


Article

Incumbent vs. New Firms' Entry into an Innovative Niche Market: Electric Motorcycles in Italy, 2010–2021

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Abstract: The recent advent of electric motorcycles represents an eco-innovation that guarantees environmental sustainability and opens up market opportunities for firms. In this paper, we analyse firms' entry into the motorcycle industry in Italy. The role of incumbent firms in the presence of new innovative niches is ambiguous. On the one hand, incumbents may display inertial behaviours, while on the other hand, they can exploit their experience and dynamic capabilities to promptly catch opportunities and enter the new niche. Based on an original dataset, we develop an empirical investigation of the role of incumbent vs. new firms in the electric motorcycle niche. We contribute to the literature by showing that new firms have so far revealed more vivid dynamics while incumbents seem to stay at the window, thus supporting the idea of the existence of inertia among incumbent firms in this industry. However, among the incumbents that have entered the new market niche, we show that the largest and those with experience in the production of scooters with 0–50 cc engines are the most likely to enter the new niche market.



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1. Introduction

Innovation and technical change have been extensively analysed in the economic literature as sources of dynamic and market niche creation. Niche innovation occurs when a new technology creates new market opportunities inside a given industry [1]. Among niche innovations, great attention has been recently ascribed to eco-innovations that guarantee environmental sustainability [2,3]. These are new productions or applications of products, processes, and organization structures that reduce the negative impacts of resource and energy use and the related environmental risks and pollution.

The impact of niche innovation on firms can be different, depending on how much technology changes affect the validity of the firms' competencies and capabilities. In particular, firms' entry decisions and the timing of entry depend on their dynamic capabilities and vary across firms [4]. Recognizing which are the firms that first enter the new industries and market niches, and which characteristics are relevant for the entry decision, is a very relevant argument if we consider that some eminent studies provide evidence that pioneer entrants gain a competitive advantage over later entrants and eventually dominate the market [5–7].

The economic literature provides inconsistent results about which firms are the first to enter new innovative niches. On one hand, incumbents may display behavioural inertia which inhibits their ability to enter new market niches [8–13]. On the other hand, incumbent firms may leverage their past experiences and capabilities to promptly adapt and catch the new opportunities in innovative niches [14–16].

In this paper, we analyse the emergence of an eco-innovative niche in the motorcycle industry in Italy: electric vehicles from 2010 to 2021. Electric vehicles can be considered an innovation that is transforming the mobility markets [13,17,18]. The registration of electric motorcycles has shown significant growth rates in the last few years. This trend seems to reveal an interesting niche that promises to continue growing in the coming years, thanks to the governmental incentives, emission restrictions, and consumers' increasing favourable attitude toward sustainability and green products. In particular, we develop the following research questions: which role did the incumbents play in the electric motorcycle niche? Are the domestic incumbents playing a leading role? Is previous experience in the internal combustion engine motorcycle industry relevant for entering this new niche? We provide an original contribution to the economic literature by providing evidence about the dynamics of the new niche. Our results show that, so far, incumbent firms are not really focusing on the new niche: only a few of them entered the electric motorcycle niche, while new firms have played a leading role. Furthermore, we show that among the incumbents, previous experience and specialization in specific segments are relevant to entering the new niche.

The remainder of the paper is organized as follows: Section 2 discusses the relevant literature; Section 3 presents the research context, i.e., the emergence of the electric motorcycle niche in Italy; Section 4 describes data and methods; Section 5 presents the results about the entry of the incumbents and new firms into the new niche and Section 6 discusses these results; and Section 7 concludes.

2. Relevant Literature

Technological change creates new opportunities and determines the competitive dynamics and organizational composition of industries over time. In the Schumpeterian tradition, modern capitalist economies have been viewed as continually evolving, with innovation and technological change powering the evolution. Understanding the drivers of innovation and technological progress has always been critical for evolutionary economists, who have long considered the creation of new industries linked to these two drivers, as suggested by Schumpeter's *Theory of Economic Development* (1934) [19] and *Capitalism, Socialism and Democracy* (1942) [20]. The former describes the process of economic change as a continuous unveiling of new products and innovations, displacing the existing ones, by entrepreneurs associated with new firms. Schumpeter's famous notion of "creative destruction" represents economic environments where innovative activity is embodied in new firms that usually do not stem from the established ones but start manufacturing beside them. On the other hand, in the latter work, it is noted that innovative conditions are more favourable to incumbent firms as the major source of innovation, thus leading to a "creative accumulation", according to a different technological regime that governs innovative activities and the evolution of industries [21,22].

In line with the Schumpeterian tradition, significant research has focused on the relationship between technological change, knowledge change, and the competitive dynamics of firms [23,24]. Firms are repositories of knowledge and specific competencies, and technological changes affect the validity of these associated competencies. As a consequence, the entry process of firms, and their fate, can be explained in terms of the type of technological change. Competency-destroying discontinuity involves new knowledge and capabilities associated with new technologies, and these may differ from the expertise previously developed by the incumbents and the know-how linked to existing products and production processes. In this case, new firms enter the market and wield new knowledge and technical expertise that makes them more effective and faster at introducing new technology, while the incumbent firms cling to old procedures and existing proven technology. In contrast, competency-enhancing technological change improves existing technology, building on the incumbent firms' accumulated skills and capabilities. In this case, incumbents can rely on their experience and knowledge base to explore new technologies and markets [25,26].

Similarly, research in economics and entrepreneurship has focused on changes in technology to explain the emergence of new market niches and the entry of firms in a dynamic fashion [27–31]. Even if new industries and market niches do not only originate from technological change [32], innovation is, undoubtedly, often the relevant engine of market-niche creation.

Niche innovation happens once a new technology generates new market opportunities inside a given industry [1]. Some interesting papers have analysed niche formation and industry dynamics [28,29]. Among niche innovations, great attention has been recently ascribed to eco-innovations and sustainable innovations that guarantee environmental sustainability [2,3]. These are new productions or applications of products, processes, or organisational structures that reduce the negative impacts of resource and energy use and the related environmental risks and pollution. There is a general and growing attitude that aims to support economic growth towards a sustainable transition that requires fundamental changes in production and consumption patterns (United Nations Environment Programme—UNEP, 2011) [33]. Among these, we can contemplate technologies for sustainable mobility, such as electric vehicles.

Recognizing which are the firms that first enter the new industries and market niches is a very relevant argument if we consider that some eminent studies provide evidence that the first entrants gain a competitive advantage over later ones and eventually dominate the market [5–7].

The economic research is not unanimous on which firms are the first to enter new market niches. Following Hannan and Freeman [8], firms are characterised by structural inertia: firms' behaviour tends to create internal rules and procedures that reproduce efficient and appropriate allocations of resources and actions. Firms' reproducibility creates a structure that generates advantages in the market selection processes associated with reliability and accountability but that in turn is resistant to change, thus generating inertial behaviours. Then, experience with operational routines in a given market may hamper a firm's ability to enter into new market niches when the conventional processes do not fit with the new ones. Age and size represent adverse aspects that gradually generate slow and inactive behaviours of the incumbent firms, thus causing less ability to adapt to change and exploit new opportunities. In this context, new, innovative, and younger firms are more efficient in governing change and catching new market opportunities while incumbent firms suffer from an inertial behaviour that impedes entry into new market niches [9–12]. In the case of electric automobiles, Bohnsack et al. [13] show that most incumbent firms are more cognitively constrained than new entrants. This induces them to stay close to their existing business logic used for traditional automobiles, targeting the same customer group with similar product-focused content.

On the contrary, other studies suggest that incumbents may have an advantage over new entrants. King and Tucci [14] analysed the disk drive industry. This industry has been characterised by various technological changes that have created new market niches. The authors conclude that static capabilities, such as experience and the elaboration of production for one set of customers that usually lead to routinization and reinforce existing practices leading to inertia, do not actually restrict the firm's ability to adapt and can certainly create dynamic capabilities. Then, incumbent firms exploit their experience to enter new market niches. In conclusion, early entrants and large firms develop superior innovative competencies and leverage their superior resources to innovate, thus gaining a competitive advantage over later and smaller entrants that cannot recover. Similar results are shown in Gang [16] with regard to the magnetic tape drive industry: incumbents are more likely than new entrants to enter new market niches and have the dynamic capabilities to be able to enter earlier. Incumbents evaluate if they can exploit their technological capabilities when deciding which market niches to enter [15]: the degree of relatedness between the current technological capabilities and those relevant in the new niche is a predictor of the decision of incumbents to enter and of the timing of entry into the new niche. Incumbents also may adopt pre-emptive strategies and enter new market niches to

deter the entry of newcomers. However, problems of cannibalization and adaptations may induce incumbents to delay entry [34].

Considering both the technological and customer competencies, Uzunca [35] defines intra-industry boundaries in terms of the competence needed to serve market niches. Technological competencies describe the capability of using technology to create a product, and customer competencies represent the skills to develop product features and market applications and understand customers' needs. An increase in the degree to which these competencies can be leveraged across market niches affect the success of new market entrants. In cases where there is a lack of convergence in any one of the two types of competence, new firms are likely to enter an industry and disrupt the incumbents, as happened in the computer or laser industries [36,37]. On the other hand, incumbents have an advantage over new entrants in case of convergence in both technological and customer competencies, as occurred in the U.S. television, automobile, and tire industries, where the convergence of previously separate submarkets did not leave enough chances for new entrants to outperform incumbent firms [38].

Given the inconsistent results provided in previous studies, in this research we intend to contribute to the economic literature by exploring the entrance dynamics in a new niche with a particular focus on the comparison between incumbent and new firms and testing the following hypothesis: *considering the incumbent firms in industry prior to the start of a new market niche, the greater their experience, the higher the likelihood of their entry into the new market niche.*

From a strategic perspective, Debruyne and Reibstein [1] analysed incumbent firms' entry into new market niches and concluded that the timing of incumbents' entry decisions is affected by the entry of similar competitors. The authors report a contagion effect among incumbents with regard to the decision about when to enter a new innovative market niche. Given the risk of cannibalization in existing markets, incumbents could find it profitable to postpone entry into the emerging market niches. However, when other competitors (similar in size and resources) enter the new niche, thus creating a substitution effect of the existing market, then incumbents feel the impulse to respond and enter the new niche to avoid the risk of missing the new niche. The degree of substitution depends on the overlapping between the new niche and the existing product [39].

3. The Emergence of the Electric Motorcycle Market Niche in Italy

The Italian motorcycle industry is characterised by a fragmented structure. In 2021, the concentration index C4 was equal to 55.7%. The most sold brands were Honda, Piaggio, Yamaha, and Kymco. Product differentiation strategies in this industry are crucial, and vehicles can be classified according to various characteristics. Firstly, official data from the National Association of Cycle Motorcycle Accessories (ANCMA) distinguishes between motorcycles with engine capacity above 50 cc and those with engine capacity 0–50 cc. The former represents the largest share of the market, above 90% in 2021, and has displayed a continuous increase in the last eight years, as shown in Figure 1, while the latter has registered a gradual decrease since 2010.

Secondly, the motorcycles with an engine capacity above 50 cc can be further classified in various submarkets, according to the use, design, and characteristics of the vehicle: scooter, cruiser, enduro, naked, sport, supermotard, trial, touring, and others. Figure 2 shows the market shares in 2021 of each submarket and puts into evidence how scooters represent the largest share. Scooters have passed through a period of decrease in 2010–2013 and thereafter started to rise in popularity again. With regard to the category of motorcycles with engine capacity 0–50 cc, it is possible to make a distinction between scooters and mopeds. Additionally, scooters represent the largest share of the new registrations in recent decades, ranging from 93% in 2010 to 75% in 2021.

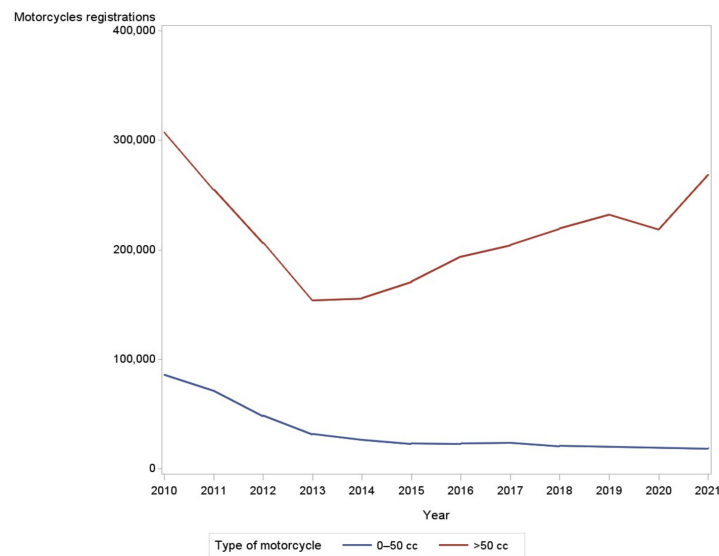


Figure 1. Registrations of motorcycles with an engine capacity above 50 cc and 0–50 cc, 2010–2021.

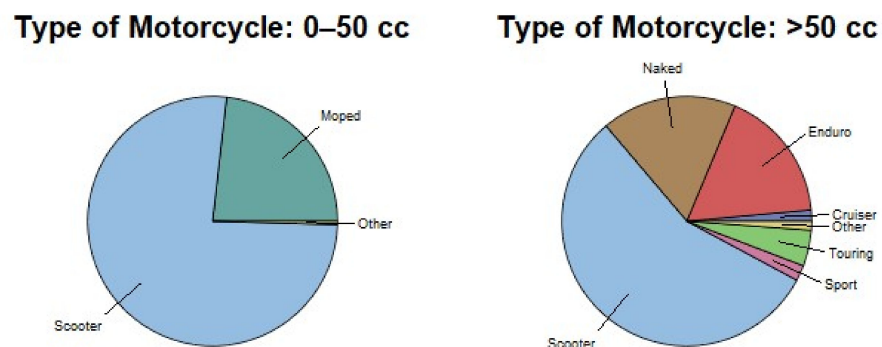


Figure 2. Motorcycles with an engine capacity of 0–50 cc and above 50 cc classified in submarkets, 2021.

According to data from the ANCMA, since 2005, innovation has been introduced into the market: the electric motorcycle. Motorcycles using electric engines represent an innovative transversal niche through the submarkets. Looking at the evolution in analogous markets, the dominance of the internal combustion engine in the automotive industry has never been eroded even if various innovative powertrains have challenged it [40]. Among these, even if there have been previous attempts, the recent electric vehicles represent a secure competitor. Many research works claim that recent electric vehicles represent a radical innovation [13,17,18].

The diffusion of electric motorcycles is encouraged by different sources. A general attitude of concern for environmental sustainability sustains the demand for green products. Among these, electric vehicles in the motorcycle industry represent an environmentally friendly product for consumers [41,42]. Governmental policies are playing a crucial role in the development of the electric vehicle market. For example, the environmental package “Fit for 55” of the EU Commission has greatly impacted the automobile industry. According to this package, the EU law introduces a set of proposals in order to reach the climate aims defined by the EU Council and Parliament. One of these proposals interdicts the sale of traditional combustion automobiles starting from 2035, thus strongly impacting automobile producers’ strategies for the future. Motorcycles are not included in the framework at the moment, even if there is uncertainty about similar future decisions in the motorcycle industry. With respect to this, as an example, the UK has already announced that motorcycles with internal combustion engines will no longer be allowed to be sold after

2035 [43]. Another impulse to the diffusion of electric motorcycles is given by the system of subsidies to reduce the purchase costs for consumers. Italy has granted many resources to incentivise the substitution of old vehicles with new electric ones, as also happened in other countries [44]. These initiatives stimulate the demand for electric motorcycles in particular among those consumers that prefer green products and technologies.

From a technical and engineering point of view, the development of electric motorcycles is not so easy and immediate. For example, they are considered to be more complex than electric automobiles: electrifying a motorcycle is hard because of the heavy batteries that may affect the handling of the vehicle. Additionally, the long stops to recharge the motorcycles represent a critical problem. Finally, the lack of the proper engine sound that only internal combustion engines can create, is a critical deficiency according to the more enthusiast riders. A recent survey conducted in 2021 by the Federation of European Motorcyclists' Associations (FEMA) on motorcycle emissions asked 23,768 responders what they would do in the case of a distant future where there would be a total ban on all fossil fuel vehicles, and in the case of transport authorities investing in a non-emission infrastructure for motorcycles as well: 53.38% answered that they would stop riding [45].

Despite this, electric motorcycles have displayed a slow but increasing diffusion in recent years. Figure 3 shows the percentage of electric motorcycles in the motorcycle industry from 2010 to 2021. Data show a growing diffusion of electric motorcycles with a fluctuating trend, registering years with downturns followed by years with positive growth rates. The percentage of electric motorcycles increased from 0.13 in 2010 to 5.28 in 2021. The increase in electric motorcycles is encouraging; however, it still remains a marginal niche.

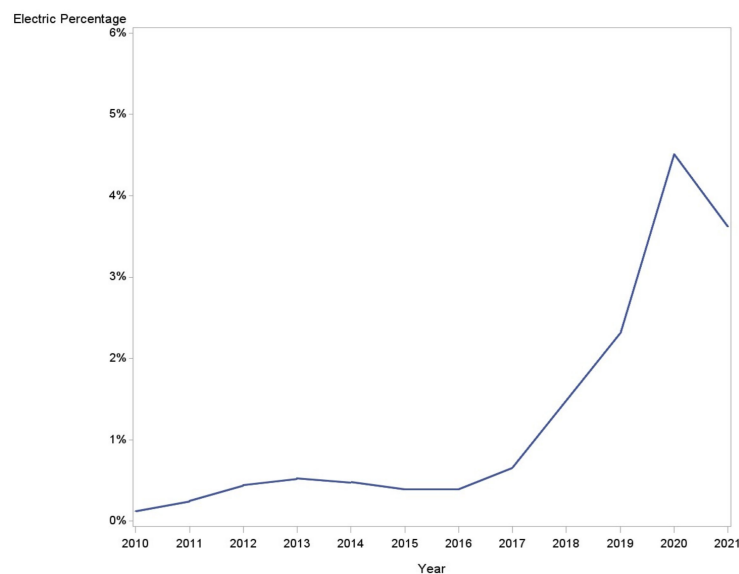


Figure 3. Percentage of electric motorcycle registrations in the motorcycle industry, 2010–2021.

Data reveal that electric motorcycles have had a different impact and success in the various submarkets in the industry: electric scooters with an engine capacity of 0–50 cc are the most successful and developed type of motorcycle. If we distinguish between vehicles with an engine capacity of 0–50 cc and those with an engine capacity above 50 cc, we can see that the diffusion of electric motorcycles is evidently related to the smallest engine displacement segment. Figure 4 shows that the percentage of electric motorcycles with an engine capacity of 0–50 cc rose from 0.31% in 2010 to 22.41% in 2021, while those with engine capacity above 50 cc rose from 0.07% in 2010 to 2.4% in 2021. However, the growth rate of electric motorcycles in the above 50 cc category is also noteworthy; it has displayed a very recent increase in the years 2019 and 2020.

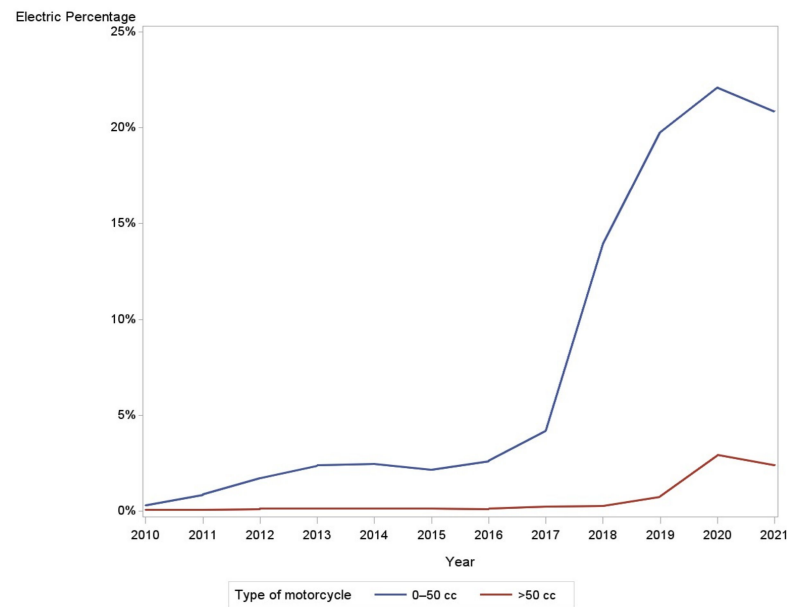


Figure 4. Percentage of electric motorcycle registrations of the 0–50 cc and above 50 cc engines.

In a finer analysis, we report the share of electric scooters and other electric mopeds in the 0–50 cc engine capacity category in Figure 5. These data testify to the increasing diffusion of electric scooters among the vehicles with an engine capacity of 0–50 cc which represent 19% of the overall registrations in 2021. On the contrary, the share of other electric mopeds in this category has not really developed yet and displays fluctuating trends. In addition, in the category of electric motorcycles with an engine capacity above 50 cc, scooters represent the largest share, with 2% of the overall registrations in 2021 against 0.45% of other types of electric motorcycles (Figure 6).

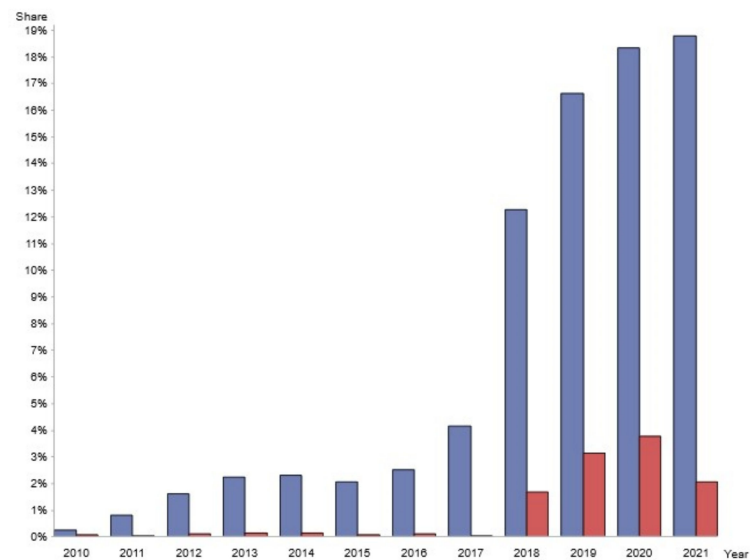


Figure 5. Percentage share of electric motorcycles in detail between electric scooters (blue) and other electric mopeds (red) with an engine capacity of 0–50 cc.

Finally, considering all firms, we computed the percentage of firms that entered the new electric niche, comparing Italian versus foreign firms: Figure 7 shows that there is no clear difference between Italian and foreign firms in the choice of entering the new niche.

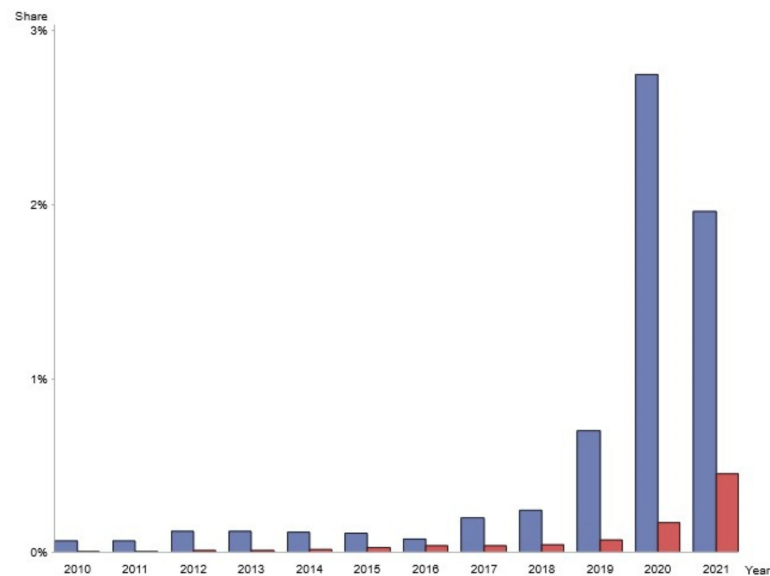


Figure 6. Percentage share of electric motorcycles in detail between electric scooters (blue) and other electric motorbikes (red) with an engine capacity above 50 cc.

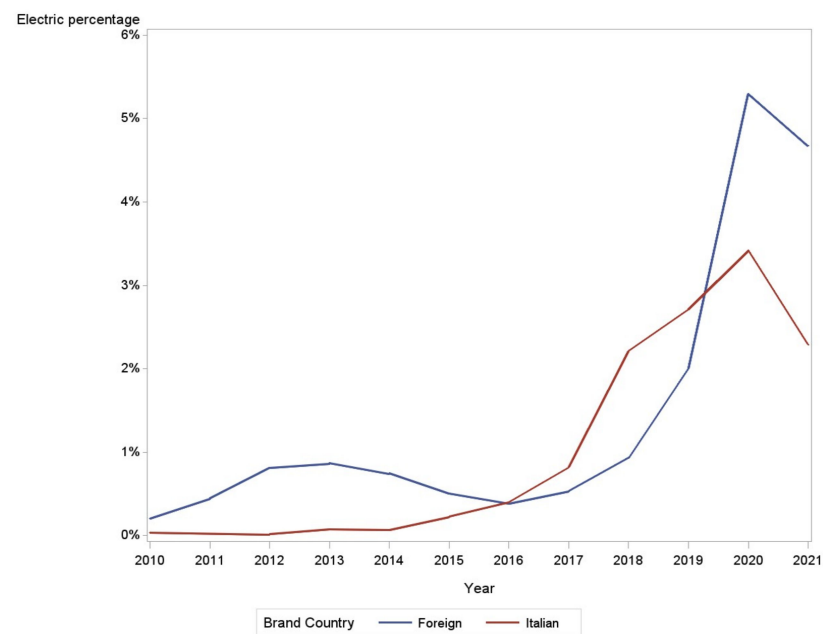


Figure 7. Percentage share of electric motorcycles in detail between foreign brands (blue) and Italian brands (red).

The cause of the different implementations of the electric engines in the various types of motorcycles can be ascribed to various reasons. Electric motorcycles are best suited for relatively short distances and daily urban travelling, considering the ease of recharging when they are deposited in the garage with a simple plug. Moreover, we need to consider that the combustion engine is a fundamental part of the pleasure of riding a motorcycle for passionate motorcyclists. These considerations explain why electric motorcycles have already diffused and gained remarkable market shares among the smallest vehicles with an engine capacity of 0–50 cc, while they have not yet fully developed into the category of bigger electric motorcycles. In addition, among smaller motorcycles, scooters seem to represent the most diffused type, thanks to their practicality, manoeuvrability, ease of driving, and the possibility of protection in case of rain. All this makes the scooters suitable

for urban use and for commuting to work [46]. For example, delivery shops in large cities very often use electric scooters for their services: this could have also given a contribution to the diffusion of electric scooters with an engine capacity of 0–50 cc.

Considering the discussion about the electric motorcycle market niche and the theoretical contributions in Section 2, we can now reformulate our main research hypothesis as follows: *considering the incumbent firms producing internal combustion engine motorcycles, the greater their experience, the higher the likelihood of entry into the electric motorcycle niche.*

4. Data and Methods

We collected data about all registrations of internal combustion and electric engine motorcycle brands in Italy in the period from 2010–2021 from the National Association of Cycle Motorcycle Accessories (ANCMA). After some cleaning procedures, we obtained 4420 different motorcycle models classified for submarket, and engine categories (0–50 cc and over 50 cc) and determined if they were foreign or Italian and if they had an electric vs. internal combustion engine. Data are organised at the brand level, which is indexed with i .

In the first part of our investigation, we provided detailed descriptive research about the dynamics of the entry of incumbents and new firms into the electric motorcycle niche. In particular, we identified in each year three types of brands: incumbents that registered only traditional internal combustion engine motorcycles, incumbents that also entered the new niche by registering electric motorcycles, and new firms that entered only the niche of electric motorcycles.

In the second part, we focused on the incumbent firms and conducted an econometric analysis on the probability of entering the electric motorcycle niche, using a binary variable as the dependent variable. We used an appropriated generalised linear model. This model assumes that, conditional on covariate values, the outcome can be modelled using an appropriate monotonic function. Calling X the matrix of covariates, we model:

$$P(\text{Entry}_i = 1 \mid X_i) = F(X_i' \beta)$$

and we estimate a Logit model on the probability of entry in the electric niche for the incumbent firms. Since the marginal effects are not constant, we refer to an odds ratio. The odds ratio shows the strength of the association between the predictor variable and the outcome variable: if the odds ratio is 1, then there is no association between the predictor variable and the outcome, while if the odds ratio is far from 1 there is an association, and the sign of the coefficient can be interpreted.

We operationalise our variables as follows. The dependent variable Entry_i is a dummy variable assuming value 1 in case of entry into the electric motorcycle niche and 0 otherwise. Our covariates X_i are the following. Brand size is measured as the log of the quantity of registered combustion engine motorcycles in the first available year in the dataset (2010), LogSize_i . Variety is measured in two ways: first, as the number of total models produced in the whole period, Models_i ; then, as the number of submarkets in which each brand i has registered a positive number of motorcycles, Submarkets_i . Experience in scooter production is operationalised as a dummy variable Dscooter_i . The specialisation in production only of vehicles with 0–50 cc engine capacity is also operationalised as a dummy variable, DFifties_i . Finally, the nationality of the firm is constructed as a dummy variable, Foreign_i , which controls if the firm is foreign vs. Italian.

5. Results

5.1. Descriptive Evidence

In this section, we aim to analyse the dynamics of entry of incumbents into the electric motorcycle niche.

Considering the category of motorcycles with engines above 50 cc, among the 189 incumbent brands that produce internal combustion engine motorcycles, only 11 (6%) also entered the electric motorcycle niche in the period from 2010–2021, while there were 54 new

entrants. Most of the electric motorcycles in this category are scooters, at 87%. Figure 8 reports the registrations of electric motorcycles of the incumbents that entered the electric motorcycles niche coloured in red, and of the new firms coloured in blue. The Figure reveals two interesting results. First, in terms of quantities, the niche started displaying significant values only very recently, since 2017. Second, we can observe that most of the 11 incumbents that entered the electric motorcycle niche have only been attempts with no continuity and no success, except for Piaggio. The most successful firms have been the new entrants. The largest market share in this niche in 2021 is owned by NIU, equal to 27.8%, followed by Askoll with 19.5%. The third-largest is Piaggio with 11.2%.

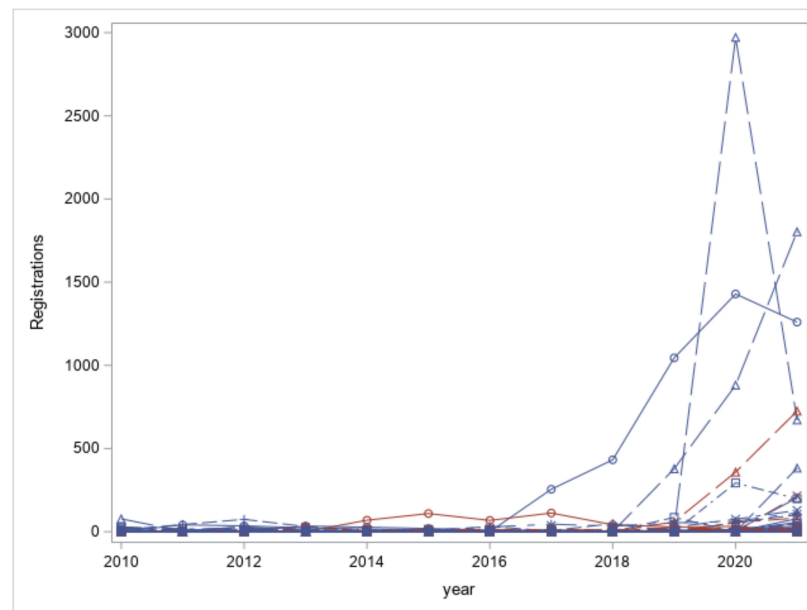


Figure 8. Quantity of registered electric motorcycles with above 50 cc engines for various brands. In red: the registrations of electric scooters produced by the incumbents; in blue: the registrations of the new firms.

A partially different scenario characterises the category of motorcycles with 0–50 cc engines. Among the 108 incumbent brands that produce internal combustion engine motorcycles, 24 (22%) also entered the electric niche in the period from 2010–2021. In this category, most of the registered electric motorcycles are scooters, 88%. The number of new firms that entered the niche is also relevant: 78. At a first sight, it seems that in this category the incumbents have played a more significant role, however, if we analyse the dynamics of the registrations of each firm, we reach a different conclusion. Figure 9 shows the registrations of electric motorcycles produced by the incumbents coloured in red and by the new firms in blue. Some incumbent firms seem to enter this niche early together with the newcomers, as shown in Figure 9, following the dynamics of the red-coloured lines. However, the firms that have been more successful are the new entrants (blue lines), with Askoll (36% of share in 2020, 16% in 2021) and NIU (22% of share in 2020, 30% in 2021) struggling for the leadership. The third is Lifan; this Chinese firm is represented as an incumbent (red line in Figure 9) but it has only 10 registrations of internal combustion engine motorcycles up to 2016 in Italy. Lifan seems to be a marginal producer of internal combustion engine motorcycles (at least in the Italian market) which instead has invested heavily in the electric niche since 2018: it registered 1253 electric motorcycles in 2018–2021 with a market share of 16.2% in 2021. Among the largest incumbents, Wangye is the unique relevant early entrant: it reached the leadership in the electric motorcycles with 0–50 cc engines in 2014, with a 29% market share, but thereafter showed a sharp decrease. Other relevant incumbent firms which entered this niche are Piaggio in 2018 and Garelli in 2019.

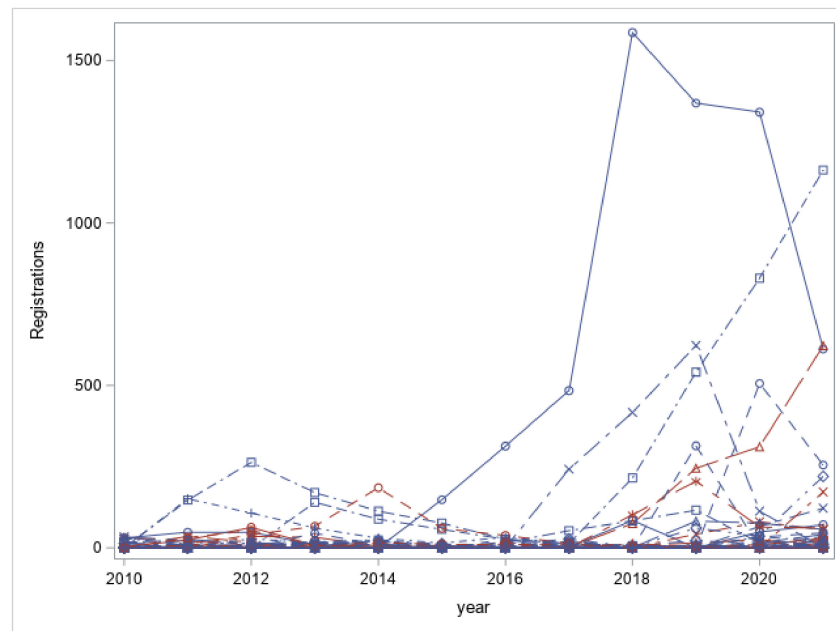


Figure 9. Quantity of registered electric scooters with 0–50 cc engines for various brands. In red: the registrations of electric scooters produced by the incumbents; in blue: the registrations of the new firms.

Considering the whole niche (both motorcycles with 0–50 cc and above 50 cc engines), Figure 10 shows the dynamics of entry and exit both for incumbents (in red) and new firms (in blue). The entry of new firms is predominant over almost all years: (with the exception of 2012) from 2010 to 2021; the number of new entrants is larger than the number of incumbents that entered the niche, as also shown in Table 1.

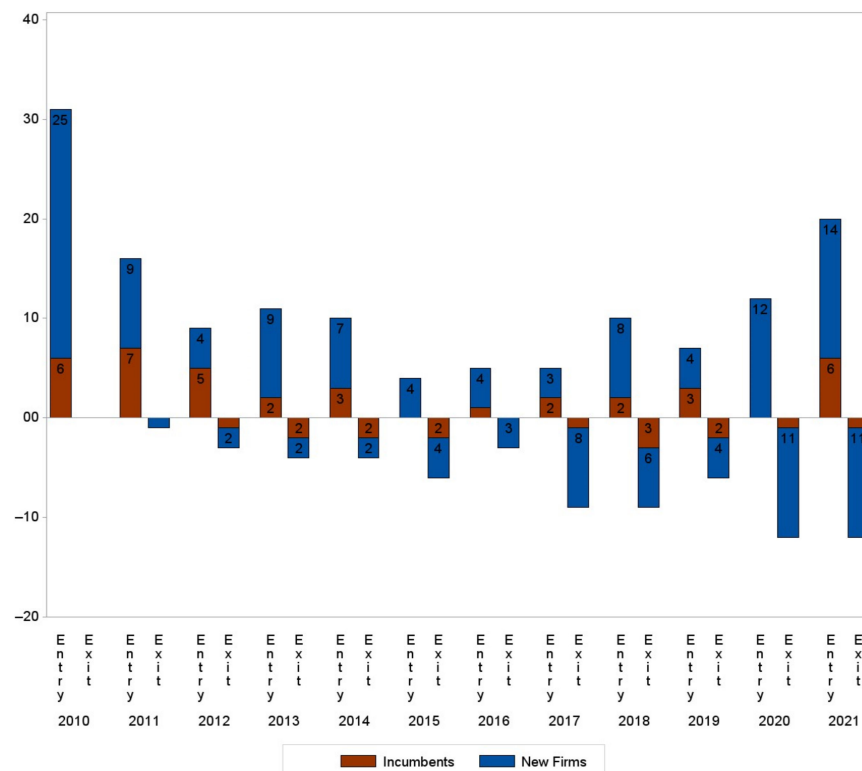
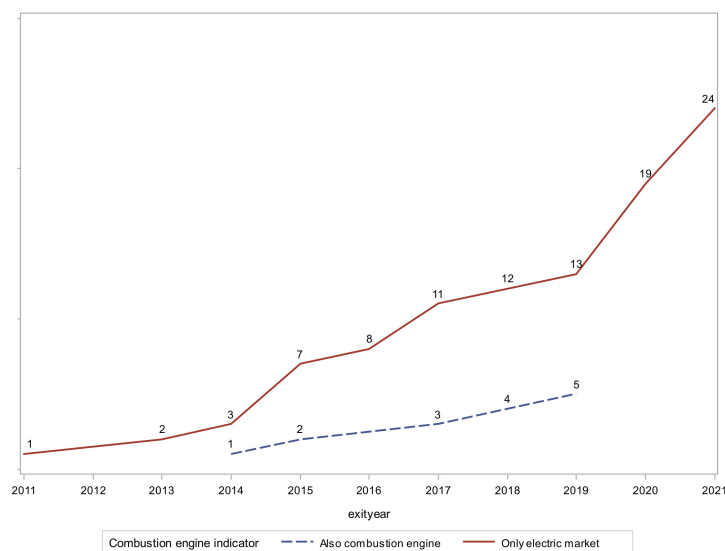


Figure 10. Entry and exit of firms in the electric motorcycle niche.

Table 1. Number and percentage of new firms and incumbents that entered the electric motorcycle niche.

Year	Number of New Firms	Number of Incumbent Firms	Percentage of New Firms	Percentage of Incumbent Firms
2010	25	6	81%	19%
2011	9	7	56%	44%
2012	4	5	44%	56%
2013	9	2	82%	18%
2014	7	3	70%	30%
2015	4	0	100%	0%
2016	4	1	80%	20%
2017	3	2	60%	40%
2018	8	2	80%	20%
2019	4	3	57%	43%
2020	12	0	100%	0%
2021	14	6	70%	30%

There is a high degree of turbulence: almost all the 32 brands that entered the electric niche market in 2010 or before, exited by 2021, as reported in Figure 11, with an average lifetime of 5 years. Both in the 0–50 cc and above 50 cc engine categories, the ranking of the three leading firms is highly unstable. There have been nine changes in the top three firms in the last 12 years in the 0–50 cc category and a change every year over the last 12 years in the above 50 cc engine category.

**Figure 11.** Exit of firms entered in 2010 or before from electric market.

From a quantitative perspective, the average number of registrations in the year of entry is twice for the new firms with respect to incumbent firms. This difference is more remarkable if we focus only on the registrations of larger firms.

5.2. Econometric Analysis

In the following, we focus only on the incumbent firms. As a preliminary analysis, to assess our main hypothesis, we will now investigate if the incumbents (considering the whole population of firms producing motorcycles with internal combustion engines) that entered the electric motorcycle niche are the more experienced. We will also analyse if the domestic incumbents played a key role in the entry into this niche.

We measured experience by considering various aspects. First, the size of the firm: larger incumbents have more experience in production and marketing and more structured

organisations. Second, the breadth of the firm's product portfolio, measured considering both the variety of different models produced and the number of submarkets in which the firm has at least one registration: incumbents that produce more models or in more submarkets have more experience. Third, we considered if the incumbent firm produces scooters and motorcycles in the category with a 0–50 cc engine. In Section 3, we claimed that: electric vehicles are best suited for urban travelling; in motorcycles, vehicles most adapted for urban travelling are scooters and small vehicles with a 0–50 cc engine. Therefore, firms that have experience in the production of scooters and small vehicles may have an advantage in entering the electric motorcycle niche. More precisely, as discussed in Section 2, we are referring to the customer competencies that embody the ability to understand customers' needs, offering tailored product features and market applications [36]. Incumbents with experience in the production of scooters and small vehicles with a 0–50 cc engine can also use their customer competencies in the new niche for developing electric scooters and electric mopeds.

To test our hypothesis, we started with yearly information about registered motorcycles in Italy from 2010–2021, as described in Section 4. The descriptive statistics of the variables are reported in Table 2.

Table 2. Descriptive statistics of explanatory variables.

Variable	Description	Type	Mean	Standard Deviation	Minimum	Maximum
<i>Entry</i>	Report if the incumbent entered into the electric motorcycle niche	Dummy	0.15	0.36	0	1
<i>LogSize</i>	Log of quantity of internal combustion engine motorcycles	Numerical	2.77	3.09	0.00	11.25
<i>Models</i>	Number of total models produced	Numerical	18.82	38.36	1.00	291.00
<i>Submarkets</i>	Number of submarkets with a positive number of motorcycles	Numerical	2.26	1.86	1.00	10.00
<i>DScooter</i>	Report if the brand produces scooters	Dummy	0.50	0.50	0	1
<i>DFifties</i>	Report if the brand produces only motorcycles with an engine of 0–50 cc	Dummy	0.12	0.33	0	1
<i>DForeign</i>	Report if the brand is foreign	Dummy	0.70	0.46	0	1

We analysed 217 incumbent firms, 32 of which entered the electric market. Looking at multicollinearity among quantitative variables, the correlation between the total number of models, the number of submarkets, and the size of the firms measured as the logarithm of registered vehicles in 2010 is quite high (60% to 79%), as expected since they are proxies of the same characteristic of the firm, i.e., experience. Therefore, we ran different specifications of the model, considering alternatively different variables that provided information on the firm experience. All the analyses were performed using SAS Software.

The results of the logistic regressions are shown in Table 3. The models satisfy convergence criteria and had significant tests over the Global Null Hypothesis at <0.01 level, proving that they provide insights about the likelihood to enter and result in a good accuracy performance, with an area under the ROC curve above 0.80.

Table 3. Logistic regression models on entry into the electric market. Standard errors are in parenthesis.

Independent Variables	Reference Level (Categorical Variables)	Model 1	Model 2	Model 3	Model 4
<i>Intercept</i>		−3.8268 *** (0.550)	−3.7063 *** (0.543)	−3.4399 *** (0.530)	−4.4529 *** (0.729)
<i>DScooter</i>	Scooter producer	1.5458 *** (0.534)	2.0054 *** (0.547)	1.915 *** (0.516)	1.4495 *** (0.538)
<i>DFifties</i>	Only 0–50 cc	1.4072 ** (0.600)	1.2768 ** (0.578)	0.979 * (0.573)	1.4682 ** (0.612)
<i>LogSize</i>		0.2291 *** (0.069)			0.2500 *** (0.072)
<i>Models</i>			0.0165 *** (0.005)		
<i>Submarkets</i>				0.1136 (0.094)	
<i>DForeign</i>	Foreign firm vs. Italian				0.7895 (0.536)
−2 log Likelihood		148.5	145.8	158.7	146.1
LR test		33.025 ***	35.756 ***	22.849 ***	35.340 ***

Significance: *** < 0.01, ** < 0.05, * < 0.1.

Model 1 estimates the positive effect of the incumbent size *LogSize* on the probability of entering the new niche: the larger the firm, the higher the probability of entering the new niche, *Entry_i*. The coefficient estimates of the variables related to the experience of the incumbents in the production of scooters, *DScooter*, and in small motorcycles with a 0–50 cc engine, *DFifties*, are also positive and significant: we computed the odds ratios and obtained that the odds of entering the new market with respect to the choice of not entering is 4.6 times higher if the incumbent is a producer of scooters and 4.0 times higher if the incumbent is specialised in the production of small motorcycles with an engine capacity of 0–50 cc. In Model 2, we also considered the effect of the firms' product variety, *Models*. The effects of *DScooter* and *DFifties* are still positive and significant, and the coefficient of *Models* also shows a significant positive effect on the dependent variable: on average, for each new model produced, the expectation is to have a 1.7% increase in the probability of entering the new niche. Model 3 includes the variable *Submarkets*, which is not significant in all the tested models, while the other variables continue to have a positive and significant impact at level 0.05, apart from *DFifties* which stays significant at the 0.1 level. In Model 4, we controlled if the variable related to nationality, *DForeign*, impacted the probability of entering, expecting that domestic incumbents play a key role in the entry of a new market niche. The results showed that it is not statistically significant.

To deepen the analysis, we performed some graphical investigations. In Figures 12 and 13 we report the evolution of the probability of entering considering the explanatory variables of Models 1 and 2. In other words, for each combination of the two dummy variables, *DScooter* and *DFifties*, we looked at the predicted probabilities of entering the new niche conditional to the values of the incumbent size. First, considering *LogSize*, a sharp difference emerges, as shown in Figure 12: an incumbent that is neither specialised in the production of motorcycles with a 0–50 cc engine nor in the scooter market (red line) has a very low probability of entering the market, reaching a 25% probability only for the largest (more experienced) firms, at the right tail of the curve. On the opposite side, all the firms that are both specialised in the production of the 0–50 cc category and scooters (green line) have at least a probability of 25% of entering the new niche, and the probability increases with the increase in size (experience), reaching 80% for the biggest firms. In Figure 13, we considered each combination of the two dummy variables, *DScooter* and *DFifties*, and we looked at the predicted probabilities of entering the new niche conditional to the values

of the incumbent product portfolio, *Models*. It is important to consider that 70% of the incumbents have a total number of models below 13, so the analysis should be focused on the left part of the curves. It emerges that incumbents that are both specialised in the production of the 0–50 cc category and scooters (green line) have a higher probability of entering the new niche. (Focusing on the right side of Figure 13, we can see that the probability of entering the new niche tends to be high in all combinations of the dummy variables, showing that incumbents with many different models produced are likely to enter the new niche, whatever the previous segment of experience.)

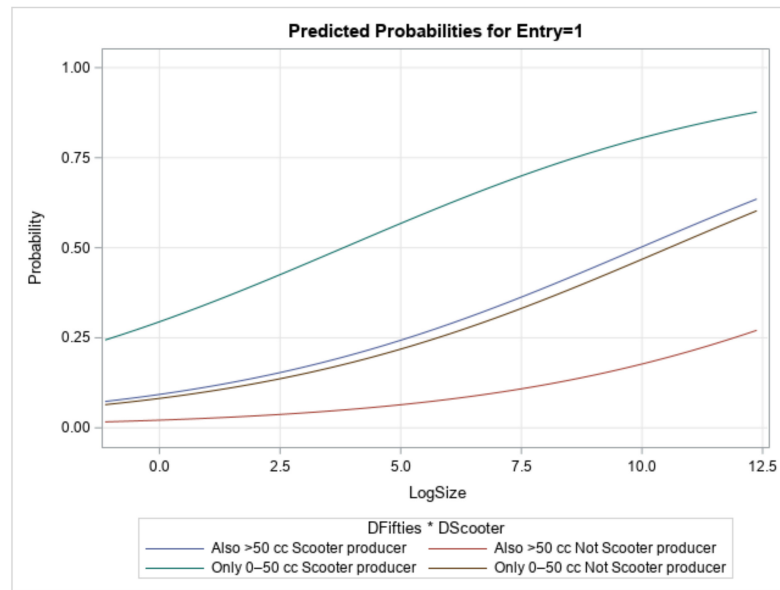


Figure 12. Probability of entering the new niche for different values of explanatory variables of model 1. The * represents that we are considering all possible combinations of the dummy values, as described in the legend.

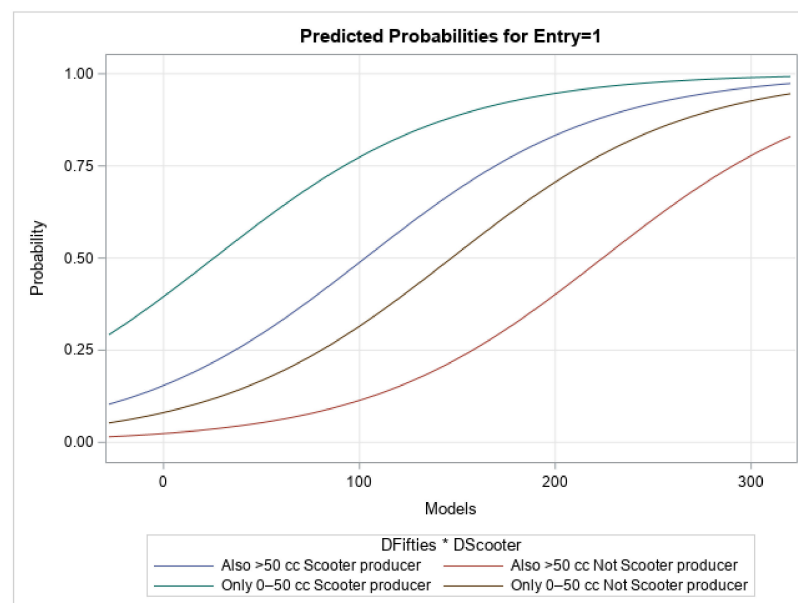


Figure 13. Probability of entering the new niche for different values of explanatory variables of model 2. The * represents that we are considering all possible combinations of the dummy values, as described in the legend.

To summarise, the results are coherent with our expectations: firms with more experience (i.e., incumbents bigger in size and with a larger product portfolio) and incumbents focused on the submarkets where the interest for electric motorcycles could grow more significantly (0–50 cc engine category, and scooter) are more likely to enter the new niche.

6. Discussion

The results of our analyses reveal that there is high turbulence in the electric motorcycle market niche. This displays the typical traits of the transitional early epoch described in the industry life cycle literature. This is an era of ferment characterised by a variety of technological approaches and improvements to the product, high uncertainty, entry of many new firms, turbulence in market shares, and ranking of firms [5]. New entrants have developed many products and components and are contributing to creating a large sustainable market for electric vehicles in this early transitional stage [40,47]. Market shares are very variable: for example, Govecs is a German firm that entered the electric motorcycle niche in 2011 and reached the second position in the firms' size ranking for 0–50 cc motorcycles in 2017. After only 4 years, Govecs is not even among the largest 10 firms in the electric motorcycle niche. Additionally, product development displays interesting dynamics: many new varieties and improvements have been introduced in the market niche in the period under study. For example, NIU invested in the development of attractive designs and electronic improvements, such as the control unit that analyses the driver's driving habits (Cloud ECU) and the energy recovery systems during braking. Soco also invested in attractive designs, in collaboration with the well-known brand Ducati, producing a scooter with Ducati's colours and aesthetic. In addition, many advancements have been done in the technology and performance of the batteries. Nowadays, most electric scooters use lithium-ion batteries or LiFePO₄ (lithium-ion phosphate) batteries which have higher energy storage capabilities than other types of batteries [48,49].

Our results reveal that only a few incumbent firms have truly invested in the production of electric motorcycles so far. The main efforts have been made by new firms. Our results are in line with other studies that consider the advent of electric vehicles a competence-destroying innovation that opened up an era of ferment [40]. In this context, in the early epoch of the industry evolution, typically, incumbents are more focused on the mainstream products to satisfy their customers and are less concerned with the development of new technologies that are not currently demanded and are characterised by small profit margins [9,11,40]. Firms that are focused on their current customers have a tendency to avoid the development of disruptive innovations [50]. However, the few incumbents that entered the new niche are the largest ones and those with greater experience in the production of scooters and/or small vehicles: the exploitation of their customer competencies in the production of vehicles suited for urban travelling has induced them to explore the electric niche where vehicles are most adept for urban use. Our results are also similar to the early era of the electric automobiles in the US from 1999 to 2008, where the class of small automobiles developed first because of the need to design light-weight vehicles for urban use that do not need to reach high speeds or do long-range driving [40].

It is plausible to claim that incumbents delay their decision to enter the new market niche for different reasons: first, to avoid cannibalization of their products. Second, the incumbent may wait until the degree of uncertainty that characterises this early stage will decrease. Incumbents can lack experience with the technological aspects in the new innovative niches. Then, incumbents could observe newcomers' behaviours and performance and disentangle the new niche market's uncertainty and decide to enter a second stage when the products and technology are better defined and refined. This result is in accordance with other cases that show that even if large incumbents produce more innovations over time than smaller firms and newcomers, they do not automatically develop the most radical innovations [51] which open up a new market or niche. It is possible that in the near future more incumbents will enter the new market niche. Firstly, this is an interesting potential market because there is a growing number of consumers that place a high value

on green products and environmental sustainability. Secondly, political authorities have increasingly adopted initiatives to discourage the production of vehicles with traditional internal combustion engines. Third, the incumbent Piaggio already entered the niche and obtained a notable success: the entry of an incumbent firm may trigger the decision to enter other incumbents [1]. A possible future scenario could be related to acquisitions of the newcomers by the incumbents (as occurred in other industries, e.g., the beer industry, see [52,53]) and operating it as a separate unit; this would send a weaker signal to the competing incumbents, thus avoiding attracting competition [1]. Diversifying firms with complementary assets may also be interested in acquisitions to obtain the technological know-how of the start-ups [34].

On a more speculative note, we claim that the incumbents' strategic responses are in a period of fine-tuning and are really still to come. At the moment, incumbents principally seem to stay at the window to observe and monitor. One exception is Harley-Davidson, specialised in the production of large motorcycles (cruisers) used mainly for long rides presented his first prototype of an electric motorcycle in 2014, which went into production in 2019. The four big Japanese firms, Honda, Suzuki, Yamaha, and Kawasaki, currently have no electric motorcycles in production. However, they have recently signed an agreement to jointly produce the batteries for the electric motorcycles of the future in order to adopt a standard charging system and interchangeable batteries for all four brands. The competitive strategies of the coming years will certainly reveal interesting dynamics both for newcomers and incumbents. Moreover, it is interesting to monitor the role of the Italian firms that so far have appeared to be in the background, with the exceptions of Askoll and Piaggio.

7. Conclusions, Limitations, and Further Research

In this paper, we analysed the emergence of a new innovative market niche: electric motorcycles in Italy from 2010 to 2021. A general demand for environmental sustainability has driven the creation and diffusion of electric vehicles. This has been fuelled both by public institutions with tailored governmental policies and by consumers characterised by preferences for environmentally friendly products.

Our investigation contributes to the economic literature in several ways. We have deepened the understanding of the emergence of an eco-innovative niche, identifying the main features that characterised its evolutionary dynamics. We showed that the dynamics in the electric motorcycle niche conform to the early era of ferment of the industry life cycle, where uncertainty, the presence of various technological approaches, the entry of new firms, turbulence, and product improvements characterise the environment.

In particular, we investigated the role of the incumbents. Two relevant results emerge. First, we showed that incumbents played a marginal role in the development of this niche. Except for a few cases, incumbent firms in the traditional internal combustion engine have not significantly entered the new niche. Our results contribute to the economic literature providing evidence in support of the economic research that identifies the inertial behaviour of incumbents. This is a relevant issue, considering that eminent research claims that the first entrants gain an increasing competitive advantage and eventually dominate the market. We claim that current incumbents need to strategically monitor the next near evolution of the market niche and plan how to act. This indication is particularly relevant if we consider that the EU public authorities are strongly promoting the use of electric vehicles and planning to ban traditional vehicles in the coming decades to reach the already settled environmental targets. Second, we contribute to the understanding of the process of entry of incumbents into new niches: we showed that the incumbents that decide to enter are the largest, more diversified in terms of the product portfolio, and more specialised in the production of scooters and small vehicles with an engine capacity of 0–50 cc. The intuition behind this result refers to the incumbent customer competencies that express the firms' ability to understand customers' needs. Given that electric motorcycles are more adapt for urban commuting through the use of scooters and small vehicles with 0–50 cc engines, then the incumbents' experience in the production of these products in the main industry

(i.e., in the production of motorcycles with internal combustion engines) increases the probability to enter and explore the new electric motorcycles niche. This result is in line with studies that explain how the most experienced firms may leverage their skills to catch new market opportunities.

This paper presents some limitations and unexplored issues that we leave to further developments and future research. First, we claim that data in this new market niche are too scarce to conduct a robust econometric analysis. We suggest continuing collecting and refining data in this market niche for more robust investigations: in particular, structuring the analysis according to panel data models could reveal interesting opportunities to deepen the investigation. Second, it could be interesting to collect data and focus on the history of the firms: we expect that some of the very first entrants produced only prototypes or vehicles for sports competitions or other very particular types of vehicles. Third, it is relevant to reconstruct the pre-entry experience of the new entrants and distinguish between start-ups and diversifying firms in order to identify the impact of pre-entry knowledge on the decision and timing to enter. Fourth, it could be interesting to develop an index of technological relatedness among the various types of motorcycles and investigate if relatedness is a determinant of entry. Fifth, we suggest continuing to monitor the early dynamics of the niche evolution in order to identify the emergence of leading firms and products in the near future. Finally, it could be informative to conduct a similar investigation about the entry of firms into the electric motorcycle niche in other countries and make comparisons to detect similar or different patterns.

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