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Determinants of State Aids to Firms: The case of the European Automotive Industry

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Abstract: Using an original database for the 1992–2008 period, we investigate the determinants of state aid to the automotive industry in the European Union (EU). We find evidence that EU policies have been effective in reducing state aid and re-orientating it toward horizontal objectives. However, national politics still have considerable relevance. During election years, governments are more generous, and this is particularly true in EU countries with proportional representation. Finally, a strategic game between countries seems to take place, whereby a country's decision to grant aid seems to be responsive to aid previously granted by other member states.

Keywords: automotive industry, state aid to business, EU competition policy.
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1. Introduction

Despite the Treaty of the European Union provides a general ban to state aid (i.e., any form of assistance by a public body, given to undertakings on a selective basis), EU member states have given their national firms vast sums of money in this form.[1] For instance, in 2013 non-crisis state aid in EU 27 countries amounted to approximately €63 billion, about 0.49% of the EU's GDP.[2]

As these interventions may reduce the benefits of integration by distorting competition and/or affecting trade among member states, the Lisbon European Council in 2000 tried to tighten controls to reduce and make state aid more effective. The motto was "less and better aid," where the notion of better aid refers to a reorientation of aid toward horizontal objectives (i.e. regional development, research, and development and innovation) from purely sectoral ones. The rationale is that horizontal aid is aimed at dealing with market failures (e.g., too little spending in research and development or training activities) or to favor cohesion, while sector-specific aid is feared to distort the competitive process and the efficient allocation of resources.

A large number of manufacturing sectors have benefitted from such aids, and some industries have been more likely than others to receive subsidies: the automotive, shipbuilding, and airline industries are regular recipients of subsidies (OECD, 2010). In this paper we focus on the automotive industry, a relevant industry with its total employment (including indirect jobs) estimated at about 12.9 million people, representing 5.3% of the EU 27's employed population and 7.2% of employment and 9% of value added of the EU manufacturing sector.[3] In the Eighties, subsidy races in this industry have been common (Dancet and Rosenstock, 1995; OECD, 2010), while even in more recent years the industry has been target of considerable attention: according to

[1] For the EU official definition of state aid, see: http://ec.europa.eu/competition/state_aid/overview/index_en.html .
[2] These data refer to total non-crisis aid provided to the agricultural, manufacturing, and services sectors, with the only exclusion of railways. More information available here: http://ec.europa.eu/competition/state_aid/scoreboard/non_crisis_en.html .
[3] See the figures provided by the European Automobile Manufacturers' Association (ACEA, 2013)

official sources (European Commission, 2014a), over the period 2007-2014, Member States contributed with approximately EUR 1.8 billion to investments in the sector.[4] Note that this is one of the few sectors for which the European Commission (EC) has issued specific documents called "Community Frameworks for State Aid," which are repeated attempts to tame the tendency of member states to grant subsidies to national car producers. Recently, the interest in state aid to the car sector has been recently shown by the parliamentary questions that have been risen at the EU level.[5] All these elements suggest that the car sector represents a relevant case study to investigate which factors affect the granting of state aids and to test the effectiveness of EU efforts to re-orientate state aid from *sectoral* to *horizontal* goals.

We have built an original database to investigate state aid granted by EU member states in the period 1992–2008 to the car sector by looking at the official decisions on each case of aid to the automotive industry authorized by the EC. We identify the amount and the aim of the aid granted to this sector, going beyond the short labels that define the objective of each subsidy and integrating all the information available about each episode of aid (see discussion about in Section 4).

To the best of our knowledge, our study represents the first empirical investigation on the determinants of state aid over time to a specific industry in the EU. Our results shed light on the EU member states' support to their national car industry over time, and on how EU addresses on competition policy and state aid have been applied in this sector. Considering that, compared with other federal systems,[6] the EU has a very detailed state aid regulation which requires costly implementation and monitoring, unraveling the determinants of state aid in a "sensitive" industrial sector can reasonably contribute to the design of more efficient rules for an effective competition policy.

Based on previous theoretical and empirical contributions on state aid, in our analysis we formulate

[4] Aid to the car sector amounts to 1.1% of total aid in the period 1992-2008 (source: own elaboration from official sources).

[5] See the European Parliament website: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+WQ+P-2015-013407+0+DOC+XML+V0//EN

[6] For a comparison on state aid regulations in USA and EU, see Martin and Valbonesi (2006).

six groups of research hypotheses and we then test them on our original database of the EU automotive sector covering the period 1992–2008. These research hypotheses are summed up as follows.

First, by considering economic variables, we expect state aid to be larger in countries *i)* where the industry considered is larger; *ii)* characterized by low income per capita, as regional support policies can be more generous; and *iii)* where the competition from abroad is fiercer.

Second, as for the political determinants, previous results in the literature suggest that *i)* in the years where political elections occur, governments grant higher amounts of state aid; *ii)* right-wing governments tend to be more generous (i.e., tend to grant more aid); *iii)* electoral systems based on proportional representation lead to higher values of state aid; and *iv)* federal systems are likely to engage in more spending (i.e., in granting larger sums of state aid).

Third, with respect to the financial attitude of each member state to grant aid - defined both by its propensity to spend and by the financial constraints it faces - we hypothesize that *i)* a country that has adopted the Euro is more likely to have a stricter fiscal discipline, which is associated to less aid in value, and *ii)* state aid to this specific industry is likely to be larger in countries that grant more state aid to industry and services in general.

Fourth, the Lisbon strategy and the subsequent State Aid Action Plan are expected *i)* to have decreased the amount of state aid; and *ii)* to have shifted subsidies toward "better aid," i.e., to horizontal aid like R&D (research and development) or training activities.

Fifth, we investigate whether despite the EU's attempt to fight subsidy races and their welfare-reducing effects, member states still engage in them.

Finally, given the specificities of the automotive industry, we expect aids to firms in this sector to be influenced by *i)* scrapping incentives; *ii)* the presence of national champions; and *iii)* the matriculation records on new cars.

Our results show that EU policies have been effective in reducing state aid and re-directing it toward horizontal objectives: the total amount of state aid has decreased after the Lisbon

declaration. However, national politics still matters in several respects. State aid is higher in election years, and this is particularly true in countries with proportional representation, where the economic literature indicates that there is a stronger tendency to increase public spending. Moreover, a strategic game between countries seems to take place, whereby a country's decision to grant aid is positively related to aid previously granted by other member states: therefore challenging the decision of a member state to give state aid has both an immediate, direct effect, as well as an indirect effect on other countries decisions. The econometric analysis confirms that the national economic context and international competition do influence the amount of aid granted. Additionally, the financial attitude of the member states, captured by the adoption of the single currency, is significant as well. Nonetheless, our analysis suggests that the analysis is improved by the inclusion of industry specific characteristics: the presence of a national champion among aid receivers, the presence of other forms of support (in this case, scrapping schemes) and data on industry sales are all factors that refine the modelling.

The rest of the paper is organized as follows. Section 2 describes the institutional framework of state aid to the EU automotive sector. Section 3 discusses previous literature and presents the hypotheses to be tested. Section 4 illustrates the data and Section 5 presents the econometric model. Section 6 discusses our results and Section 7 concludes the paper, discussing some policy implications of our analysis.

2. The Institutional Framework

In the field of state aid, EU member states are subject to a supranational monitoring by the EC.[7] The legal basis for this control is provided by Articles 107–109 of the EU Treaty, which indicate that state aids to firms are normally incompatible with the common market, but also list mandatory and

[7] Actually, the very notion of state aid is clear in the EU, while it is not even defined in other countries; see for example Martin and Valbonesi (2006) on USA. Notice that the WTO has drawn up an agreement on subsidies and countervailing measures that defines state aid and attempts to regulate it. Until now, 105 cases of disputes among states refer to such an agreement. See http://www.wto.org/english/tratop_e/scm_e/scm_e.htm

discretionary exceptions. Article 107 confines legitimate aid to cases that aim to promote relevant projects of European interest, training, research and development (R&D), regional economic development in "weak" areas, or to remedy a serious disturbance in a member state economy. Article 108 gives the EC the power to investigate potentially illegal aids,[8] and Article 109 represents the legal basis for the adoption of secondary legislation (i.e. regulations, exemptions, etc.) in the field of State aid, assigning this role to the European Council.

The combination of general prohibition and discretional exemptions leaves room for a case-by-case evaluation, a very costly and difficult process. Over time, the EC has tried to reduce the potential arbitrariness of such process and to introduce more rigorous standards in the analysis, reacting to Member States' waves of subsidies in periods of crisis.[9] This was evident for the automotive industry at the beginning of the Eighties, when the oil shock and the subsequent recession gave rise to a real subsidy race (Dancet and Rosenstock, 1995; OECD, 2010). The EC's response led to the 1989 Community Framework on State Aid to the Motor Vehicle Industry, the first systematic attempt to discipline state aid in the sector, ensuring that aid is compatible with the development of competition. Specifically, its main aim was to increase the transparency of state aid to automotive producers, and to specify some conditions that the EC may impose before allowing specific subsidies.[10]

[8] For a description and discussion of the criteria and procedures included in Articles 107 and 108 the EC can adopt to examine state aid, refer to Sections 1–5 of the *State Aid. Manual of Procedures* (European Commission, 2013) and the recent report on a *Common methodology for State aid evaluation* (European Commission, 2014b).A discussion of the criteria and operational details of EU state aid policy can be found in dedicated textbooks; see for example Nicolaides (2008).

[9] With the exception of aid covered by Block Exemptions, *De minimis* aid or aid granted under a scheme already authorized by the EC, member states have to notify the EC, which requests further information if necessary. Upon receiving a completed notification, the EC has two months to decide whether the notified measure really counts as aid within the meaning of the EU rules, and whether the aid is compatible with them. If the measure is considered incompatible with the EU rules, the EC must open a formal investigation under Article 108(2) TFEU. Details of these procedures and their implementation can be found here: http://ec.europa.eu/competition/state_aid/overview/state_aid_procedures_en.html

[10] The framework displays a positive attitude toward regional development aid, limits the possibility of subsidizing minor technological improvement (rather than genuine R&D), and specifies that training aid could be allowed *per se* if not linked to new investments. As for rescue and restructuring processes, aid to a firm in financial difficulties should not help increase its market share, and in some cases capacity cuts may be required. As for transparency, the framework envisages *an obligation* for member states to notify i) all proposed aids outside already approved schemes, and ii) all

After 1993, a sharp drop in demand induced some member states to take a more interventionist stance, and new controls were considered necessary, as stated in the Second Framework issued in September 1997. This EC document broadly reflects a general evolution in the EU policy on state aid control and in many respects, simply introduces in the sectoral discipline the new, more rigorous principles that in the meantime had been developed in evaluating different categories of aid.[11]

A major evolution of the general EU policy toward state aid was provided by the Lisbon Declaration in 2000. This declaration expresses a clear preference for horizontal interventions aimed at general objectives such as regional development or better training, while aids purely aimed at promoting specific sectors are – at least on paper – banned. As our direct analysis of the documents shows, the immediate *formal* consequence of this declaration was that while before 2000, a considerable amount of aid to the automotive sector was declared by member states as being aimed at "sectoral development", this wording disappeared afterwards. State aid specifically targeting automotive producers—as we have seen while building our database — is now more often presented by member states as being aimed at "regional development".[12] Whether this change is substantial rather than merely cosmetic, is a topic we will empirically analyze in our study.

The attempts of the EC to rationalize state aid policy have continued with the 2005 State Aid Action Plan, a broad framework aimed at achieving greater legal certainty, a more economic approach,

subsidies within approved schemes if their total cost is above the threshold of 12 Million Ecu, a former basket of the currencies of the European Community, precursor to the euro.

[11] The evaluation of regional development aid required something reasonably close to a cost-benefit analysis, including the proof that a viable alternative exists, so that—in the absence of a subsidy—the firm would develop the same project elsewhere. For example, BMW planned to open a new production plant, a project expected to create some 5400 direct new jobs. The Commission decided that the €363.16 million (net present value) to open the plant in Leipzig was compatible with the common market under the regional aid. This however required that, "following an extensive selection procedure, the five most attractive locations (Bavaria, France, Saxony, Czech Republic and Mecklenburg-Western Pomerania) were identified. These locations were analyzed in detail and assessed over several months, and specific siting and land-purchase contracts were negotiated with the respective authorities. Finally, Leipzig was identified as the best location in Germany and Kolin as the best alternative location abroad. […] The Commission justified its decision to initiate the procedure as […] it doubted whether Leipzig's regional handicap was in fact as great as indicated." (2003/373/EC published on OJ L 128, 24/5/2003). Analogously, the definition of training aid had to distinguish between the normal level of training activity (which cannot be paid through state aid), and those extra training activities that would give workers a broader set of competencies than what would be normally justified for a profit-oriented firm. And so on.

[12] When a member state requests to pay some state aid, it has to declare its main objective, in a sense, "labeling" the measure. This is a kind of self-certification with limited practical effects, but which affects some EU official statistics. Concentrating on these labels, some official EU documents and speeches refer to the decrease of "sectoral aid" as a success of the Lisbon policy.

transparency, and a more efficient decision process. With this document, the EC encouraged member states to contribute to the Lisbon Strategy by focusing aid on improving the competitiveness of EU industry (i.e., more aid for R&D and risk capital for small firms).

Finally, the recent financial crisis has led to the Temporary Framework for the years 2009–10 (2009/C 83/01) that has allowed member states to grant aid with even fewer controls (European Commission, 2014a).[13] An often underestimated consequence of these exemptions from the duty to notify aid and to provide details regarding the implementation of the subsidies and their actual beneficiaries, is that under this regime it will result possible to calculate the actual amounts of total aid only with considerable approximation and in very aggregate terms. Therefore, extending the current analysis beyond 2008 is difficult, raising serious issues of data comparability.

3. Literature Review and Research Hypotheses

In order to better understand why aid is given by member states we now consider the economic literature on the determinants of state aids to businesses; we arrange these determinants in different groups of research hypotheses to be tested on our original dataset.

The first (relatively trivial) issue is that aid is naturally targeted at sectors that are of great importance to the country. Therefore, considering our dataset, countries with a large automotive industry shall – other things equal – pay larger amounts of subsidies to this sector. Analogously, aid will be more important if the automotive plant is located in regions with "weaker" economies. This is particularly true within the EU, where "*aid to promote the economic development of areas where the standard of living is abnormally low*" is explicitly indicated by the Treaty as being compatible with the internal market (Article 107 of the EU Treaty on regional aid).

Furthermore, the competitive pressure from foreign producers may push member states to distribute larger subsidies, as losers from international competition will demand more support (Baldwin,

[13] See Aggarwal and Evenett (2012) for an analysis of industrial policies around the world during the crisis. For a discussion of the evolution of state aid policy in the EU in the same period, refer to Heimler and Jenny (2012) and Nicolini et al. (2013).

1994; Rodrik, 1998). Thus, we expect aid to increase as countries face stronger competition from foreign producers. Summing up, our empirical analysis will test the following hypothesis:

Hypothesis 1 - Economic determinants of state aid

The demand for state aid from the sector will be higher in countries a) where the sector is large; b) characterized by lower income per capita; and c) where international competition is stronger.

Another relevant aspect in granting state aid is the policymakers' objective functions, especially when the face electoral competition. As highlighted by the "political business cycle" and "political budget cycle" literature, greater spending is expected in periods before elections take place (Nordhaus, 1975; Hibbs 1977; McRae, 1977; Rogoff 1990). Dewatripont and Seabright (2006) show theoretically that wasteful state aid can be granted by national politicians to improve their chances of re-election by signaling their commitment to protect national interests. Based on this argument, one may expect that forthcoming political elections will lead to an increase in state aids.

The political orientation of national governments might also be relevant. The partisan theory posits that governments adopt policies for ideological reasons (Hibbs 1977, 1992; Alesina 1987). To the extent that state aid benefits capital owners and firms more than workers, we might expect higher subsidies under right-wing governments. For example in the UK, to write off the Rover Group's debt in 1988, the Thatcher government injected £801.1 million, later reduced at the insistence of the EC to £469 million plus £78 million in regional aid (McLaughlin and Maloney, 1999). Conservative governments allocated, on average, £744.33 million per year in terms of state aid during the period 1992–1997, while Labour governments gave, on average, £538.24 million during the period 1998-2004. Econometric evidence provides support to the finding that right-wing governments in the EU tend to subsidize more (Neven, 1994; Zahariadis, 2010). The political science literature argues that industrial subsidies are a direct and visible help to the core constituents of right parties' electoral base, while the left might prefer for the same reason other welfare

instruments, such as unemployment benefits (Cao et al., 2007).[14] Accordingly, we expect our data to show that state aids amounts are larger with right-wing governments.

The political economics literature stresses that electoral systems and government forms may have an important impact on the size of the welfare state. Within the EU, as all regimes are classified as parliamentary,[15] a comparison between parliamentary systems and presidential ones cannot be carried out. Nonetheless, we can investigate the role of electoral systems. Previous research suggests that majoritarian rules are associated with stronger accountability and less wasteful spending (Persson and Tabellini 2000, 2004), while proportional systems favor redistributive policies and high generic spending (Milesi-Ferretti *et al.*, 2002; McGillivray, 2004). Moreover, the literature suggests that countries where the spending authority is more fragmented - i.e., those with a federal structure - are likely to have larger public spending (Downs, 1964; Niskanen, 1971; Wildavsky, 1974; Tarschys, 1975). To sum up, we can formulate the following hypothesis:

Hypothesis 2 - Political determinants of state aid

The amount of state aid granted in each member state is larger a) in years when political elections take place; b) if right-wing governments are ruling; c) if the electoral system is proportional; d) in countries with a federal structure.

As different countries seem to have different attitudes towards public spending, the fiscal behavior of the EU member states deserves particular attention. In this respect, the adoption of the single currency is a *proxy* for the fiscal discipline that a country is likely to have faced over the period we consider in our study; this *proxy* has the positive feature of being totally exogenous relative to the automotive sector (ECB, 2005). Additionally, the *general* attitude toward state aids is likely to be reflected in aid to this specific industry. Thus, in each country we expect aid provided to the

[14] See Zahariadis (2010) for a recent extensive review of the recent empirical evidence and the theoretical explanations put forward by the political science literature on this issue.
[15] Cyprus being the only relevant exception. See Armingeon *et al.* (2008) for details.

automotive industry to be positively related to total state aid. We can thus test the following hypothesis:

Hypothesis 3 -Financial attitude of the EU member states

We expect state aid to the automotive sector a) to be lower in countries that have adopted the Euro, and b) to be positively related to total state aid granted.

Moreover, as discussed in Section 2, in the EU there has been a clear political address with the Lisbon Strategy in 2000 aiming at "less and better aid," which has been reinforced in 2005 through the State Aid Action Plan. We expect to find empirical evidence of these policies:

Hypothesis 4 - The role of the EU

If the EU address manifested through the Lisbon Declaration in 2000 and the State Aid Action Plan in 2005 have been effective, then we should expect state aid to the automotive sector a) to decrease after these two documents were enacted; and b) to show a reorientation of aid from increasing productive capacity toward promoting competitiveness.

Aside from these factors, the economic literature has analyzed the effects of subsidizing a national firm competing in an international market, as well as the issue of competition and coordination of policies to attract foreign investments. When a domestic firm faces foreign competition, granting aid can help domestic firms capture a larger share of the rents in imperfectly competitive markets. While such policy may increase domestic net welfare, the non-cooperative equilibrium is jointly suboptimal: subsidies typically lead to an increase in national welfare if other countries do not react, and to a reduction if all countries engage in subsidy races.[16]

[16] Among others, see Spencer and Brander (1983), Bagwell and Staiger (1994); Brander and Spencer (1985), Maggi (1996), Neary and Lehay (2000) and Leahy and Neary (2001).

Leahy and Neary (2009) discuss multilateral subsidy games and show that multilateral agreements to limit investment subsidies could be optimal for social welfare. Bertsch, Calcagno, and Le Quement (2015) theoretically investigate a repeated-game setting in which governments might set up schemes that rescue failing firms and find that such a systematic bailout regime increase the likelihood of (tacit) coordination among national firms.

With specific reference to the EU, Besley and Seabright (1999) argue that aid by a group of countries is welfare-reducing, while Collie (2000) shows that each national government has the incentive to grant state aids; whereas — under symmetry assumptions and considering that public spending normally calls for distortionary taxation — the prohibition of subsidies would increase the welfare of all member states. Focusing on the effects of state aid on market performance in an integrating market when the process of integration is driven by consumer inertia, Martin and Valbonesi (2008) find that granting state aid is an equilibrium, even though this reduces common market welfare.

Many of these effects were evident when different jurisdictions were competing to attract automotive investments in the 1980s and 1990s: Thomas (2000) discusses the multi-state bidding war for Daimler-Benz's first assembly plant in the USA in 1993, while Rodriguez-Pose and Arbix (2001) focus on Brasil and Molot (2005) on USA and Canada. Empirical evidence on Europe is lagging behind, and the present analysis contributes to fill that gap.

All in all, we address the potential strategic interactions among EU member states in granting aids by testing on our dataset the following hypothesis:

Hypothesis 5 - Strategic subsidy race in EU

The granting of state aid by one member state in any year is positively affected by the amount granted by other member states in the previous years.

Coming to sector specific indicators, one could normally expect that aid is seen as more legitimate

when demand is weak and thus firms are financially stressed. As an index of demand, we consider the number of cars' matriculations, which we expect to be negatively correlated to state aid to the sector. A second potentially relevant issue is that when the car industry is in need, another way to help the industry may is to introduce demand support policies, i.e., in the form of scrapping incentives.[17] On the interaction between these policies and state aids, we expect to find support to the evidence provided by Grigolon et al. (2015) that these two instruments are complementary.

Finally, aid is often given to "national champions", firms whose political influence (and/or support by the public opinion) is particularly high (OECD, 2009). Thus, we expect a positive relationship between the presence of "national champions" and the amount of aid granted.

Hypothesis 6 – Industry specific factors

The granting of state aid to the automotive industry depends on industry-specific factors: we expect a) a negative relationship between aid granted and industry demand (i.e. matriculation of new cars); and a positive relationship with b) demand support policies (i.e. scrapping incentives) and c) the presence of national champions.

We test the six groups of hypotheses above on our original database on state aid granted to the automotive sector. This is described in detail in the following Section.

4. Data Description

The time span of our analysis, from 1992 to 2008, is delimited by policy changes. State aid has been paid particular attention since 1992, when the Single European Act entered into force and the creation of a single internal market became a clearer policy objective; possibly as a consequence, systematic information on state aid is relatively easy to obtain only after this date. After 2008,

[17] Demand subsidies for the purchase of new green cars while scrapping old ones have been adopted for instance by France, Germany, Italy, Spain, and the UK. Although they are considered subsidies to consumers and not to firms, they still entailed public resources devoted to boosting demand in this specific sector.

instead, because of the financial crisis the EC became more lenient towards state aid. Hence, since the implementation of Temporary Framework (2009–2010) — see Section 2 above — the data are not comparable to those collected previously.[18]

We include all EU member states, which means that due to the EU enlargement process, the set of countries in our dataset increases over time (although we check that the same results hold looking at for the original set of countries).[19] We build our dataset by collecting information from several data sources; a complete list of definitions and sources can be found in Table A.1 in the Appendix.

4.1 The dependent variable

The dependent variable is the amount of aid granted to the automotive industry by each EU member state yearly during the period 1992–2008. Thus, for each country we sum the value of different aids granted in a given year. Official data on total state aid to industry and services are provided from 1992 onwards by the Directorate General (DG) for Competition on its website. We have collected a considerable amount of data from the state aid register of the DG Competition for cases after 2000, and from a thorough issue-by-issue analysis of the Official Journal of the European Communities and of annual issues of the EC *Report on competition policy* for previous years. For each case found, we have retrieved the EC's decision documents to obtain the official amount granted. In each aid case record, the notifying member state specifies:

i) the "primary objective" (e.g., sectoral development, R&D, etc.) of the aid; and

ii) the sector(s) eligible for that subsidy. Sometimes the list of sectors is very long, while in other cases only one industry is mentioned.

These two pieces of information are not necessarily related. While aid declared as "sectoral development aid" is clearly sector-specific, sometimes aid is officially granted for horizontal

[18] See Grigolon et al. (2015) for a discussion about the difficulties in estimating public support for the EU car industry in the more recent years, which are not included in our analysis.

[19] The EU had 12 member states between 1992 and 1994, namely Belgium, Denmark, Germany, Greece, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and United Kingdom. In 1995 Austria, Finland, and Sweden joined the EU. In 2004 the EU saw the largest enlargement so far with the addition of ten new members: Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia, and Slovenia. The last enlargement in our analysis includes Bulgaria and Romania, which joined the EU in 2007.

objectives (e.g., R&D or training) but is actually earmarked for a specific sector if not for individual firms or even plants.

We have included in our database aid decisions that explicitly target the automotive sector, or to specific firms belonging to this industry.[20] The automotive sector is identified by the official NACE (European Classification of Economic Activities) Rev. 2 sector 29, labeled Manufacture of Motor Vehicles, Trailers and Semitrailers, which includes also bodies, parts and accessories, electrical and electronic equipment for motor vehicles, and so on.

By inspecting all cases, we are able to classify them according to their expected effects on the target firm (hence, the "aim" of the aid). This is relevant as it allows us to test Hypothesis 5 going beyond the formal classification provided by the notifying member state.

We distinguish between two types of aim of the granted state aid. The first may be to directly increase productive capacity, either by expanding existing plants or by establishing new ones (i.e. greenfield investments): this *capacity-increasing aid* is typically targeted at less developed areas of the EC, where such support for employment is compatible with the Treaty. In the description of the aid program, these subsidies are usually labeled as "regional development aid" and are subject to the joint scrutiny of the DG Competition and DG Regional Policy, which looks at aid in the perspective of cohesion and regional development. For example, State aid N767/2007 to Ford for an investment project in Romania was authorized with the primary objective of regional development, in light of the expected benefits in terms of employment and local development; in the official document it is stated that: "The Romanian authorities expect that, using the standard auto industry multiplier effect, more than 40,000 direct and indirect jobs are likely to be created, making an estimated economic contribution to Romania of more than €13 billion by end 2012 and €50 billion by end 2020."

[20] For instance, some aid to new car plants in less wealthy regions is justified as "regional aid," but it is meant for a specific car plant. These cases are included in our database. In some cases, aid is earmarked for specific sectors, among which the automotive industry, but the list of interested sectors is in fact very large. These cases are not considered by our analysis since we cannot quantify the exact amount granted to the specific factor.

The second type of aim refers to subsidies that contribute to R&D or training programs: they do not directly affect plant size, but are meant to support activities aimed at generating positive externalities or to increase spending beyond what would be justified by pure profit maximization.[21] However, it is extremely difficult to distinguish between "normal" or "abnormal" levels of these activities, or between choices undertaken to protect the environment rather than to improve a firm's image. Despite the EC scrutiny, these subsidies end up helping a firm improve either its physical productivity or its product quality. Therefore, it seems appropriate to label these subsidies as *aid to competitiveness*.

Finally, while these two types of aid represent fairly ordinary aid measures, the traditional category of *rescue and restructuring aid* is meant to help firms in financial distress. This type of aid is incompatible with capacity increases and it is not linked to any specific R&D or training investments; it is only meant for companies in financial difficulty.

Notice that aid is granted by member states and may take different forms, such as direct grants, tax exemptions, soft loans, etc. To have comparable data, in our database we have used the *Gross Grant Equivalent* of non-grant subsidies.[22] In recent years, this value was calculated officially by the EC, while for previous years we have calculated it by applying the same methodology currently adopted by the EC.[23]

All in all, in the period 1992–2008, we have been able to single out 185 cases of aid specifically earmarked for the EU automotive sector, for a total amount of Gross Grant Equivalent around €9.2

[21] The rationale for this training aid, for example, is stated in Paragraph 10 in the preamble of EC Treaty to training aid (OJ L10 of 13/1/2001, page 20): "Training usually has positive external effects for society as a whole since it increases the pool of skilled workers from which other firms may draw, improves the competitiveness of Community industry and plays an important role in employment strategy. In view of the fact that enterprises in the Community generally underinvest in the training of their workers, State aid might help to correct this market imperfection and therefore can be considered under certain conditions to be compatible with the common market".

[22] The Gross grant equivalent is the present discounted value of the aid given, where grants or tax exemptions are treated as equivalent. For loans, the aid component is defined as the difference between ordinary and preferential rates. For guarantees, the methodology is explained a few times, e.g., in the Commission Regulation (EC) No 736/2008 of July 22, 2008.

[23] We have computed it on the basis of the spread between the required interest rate (which could be nil) and the interest rate of the ECB for its main financing operations, as reported monthly in the Official Journal.

billion (constant 2000 values).[24]

We focus on the amount of aid effectively *granted,* as indicated in the final decision published in the Official Journal of the European Communities, rather than on the amount *proposed* by the member state.[25]

It is only fair to stress here that the aid specifically targeted at and granted to the automotive industry is lower than the total public subsidy received by it, as some firms may have received aid under general programs that were accessible to many other sectors. Unfortunately, the information on the final beneficiaries of these general subsidy schemes is not publicly available for all countries.[26]

4.2 The explanatory variables

We retrieve our explanatory variables from a number of different sources. To test Hypothesis 1, we need a proxy for the size of the car industry. We use the value added, which comes from Eurostat and EU KLEMS databases.[27] Income per capita in real terms is collected from Eurostat and OECD statistics.

To test whether the competitive pressure from foreign producers drives member states to distribute larger subsidies, we include an index of sector-specific *import penetration*, i.e. the share of

[24] Although the sum might be paid over several years to companies, we attribute the amount paid to the year in which it was granted, as we are interested in the determinants of state aid, which are at play when the decision takes place.

[25] The information on the amount of aid proposed by the member state is harder to trace, and sometimes the application is withdrawn by the member state, leaving only a faint mark in official documents as, for example, the planned regional aid of €89.4 million by the German government to Edscha group for a new "greenfield" plant in Thuringen for the production of niche passenger cars in the premium segment. Moreover, some member states may try to propose aid programs that will certainly be blocked by the EC with the sole purpose of satisfying the request of some internal lobby, but knowing that the proposal entails no serious financial commitment by the Government. Focusing on approved aid allows us not to include these requests.

[26] On top of this, the European Investment Bank (EIB) is sometimes asked to target its funds to specific sectors. However, these funds do not come from national budgets, and neither do they flow through governmental channels, so it would be inappropriate to include them in an analysis of state aid.

[27] Eurostat - Structural Business Statistics database - provides information at sectoral level from 1995 onwards. We retrieve information on previous years from a comparable database, the EU KLEMS. This is the result of a project funded by the EC's Research Directorate General to create an industry level database on measures of economic activity for all EU member states from 1970 onwards. (O'Mahony and Timmer, 2009). An alternative measure to account for the industry's size would be its employment. Nonetheless, even combining data from Eurostat and EU KLEMS databases, we do not get a satisfactory coverage, with a 16% of missing observations; moreover, in our setting, value added and employment display a positive correlation of 0.97, significant at 1%. We thank an anonymous referee for rising this point.

domestic demand in each country's automotive industry met by imports. Such index is thus equal to $M_{ct}/(P_{ct}+M_{ct}-X_{ct})$, where M_{ct} is the value of imports in country c at time t for the automotive industry, P is proxied by the gross output (EU KLEMS) and production value (Eurostat) of the industry, and X are exports. In this way, we are considering the relative pressure that automotive imports exert on national production. Additionally, we include the *export ratio*, i.e., the ratio of exports to production. Data on trade flows are sourced from the UN Comtrade database.

The political variables we use are sourced from the Database of Political Institutions produced by the World Bank (Keefer, 2007), and from the Comparative Political Data Set (Armingeon, *et al.*, 2008). We include a dummy variable that takes value 1 if there is a legislative election in the year. We add a categorical variable to describe the electoral system of each country. On one extreme, - with plurality systems - the winning candidate is awarded the contested seat if it polls more votes than any other single opponent; on the other extreme - with proportional systems - the distribution of seats among political parties results to be proportional to the distribution of votes among them. Following the classification by Lijphart (1999), we use a variable labeled *proportional*, which ranges from 1 for simple plurality formula, as in the United Kingdom, to 4 for list proportional representation, as in Belgium. The political orientation variable ranges from 1 to 5, with 1 corresponding with hegemony of left-wing parties, and 5 with hegemony of right- (and center-) wing parties, and has therefore been labeled *right-wing government*. Finally, we include *federalism*, a dummy that is equal to one if the country has a federal structure.

To test the fiscal discipline of the member states, we include *Euro*, a dummy that is equal to one when a member country is currently a member of the Euro area. Additionally, we include total state aid (*total aid %*) granted yearly by each country; this data is sourced from Eurostat.

As for the role of the EU, we control for it with a dummy variable for the period after the Lisbon Declaration. Additionally, we also test whether the 2005 State Aid Action Plan has affected the amount of aid granted.

To test the presence of a strategic interaction among EU countries in the period covered by our

database, we include among the regressors the aid granted by all other countries to the automotive sector in year *t-1* as an explanatory variable for the aid granted by each country in year *t*.

As for industry-specific characteristics, we consider the *percentage change in new automotive registrations*. These data are obtained from Eurostat, and cross-checked with data collected by the European Automobile Manufacturers' Association (ACEA).

Concerning the demand support policies to the sector, we include in our econometric analysis a dummy that is equal to one if a *scrapping scheme* was active in a given country in a given year, and zero otherwise. The information on scrapping incentive programs is obtained from Global Insight (2010).

National champions might be defined in different ways, such as the largest national producer, or any large national producer, or a historical brand (whether or not still in the hands of national shareholders). We adopt the latter definition, as we believe the political relevance of a firm is often related mainly to its historical network of relationships, rather than to the nationality of the ultimate shareholder (even assuming one can be identified). For instance, with different definitions a firm such as Opel – the German brand owned by GM since 1929 – would not be considered a national champion in Germany; this would not strike us as intuitive.[28] In our empirical analysis we include a dummy that is equal to one if, in a given country and year, some form of aid has been granted to a national champion.[29]

4.3 Descriptive statistics

Table 1 provides the main aggregate data, actually showing that state aid yearly granted in the EU 12 (or 15) has decreased over time in absolute terms.

[28] According to this definition, among the firms that have been granted some aid in their own country over the 1992–2008 period, the following companies have been classified as national champions. In France: Renault; in Germany: Audi, BMW, Mercedes Benz, Opel, Volkswagen; in Italy: Fiat; Spain: Seat; in Sweden: Volvo; in the United Kingdom: Jaguar, Rover. Furthermore, episodes of aid granted to national champions not in their own country do not fall in our definition (i.e. aid to Peugeot in United Kingdom, (C 30/03), Bosch in Italy (N510/01) and Continental in Belgium (XT25/04).

[29] We have tried different specifications with alternative definitions of national champions, but little changes are to be recorded; results adopting alternative definitions of national champions are available upon request.

[insert Table 1 about here]

While in the Nineties it was common to see hundreds of millions in aid granted every year, in the following decade total values rarely reached the previous peaks. Moreover, if one looks at the main cases after 2000, some of the largest ones relate to new accession countries or to former East Germany Länder. This is because new member states are often characterized by a particularly large presence of areas eligible for regional aid, for which the EU makes an explicit effort to achieve integration. Table 2 shows how different member states have operated in this period.

[insert Table 2 about here]

In terms of *total aid to industry and services as a percentage of GDP*, the most generous country has been Germany, followed by Cyprus and Portugal. The new EU member states seem to belong to two different clubs: on the one hand, we find generous governments, such as Cyprus (0.938% of GDP devoted to state aid), followed by Czech Republic (0.704%), Hungary, Romania, and Poland. On the other hand, we have—generally—small countries that tend to subsidize little (the Baltic Republics, as well as Bulgaria, Slovenia, and Slovak Republic).

However, when one looks at the relative weight of the automotive industry *within the general state aid policy*, a different pattern seems to emerge. The countries that pay particular attention to the automotive sector are mainly accession countries (the Slovak and Czech Republics, and Romania) and Italy. Notice that if we consider the average weight of the automotive industry relative to each country's GDP, there is quite a tight correspondence between aid granted and the size of the sector, the correlation between the two series being 0.74.

Finally, if we look at the relevance of *aid to the car sector as a percentage of GDP* we find a confirmation that the most generous countries in granting supports are Central and Eastern European ones and Italy.

Table 3 reports the breakdown of aid measures into the three categories discussed above. Subsidies for competitiveness are very common but they justify only approximately 8% of total aid, while aid aimed at increasing capacity corresponds to 85% of the total amount granted. Notice that the same

case may grant sums under different objectives, and we record which sum is justified by which objective, as specified in the EC decision.

[insert Table 3 about here]

Some descriptive statistics for the variables adopted in the econometric exercise are reported in Table 4.

[insert Table 4 about here]

The correlations among the explanatory variables are generally below 0.5. To grasp the presence of collinearity we compute the variance inflation factors and the condition number, which suggest that collinearity is not an issue in our analysis.[30]

5. The Empirical Model

Using econometric analysis, we test the hypotheses – presented in Section 3 -– on the determinants of state aid granted by EU countries to the automotive sector between 1992 and 2008. We arrange our data in a panel defined by country and time. This means that our dependent variable is the amount of aid granted in country *c* at time *t* under different cases. By definition, it displays only non-negative values, and it presents a large number of zeros.

Facing data structures of this type, the traditional practice in the literature was either to drop observations where the dependent variable was equal to zero, or to estimate the model using the log of the dependent variable plus one (to avoid the loss of observations), or - finally - to adopt a Tobit estimator. However, these practices generally lead to inconsistent estimators of the parameters of interest: to deal with such issues, Santos Silva and Tenreyro (2006) suggest adopting a Poisson Pseudo Maximum Likelihood (PPML) estimator, which does not require the data to be Poisson

[30] A common rule of thumb states that if the variance inflation factor (VIF) is larger than 10 there may be reasons for concern. In our data the highest VIF is 4.2, associated to industry's value added, nonetheless the mean VIF is 1.72, a value which suggests that collinearity is not a problem. As for the condition number, values above 15 are generally considered as pointing to collinearity. However, we have a value equal to 4.4 in our sample. The correlation matrix as well as the full set of results on the variance inflation factors and the condition number are available upon request.

distributed, nor even to be integer. This estimator fits well with our case.[31]

Given the large presence of zeros in our sample, we adopt a zero-inflated Poisson (ZIP) estimator, which splits the estimation into two parts.[32] The logit estimate models the probability to observe aid, while the PPML estimator models – for every positive value of the dependent variable – the amount of aid effectively granted. As the probability to observe some aid is likely to be determined by country-specific differences in sectoral structures and regional disparities, we include in the logit model a set of country dummies as control variables. Additionally, we include a set of year dummies to control for time-specific common shocks to the EU member states considered in the analysis. The Poisson Pseudo Maximum Likelihood estimator models the amount granted as a function of a set of explanatory variables that allow us to test our hypotheses. We thus estimate the following model:

$$\begin{cases} \Pr(aid_{ct} = 1) = \alpha_0 + \sum_{c=1}^{27} \alpha_c country\ \ dummies_{c} + \sum_{t=1}^{17} \beta_t time\ \ dummies_{t} + u_{ct} \\ aid_{ct} = \gamma_0 + \gamma_1 economic\ \ variables_{ct} + \gamma_2 political\ \ variables_{ct} + \gamma_3 financial\ \ attitude_{ct} \\ \qquad + \gamma_4 EU_{t} + \gamma_5 aid\ \ by\ others_{ct-1} + \gamma_6 industrial\ \ variables_{ct} + \varepsilon_{ct} \end{cases}$$

where *economic* and *political variables* test respectively Hypotheses 1 and 2 presented in Section 2 above, *financial attitude* corresponds to Hypothesis 3, *EU* refers to the 2000 and 2005 EU statements as discussed in Hypothesis 4, *aid by others* controls for the strategic interaction among states described in Hypothesis 5, and *industrial variables* test Hypothesis 6.

[31] See Santos Silva and Tenreyro (2006) and Gourieroux *et al.* (1984) for further discussion on the properties of the Poisson Pseudo Maximum Likelihood estimator.

[32] The choice of the proper estimator in the case when the variable of interest is non-negative and its distribution has a mass-point at zero has been the subject of huge debate in the literature. Santos Silva *et al.* (2015) proposes a formal test for non-nested models for non-negative data with many zeros. We implement the HPC test proposed to discriminate between Poisson Pseudo Maximum Likelihood and Zero Inflated Poisson, and the choice of ZIP versus PPML, given the nature of our data, is supported also by the HPC test. As Santos Silva *et al.* (2015) recommend, any result from this test should not be taken as a general recommendation but is specific to the particular example considered. Results are available upon request.

6. Results and Discussion

6.1 State aid between EU policy and national aims

Table 5 reports the first set of results. With respect to the logit equation, the Wald test suggests that the country dummies are jointly statistically significant, thus confirming that it is appropriate to control for time-invariant country characteristics. The yearly dummies instead are jointly not significant.[33] The coefficients for the PPML equation have been transformed to incidence-rate ratios, i.e., e^{γ_i} instead of γ_i: a coefficient greater than one implies an increase in the probability of observing aids, while a coefficient smaller than one points to a decrease in the probability. Table 5 also reports the log likelihood and the Akaike's (AIC) and Schwarz's Bayesian (BIC) information criteria.[34]

[insert Table 5 about here]

We find evidence in support of our research Hypothesis 1: aid increases with the *industry's value added* expressed in logs, while the log of *income per capita* displays an incidence-rate ratio smaller than one, which confirms that in this aggregate analysis, automotive industries in lower per capita income EU countries receive more aid. Additionally, the results for *industry's import penetration* and *industry's export ratio* suggest that stronger competitive pressure from foreign producers increases the granting of state aid (Baldwin, 1994; Rodrik, 1998).

Among the political variables, which are the object of Hypothesis 2, the election year shows an incidence ratio greater than one and highly significant: this supports the "political business cycle" view that public spending, i.e. state aid to the automotive industry in our context, is larger when elections take place (HP 2.a). The significant coefficient attached to *right wing government* – see

[33] We have tested the robustness of the results in the PPML equation to different specifications for the logit equation, excluding the time dummies or including the time trend. The latter displays an incidence-rate ratio smaller the one. This can be interpreted as a decrease in the probability of observing a certain phenomenon over time, i.e., over time we are less likely to observe aid to the automotive industry. The PPML estimates are unaffected and detailed results about are available upon request.

[34] AIC and BIC are functions of the log-likelihood of the model and the number of parameters estimated: a smaller value suggests that the model better fits the data.

HP 2.b - confirms previous results in the literature (Neven, 1994; Zahariadis, 2000).

Our findings on aid to the automotive sector support the view that proportional electoral systems favor general redistribution systems, (i.e., high generic spending) relatively more than majority ones (see HP 2.c). Finally, our empirical results highlight that the federal structure of a country negatively influences the granting of aid (see HP 2.d): this is in contrast with the prediction from the theoretical literature on the topic (see Downs, 1964; Niskanen, 1971; Wildavsky, 1974; Tarschys, 1975).

As for Hypothesis 3 on the fiscal discipline of the member states, we observe that participation in the Eurozone reduces the amount of subsidies granted, as revealed by the smaller than one incidence-rate ratio associated with the *euro* variable. This supports the view that the adoption of the single currency is met by tighter spending policies (ECB, 2005).

We also test whether aid to the automotive sector relates to the general aid policy of each member state: the amount of total aid granted as a percentage of GDP displays an incidence-rate ratio greater than one – see column (3) – suggesting that the general attitude toward industry and services is reflected in the propensity to subsidize the automotive industry.

Concerning Hypothesis 4 on the EU state aid policy, we observe that the *Lisbon Declaration* dummy shows a smaller than one and significant incidence-rate ratio, providing evidence that after the declaration there has been a statistically significant decrease in state aid to the sector. Additionally, the incidence-rate ratio of the *State Aid Action Plan* dummy suggests that aids have further decreased after 2005. These results highlight that the EC attempts to reduce sectoral aid over time seem to have yielded some results in the automotive sector, providing support to Hypothesis 4.a.

Considering Hypothesis 5, we observe that the coefficient attached to the *aid by other countries* is greater than one and significant. This is in line with theoretical as well as empirical studies on subsidy races and it suggests that a dynamic strategic game exists among EU governments, so that a subsidy in one member state today leads to more subsidies in other member states tomorrow (see

the discussion in Section 3 and the empirical analyses on this sector by Thomas, 2000; Rodriguez-Pose and Arbix, 2001 and Molot, 2005). This also suggests that the EC attempt to rationalize and coordinate aid policy is far from perfect, as it does not anticipate how granting state aid today triggers state aid by other member states in the future.

We then test the relevance of some industry-specific aspects, summarized in Hypothesis 6. The dynamics of new automotive registrations are significant and display an incidence-rate ratio smaller than one, thus suggesting that state aid does seem to respond to demand shifts. The presence of scrapping schemes displays an incidence-rate ratio greater than one, suggesting that subsidies to firms and demand subsidies appear to be complementary, in line with the evidence provided by Grigolon *et al.* (2015) on a partly overlapping time span. Finally, our empirical results confirm that the presence of national champions in the automotive sector increases aid to this industry (OECD, 2009).

In the last column of Table 5 we report the full model that tests the six hypotheses jointly, also showing that the results are robust. To test Hypothesis 4.b, namely, if a reorientation of aid from a support to an increase in capacity towards a promotion of competitiveness has taken place, we need to distinguish aid by the effect it has on firms (thus, probably, on the aim of the member state). To this end, we again estimate a zero-inflated Poisson model, which in the dependent variable considers, in turn, these two different types of aid presented in Section 4.1. We do not include in the analysis *rescue and restructuring aid* which, being an extraordinary measure, responds to a different economic rationale. Moreover, given its nature, it is a measure rarely adopted: we observe in our sample only seven episodes of *rescue and restructuring aid* (all before year 2000). Such a low variability in the dependent variable makes this type of aid unfit for an econometric analysis.[35] Table 6 collects the results.

[35] While we cannot consider episodes of rescue and restructuring aid alone, we can sum them to capacity increasing aid. This is not advisable, as the two types have different rationales, as discussed above. Nonetheless, these are both forms of aid that are not pro-competitiveness. The results are very similar to those reported in Table 6, column (2). Estimates are available upon request.

[insert Table 6 about here]

As the Lisbon Declaration points to "less and better aid" and the State Aid Action Plan presented in 2005 proposes a roadmap for state aid reform in the attempt to reduce aid aimed at pure sectoral development, we expect to find different results according to the type of aid granted. Our results support the idea that these efforts have had some effect. Both *capacity increasing aid* and *aid to competitiveness* have decreased significantly after Lisbon. Interestingly, we observe different trends after the State Aid Action Plan was formulated in 2005: *capacity increasing aid* has decreased even further, while *aid to competitiveness* is not affected. Thus, the EU address by the Lisbon Declaration seems to have promoted a reorientation of aids away from subsidies aimed at purely strengthening productive capacity, leaving some room to subsidies aimed at increasing the firms' productivity. The Wald tests reported suggest that country and time controls in the logit equation are generally poorly significant. Overall, these results provide empirical support to our Hypothesis 4.b on the reorientation of aid.[36]

6.2 Robustness Checks

In our analysis we perform a number of robustness checks, which are reported in Table 7 and discussed in what follows.

[insert Table 7 about here]

First of all, one could suspect that our results are affected by the changes in the geographical definition of the area considered, as in the period of our study the number of EU member states has changed a few times. We therefore replicate our estimate on the sub-sample of EU 15 countries in column (1): this new regression confirms our previous results. Our findings are robust also to the exclusion from the sample of the countries that might be considered outliers due to their particularly aggressive policy in support of the automotive sector, i.e., the Slovak Republic or Germany.[37]

[36] This confirms the descriptive evidence discussed in Nicolini *et al.* (2013) that aid to this industry has faced a shift in its objectives, following the Lisbon address.
[37] Results are not reported to save space but are available upon request.

To investigate whether the strategic interaction is driven by the new accession countries, we check if the same effect remains, considering the aid granted by the subset of older members states (EU 15). Again, the *strategic subsidy race* hypothesis (HP 5) is confirmed in this smaller sample.[38] Analogously, we include in column (3) a dummy to control for new member states; as many of their regions are "objective 1" regions, where state aid controls are less stringent,[39] their attitude to state aid toward the automotive industry might appear structurally different. We find indeed that, considering all other effects, new member states tend to subsidize this industry relatively more.

Additionally, we check the robustness of our results along the time dimension. First, the year 1992 was characterized by high levels of aid (as shown Table 1), therefore we estimate our model dropping it from the sample. Column (4) shows that results are unaffected. Analogously, as in 2008, the granting of aids has already been partially influenced by anti-crisis policies, and we estimate the model in column (5), excluding this year from the sample, finding that our results are still robust.

7. Conclusions

Since the end of the Eighties, the automotive sector has become one of the main recipients of state aids in the EU, with the main beneficiaries being large automotive firms often considered as national champions. Investigating the determinants of subsidies to this specific industry is thus an interesting task that could highlight the EU state aid policy from a sectoral perspective and help inform how to better address competition policy. Moreover, the EU policy is unique in the international practice of controlling subsidies to business, and comprises very strict — and costly — regulations that try to balance the member states' efforts to help local firms with the creation of an integrated market.

To analyze these issues and to understand the determinants of subsidies to firms in the EU

[38] It would be interesting to control for this mechanism on a finer sample, i.e., considering only countries that have national champions or, an extreme case, a bilateral interaction between countries. Unfortunately, we would have too few observations to obtain meaningful estimates. We thank an anonymous referee for raising this point.

[39] Namely, they are regions for which convergence toward the richer regions is considered a paramount issue. In the EU practice this justifies a less strict attitude toward state aid.

automotive sector, we have built an original database on state aid granted in the period 1992–2008.

Our estimates suggest that the EU policy aimed at reducing state aid and directing it away from unconditional help to firms has been effective: state aid to the automotive sector has decreased in value after the Lisbon Declaration in 2000, and even more so after the State Aid Action Plan was issued in 2005. Moreover, the objectives pursued by the grants change over time: while *capacity increasing aid* has decreased after 2005, *aid to competitiveness* (namely, R&D and training) has not, supporting the idea that in recent years, aid has become more consistent with the "less and better" policy address.

However, the EU efforts have not eliminated the incentive for and the ability of countries to play strategically: state aid in one country still leads to higher future aid in other countries. This is probably due to a combination of two factors. On the one hand, state aid approval is part of a multi-stage game; accepting one member state's intervention makes it more likely that analogous subsidies by other member states will be allowed by the EC. On the other hand, during decades where excess capacity has been identified as a recurring problem for the sector, any support to one firm may increase the difficulties of other firms, thus pushing the demand for aid. A more rigorous approach to aid today has the additional effect of reducing future demand for aid.

Our analysis allows us to draw some further policy implications. The first is that the general attempt by the EC to reduce sector-specific state aid has had some effect; hence, a criticism of EU policies in this respect does not seem justified. This is also due to the fact that over time the EC scrutiny on aid has improved and has become more severe. Now, R&D projects distinguish between actual research and the mere implementation of new technologies. In the same way, training programs have to clarify whether the firm is engaged in normal commercial practices or is going beyond that. Regional projects are now evaluated on a comparative basis: for a subsidy to a project in a specific location to be allowed, member states must prove that the firm could well have invested elsewhere. All this seems to have deterred less justifiable requests.

However, the subsidies awarded for regional aid are still largely firm-specific. Despite EC scrutiny

being more severe than previously, this type of "horizontal" aid is not necessarily "better" (as the Lisbon Declaration would suggest instead). Moreover, the fact that upcoming elections are associated with larger subsidies indicates that the electoral concern remains a strong motive for state aid, but this is hardly an element the EU can seriously hope to eliminate. As long as the projects to be subsidized are reasonable, the fact that in election years governments are more prone to spending is only natural.

The role of "national champions" still remains, but the meaning of this expression has probably changed over time. In the Seventies and Eighties, national champions were often national state-owned enterprises (e.g. Renault or British Leyland) or private firms controlled by national shareholders, often able to manipulate national policies (Fiat in Italy being an obvious example). Now these firms have changed skin, either because of privatization or because of the globalization of financial markets and internationalization of the governance structure. In the same way, governments seem to care mainly about the preservation of existing (or installment of new) plants rather than with the nationality of the shareholders. In a way, this is a healthier approach, but firm-specific state aid remains a relevant feature of EU policies.

To sum up, the EU aid policy has an impact, but many things still have not been put straight. For instance, massive interventions in terms of *rescue and restructuring aid* have been recorded during the economic crisis in 2009–2010.[40] Although these recent years are hardly comparable with the previous ones, there is still a strong sense that countries are engaging in subsidy races.

In particular, we still have years in which the EC authorizes some member states to help firms remain in the market despite their excess capacity, while at the same time allowing productive capacity expansion elsewhere. This comes as no surprise: merely controlling *individual* aid decisions by member states is not sufficient. The EU simply *reacts* to member states' decisions and

[40] See Heimler and Jenny (2012) and Nicolini *et al.* (2013) for more details on these issues.

lacks a consistent policy toward industrial sectors. Unless this changes in the future, decisions to grant aid are bound to lead to an increase in requests (and possibly the need) for more aid.

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Tables

Table 1: Total state aid to the car sector, 1992-2008

	EU12	EU15	EU25	EU27
1992	3748.62	-	-	-
1993	388.55	-	-	-
1994	466.10	-	-	-
1995	377.40	393.65	-	-
1996	769.45	772.57	-	-
1997	57.24	57.24	-	-
1998	263.06	264.78	-	-
1999	310.32	310.32	-	-
2000	90.90	90.90	-	-
2001	342.88	342.88	-	-
2002	563.21	563.21	-	-
2003	258.80	289.36	-	-
2004	205.61	215.21	-	-
2005	237.33	264.09	264.09	-
2006	199.37	206.00	348.36	-
2007	104.13	104.13	265.64	266.39
2008	127.51	127.51	243.68	352.10

Source: Own elaboration from DG competition and OJEU (Million €, 2000 constant values)

Table 2: Indices on total state aid and state aid to the car sector by country, 1992-2008

Country	Total aid/GDP	Aid to the car sector/total aid	Value added of the car sector/GDP	Aid to the car sector/GDP
Austria	0.295%	0.719%	1.013%	0.002%
Belgium	0.385%	1.170%	1.316%	0.005%
Bulgaria	0.133%	0.000%	0.040%	0.000%
Cyprus	0.938%	0.000%	0.050%	0.000%
Czech Republic	0.704%	3.376%	2.147%	0.024%
Denmark	0.637%	0.000%	0.195%	0.000%
Estonia	0.071%	0.000%	0.362%	0.000%
Finland	0.330%	0.000%	0.254%	0.000%
France	0.560%	0.192%	1.065%	0.001%
Germany	0.943%	0.442%	2.696%	0.004%
Greece	0.432%	0.000%	0.065%	0.000%
Hungary	0.682%	1.903%	2.044%	0.013%
Ireland	0.463%	0.000%	0.152%	0.000%
Italy	0.631%	3.707%	0.659%	0.023%
Latvia	0.152%	0.000%	0.057%	0.000%
Lithuania	0.195%	0.000%	0.056%	0.000%
Netherlands	0.204%	0.805%	0.431%	0.002%
Poland	0.485%	0.563%	0.854%	0.003%
Portugal	0.881%	0.974%	0.514%	0.009%
Romania	0.665%	3.220%	0.725%	0.021%
Slovak Republic	0.263%	6.200%	15.083%	0.016%
Slovenia	0.369%	0.000%	0.718%	0.000%
Spain	0.597%	1.777%	1.252%	0.011%
Sweden	0.453%	0.119%	1.913%	0.001%
United Kingdom	0.207%	1.529%	0.822%	0.003%

Notes: average values for the 1992-2008 period. Data sourced from Eurostat and own ekaboration from DG Competition and OJ EU information

Table 3: State aid according to the aim

	nr of cases	cumulated amount of nominal aid (Millon €, 2000 constant values)	aid as a share of total aid to the car sector
aid to competitiveness	60	757	8%
capacity increasing aid	118	7810	85%
rescue and restructuring aid	7	653	7%
total aid to the car sector	185	9220	

Notes: data refer to the 1992-2008 period.

Table 4: Descriptive statistics

Variable	Obervations	Mean	Std. Dev.	Min	Max
State aid to the car industry	300	33.775	219.203	0.000	3618.593
Industry's value added	300	6891.995	12794.130	0.463	67778.950
Income per capita	300	0.020	0.008	0.003	0.036
Industry's import penetration	268	0.808	0.402	0.036	2.108
Industry's export ratio	268	1.347	3.935	0.052	46.270
Election year	300	0.260	0.439	0.000	1.000
Right-wing government	300	3.184	1.433	1.000	5.000
Proportional	300	3.560	0.869	1.000	4.000
Federalism	300	0.163	0.370	0.000	1.000
Euro	300	0.360	0.481	0.000	1.000
Total aid (%)	278	0.814	0.491	0.190	3.020
Lisbon declaration	300	0.583	0.494	0.000	1.000
State Aid Action Plan	300	0.361	0.481	0.000	1.000
Aid by other countries	300	445.168	642.040	2.401	3748.619
Percentage change in new car registrations per capita	297	0.008	0.266	-2.329	2.337
Scrapping scheme	300	0.127	0.333	0.000	1.000
Aid to national champions	300	0.363	0.482	0.000	1.000
New Member	300	0.170	0.376	0.000	1.000
Capacity increasing aid	300	27.428	176.046	0.000	3386.599
Aid to competitiveness	300	2.594	14.129	0.000	231.994
Rescue and restructuring aid	300	2.178	21.588	0.000	322.670

Notes: alla monetary variables are expressed in million euro, 2000

Table 5: Determinants of state aid to the car industry

	Hp 1	Hp 2	Hp 3	Hp 4.a	Hp 5	Hp 6	Full model
Poisson equation							
Log of industry's value added$_{ct}$	2.626***						3.163***
	(0.071)						(0.104)
Log of income per capita$_{ct}$	0.111***						0.428***
	(0.006)						(0.029)
Industry's import penetration$_{ct}$	1.084***						1.081***
	(0.002)						(0.002)
Industry's export ratio$_{ct}$	0.916***						0.925***
	(0.002)						(0.002)
Election year$_{ct}$		3.581***					1.721***
		(0.077)					(0.049)
Right-wing government$_{ct}$		1.016**					1.895***
		(0.008)					(0.009)
Proportional$_{ct}$		1.299***					2.246***
		(0.014)					(0.050)
Federalism$_{ct}$		0.486***					0.349***
		(0.013)					(0.026)
Euro$_{ct}$			0.384***				0.245***
			(0.010)				(0.011)
Total aid(%)$_{ct}$			2.170***				3.332***
			(0.071)				(0.281)
Lisbon declaration$_{t}$				0.288***			0.886**
				(0.008)			(0.042)
State aid Action Plan$_{t}$				0.670***			0.562***
				(0.025)			(0.026)
Log of aid by other countries$_{ct-1}$					1.486***		1.056***
					(0.014)		(0.014)
Percentage change in new car registrations per capita$_{c(t-(t-1))}$						0.540***	0.548***
						(0.039)	(0.040)
Scrapping scheme$_{ct}$						1.040***	1.426***
						(0.007)	(0.070)
Aid to national champion$_{ct}$						5.410***	3.765***
						(0.116)	(0.147)
Constant	0.000***	33.943***	11.237***	1.939***	9.509***	51.246***	0.000***
	(0.000)	(1.295)	(0.168)	(0.002)	(0.560)	(0.894)	(0.000)
Logit equation							
Wald test for the joint significance of country dummies	988.15***	36.28*	36.28*	36.28*	36.28*	35.73*	873.84***
	(0.000)	(0.087)	(0.087)	(0.087)	(0.087)	(0.097)	(0.000)
Wald test for the joint significance of year dummies	21.77	21.34	21.34	21.34	21.34	21.03	21.70
	(0.151)	(0.166)	(0.166)	(0.166)	(0.166)	(0.177)	(0.153)
Observations	268	300	300	300	300	297	267
Log likelihood	-11829	-11376	-12712	-11611	-13143	-10866	-3229
AIC	23747	22848	25515	23313	26375	21824	6572
BIC	23909	23025	25686	23484	26542	21994	6776

Notes: dependent variable is aid to the car industry in country c at time t (constant values). Estimates obtained with Zero inflated Poisson estimator. The inflation equation (not reported) includes a set of country and year dummies. Incidence-rate ratios are reported. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6: Determinants of different types of aid to the car industry

	Total aid to the car industry	*Capacity increasing aid*	*Aid to competitiveness*
Poisson equation			
Post Lisbon$_t$	0.288***	0.265***	0.630***
	(0.008)	(0.008)	(0.056)
Post State aid Action Plan$_t$	0.670***	0.565***	1.175
	(0.025)	(0.023)	(0.116)
Constant	1.939***	2.455***	2.159***
	(0.002)	(0.003)	(0.011)
Logit equation			
Wald test for the joint	36.28*	35.77*	19.44
significance of country dummies	(0.087)	(0.096)	(0.817)
Wald test for the joint	21.34	22.34	11.46
significance of year dummies	(0.166)	(0.133)	(0.780)
Observations	300	300	300
Log likelihood	-11611	-9116	-889
AIC	23313	18323	1870
BIC	23484	18493	2040

Notes: dependent variables are aid to the car industry either total, or divided according to their aim, in country c at time t. Estimates obtained with Zero inflated Poisson estimator. The inflation equation (not reported) includes a set of country and time dummies. Incidence-rate ratios are reported. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 7: Robustness checks

	(1) EU 15	(2) EU 15	(3)	(4) no1992	(5) no 2008
Poisson equation					
Industry's value added$_{ct}$	3.178***	3.185***	2.891***	1.503***	3.168***
	(0.111)	(0.111)	(0.178)	(0.053)	(0.104)
Income per capita$_{ct}$	1.608***	1.603***	7.228***	0.550***	0.424***
	(0.218)	(0.217)	(0.852)	(0.037)	(0.029)
Industry's import penetration$_{ct}$	1.094***	1.094***	1.098***	0.996	1.083***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Industry's export ratio$_{ct}$	0.909***	0.908***	0.900***	0.908***	0.923***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Election year$_{ct}$	1.996***	1.991***	2.343***	1.369***	1.768***
	(0.061)	(0.061)	(0.067)	(0.041)	(0.051)
Right-wing government$_{ct}$	1.805***	1.804***	1.859***	1.946***	1.885***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Proportional$_{ct}$	2.474***	2.471***	3.740***	0.974	2.277***
	(0.063)	(0.063)	(0.088)	(0.030)	(0.052)
Federalism$_{ct}$	0.372***	0.373***	0.368***	0.737***	0.371***
	(0.029)	(0.029)	(0.041)	(0.055)	(0.028)
Euro$_{ct}$	0.413***	0.415***	0.654***	0.758***	0.241***
	(0.022)	(0.022)	(0.032)	(0.041)	(0.011)
Total aid(%)$_{ct}$	4.736***	4.715***	2.945***	1.431***	3.229***
	(0.416)	(0.413)	(0.248)	(0.116)	(0.281)
Post Lisbon$_{t}$	0.501***	0.499***	0.312***	0.665***	0.891**
	(0.029)	(0.029)	(0.017)	(0.034)	(0.043)
Post State aid Action Plan$_{t}$	0.402***	0.416***	0.336***	0.667***	0.547***
	(0.021)	(0.022)	(0.016)	(0.030)	(0.027)
Aid by other countries$_{ct-1}$	1.091***		1.089***	1.059***	1.059***
	(0.015)		(0.015)	(0.014)	(0.014)
Change in new car registrations per capita$_{c(t-(t-1))}$	0.558***	0.560***	0.540***	0.455***	0.518***
	(0.051)	(0.051)	(0.046)	(0.047)	(0.040)
Scrapping scheme$_{ct}$	2.346***	2.355***	1.352***	1.604***	1.499***
	(0.130)	(0.130)	(0.071)	(0.081)	(0.077)
Aid to national champion$_{ct}$	3.153***	3.157***	2.553***	1.963***	3.689***
	(0.128)	(0.128)	(0.444)	(0.079)	(0.146)
Aid by other EU 15 countries$_{ct-1}$		1.095***			
		(0.015)			
New member$_{ct}$			1.389***		
			(0.029)		
Constant	0.003***	0.003***	0.987	0.156***	0.000***
	(0.002)	(0.002)	(0.664)	(0.083)	(0.000)
Logit equation					
Wald test for the joint	33.54***	33.52***	806.8***	35.58*	671.32***
significance of country dummies	(0.001)	(0.001)	(0.000)	(0.060)	(0.000)
Wald test for the joint	18.78	18.78	21.58	20.83	20.48
significance of year dummies	(0.280)	(0.280)	(0.157)	(0.143)	(0.154)
Observations	223	223	267	257	250
Log likelihood	-2591	-2591	-3480	-2244	-3172
AIC	5280	5276	7075	4601	6453
BIC	5440	5436	7283	4803	6647

Notes: dependent variable is aid to the car industry in country c at time t (constant values). Estimates obtained with Zero inflated Poisson estimator. The inflation equation (not reported) includes a set of country and timedummies. Incidence-rate ratios are reported. * significant at 10%, ** significant at 5%, *** significant at 1%.

Appendix

Table A.1: Variables' definitions and sources

Variable	Definition	Source
State aid to the car industry	The amount of state aid granted by country *c* at time *t* to the car industry	Own elaboration from DG competition and OJEU
Industry's value added	The value added of the car industry in country *c* at time *t*	Eurostat and EU KLEMS database
Income per capita	Real gross domestic product per capita in country *c* at time *t*	Eurostat
Industry's import penetration	$\frac{M_{ct}}{P_{ct} + M_{ct} - X_{ct}}$ where *M* are imports of country *c* at time *t*, *P* is production and *X* are exports	UN Comtrade database, Eurostat and EU KLEMS
Industry's export ratio	$\frac{X_{ct}}{P_{ct}}$ where *X* are exports of country *c* at time *t* and *P* is production	UN Comtrade database, Eurostat and EU KLEMS
Election year	A dummy equal to one if there is a legislative elenction in country *c* at time *t*	Database of Political Institutions and own search on the web
Right-wing government	A categorical variable that describes the cabinet composition following the Schmidt-Index. Ranges from 1 to 5. 1 = hegemony of social-democratic and other left parties ; 2 = dominance of social-democratic and other left par-ties; 3 = balance of power between left and right/centre; 4 = dominance of right-wing (and centre) parties; 5 = hegemony of right-wing (and centre) parties	Comparative Political Data Set III
Proportional	A categorical variable that describes electoral systems according to Lijphart (1999). Ranges from 1 to 4. 1 = simple plurality formula; 2 = majority-plurality/alternative vote; 3 = mixed member proportional formula; 4 = semiproportional formulas, list proportional representation and single transferable vote.	Comparative Political Data Set III
Federalism	A dummy equal to one if country *c* has a federal structure	Comparative Political Data Set III
Euro	A dummy equal to one if country *c* is adopting Euro at time *t*	Own elaboration
Total aid (%)	Total state aid as a percentage of GDP	Eurostat
Lisbon declaration	A dummy equal to one for 2000 onwards	Own elaboration
State Aid Action Plan	A dummy equal to one for 2005 onwards	Own elaboration
Aid by other countries	The amount of state aid granted by all countries except country *c* at time *t-1* to the car industry	Own elaboration from DG competition and OJEU

Percentage change in new car registrations per capita	Percentage variation between new car registration in country *c* at time *t* and time *t-1*	Eurostat and ACEA
Scrapping scheme	A dummy equal to one if a scrapping program is active in country *c* at time *t*	Global Insight (2010)
Aid to national champions	A dummy equal to one if some aid was granted to a national champion in country *c* at time *t*	Own elaboration from DG competition and OJEU
New Member	A dummy equal to one if country *c* joined the EU in 2004 or 2007	Own elaboration