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Abstract

This paper presents an indicator-based methodology to identify lead markets in the European automotive industry. The lead market approach tries to explain why certain countries are better positioned than others for developing and launching new products. While much research stresses the role of excellence in technology and interaction among users and producers, the lead market approach focuses on the role of demand characteristics. Based on the concept of innovation design, a lead market is defined as a country where customers prefer that design which subsequently becomes the globally dominant design. We use an indicator-based approach which has been successfully employed for individual products as well as for various industries in order to identify lead markets in the European automotive industry. Employing five lead market factors, our results show that the EU is by far no homogeneous market for automobiles and national markets differ considerably in their lead market potential. The German market is found to be most promising to serve as a lead market while other European countries with a strong automotive tradition like France, Italy, the UK and Sweden score lower. Our findings suggest that firms from the automotive industry should exploit this diversity of market characteristics within Europe when developing and launching new products.

Keywords: Lead markets, automotive industry, Europe

1 Introduction

In many industries, certain countries are constantly leading new technological developments and set most of new innovative trends that shape the industry's future. The US is certainly leading in many areas of online-based services while Japan has been a trend-setter for computer games. Innovation dynamics in mechanical engineering often originate from Germany while Italy and France are frequently associated with new developments in the fashion industry. What is common to all these examples is that innovations developed in the leading country often become adopted globally, ousting innovations developed in other countries. For explaining this country persistence in leading innovation in a certain industry, the innovation system approach (Freeman, 1988; Lundvall, 2007) stressed the role of supply-side factors such as research excellence, the links between industry, science and governments (Etzkowitz and Leydesdorff, 2000) as well as user-producer interaction (Fagerberg, 1995).

This paper wants to add another dimension by pointing to the role of demand. We argue that demand for innovation differs across countries, and that in some countries, customers demand certain types of innovations ('innovation designs') that later become a global standard, i.e. a dominant design. We denote markets with such an anticipative demand a 'lead market'. Lead market characteristics of countries always refer to a specific industry and can differ substantially among industries, making the same country a lead market for one industry but a lag market for others. Firms that shape the design of their innovations along the requirements of customers in lead markets can profit by the ability to market their innovations early on a global scale. At the same time, countries where demand owes lead market characteristics can profit by attracting firms from abroad that wish to learn from lead market information. In addition, native firms from a lead country can profit from the reputation advantage that goes along with products originating from a lead market.

The concept of lead markets as a tool for analyzing country differences in innovation performance was proposed by Beise (2001, 2004, 2005) and has been successfully used to guide new product development in firms (Beise and Cleff, 2004). The purpose of this paper is to apply the lead market concept on an industry level, namely the automotive industry. We employ an indicator-based approach to measure demand characteristics that are associated with a lead market. On the one hand, the results of this analysis are intended to contribute to a better understanding of the underlying factors that drive innovation performance of countries in the automotive industry. On the other hand, it aims to provide new insights for innovation

management by offering a tool to identify those markets that are most promising for developing innovation designs through learning from customers.

The role of demand for successful innovation has been stressed for a long time (e.g., Kline and Rosenberg, 1986; Dosi, 1988; Cooper, 2003; Aschhoff and Sofka, 2009). Aiming at customer problems and latent user needs has been shown to impact a firm's success with new products (Frishammar and Ylinenpää, 2007). Integrating information about customer preferences in the innovation process ensures that new products are market oriented (Ernst, 2002). Lead users, for example, can offer more detailed information on (future) customer demands which can subsequently be integrated into new products (von Hippel, 1986; Schreier and Prügl, 2008). The lead user approach, which is based at the individual level, has received ample attention in the literature, especially when it comes to technological innovation (Lilien et al., 2002). Relatively little is known, however, about how firms can identify – at the country level – the markets on which they may gauge the viability of a new product before it is introduced internationally.

Responsiveness to demand in innovation is relevant for many industries, but particularly for consumer markets for high-end products and brands where innovation is based rather on incremental improvements and the combination of existing technologies rather than breakthrough inventions. This is particularly true for the automotive industry, which we have chosen as a test case. On the one hand, innovations are fundamental to the long run success of automotive companies (Srinivasan et al., 2009). Although innovation processes in the automotive industry are clearly driven by the development of new technologies, there are numerous examples of technological innovations that – from a technological point of view – were superior but failed to become the standard on the world market because they lacked customer response (e.g., Beise, 2001, 2004). On the other hand, most automotive firms supply various national markets and are confronted with different demand preferences. Since adapting the design of automobiles to each national market is costly, automotive firms may look for test markets where customers are likely to demand innovation designs that can be successfully commercialized in other regions, too. An example is Honda's decision in November 2011 to select Oregon and California as test markets for the new "Fit EV", an electric vehicle. Both U.S. states are particularly known for their customer sophistication and demands when it comes to environmental sustainability and "green thinking".¹

¹ See <http://www.sustainablebusinessoregon.com/articles/2011/11/oregon-picked-as-honda-fit-ev-test.html>.

Firms that develop innovations in response to demand from lead markets can benefit from lower development costs as the probability of failure due to a lack of customer response is lower in a lead market (Beise, 2001, 2004). Particularly the early stages of the innovation process have been characterized as being dependent on information on customer demand as they constitute the basis for further product planning (Cooper et al., 2004; Song and Parry, 1997). In addition, firms can market their innovations faster and more extensively on a global scale since other markets will later adopt innovations that come from the lead market. The lead market approach thus goes beyond merely adapting existing products to specific customer needs abroad (di Benedetto, 1999). Using a lead market approach to explain the international success of locally introduced innovations was first suggested in the 1980s by Porter (1986) and Bartlett and Ghoshal (1990) and has since then received some, even though relatively limited, attention (e.g., Gerybadze et al., 1997; Johansson, 2000).

While there are other examples for the existence of lead markets (see Beise, 2006), identification of such markets for a specific industry is an empirically challenging task. In this paper, we build upon prior work that developed a conceptual foundation of the lead market approach (Beise, 2001, 2004, 2005; Beise and Gemünden, 2004) and derived a system of five market characteristics that allow assessing the lead market potential of national markets empirically (Beise and Cleff, 2002; Beise et al., 2002; Cleff et al., 2007). Using this methodology, Beise and Cleff (2004) analyzed lead market potentials of a large set of countries for a specific innovation in the automotive industry, a remote repair system. The insights gained from their study are used in this paper to apply an indicator-based methodology to the automotive industry in 25 member states of the European Union (EU-25). By focusing on the automotive industry, which is characterized by high competition and at the same represents a significant share of many countries' gross value added, this paper complements and extends prior research which has attempted to identify lead markets in sectors like chemicals, energy production, food and drink, information and communication technology (ICT), textiles, or for environmental innovations (Cleff, 2008, 2010; Cleff et al., 2009a, 2009b, 2011; Cleff and Rennings, 2012, 2014). Using more comprehensive data recently made available and theoretically linking the lead market approach to lead user theory (von Hippel, 1986; Schreier and Prügl, 2008), this paper also extends prior research on lead markets in the automotive industry (Cleff et al., 2008).

Our paper proceeds as follows. The next section discusses the lead market approach, its theoretical foundations and what characterizes a lead market. Section 3 presents the empirical methodology to measure lead market potentials at the country level. Section 4 contains the

results of our analysis for the European automotive industry. Section 5 discusses the findings and their implications for management and policy making. The concluding section stresses some limitations of our analysis and points to fields for future research.

2 The lead market approach

2.1 A conceptual framework

In essence, the lead market approach aims at explaining the market success of competing innovation designs by stressing the role of user responsiveness and anticipative demand. Key to the lead market approach is the concept of ‘innovation design’. Innovation design denotes a certain technical and design solution for a new product or for improving the performance and usability of a product. A classical example is the development of type-writers in the second half of the 19th century. A number of different designs for arranging letters on the keyboard have been proposed, with one design -the still used QWERTY design- out-competing others and becoming the dominant design globally (see David, 1985). Competition of innovation designs can be observed for most new products. And also common to most product innovations is the fact that after some time one design becomes dominant and displaces alternative designs (e.g., Anderson and Tushman, 1990).

Typically, different innovation designs are not introduced simultaneously across all geographical markets but are often first confined to a certain regional market and respond to the specific conditions of this market in terms of user preferences, environmental factors and government regulation. A lead market is hence that geographical market which induces global innovation by local conditions (Bartlett and Ghoshal, 1990). This is not necessarily the market where the technological solution has been developed nor must it be the home market of the innovating firm. But it is the market where demand for a later globally successful innovation design first took off.

In order to empirically determine the lead market potential of regional markets within the EU, we apply a conceptual framework that builds upon the work of Beise (2001, 2004, 2005). He identified four main mechanisms that can explain why a certain innovation design becomes the globally preferred (‘dominant’) design: (a) a change in relative prices of competing innovation designs, (b) a change in the relative benefit of innovation designs, (c) a change in the willingness to pay of users, and (d) a competitive environment. These generic mechanisms are linked to five lead market advantages which can be operationalised and measured through a set of indicators. Figure 1 illustrates the basic elements of this framework.

Figure 1 about here

A relative price reduction for the lead market design may occur either if an initially lower price level in the lead market became available to other regional markets ('lag markets') with some delay, or if the price of the design preferred in a lead market decreases faster than the price of alternative designs preferred in lag markets. The price reduction effect reflects the ability of the lead market to anticipate upcoming price trends and has been found to play a major role in the globalization of markets (Levitt, 1983, p. 93). Levitt asserts that global producers "attract customers who previously held local preferences and now capitulate to the attractions of lesser prices".

Changes in the relative benefit of innovation designs may be linked to two effects. On the one hand, some markets may be at the forefront of international trends which later become dominant in other markets, too. As Bartlett and Ghoshal (1990, p. 243) put it, "local innovation in such markets becomes useful elsewhere as the environmental characteristics that stimulated such innovations diffuse to other locations." Markets that anticipate upcoming industry trends earlier than other markets are therefore more likely to become lead markets (Porter, 1990). On the other hand, consumer choices in one market may influence users in other markets in their demand behavior. The adoption of a certain innovation design in one market reduces uncertainty over the benefits of that innovation and may stimulate demand in other markets for the innovation (Kalish et al., 1995). This demonstration effect has been found relevant to explain the adoption of innovations across countries and sectors (Mansfield, 1968). For the automotive industry, a reputation effect can also be important in case reputable first adopters signal the credibility of an innovation. A reputation effect can often be observed for the diffusion of innovations across social groups but is also relevant for consumer goods when users in specific regions serve as prestigious peer groups (Brodowsky, 2008). The adoption of innovations from one market by other markets can be facilitated if users in that market do not only consider the local context when building their preferences but also account for the situation in other markets. This will most likely be the case if users are highly internationally oriented and locally produced products are regularly exported to other markets. Therefore, a high export orientation of a country should contribute to becoming a lead market.

Increasing income in lag markets can also cause a shift in demand patterns that lead to the adoption of a lead market design, particularly if this design is linked to high prestige or is associated with superior, though more expensive, product features. This mechanism relates to

the product-life-cycle theory by Vernon (1966). Since an increasing income level can be interpreted as a secular trend, markets that demand products with a high income elasticity can be viewed as being at the forefront of this trend and thus lead consumption patterns that will be later adopted by emerging markets.

The role of competition for the emergence of lead markets is linked to the diversity of competing innovation designs that the industry in a regional market creates. Imperfect information on user preferences for innovations requires testing alternative innovation designs. In markets with fierce competition and a large number of competitors, it is more likely that several different innovation designs will be tested. The more alternatives offered the higher the probability that one design will address most of the latent user needs. Such a design should also have a greater potential to meet user needs in other markets. Competitive markets may therefore be expected to generate globally successful innovations more often than less competitive markets. This is in line with Porter's (1990) finding that customers in very competitive markets can be "choosier" than in oligopolies or monopolies.

2.2 Lead market characteristics

Based on these theoretical arguments, five features of markets can be identified that will be the key indicators in our empirical analysis (Beise, 2001). We assume that the lead market potential of a country can be measured by these five lead market characteristics. In the following, we do not run a factor analysis on the five lead market characteristics but rather qualitatively evaluate the lead market potential of a country based on how a country scores on each dimension. In that sense, the five lead market characteristics are certainly related to each other, which is to be expected when using indicators that "reflect" the underlying construct (Diamantopoulos, 1999; Diamantopoulos and Siguaw, 2006). However, even though they may be correlated we expect these characteristics to capture distinct features of the market that one single indicator would be unlikely to capture, thus improving the reliability of the measure. The lead market factors need to be seen as continuous rather than dichotomous variables, i.e. countries may vary depending on the degree to which a certain lead market advantage is present. In that regard, the lead market factors can be connected to the micro-level concept of "lead useriness" (Schreier and Prügler, 2008). Following this rationale, countries on the macro-level vary depending on their "lead marketness".

The five lead market characteristics have been identified from a series of case studies that looked at the characteristics of those markets where customers did prefer a certain innovation design that later became the global standard (see Beise, 2001, 2004, 2005; Beise et al., 2002):

- A *demand advantage* relates to an early anticipation of developments that later become global trends. Such trends may include changes in user preferences, income trends and associated changes in demand sophistication or building-up infrastructure that complements to future innovation. An example for the latter would be cars powered by alternative fuel. Their utility increases only with the extension of a suitable network of filling stations. In this regard, the demand advantage relates closely to the concept of “lead useriness” on the micro level (Schreier and Prügl, 2008).
- A *price advantage* refers to the potential to reduce a product’s price through cost reductions as well as to anticipate future factor costs developments. In the automotive industry, cost reductions are strongly related to scale economies and the utilization of platform concepts. Markets with high sales volumes ease the exploitation of scale and scope economies. This is why market size and market growth can reinforce lead market potentials (Levitt, 1983). The effect of a price advantage will be stronger if price differences to lag markets are great as switching to an alternative design imposes transaction costs on users.
- A *transfer advantage* captures a market’s link to other markets and the ease of adopting the experience made with a certain innovation design in one market by users in other markets (Takada and Jain, 1991). Exchange of experiences can be facilitated when users are regarded as highly reputable and sophisticated. A country’s market has a transfer advantage if it raises the perceived utility of customers on other markets as well as those at home.
- A *export advantage* represents the extent to which local producers and users respond sensitively to global developments. A local market will show an export advantage if local users are aware of global problems and needs and local producers have experience with other markets and their specific conditions because of prior export activities (Dekimpe et al., 1998).
- A *market structure advantage* highlights the crucial role of competition for successful innovation. In competitive markets, users tend to be more demanding and firms are under higher pressure to respond to innovations by competitors with own innovation activities (Arrow, 1962; Gilbert, 2006), leading to a higher number of different innovation designs that will be tested compared to a monopolized market.

The five lead market characteristics refer to features of sales markets, including price levels, market size, customer characteristics, the type and degree of competition, and the

availability of complementary infrastructure relevant to the use of a certain product. The local industry that serves the respective market does not necessarily share these features, particularly if most local producers sell to customers outside their home region. Nevertheless, there are theoretical arguments why lead market advantages may also be reflected by features of the local industry. If firms want to profit from lead market characteristics, they need to respond to the specific demand conditions in the lead market. Learning from a market does not necessarily imply developing and producing innovations locally. However, local user-producer interaction helps manufacturers to better learn about demand requirements and to adapt their innovation designs accordingly (Fagerberg, 1994; Beise-Zee and Rammer, 2006). Moreover, lead market characteristics primarily represent market features that tend to be rather stable over some time, such as demand preferences or the degree of competition.² Continued user-producer interaction in a lead market will therefore change the way local industry acts such that firms become more and more responsive to lead market impulses, e.g. by designing innovation processes in a way that allows an early response to user needs and a regular test of new technological solutions against user response. However, lead market characteristics will change in the longer run, reflecting changes in relative income of users, new upcoming trends, changes in government policy or market entry of new competitors. It is hence an ongoing task of firms to constantly evaluate lead market potentials in their markets. Moreover, it is important to note that the lead market advantages may also turn into lead market disadvantages. A demand advantage of a country could, for example, turn into a disadvantage if there is no early anticipation or adoption of global trends, technologies and needs. In that case, such lead market disadvantages would actually reduce the likelihood that a certain innovation design becomes a globally preferred design.

3 Methods

3.1 Indicator-based approach

In order to measure the five lead market characteristics empirically it is necessary to identify variables that represent the theoretical concepts described above. Several different approaches have been applied in the literature. Beise and Cleff (2004) developed an indicator-based approach for identifying lead market potentials for two specific products in the truck market: The first innovation project has been the development of a remote diagnosis system (RDS) for modern trucks, the second one the development of a system that automates a

² Comparing the results of this analysis with a related analysis based on earlier data (Cleff et al., 2007) reveals similar patterns of lead markets.

standard truck or lorry (AGV). Both lead market analyses were conducted in 1999 and 2000. The approach was based upon detailed knowledge about the products, their potential users and their performance characteristics in order to build tailor-made indicators that can be measured for various national markets. Each of the five lead market characteristics was measured by a set of market-related indicators, including market size and growth, costs of complementary infrastructure, demand specialization and industry competitiveness. A total of 34 indicators were used to construct a composite index on a country's lead market potential for each of the two products. In order to rank the countries, principal component factor analysis has been applied to reduce the 34 variables into two main components for each lead market characteristic. Components were then merged into a variety of country-specific indices using different methods of aggregation. In the case of RDS with most aggregation methods, the US has been identified as the country holding the strongest lead market characteristic. The validity of this prediction has been proven twelve years later by the successful first mover market entry of the *Virtual Technician* – a US-American real-time diagnostic system which has become standard on Freightliner and Western Star trucks.³

In another study, Beise et al. (2002) combined a survey-based method with an indicator-based approach to identify lead markets for four application fields of technical textiles. Through a telephone survey of product managers from selected producers of technical textiles in Europe expert assessments on the significance of certain lead market characteristics in different national and regional markets were obtained. The findings from the survey were combined with market-related indicators on consumer preferences, market volumes, competition, export activities and foreign direct investment to derive a country-specific index for each lead market characteristic. Cleff et al. (2007) built upon the findings of these two papers and identified a key performance indicator for each lead market characteristic. This indicator-based approach was applied on the industry level to identify country-specific lead markets in Europe for four industries (chemicals, machinery and equipment, automotive, information and communication technologies).

In this paper, we follow Cleff et al. (2007) and use an indicator-based approach. Such approaches are widely used to evaluate the performance of countries and industries in

³ See <http://www.westernstartrucks.com/MediaCenter/PressReleases/default.aspx?n=detroit-virtual-technician-achieves-100-000th-installation-2014-08-21> and <http://www.vehicleservicepros.com/news/10614527/virtual-technician-real-time-remote-diagnostics-joins-the-detroit-brand-family>. In July 2014, we conducted an interview with a former manager of Daimler who was involved in the development and commercialisation of the RDS system to evaluate the relevance of the five lead market characteristics considered. The manager confirmed that these characteristics have indeed been the relevant ones to predict the right market to introduce this innovation and to learn from users.

international comparisons. In the field of innovation several indicator-based studies have been published in recent years (Andrew et al., 2009; Atkinson and Andes, 2009; Economist Intelligence Unit, 2009; INSEAD, 2010; World Economic Forum, 2010; IMD World Competitiveness Center, 2011; European Commission, 2012). These studies share two features. First, a list of theoretically derived constructs is established which are supposed to influence innovation performance. Secondly, these constructs are measured empirically through observable indicators which are available from international statistics. This approach has some merits and limitations. Relying on indicators from international statistics increases comparability of data and reproducibility of results and eases analysis over time. On the negative side, indicators are rarely perfect representatives for the underlying theoretical constructs. For some theoretically derived constructs, there may even be no useful indicator available at all. In general, an indicator-based approach seems to be more appropriate if the level of market aggregation is high, i.e. one does not look at specific products but on a whole industry since the availability of internationally comparable industry-level indicators is much better than data on individual product markets while a survey-based method would require considerable efforts to obtain representative results for a whole industry. As our research aims at a lead market analysis at the industry level, we believe that the indicator-based approach provides a useful setup for our study.

A critical issue for empirically analyzing lead markets is the geographical dimension. So far, we implicitly assumed that a lead market is equivalent to a national market. The main argument behind this assumption is that national markets have been standardized over a long period of time, causing a certain unification of demand preferences, market structure and firm strategies. But this is not necessarily the case for all product markets. Sometimes regional variations in market characteristics may be high within a country, e.g. in the field of consumer taste with regard to food and beverages, while in other product markets cross-national markets may emerge. In the automotive industry, we argue that national markets are still highly prevalent due to national regulations of design features of cars (including national specific approval regulations for new cars) and national retail markets. In addition, and despite the globalized activities of OEMs, production networks in the automotive industry tend to be regionalized (Sturgeon et al., 2008) and rest to a lesser extent on international sourcing compared to other industries such as electronics.

3.2 Measures and Data

Price advantage

According to Levitt (1983), in the context of the internationalization of innovations, an innovation design sold at a lower relative price on a lead market can squeeze out existing – but relatively more expensive – innovation designs on other markets abroad. Price advantages can only be used as a lead market characteristic, however, if there is price competition. This is the case for the automotive industry which means that price advantages are indeed of relevance in this context.

Purchasing Power Parities (PPP) statistics provide information on total domestic demand (expenditure) and prices for a large variety of products, including automotive products. This statistics is collected and published by Eurostat, the statistical office of the European Union, and is used to compare price levels for cars among European countries. As price and demand data refer to the same good in all countries they are neutral to quality differences between countries (OECD/Eurostat, 2006). PPP data for the automotive industry refer to four groups of goods: motor cars with diesel engine (1107111), motor cars with petrol engine (1107112 to 1107115), motorcycles (1107121), spare parts and accessories for personal transport equipment (1107211). The good-specific prices are weighted using their demand propensity. National currencies were converted to Euro using the average annual exchange rate. The data we use refer to the years 2004 to 2008 which is the most recent period available for most countries at the time of analysis. Data for a longer period of time using the same breakdown by goods are not available.

Relative prices of a country are calculated by taking the negative logarithm of the ratio of automotive-specific PPP and the average PPP across all sectors of a country's economy. This relative PPP controls for country-specific differences in per capita income and corresponding variations in price levels. Hence, a country showing a value above the EU-25 average indicates a price level for automotive goods that is below the average relative price for the EU-25 countries which as a consequence can be characterized as a price advantage.

Demand advantage

We have argued that a demand advantage basically refers to the ability of a national market to adopt global trends early or even to initiate such trends. Since it is extremely difficult to find indicators for a country's position in adopting new demand trends (which would require some sort of diffusion data for various trends for all countries to be considered), we choose a simpler but robust approach and use a demand specialization index. The reasoning behind this choice is that a high propensity of domestic users to demand automotive products is positively related to demanding high-quality and more expensive cars (particularly when controlling for the price level, i.e. the price advantage indicator). Since most demand trends in the

automotive industry are related to new quality characteristics of cars such as higher safety standards, higher energy efficiency or higher comfort, a positive demand specialization indicates a higher response to such trends. In addition, if a larger share of total domestic demand is used for automotive products, users in this country will pay more attention to this product group as compared to other products and observe more carefully ongoing trends than users in countries where demand specializes on other fields of consumption.

To measure demand specialization, we again use data from the PPP statistics which contain data on the absolute amount of expenditure for different groups of goods. On the basis of the data for 2004 to 2008, we calculate a country's share of domestic demand for automotive products in total domestic demand (using annual average exchange rates to convert national currencies into Euro values) and subtract this figure from the respective share for all EU-25 countries. If a country's share in automotive demand is higher than the respective average share in the EU-25, the country's demand is specialized on automotive products and hence constitutes a demand advantage.

Transfer advantage

A country can have a transfer advantage if its market has strong communication ties with other countries (Takada and Jain, 1991). The adoption of one innovation design in one country can influence the adoption decisions of users in other countries because the perceived benefit of an adopted design increases for users in other countries. The perceived benefit increases when information on the usability of the innovation design is made available. However, a transfer advantage in the automotive industry is difficult to operationalize, as Beise and Cleff (2004) have shown for selected automotive innovation projects. Since the differences between countries are less pronounced at the industry level than at the level of individual products, it is even more difficult to find appropriate indicators at the industry level. Cleff et al. (2007) used the amount of foreign direct investment (FDI) as a proxy for the potential international orientation of innovators. One benefit of foreign subsidiaries is that they provide companies with information about the particular nature of demand in a country.

Based on Eurostat's statistics on the structure and activity of foreign affiliates (FATS), we use the number of employees as a proxy for the stock of FDI. Data for 2007/2008 on economic activities abroad by enterprises from European countries as well as activities of foreign affiliates located in European countries are available for the automotive industry for 16 of the EU-25 countries. In order to determine the outward orientation of the domestic automotive industry, we calculate an indicator that shows whether the automotive industry in a certain country is more or less internationalized than the economy of that country in total.

The measure of specialization for a given country is calculated by taking the ratio of (1) the total number of employees in the automotive industry at foreign subsidiaries of companies headquartered in the given country divided by the number of employees in the automotive industry of the given country who work in foreign-owned companies and (2) the respective ratio for the total of all industries in country.⁴ Consequently, a higher value of the measure indicates that the country possesses a transfer advantage.

Export advantage

The lead market approach is not based on the traditional view that export success is an indicator of a country's technological – or, more generally, economic – competitiveness. Instead, pronounced export activity is seen as an input factor for a country's success in innovation. A strong position in terms of exports in the past may encourage innovators to make their products suitable for international markets. This, in turn, promotes innovation designs that will be a success when exported.

To assess the export advantage in the automotive industry we have to evaluate the extent of export success for each country. We do this by examining export performance of each country in bilateral trade to all other European countries for a set of 143 automotive products observed in international trade statistics (using the 8-digit level of the Combined Nomenclature of Eurostat's European Trade Statistics. For each product, we calculate a comparative advantage (CA) indicator in bilateral trade which is the ratio of exports minus imports to total bilateral trade volume of countries i and k (CA_{ik}) as an average over a sixteen-year period from 1998 to 2005.⁵ The greater a country's export surplus in bilateral trade the higher the underlying competitiveness vis-à-vis the other country will be (Grubel, 1975). We then calculate for each product the average comparative advantage for all European countries that export the respective product. This average value is used as a reference for determining country-specific export success. For each country we determine the share of automotive products that show a comparative advantage significantly above the average, indicating that the country exhibits an export advantage.

Market structure advantage

⁴ For presentation purposes, the hyperbolic tangent of the logarithm of the quotient is calculated, resulting in a normalized value between -1.0 (no foreign activities of the automotive industry in country i) and +1.0 (automotive industry is the only industry of country i with activities abroad).

⁵ The Revealed Comparative Advantage - RCA (Balassa, 1965) - applied in the tradition of economics for determining comparative advantages, is considered not to be an appropriate indicator in this case. A positive competitive advantage of a country can be hidden to some extent behind a low RCA if the ratio of exports to imports of a particular product group is indeed higher than 1, but the corresponding ratio in total trade of a country turns out to be higher. This can lead to an underestimation of the product-specific absolute competitiveness of nations that have a high overall product export surplus, and vice versa (Cleff, 2006).

Prior literature has shown that lead markets are characterized by particularly strong competition (Beise, 2001). The market structure advantage refers to the degree of competition in a market which could be measured in several different ways. In a market with perfect competition, firms theoretically adjust their supply to fit the market price. In this case, the price level is lower than in a monopoly. Taking this relationship as a starting-point, we can assume that the price level on a market tends to decrease with more intense competition.

Based on Eurostat's Structural Business Statistics from 2004 to 2008, we use the operating surplus as a share of sales ('profit margin') of firms in the automotive industry in a given country to measure the degree of competition. The rationale behind this measure is the fact that monopolistic markets are typically characterized by rather high relative prices and resulting high profit margins of the monopolists. Competition instead drives down the prices and, as a consequence, also the profit margins. Since high competition encourages firm innovation, a low profit margin constitutes a market structure advantage.

Table 1 summarizes the indicators used to measure the five lead market advantages of countries for the European automotive industry. All indicators are measured on the industry level for 25 countries that are member states of the European Union.⁶ The delineation of industries is based on the NACE, rev. 1.2, industry classification in which the automotive industry corresponds to NACE 34.⁷

Table 1 about here

Our analysis will first present the results for the five lead market characteristics individually before they will be combined and plotted to gain additional insights on whether a particular country has an advantage that increases its lead market potential in the automotive industry. Combining the indicators gives an impression how they relate to each other and whether trade-offs exist between them.

The choice of the time frame for the variables under study reflects the ambition to use the latest data available while at the same time making sure that data are actually available for all or most countries. All measures are calculated as averages of the years mentioned in Table 1.

⁶ The European Union today has 27 member states. Bulgaria and Romania are however excluded from the analysis because they were the last two countries to join the EU in 2007. As a consequence, availability of comparable data for these two countries was rather limited at the time of analysis.

⁷ NACE stands for "Nomenclature statistique des activités économiques dans la Communauté européenne" and provides a statistical classification of economic activities in the EU. It consists of a 6 digit code and is similar in function to the standard industry classification system (SIC) used in the U.S.

For some variables there are no longer time series data available. This is however relatively unproblematic because our study focuses on the structural differences, which have developed in the European automotive industry over the long run. By using the mean value we control for cyclical influences.

4 Results

4.1 Results for individual indicators

The results for the five lead market indicators are summarised in Table 2. In the following, we discuss the main findings by indicator.

Table 2 about here

Differences in relative prices of automotive markets among the EU-25 are significant. A value for a country above the EU-25 average means that the relative price level for cars is actually below the average relative price for the EU-25 countries and hence constitutes an advantage. Eastern European countries report higher relative prices in the automotive industry than Western European countries, except for Portugal and Denmark. Comparatively low relative prices can be found in countries with a tradition of car manufacture, namely Sweden, the UK, Germany and France. The first indicator would therefore suggest that these countries possess a price advantage compared to the other European countries.

Countries with a demand specialization well above the EU-25 average are Cyprus, Portugal, Slovenia and Hungary, all of which scored more than one percentage point above the average. Shares of demand that were significantly below average can be found in Slovakia, the Netherlands and Poland. The former countries can thus be said to exhibit a demand advantage. Because the automotive industry accounts for a larger proportion of those countries' aggregate demand, firms may be stimulated to make greater efforts to develop and improve products. As a result, firms can also benefit when they aim at commercializing new products abroad.

The FDI specialization indicates whether the automotive industry in a certain country is more or less internationalized in terms of FDI than the average of the economy in that country. If the proportion of investment abroad is above average, the resulting value is positive, suggesting a transfer advantage. It becomes apparent that the automotive industries in Germany, Italy, France and Sweden specialize in FDI more than the average of the

economy, while the other countries have below-average values. The German automotive industry in particular has followed a strategy of internationalization for a number of years. In this strategy, innovations that attract high demand in Germany are subsequently used in cars developed and manufactured in other parts of Europe. Examples of this include high-pressure fuel injection, airbags and electronic systems for automobiles.

The export advantage informs about a country's position in international trade of automotive goods, with a high value indicating an export surplus for a large number of automotive products. Germany, France, Italy, UK, the Netherlands, Belgium, Sweden and Spain have particularly large export advantages, with more than 50 percent of their automotive industries' products proving successful abroad. Austria, Denmark and the Czech Republic follow, although their export advantages in the industry are essentially average. The other countries have values well below average.

The results for the market structure advantage are based on an examination of profit levels. A small value indicates a high degree of competition. Market structure advantages are found primarily for countries with large OEMs and/or large production facilities for car assembling. Germany shows the highest degree of competition in the automotive industry, followed by Italy, France and Belgium. Market structure advantages are also evident for Sweden, Spain and the UK. Most Eastern European EU member states as well as Greece, Ireland and the Netherlands report a low level of competition. A market structure advantage of countries with large OEMs may represent strong competition among suppliers to provide cost-efficient inputs to OEMs. The larger OEMs' production capacities, the larger will be their buyer power vis-à-vis suppliers. At the same time, large OEMs will enter into more stable, long-term oriented relations to their suppliers. A recent study by Felli et al. (2011) shows that such a relationship further increases competitive procurement of OEMs. Fierce competition in the automotive industry represents a lead market advantage since it contributes to more efforts among suppliers to compete not only through lower price but also by offering more innovative products. In such an environment, more innovative ideas are tested while offering innovations at a competitive price will be a priority of suppliers right from the beginning.

4.2 Combining lead market indicators

The combination of the indicators can be expected to yield additional insights since they show how two indicators relate to each other. We look at three such combinations: price and demand, demand and export, and market structure and price, since these are three combinations where trade-offs between two factors can be particularly significant (e.g. when

a low relative price level reduces an industry's share in total demand). We refrain from considering the transfer advantage in this part of the analysis owing to the limited number of countries for which data on our transfer indicator is available.

When combining the indicators for price and demand advantage, it is important to consider that company strategies and competitive behavior strongly affect the price level. However, a price-dependent demand advantage is often characterized by a low price level and a relatively high consumption propensity. In this case, demand for the product responds to a low price level with an above average increase, i.e. the price elasticity is very high. A low price level thus makes for a clear demand advantage when it is accompanied by high demand specialization. Figure 2 plots the relative price level against demand specialization for all countries.

Figure 2 about here

The countries that are of particular interest are those located in the upper right quadrant. These are countries with both a low relative price level and a high propensity to consume. The countries in question are Germany, the UK and Luxembourg. The price level in these countries constitutes a lead market advantage. Drops in prices are met by a large increase in demand. Innovation designs that exploit this price elasticity can spread quickly and make use of market size advantages to increase their ability to compete on price. This market characteristic should encourage developers of new products to follow a price-cutting strategy from the outset. New products designed within this system of incentives should have an advantage over alternative innovation designs on the basis of price.

Cyprus, Slovenia and Greece are in the upper right quadrant, too, but only marginally above average price specialisation, which is why the price advantage seems to be rather small. In other countries, the propensity to consume remains low in spite of a relatively low price level, i.e. the relatively low prices do not lead to increased demand. This is particularly the case in Sweden and Austria. When a high price level meets with high demand specialization, this suggests that price elasticity on the market is low. Examples are Denmark, Slovenia, Portugal and Hungary. These markets are rather unfavorable for innovators. Finally, there are several countries with a relatively high price level and at the same time below average demand specialisation. In these cases, the high price level incurs a higher than average (compared with other countries) drop in demand. Obviously, the high price level

disadvantages export-oriented innovators, since it prevents the emergence of lower-cost innovation designs. Particularly the Eastern European countries face this problem.

Second, the combination of the demand and export advantage provides interesting insights. Lead markets are more likely to emerge when demand in a certain country provides incentives for firms to innovate and, at the same time, those firms generate a large proportion of their sales abroad. If quantities of product innovations exported are high and the impulse to innovate comes from customers in the home market, demand at home prefers an innovation design that has the potential to succeed internationally. In contrast to this, it is a sign of a rather idiosyncratic market when firms only export a small share of their products because they overly respond to highly specific wishes in the home market. In this case, customers appear to prefer product solutions that cannot be marketed internationally (i.e., demand is idiosyncratic).

Figure 3 plots the demand advantage against the export advantage since above-average customer demand combined with an above-average export advantage would suggest a particularly high lead market potential. Countries in the upper right quadrant of the portfolio develop new products driven by demand and at the same time exploit the lead market properties of home demand for successful exports. The home markets in these countries – Germany, the UK and Denmark – offer particularly favorable conditions for the launch and testing of new products, with the aim of successfully marketing the innovation designs tested at home in other countries.

Figure 3 about here

Exportable new products may also originate from sources outside the home market. Highly export-oriented innovating companies that do not primarily rely on home demand as an innovation source may be categorized into three different types. In the first type, the impulse for new products that are suited to the world market results from the company's own R&D, or from externally purchased technological know-how (e.g. from technology suppliers or academic research). Second, new products can be based on the innovations of foreign competitors, i.e. they can be imitated. Third, firms can be driven to innovate by demand from abroad, indicating that the home market is a successful lag market. Home companies may in this case not be leaders in launching internationally successful product innovations, but they are particularly skilled in picking up new trends from abroad and converting them into export

success. In the following, we will refer to these effects as “technological impulses to export”. The upper left quadrant in Figure 3 contains France, Italy, the Netherlands, Sweden, Belgium, Spain, Austria and the Czech Republic, which primarily bring out new products driven by technology and then succeed in exporting them.

In case product innovators are less successful in exporting and home demand is a less important source of innovation, companies have a tendency to focus on home market specific technology. Consequently, innovators rely primarily on product innovations based on their own R&D or external knowledge sources without suitable solutions for exporting. This situation which we can characterize as idiosyncratic technology applies to countries in the lower left quadrant: Poland, Slovakia, Finland, Ireland, as well as the Baltic states.

Finally, firms in countries in the lower right quadrant face the difficulty that these countries are largely dependent on demand as a major innovation impulse, even though home market demand is idiosyncratic. In this case, export activities are impeded by the home market because adapting to the specifics of the home market complicates selling to other countries. This applies to firms in Luxemburg, Portugal, Hungary, Slovenia, Greece, Malta and Cyprus.

Third, we combine the indicators for the market structure advantage and the price advantage. A market structure advantage, i.e. a high level of competition among automotive firms, will be particularly effective if it comes along with a low price level for cars. Figure 4 shows the relation between the price level for automobiles and the profit margin of firms in the automotive industry. Note that lead market advantages for the two factors are associated with a low profit margin and a low price level, respectively.

Figure 4 about here

Figure 4 clearly shows a positive correlation between price level and profit margins. Most countries with a profit margin below the mean also show a price level below the average (Germany, Sweden, the UK, France, Belgium, Spain, Italy, Slovenia, Finland). In these countries, fierce competition among producers translates into a low level of product prices. One driver for this result may be market size. Another may be linked to the presence of strong domestic OEMs which may be challenged by OEMs from abroad by a low-price strategy in order to attack the domestic OEM's home market advantage. There are only two countries with a market structure advantage that report clearly above average price levels (Slovakia and

Portugal). Both countries are home to significant production facilities of foreign OEMs which most likely put pressure on local suppliers to offer inputs at low costs. Sales markets for automobiles seem to be less competitive in these countries, which may be linked to small market size. The lower left quadrant of Figure 4 contains those countries which combine a price disadvantage and market structure disadvantage. They comprise six Eastern European countries. Countries with a price advantage but a low level of competition among automotive firms include Austria, Ireland, the Netherlands, Greece and Cyprus. All these countries have limited domestic car production capacities while sales markets are served by OEMs from abroad which seem to compete over market shares through price competition.

5 Discussion and implications

Our analysis investigated the role of market characteristics in shaping lead markets in the automotive industry. Based on five lead market characteristics, we examined 25 European countries with regard to their lead market potential. The analysis contributes to our understanding of why some countries offer a better environment for testing and launching new products in the automotive industry than others, so that certain innovation designs are in a position to spread internationally. In other words, innovations favoured by a national market with a high lead market potential are more likely to meet high demand abroad.

Germany is the only EU-25 country to exhibit above average values for all five lead market advantages. Four countries follow – France, Italy, the UK and Sweden – which all show four positive evaluations. Another country with a long tradition in the automotive industry, Spain, only shows three positive evaluations although no data were available to investigate the transfer advantage of this country. Several countries score particularly badly, with negative evaluations for all or most lead market advantages. This concerns virtually all Eastern European countries but also some Western European countries like Ireland or Portugal. On the one hand, the summary thus confirms anecdotal evidence about countries like Germany being central for the automotive industry in Europe. On the other hand, it provides a differentiated picture about the particular strengths and weaknesses of the countries when it comes to assessing their lead market potential. Our results have implications for the NPD strategies of firms in the automotive industry as well as for policy making that aims at fostering the creation of lead markets.

5.1 Implications for management

First of all, market research and interaction with customers on the lead market – not necessarily the home market – takes centre stage when product innovations are in the development phase. If automotive firms aim at transferring their innovation design to other countries new products must be targeted to fit the preferences of users in the lead market. Those customers might convey valuable information that customers from lag markets cannot offer. For the automotive industry it will thus particularly pay off to access market information in Germany, France, the UK and Sweden. Making use of the lead market can be in different forms. These range from simply employing listening posts in the lead market to testing and/or launching new products there.

At the same time, it is vital to take account of factor prices and how they will develop, as well as the cost of the infrastructure used. Furthermore, lead markets need to be examined to find out what complementary products exist, what innovation designs competitors have come up with and what laws and regulations are in force. The latter might refer to required exhaust emission standards but, more importantly, firms might need to satisfy the customers' preferences for environmental protection. For this reason, many new cars over-comply with currently enforced EU emission standards. An example for the importance of complements is the search for alternative fuels like electricity or hydrogen whose success will be critically dependent on the proliferation of an appropriate refuelling infrastructure in a particular market. All these parameters influence the NPD process.

All too often, however, companies might lack the capacity to take up all information available on lead markets. In this case, automotive companies can employ a number of other possible strategies to ensure that adequate attention is paid to the lead market:

- Developing a new product at home but taking account of information about the specific conditions on the lead market.
- Developing dual-use innovations, which satisfy demand both on the lead market and at home.
- Avoiding technological designs that would be atypical on the lead market when developing an innovation for the home market.

Another option for automotive companies to establish links with a lead market is via cooperation partners, particularly when a company has not yet built up any resources or accumulated any experience on the market. Compared to establishing a subsidiary in a potential lead market, cooperation with an existing company has the advantage that such a

company already has longstanding relationships with customers and, as such, can offer considerable insight into conditions on the lead market. This is of particular significance during the market launch, since that is when the most important information for the further development of the product comes to light. Furthermore, cooperations cost less than building up a subsidiary and thus involve less entrepreneurial risk. The alliance between Volkswagen (Germany) and Suzuki (Japan) established in 2009 can be interpreted as an attempt in this direction.

5.2 Implications for policy making

From an innovation policy perspective, the lead market analysis offers several insights for policy makers who might aim at providing favorable market conditions for the national automotive industry. Of all the lead market characteristics, the price advantage seems to be the easiest to influence by means of political intervention. One form this intervention may take is the use of taxation on particular factors or goods to directly affect the price and cost structure of innovation designs. Any such tax policy should be “trend-oriented” and anticipate future cost developments at an international level. Only in this case the automotive industry would be able to produce innovations that are also subsequently demanded in other markets. In contrast, a policy of taxation and subsidization that went against the international cost trend would only increase the probability of idiosyncratic innovation. Moreover, price advantages can also be promoted by policies aimed at fostering competition, since intense competition lowers prices for end users.

Innovation policy can also influence NPD processes in the automotive industry by how government subsidies for technology development projects are designed. To create an export advantage, the potential exportability of the technology could be included as a criterion for subsidization. Innovation policy should also refrain from insisting on national solutions, but instead taking experiences from potential lead markets into account, for example when approving the environmental impact of new automotive products. Apart from this, policy should aim at preventing the infrastructure for science and technology (educational institutions, research establishments, standards agencies etc.) from becoming idiosyncratic.

To foster a transfer advantage, countries need to succeed in propagating their international standards in innovation designs. It is common for government funding of innovations to aim at promoting a demonstration effect in order to foster the international adoption of innovations (e.g. through application centres designed to give businesses the chance to experience new process technologies). This can be a particularly decisive factor for the international diffusion

of a technology if there is a large amount of uncertainty about how readily it can be implemented in practice and how efficient it is in economic terms. However, there is a considerable risk that idiosyncratic technologies will be subsidized, particularly in lag market industries. The degree of openness of a standard should therefore be used as a criterion to determine whether a technology is eligible to receive government subsidies. Equally, increased bargaining power for politicians and companies in international standardization committees can help to improve the transfer advantage. Examples for when a transfer advantage is crucial may be refuelling interfaces between a car and the refuelling station, or the demanded quality/specification of the fuel itself.

Finally, innovation policy should be concerned with strengthening competition between firms in the automotive industry to promote a market structure advantage. The idea is that confronting innovators with free competition on the market at an early stage is a more effective way of increasing international competitiveness than offering protection from competition in the hope of building up a strong national position. From a technology policy point of view, this means focusing on measures that guarantee favorable conditions for the development of successful innovation designs. This can be achieved by implementing legal measures to prevent cartels, promoting start-ups, supporting newer technology companies and breaking down non-tariff barriers to international trade.

5.3 Implications for future research on lead markets

This research presents an attempt to measure lead market potentials for European Union member states for a particular industry, the automotive sector. While we believe that our research provides relevant insights into the relative importance of national markets within the EU for developing and marketing new product innovation in the car market, it has certainly a number of limitations that call for future research efforts. One critical issue is the level of aggregation. In this paper, we focused on an entire industry, using indicators that represent average characteristics of the various sub-markets and sub-sectors within the automotive industry for each country. This approach is useful for capturing lead market characteristics that go beyond single products such as the transfer ability and export orientation of an industry or the degree of competition within an industry. This approach is only of limited use, however, if one wants to determine lead market potentials for specific products such as electric cars, autonomous/self-driving cars, new car designs like SUV, new car features such as eco-efficient engines or new lighting systems. A main difficulty for analyzing lead market

potentials at the level of individual product markets within an industry is the lack of appropriate and internationally comparable data.

This limitation relates to another aspect, namely the importance of regional markets within a certain country. Highly heterogeneous countries like the United States may feature several different submarkets for automobiles as the example of the success of eco-friendly vehicles in states such as California or Oregon illustrates. Accordingly, these states could serve as lead markets themselves. Again, data availability on the sub-national level complicates the analysis of such lead markets. However, it has to be noted that, at least for automobiles, we do not see indications for the existence of sub-national lead markets within Europe.

Another field for future research relates to the indicators for measuring lead market advantages. In this paper, we focused on a single indicator for each of the five factors. Other studies (e.g. Beise and Cleff, 2004) apply a multi-indicator approach that rests on a wide variety of indicators for each lead market advantage and uses statistical methods such as factor analysis to aggregate results to a single measure for each lead market advantage.

6 Conclusion

By providing a comparison of lead market characteristics across 25 European countries for the automotive industry, this paper contributes to the literature in several ways. First, the results contribute to our understanding regarding where to test and launch new products and where to target customers as sources of market information. The results thus complement lead user theory that has so far been rather silent regarding the geographical location that might be particularly promising to target. Further, the results provide indications for management in the automotive industry about attractive lead markets in Europe by quantifying the aspects that are positively or negatively associated with the establishment of a lead market. This assessment also enables policy makers to make informed policy choices. Using the EU-25 member states as the context of our study also enables a comparison of the developed Western European markets with the emerging Eastern European markets. The analysis has shown that these latter markets have considerable lead market disadvantages compared to Western Europe. Nevertheless, policy makers in Eastern European countries may use the framework to deliberately influence features of their local markets in order to increase their lead market potential.

Our research also needs to acknowledge limitations of the chosen approach. First, lead market characteristics refer to the aggregate automotive sector. It may well be that lead market characteristics can vary from one product group to another within the automotive

sector. Nevertheless, we believe that a sector-level approach is useful since the lead market approach refers to structural features of demand and competition that drive the adoption of innovations in an industry. Another limitation refers to the relatively short time series of data available which hampers a comparison of the indicators over time. The main reason for this is that data were not available for most Eastern European countries that only recently joined the EU. That being said, observations of a country's lead market potential that are aggregated at the sector level are still of great interest, as they offer a means of explaining the future competitiveness of different markets. Moreover, an analysis of the aggregate sector enables a cross-country comparison that – due to the lack of statistical data – would be impossible for individual products. Finally, and again due to a lack of harmonized datasets, this analysis is restricted to 25 European countries although the automotive industry is essentially a global industry with companies from the United States and Japan being important players on the market. Future research should thus try to put our results into perspective with other markets and their potential as lead markets.

We believe that the lead market approach can be readily applied to other industries than the automotive industry, particularly to those industries in which new product development often aims at international markets from the outset and is based on technological innovation. Examples include industries like electronics or machinery and equipment. Although the chosen indicators should produce meaningful results for other industries, the approach could be modified in a way that the indicators better reflect a specific industry context.

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Tables and figures

Table 1: Measurement and data of lead market advantages in the European automotive industry

Lead market advantage	Indicator	Source	Period of Time
Price	$PA_i = \ln \left(\frac{PPP_{\text{auto sector},i}}{PPP_{\text{all sectors},i}} \right) \cdot (-1)$ <p>where $PPP_{j,i}$ are Purchasing Power Parities of sector j in country i</p>	Expenditure & PPP Statistics (Eurostat)	2004-2008
Demand	$DA_i = \frac{C_{\text{auto sector},i}}{C_{\text{all sectors},i}} - \frac{C_{\text{auto sector},\text{EU-25}}}{C_{\text{all sectors},\text{EU-25}}}$ <p>where $C_{i,i}$ are the spendings for sector j in country i [in €]</p>	Expenditure & PPP Statistics (Eurostat)	2004-2008
Transfer	$TA_i = \text{hyptan} \left(\ln \left(\frac{\left(\frac{DI_{\text{auto sector,home to foreign market}}}{DI_{\text{auto sector,foreign to homemarket}}} \right)}{\left(\frac{DI_{\text{all sectors,home to foreign market}}}{DI_{\text{all sectors,foreign to homemarket}}} \right)} \right) \right)$ <p>where $(DI_{j,\text{home to foreign market}})$ is the total number of employees in sector j at foreign subsidiaries of companies headquartered in country i and $(DI_{j,\text{foreign to homemarket}})$ is the number of employees in sector j of country i who work in foreign-owned companies</p>	FATS - Statistics on the Structure & Activity of Foreign Affiliates (Eurostat)	2007-2008
Export	$EA_i = \Sigma_t CA_{+tik} / \Sigma_t CA_{ti}$ <p>with $CA_{+ti} = \Sigma_t CA_{tik}$ for $CA_{tik} > CA_t$</p> $CA_t = \Sigma_{ik} CA_{tik}$ $CA_{tik} = \frac{(x_{tik} - m_{tik})}{(x_{tik} + m_{tik})}$ <p>where x_{tik} is the export value from the supplier country k to the supplied countries i in product t and m_{tik} represents the respective import value</p>	European Foreign Trade Statistics (Eurostat)	1988-2005
Market structure	$MSA_i = \frac{\text{Operating Surplus}_{\text{auto sector},i}}{\text{Sales}_{\text{auto sector},i}} \cdot (-1)$	Structural Business Statistics (Eurostat)	2004-2008

Table 2: Lead market potentials of the EU-25 countries in the automotive industry

Country	Advantage				
	Price	Demand	Export	Transfer	Market structure ¹⁾
Austria	0.027	0.020	0.489	-0.48	0.099
Belgium	-0.046	0.023	0.571	-0.97	0.041
Cyprus	-0.164	0.045	0.014	NA	0.117
Czech Republic	-0.473	0.019	0.384	-1.00	0.117
Denmark	-0.241	0.029	0.412	-0.91	0.077
Estonia	-0.399	0.024	0.046	NA	0.131
Finland	-0.051	0.023	0.159	-1.00	0.079
France	-0.012	0.025	0.817	0.35	0.041
Germany	0.055	0.031	0.930	0.80	0.033
Greece	-0.100	0.030	0.000	NA	0.143
Hungary	-0.461	0.033	0.217	-1.00	0.127
Ireland	-0.032	0.022	0.058	NA	0.143
Italy	-0.166	0.024	0.816	0.50	0.039
Latvia	-0.442	0.024	0.000	NA	0.118
Lithuania	-0.554	0.026	0.009	NA	0.110
Luxembourg	0.164	0.030	0.183	NA	NA
Malta	-0.554	0.032	0.043	NA	NA
Netherlands	-0.088	0.016	0.664	-0.99	0.143
Poland	-0.483	0.016	0.273	-0.71	0.116
Portugal	-0.412	0.037	0.137	-1.00	0.070
Slovakia	-0.550	0.012	0.116	-1.00	0.063
Slovenia	-0.185	0.035	0.135	-1.00	0.067
Spain	-0.056	0.024	0.521	NA	0.054
Sweden	0.165	0.020	0.564	0.02	0.053
United Kingdom	0.105	0.031	0.683	-0.55*	0.057
Mean	-0.198	0.026	0.330	-0.56	0.089

Note: bold figures are above average advantage; NA: not available

1) Lower values indicate a lower operating surplus per sales and hence a higher degree of competition.

* Data for UK based on employment are not available. Instead, we used FDI stock data taken from UNCTAD.

Source: Eurostat PPP statistics; Eurostat Foreign Trade Statistics; United Nations Conference on Trade and Development (UNCTAD) FDI statistics; Eurostat FATS statistics; Eurostat Structural Business Statistics.

Figure 1: Conceptual framework of the empirical analysis

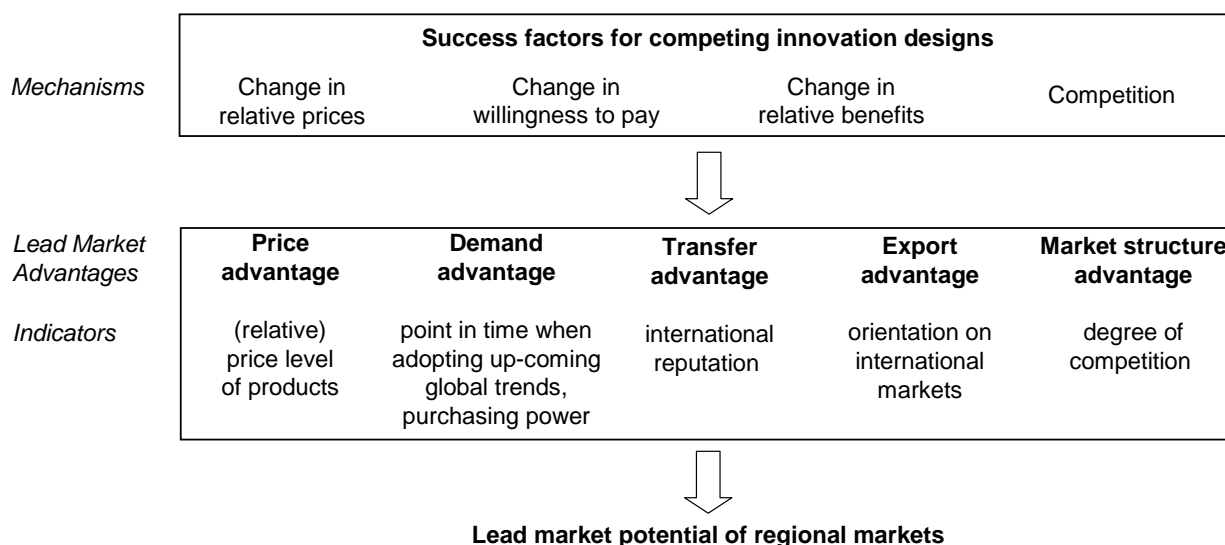
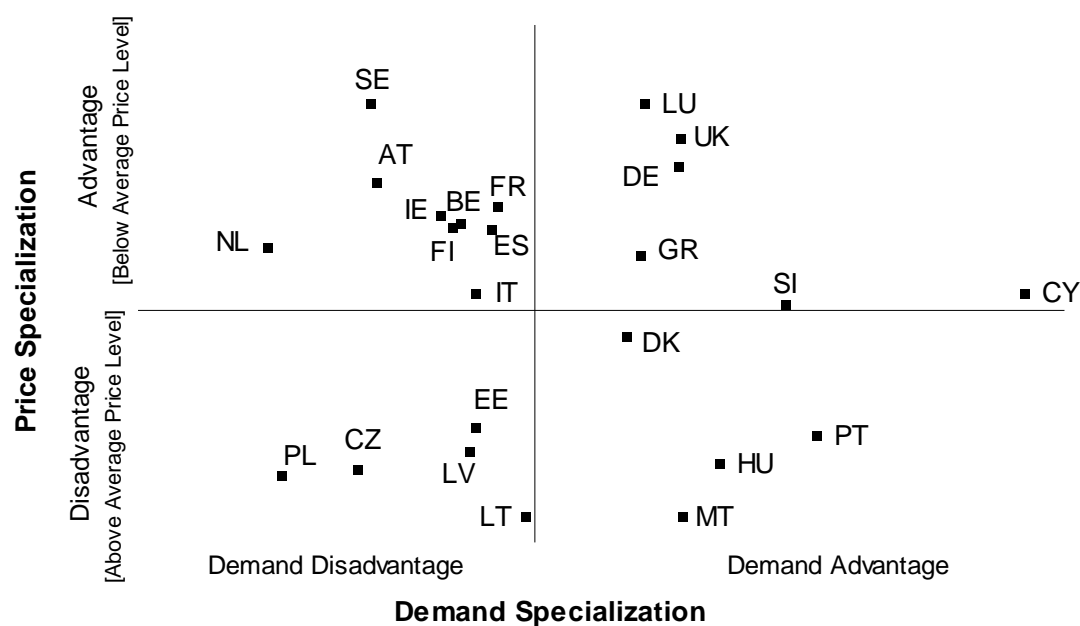
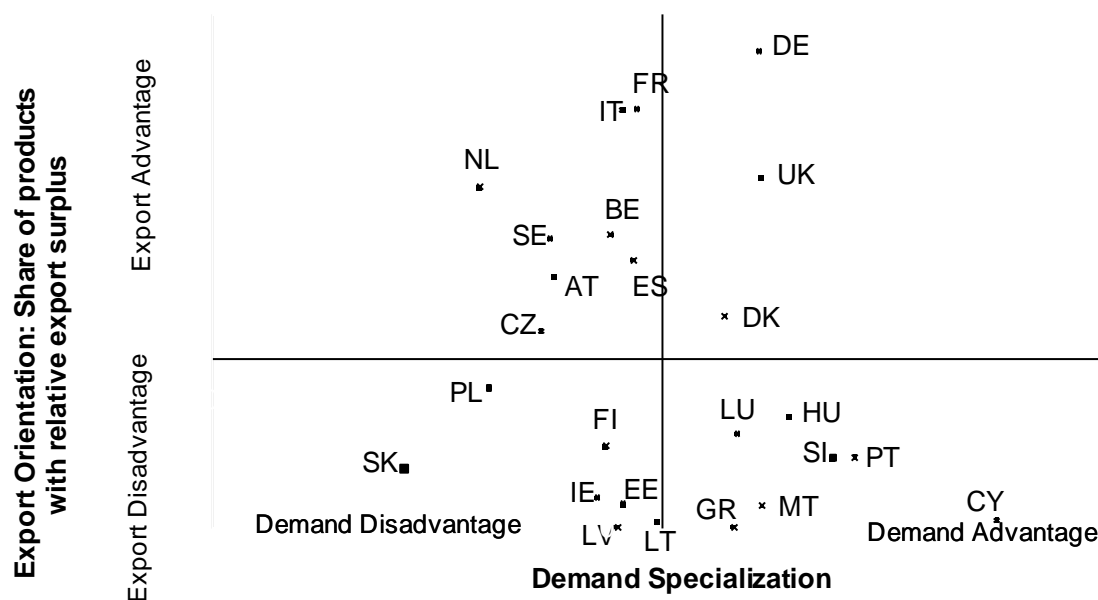


Figure 2: Price advantages and demand advantages in the automotive industry



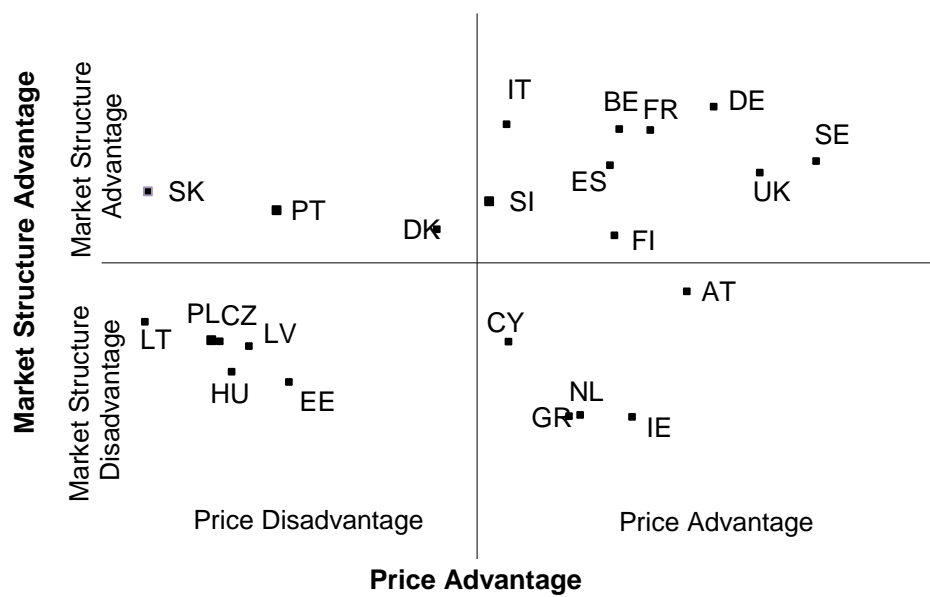
Source: Eurostat PPP statistics, 2004-2008.

Figure 3: Export advantages and demand advantages in the automotive industry



Source: Eurostat Foreign Trade Statistics, Eurostat PPP statistics, 2004-2008.

Figure 4: Market structure advantages and price advantages in the automotive industry



Source: Eurostat PPP statistics, 2004-2008.