of nested logit with restricted segmentation and 5% for the flexible specification with instrument set 2. The variable economy is statistically significant (1%) at all nested logit specifications and instrument sets except for instrument set 1 with restricted specification. The variable inject is statistically significant (10%) at all nested logit specifications and instrument sets except for instrument set 1 of flexible specification. The variable clima is statistically significant (1%) at all nested logit specifications and instrument sets except for instrument set 2 of flexible specification. Finally, diesel is statistically significant for a critical value of 1% for all sets and specifications of nested logit except for the set 1 of restricted specification which is statistically significant for a critical value of 10%.

Tables 3.3.1 and 3.3.2 summarize the per segment mean cross-elasticity with cars of the same segment and cars of a different segment, respectively. Table 3.3.3 summarizes the weighed sales average of own elasticity for each segment, for the whole market and the percentage of the estimated marginal costs that are negative. From Table 3.3.3, OLS results in very small own elasticities (weighted sales average is around 0.4), a huge percentage of estimated marginal costs that are negative (92.31%) and the own elasticity seems to increase as we move to the higher more expensive segments. Furthermore, very few differences are observed between the cross-elasticities with cars of the same segment and cars from different segments (Tables 3.3.1 and 3.3.2).

The results from simple logit models seem more “reasonable” for both elasticities and estimated marginal costs. For simple 1 and 2 the weighted average own elasticity is 1.94 and 1.48, respectively, while the percentage of negative marginal cost equals 3.56% and 9.76%, respectively. However, the cross-elasticities are still not higher for cars of the same segment (Tables 3.3.1 and 3.3.2) and again the own elasticity is higher as we move to the more expensive segments (Table 3.3.3).

Nested logit seems to perform even better. For fix 1 and 2 the weighted average own elasticity is 2.76 and 1.34, respectively, while the percentage of negative marginal cost equals 0.19% and 21.95%, respectively. Furthermore, for both fix 1 and fix 2 the cross-elasticities are much higher for cars of the same segment, around 0.01 to 0.07, compared to the others which are

around $1.83*10^{-5}$ to $4.11*10^{-5}$ (Tables 3.3.1 and 3.3.2). Nevertheless, the average own elasticity still increases as we move to the higher segments (Table 3.3.3).

Nested logit with flexible specification in some areas performs better and in others worse. Its advantage is that it results in a more reasonable weighted average own elasticity per segment. As we move from segment 1 to 3 we get lower own elasticities for both flex 1 and flex 2 (Table 3.3). However, own elasticity increases as we move to segments 4 and 5. Nevertheless, segment 4 is still lower than segments 1 and 2. Furthermore, we still have higher cross-elasticities among cars of the same segments than others (Tables 3.3.1 and 3.3.2). On the other hand, despite the fact that we get higher weighted average own elasticity (1.39 and 1.29) and smaller percentage of negative marginal costs (40.34% and 57.04%) from both flex 1 and flex 2 than OLS, these results are worse when we compare them with fix 1 and fix 2 (Table 3.3.3). Even simple logit results in a lower percentage of negative marginal cost.

Table 3.2 Results of primary characteristics

		Simple logit		Nested logit (fix)		Nested logit (flex)	
VARIABLES	OLS	Instruments set 1	Instruments set 2	Instruments set 1	Instruments set 2	Instruments set 1	Instruments set 2
price	-1.85e-05***	-8.95e-05**	-6.82e-05**	-1.06e-05***	-5.40e-06***	-4.20e-06***	-2.13e-06***
	(2.20e-06)	(4.26e-05)	(2.98e-05)	(1.25e-06)	(8.68e-07)	(6.81e-07)	(6.04e-07)
power	-3.02e-06***	9.04e-06	5.58e-06	1.25e-06***	2.87e-07*	2.08e-07	-6.38e-08
	(9.58e-07)	(7.08e-06)	(4.91e-06)	(2.38e-07)	(1.74e-07)	(1.45e-07)	(1.38e-07)
size	0.00962***	0.0267**	0.0217***	0.00327***	0.00182***	-0.000217	-0.000728**
	(0.00294)	(0.0106)	(0.00762)	(0.000483)	(0.000369)	(0.000377)	(0.000350)
economy	0.0276***	0.00363	0.0112	-0.000392	0.00173***	0.00305***	0.00340***
	(0.00386)	(0.0155)	(0.0111)	(0.000630)	(0.000539)	(0.000459)	(0.000452)
inject	-0.132**	-0.0919	-0.114*	0.0126*	0.00952*	-0.0107	-0.0111*
	(0.0557)	(0.0705)	(0.0642)	(0.00660)	(0.00573)	(0.00653)	(0.00647)
diesel	-1.201***	-0.676**	-0.838***	-0.0327*	-0.0809***	-0.132***	-0.130***
	(0.0991)	(0.338)	(0.247)	(0.0174)	(0.0158)	(0.0127)	(0.0128)
turbo	-0.148*	-0.111	-0.127	-0.00309	-0.00487	-0.0242***	-0.0246***
	(0.0787)	(0.0853)	(0.0813)	(0.00811)	(0.00746)	(0.00897)	(0.00910)
clima	-0.101	0.808	0.539	0.128***	0.0556***	0.0354***	0.0146
	(0.0779)	(0.547)	(0.386)	(0.0182)	(0.0136)	(0.0122)	(0.0118)
σ				0.919***	0.915***		
				(0.00902)	(0.00893)		
σ Mini/Super-mini						0.972***	0.989***
						(0.00890)	(0.00842)
σ Small Family						0.955***	0.971***
						(0.00831)	(0.00949)
σ Medium						0.832***	0.830***
						(0.00935)	(0.00922)
σ Executive						0.874***	0.855***
						(0.0143)	(0.0181)
σ Luxury						0.911***	0.939***
						(0.0124)	(0.0126)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.3.1 Mean cross-elasticity among cars of the same segment

	OLS	Simple1	Simple2	Fix1	Fix2	Flex1	Flex2
Mini/Super-mini	8.25E-05	0.000399	0.000304	0.021887	0.01058	0.026496	0.034787
Small Family	7.69E-05	0.000372	0.000284	0.022029	0.010649	0.016312	0.013046
Medium	7.96E-05	0.000385	0.000293	0.01677	0.008107	0.002911	0.001455
Executive	4.34E-05	0.00021	0.00016	0.047094	0.022763	0.011412	0.004921
Luxury	2.98E-05	0.000144	0.00011	0.070964	0.034301	0.025368	0.019346

Table 3.3.2 Mean cross-elasticity among cars of different segments

	OLS	Simple1	Simple2	Fix1	Fix2	Flex1	Flex2
Mini/Super-mini	6.27E-05	0.000303	0.000231	3.59E-05	1.83E-05	1.42E-05	7.22E-06
Small Family	6.28E-05	0.000304	0.000231	3.6E-05	1.83E-05	1.43E-05	7.23E-06
Medium	5.88E-05	0.000285	0.000217	3.37E-05	1.72E-05	1.34E-05	6.77E-06
Executive	7.05E-05	0.000341	0.00026	4.04E-05	2.06E-05	1.6E-05	8.12E-06
Luxury	7.16E-05	0.000347	0.000265	4.11E-05	2.09E-05	1.63E-05	8.26E-06
Cross all	6.56E-05	0.000317	0.000242				

Table 3.3.3 Own elasticity and marginal cost

	OLS	Simple1	Simple2	Fix1	Fix2	Flex1	Flex2
Mini/Super-mini	-0.26176	-1.26637	-0.96499	-1.77849	-0.86354	-2.03372	-2.62334
Small Family	-0.35824	-1.73311	-1.32065	-2.46691	-1.19773	-1.75754	-1.38243
Medium	-0.44734	-2.16417	-1.64912	-3.10382	-1.50691	-0.59404	-0.29773
Executive	-0.70216	-3.39693	-2.5885	-4.77711	-2.3195	-1.21918	-0.53772
Luxury	-0.85119	-4.11791	-3.1379	-5.85545	-2.84294	-2.11206	-1.56143
Total market	-0.40185	-1.9441	-1.48143	-2.76454	-1.34224	-1.39572	-1.29451
Percentage of mc that are negative	92.31%	3.56%	9.76%	0.19%	21.95%	40.34%	57.04%

3.6 Results and evaluation of merger simulation

Most empirical research that used merger simulation did not examine its efficiency. Ex-post evaluation of merger simulation is a very recent topic in literature. Thus, an important part of my research is the evaluation of the accuracy of the simulated results. This is not an easy task since in the real word the moment of coordination or the structure of the market may have differed significantly.

Results vs Actual price changes

Table 3.4.1.a summarizes the actual and predicted change of the average real price of the segments, Ford and total market with and without the 4by4 segment. Table 3.4.1.b summarizes the p-value from the t-test if the predicted price change is equal to zero. Tables 3.4.2.a and 3.4.2.b summarize the respective results when we use only the cars that were sold both before and after the merger. Table 3.5 summarizes the p-value from the t-test if the predicted prices are equal to the actual post merger prices, i.e. the actual prices from year 1997. Table 3.6 summarizes the number of total different cars sold in 1995 and 1997 for the full market, the market without the 4by4 segment and the cars that were in common for both years.

From Tables 3.4.1.a and 3.4.1.b we understand that all specifications predict a statistically positive effect on the weighted average prices of the market, and from Table 3.5 we fail to reject that the predicted prices are equal to the actual post-merger prices. However, this increase seems to be much lower than the actual one from our direct computation (Table 3.4.1.a).[53] Furthermore, they fail to predict the decrease in the prices of the Executive and Luxury segment. Fix 1 specification results in the higher price increase (0.17%), followed by Flex 1 and Flex 2 with a 0.15% and 0.14% price increase respectively, and lastly Fix 2 which predicts just a 0.03% price increase. Nevertheless, Flex 1 and Flex 2 were more accurate regarding the relative price changes among the first 3 segments. Those segments are the ones that Flex 1 and Flex 2 gave the more consistent results regarding the own elasticities, i.e. the more expensive segments resulted in lower price elasticities. Hence, while the flexible specifications perform even worse regarding

[53] I do not comment on the significance level of the actual effect because I will use later the significance levels from the results of difference-in-differences from Chapter 1.

the prediction of the total market price, they perform better regarding the relative price change of the segments.

A partial explanation regarding the failure of capturing the full extension of the actual price increase might be the changes in the structure of the market. In years 1995 and 1997 there were 580 and 628 different cars sold, respectively. However, only 269 were the same in the predicted market and the actual market of 1997. Furthermore, our predicted market lacks the 4by4 segment which I was obliged to drop since there were not enough observations in the previous years to compose a separate nest. As a result, it may be useful to summarize the price changes for the cars that were in common for both years.

From Tables 3.4.2.a and 3.4.2.b, in addition to our previous results, we have the opposite outcome for the actual market. According to my results, the actual prices drop by 0.13% while the predicted ones remain positive and slightly bigger than before. Hence, the diversification of the market complicates and weakens even more the predictability of the structural model. Nevertheless, despite the lack of precision it does predict the sign of the change of the average market price while the flexible specification gives consistent results regarding the relative price change of most of the segments.

Table 3.4.1.a Predicted and actual weighted average price changes from year 1995 to 1997

	Actual	Fix 1	Fix 2	Flex 1	Flex 2
Mini/Super-mini	6.563%	0.042%***	0.002%***	-0.001%	0.003%
Small Family	9.698%	0.248%***	0.034%***	0.201%***	0.149%***
Medium	7.885%	0.103%*	0.046%***	0.164%***	0.166%***
Executive	-6.749%	0.016%	0.000%	0.009%***	0.012%***
Luxury	-0.149%	1.012%**	0.005%	0.682%***	0.543%***
4by4	4.430%	-	-	-	-
Ford (drop 4by4)	10.996%	0.303%***	0.117%	0.502%	0.466%***
Ford (full market)	10.769%	-	-	-	-
Total (drop 4by4)	7.023%	0.168%***	0.027%***	0.154%***	0.137%***
Total (full market)	6.525%	-	-	-	-

Table 3.4.1.b P-value from t-test of Ho: predicted price = price before merger

	Fix 1	Fix 2	Flex 1	Flex 2
Mini/Super-mini	0.00	0.00	0.84	0.68
Small Family	0.17	0.00	0.01	0.00
Medium	0.05	0.00	0.00	0.00
Executive	0.41	0.86	0.00	0.00
Luxury	0.03	0.32	0.00	0.00
Ford	0.00	0.56	0.58	0.01
Total	0.00	0.00	0.00	0.00

Table 3.4.2.a Predicted and actual weighted average price changes of the cars produced both before and after the merger

	Actual	Fix 1	Fix 2	Flex 1	Flex 2
Mini/Super-mini	12.407%	0.032%**	-0.001%	0.002%	-0.001%
Small Family	4.179%	0.297%	0.047%***	0.254%***	0.194%***
Medium	6.134%	0.119%*	0.069%***	0.208%***	0.202%***
Executive	-10.815%	0.013%	0.000%	0.008%**	0.012%***
Luxury	-4.906%	1.445%	0.007%***	0.950%***	0.750%***
Ford	-10.744%	0.475%***	0.184%	0.746%	0.656%**
Total	-0.130%	0.179%**	0.039%***	0.199%***	0.174%***

Table 3.4.2.b P-value from t-test of Ho: predicted price = price before merger for the cars produced both before and after the merger

	Fix 1	Fix 2	Flex 1	Flex 2
Mini/Super-mini	0.00	0.17	0.12	0.73
Small Family	0.36	0.00	0.06	0.01
Medium	0.09	0.00	0.00	0.00
Executive	0.60	0.75	0.02	0.00
Luxury	0.02	0.22	0.00	0.00
Ford	0.00	0.79	0.53	0.02
Total	0.04	0.00	0.00	0.00

Table 3.5. P-value from t-test of Ho: predicted price = actual price

	Fix 1	Fix 2	Flex 1	Flex 2
Mini/Super-mini	0.80	0.80	0.80	0.80
Small Family	0.65	0.64	0.65	0.65
Medium	0.64	0.64	0.64	0.64
Executive	0.75	0.75	0.75	0.75
Luxury	0.95	0.99	0.96	0.97
Ford	0.34	0.35	0.35	0.35
Total	0.35	0.34	0.35	0.35

Table 3.6. Number of car models (per year)

	1995	1997
Full market	580	628
Without 4by4	533	579
Only in both years	269	269

Results from difference-in-differences

So far I have compared my findings to the actual price change. However evaluating the effect of the merger from the direct estimates of the price change might not be credible. The merging party may have started to collude before the announcement of their merger. Furthermore, any coincident irrelevant factors that affect prices will lead to biased results, not to mention that the merger's effect may not be completed in just one year. Hence, it would be safer to conclude the actual effect of the merger using the results of difference-in-differences from Chapter 1.

Table 3.7 summarizes the percentage effect of the merger to its close competitors, i.e. the car models of the same segment as those of the merger which were manufactured by factories in the same country[54] . As a control group I used the rest of the automobile market which should control for shocks that affect demand or supply. I have used two different time windows. The first is 1 year before and 1 year after the mergers. The second is wider with 2 years before and 2

[54] For example if one of the merged cars is a sports car manufactured in France, then I will include in my treatment group all sports cars manufactured in France

years after the merger. Furthermore, I have used two different hypothesis for the error (robust and cluster over brand) and three alternatives of my model regarding the used characteristics to my regressions (basic, primary and all). The results from all of these specifications are all included in table 3.7. However, I have also used an alternative of my model which controls the effects from other mergers that happened relatively close to the Mazda-Ford merger. Nevertheless there was no serius change on the significance level or or the sign of the results [55].

When I use robust standard error and the "1 by 1" time window, I get a statistically positive effect on prices, around 5.2% to 5.5% from the "basic" regression with or without the merger dummies and this is statistically significant for a 5% critical value. When I use the wider time window, all results are statistically significant for a critical value of 1% and equal, around 2.3% to 5.5% except for the result of the "all" regression which is statistically significant for a critical value of 5%. If I change the hypothesis about the standard error and do clustering over brand we have even more regressions with significant positive effects on the same regressions where they "primary" regression using the "1 by 1" time window with or without other merger dummies results in a statistically positive effect, around 2.3%, and statistically significant for a 10% critical value. However, the results for the "all" regressions of the "2 by 2" time window, with or without the merger dummies, are now statistically significant only for the less restrictive critical value of 10%. The rest results are not affected.

Hence, the merger seems to have led to an increase in the prices of close competitors. As a result the statistically positive effect that predicts the simulation seems to be accurate. However, the actual effect is still much higher than the predicted one.

[55] For further details, see Chapter 1.

Table 3.7. Actual effect on Ford's close competitors' price (diff-in-diff)

	Robust s.e.			Cluster brand		
	basic	primary	all	basic	primary	all
Window "1 by 1"	5.47%**	2.35%	1.46%	5.47%**	2.35%*	1.46%
Window "2 by 2"	5.47%***	3.9%***	2.45%**	5.47%***	3.9%***	2.45%*
Window "1 by 1" controlling for other merger effect	5.19%**	2.26%	1.37%	5.19%**	2.26%*	1.37%
Window "2 by 2" controlling for other merger effect	5.3%***	3.79%***	2.26%**	5.3%***	3.79%**	2.26%*

*** p<0.01, ** p<0.05, * p<0.1

3.7 Difference-in-differences or merger simulation?

In order to predict how a merger will affect the prices, in addition to the merger simulation, one can use the findings from similar mergers regarding how they affected prices and decide based on those findings. The obvious candidates are the previous mergers in the car industry. In order to evaluate how these mergers affected prices, I used a difference-in-differences application (henceforth diff-in-diff). The key idea behind the diff-in-diff methodology is to compare prices before and after a merger. This comparison relies on three factors: (i) that the merger is an exogenous, unexpected event for all non-merging firms, (ii) an appropriate control group is selected to control for any other irrelevant factors affecting prices post-merger, and (iii) an appropriate time window around the merger is chosen. The main advantages of this methodology stem from the clear identification (conditional on the three previous factors) and the ease of estimation. Its empirical credibility though comes at a cost: it is very difficult to generalize the results derived from one merger to future mergers in other industries or even the same industry.

During the decade before the acquisition of Mazda by Ford, there was an intensive change in the ownership structure of the automobile industry as they had been preceded by the mergers of Seat by VAG in 1986, Jaguar by FORD in 1990, Saab by GM in 1990, Skoda by VAG in 1991 and Rover by BMW in 1994. As a treatment group I used the close competitors of the merging party. As a control group I used the rest of the market. From my results most of these mergers

had no statistically significant effect on the prices of the merging parties' close competitors. Seat –VAG and Rover-BMW had no results at all with a statistically significant effect. Jaguar - Ford and Skoda - VAG had some significant positive effects while Saab – GM showed a significant negative one. However, only the results from Saab - GM are robust enough to conclude that this merger had an effect on the prices of its close competitors which, in fact, was a negative one. Furthermore, even the results of the regressions that showed a significant positive effect on prices, they were smaller (around 2% to 6%) than those of Saab – GM, which showed a negative effect (around 4% to 7%). [56]

Hence, the results of diff-in-diff for the mergers before Mazda-Ford showed either no statistically significant effect or a decrease in prices in the case of the Skoda-VAG group merger. Therefore, if we use those findings to determine whether the merger of Mazda-Ford should be allowed, then obviously we would answer positively. However, the results from both the actual outcome and the diff-in-diff of Mazda-Ford seems to disprove this decision. Hence, using the results of previous mergers as a means of evaluation of proposed mergers is not very reliable since it is quite obvious that we cannot generalize these results even for the same industry.

On the other hand, the structural method seems to be more accurate. Its results indicate correctly an increase in prices. However, it failed to capture the full magnitude of this price increase and even the flexible nested logit was only partly consistent with respect to the relative price changes on the segments. Furthermore, there were a lot of inconsistencies (negative marginal cost and higher elasticities for the more expensive segments) which again were only partialy corrected when using the flexible nested logit. But even if there were no inconsistencies, in order to proceed to our estimation, there were a lot of non-trivial assumptions regarding the form of competition, the used instruments and the assumption that both the marginal costs and the cars that are produced will remain the same.

3.8 Conclusion

In my research I have used the acquisition of Mazda from Ford to evaluate the predictability of merger simulation, comparing the predicted changes in prices with the actual ones from the difference-in-differences of Chapter 1. Furthermore, I compared the findings of difference-in-

[56] For a more extensive description of the methodology and the results, see Chapter 1.

differences from all the previous mergers with those of Mazda-Ford in order to examine how useful they are for evaluation of future mergers. The actual prices show that the merger probably affects prices positively, leading to higher ones.

In order to derive the demand function I have used a discrete choice model with an outside good. Assuming that the market size is equal to the number of households it is easy to compute the share of the outside good. Furthermore, I used the estimated demand function with the observed market shares to extract mc for the supply function. Due to endogeneity I used three different logit models with two different sets of instruments. The first logit model is the simple one. The other two are nested logit models whose nests are the car segments. The difference between these two specifications is that the one has a fix specification and the other a flexible one regarding the segmentation parameters. Both allow for more consistent cross elasticities estimates, i.e. higher cross elasticities among cars of the same segment. However, the flexible one should also allow for more reasonable weighted average own elasticity per segment where the more expensive segments should have lower own elasticities. Lastly, I alter the ownership matrix and estimate the post-merger equilibrium.

My findings from all alternative models of merger simulation show that it highly underpredicts the price change. Furthermore, they fail to be consistent with the relevant price changes of the segments even for the nested models. Although this inconsistency is reduced when I use the flexible specification, it does not fully correct the relative price changes. However, this was expected since the per segment mean elasticities also were not fully consistent with the per segment mean price. Nevertheless, all models of merger simulation do indeed predict a statistically significant positive effect in contrast to the findings from the previous mergers which result in either no significant effect or even a statistically significant negative one. Moreover there seems to be quite an intensive change of the structure of the market which complicates and weakens even more the predictability of a structural model.

As a result, I conclude that despite the problems of merger simulation, it did predict the increase of prices and still performs better in terms of the evaluation of proposed mergers than simply using the findings from previous mergers. Hence, while merger simulation is not perfect, future research will lead to improved models with higher flexibility and render it a powerful tool regarding the evaluation of future proposed mergers.

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