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## **The evolution of the Italian motorcycle industry (1874-1980): Klepper's heritage theory revisited**

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### **Abstract**

Since the seminal work of Marshall, the concentration of economic activities in space has been explained essentially in terms of agglomeration economies. The work of Klepper has challenged this view suggesting that externalities play no role in the agglomeration process (Klepper 2007). Based on the empirical investigation of a disparate set of industries which are strongly concentrated in space (e.g. automobiles in Detroit; tires in Akron), they argued that the spin-off process is the main driver of the formation of clusters. However, there are a number of questions left open in the heritage theory (Boschma, 2015; Cusmano et al. 2015). In our study we aim at reconciling the heritage theory of Klepper with the cluster approaches, by including in the heritage theory framework additional explananda of cluster emergence and evolution, such as social capital, competition and related variety. We test our framework in the case of the Italian motorcycle industry, which is an interesting case as it owns features that are similar to those of other industries (eg automobile) investigated in the literature. The empirical analysis is based on an original dataset of 739 motorcycle companies operating in Italy in the period 1874- 1980. In line with the literature, we estimate a survival model. Our findings show that the spatial concentration of the industry is driven by different mechanisms, which can be ascribed to both the heritage theory and the traditional agglomeration theories.

## The evolution of the Italian motorcycle industry (1874-1980): Klepper's heritage theory revisited

### 1. Introduction

Since the seminal work of Marshall (1920), the concentration of economic activities in space has been explained essentially in terms of agglomeration economies. The core of this approach suggests that industries tend to agglomerate in space due to the presence of economies of scale, which are external to the firm, but internal to a delimited geographical area. The co-location of a pool of specialised workers, along with a specialised market of suppliers generate pecuniary externalities, so physically proximate firms can access them at lower costs (than those located elsewhere). More importantly, economic agglomerations tend to favour knowledge spillovers (Krugman, 1991; Audretsch and Feldman, 1996; Klepper, 2011; Maskell and Malmberg, 1999)<sup>1</sup>: firms and workers can match their (often idiosyncratic) characteristics and disseminate knowledge via labour mobility (Breschi and Lissoni, 2009), imitation (Maskell, 2001), user-producer interactions (Lundvall, 1992), informal know how bartering (von Hippel, 1987). Despite knowledge externalities are captured by individual firms according to their absorptive capacity (Cohen and Levinthal, 1989), the fast and wide circulation of tacit knowledge among co-located firms, as it has been experienced by many historical examples of industrial clusters, contributes to the emergence of collective learning, which becomes embedded in the social glue of firms and people living in the same territory (Becattini, 1990; Capello and Faggian, 2005; van der Panne and van Beers, 2006).

The presence of thick institutions and specialised organisations that provide local “collective goods”, such as training and specialised education, R&D centres, technical and financial services and institutions of governance reduces uncertainty and transaction costs and lower the entry barriers for new enterprises. Moreover, cooperation, informal know-how sharing and the easy of doing business is enhanced by a shared common culture, which is also advocated as a quintessential feature of industrial clusters, both in traditional and high-tech sectors (Saxenian 1994; Becattini 1990; Dei Ottati 2002). All in all, the above arguments point to the fact that that the development of agglomeration economies is fundamentally shaped by meso-level factors and in particular by the presence of some form of external economy which local firms can easily reap by being there.

The work of Klepper and colleagues challenged the main pillar of the traditional cluster literature, suggesting that Marshallian externalities play no role (or a minor role) in the agglomeration process (Klepper 2002, 2008, 2009, 2010). Based on the empirical investigation of a disparate set of

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<sup>1</sup>An alternative argument, inspired by Jacobs (1969), identifies inter-industry agglomeration forces (“diversification externalities”), highlighting the knowledge exchange across firms in complementary sectors.

industries which are strongly concentrated in space (e.g. automobiles in Detroit; tires in Akron), they argued that the spin-off process is the main driver of the formation of clusters. These studies show indeed that these industries grew thanks to the high rate of spin offs, which were founded by former employees of firms operating in the same or similar industry. In this conceptual framework the spin-off process is interpreted as an evolutionary mechanism of knowledge transmission between genes (i.e. parent firm) and offsprings (i.e. spin off) (Nelson and Winter, 1982), whereby founders of new ventures inherit the competences and skills they have acquired during their prior work experience in the parent company, which operates in the same or a related industry (Klepper and Sleeper, 2005). From this latter argument it descends that a prospective spin-off working at a firm with fit routines will acquire the superior skills of the parent, which can be applied and replicated in the new venture. A central tenet in this literature is that successful firms tend to generate more spin offs, which are also on average more successful (Klepper and Sleeper (2005). Therefore the higher performance of firms in clusters, as compared to firms outside clusters, does not descend from the benefits of local externalities, but rather from the inherited routines these firms possess at the time of entry (Klepper, 2010). The agglomeration process is in itself driven by the spin off process, as spin-off founders tend to locate close to their parents. The growth of a cluster is then possible when one or more early outstanding entrants (e.g. Olds Motor Works in Detroit and Fairchild in Silicon Valley) spur many successful spinoffs, which locate nearby the parent company. Agglomeration forces can still play a role in attracting firms to a cluster, however, as Klepper shows, it is the inheritance from the parent that explains the performance of the spin off.

The work of Klepper and colleagues has certainly changed the view the literature looks at industrial clusters and their internal dynamics, however, despite its ambition, there are a number of questions left open, which call for additional investigation. We would like to pinpoint two main limitations (Boschma, 2015; Cusmano et al. 2015):

1. industry specificity: the relative importance of spin off dynamics versus agglomeration economies might be related to the characteristics of the industry (De Vaan et al. 2013). On this point, it is worth noting that Klepper himself indicated that the spin off process cannot be the only reason of why spin off locate in clusters. More than that, he did not discard completely in his work (though he did not tested it empirically) that the superior performance of spin offs is in a cluster, as opposed to those outside a cluster, is compatible with the Marshallian externality argument. He recognised that spin-offs, besides inheriting superior capabilities from their parents, are outperforming other firms because more capable of taking advantages of local externalities. In his words "it is possible that

agglomeration economies in the Detroit area were significant but only benefitted spinoffs, perhaps because only they had suitable pre-entry backgrounds to benefit from agglomeration economies. It is hard to rule out such a theory ..." (p. 629). Evidence supporting this latter view comes from studies that have applied the Klepper's framework to different sectors and countries, such as automobile in UK (Boschma and Wenting, 2007) and ceramic in Italy (Cusmano et al. 2015).

2. local institutions and social capital: Klepper's work has challenged the role of culture and institutions in explaining the success of clusters like Silicon Valley. However, he also recognised that institutions can play a role: for example the presence of relational capital or social networks, which are well known levies of both financial and knowledge capital, can influence the spin off decision to co-locate nearby its parent (Klepper, 2009). Some recent empirical works already show that by integrating institutions in the Klepper's spinoff framework, significant differences across countries appear (Menzel and Kammer, 2012). Therefore, an explicit inclusion of these factors in framework of analysis is highly needed.

In our study we aim at reconciling the heritage theory of Klepper with the more traditional approaches of industrial clusters, in particular including in the heritage theory framework additional *explananda* of cluster emergence and evolution, such as social capital, competition and related variety, which allow addressing the open questions presented above.

We test our framework in the case of the Italian motorcycle industry. This is an interesting case as it owns features that are similar to those of other industries (eg automobile) investigated in the literature. The industry started in the late nineteenth century with several small and micro workshops which turned into larger producers. The industry became concentrated both spatially, around two main clusters, and organisationally, with fewer players growing in size. However, differently from the automobile industry, the motorcycle sector was characterised by lower economies of scale and higher fragmentation. Also the life cycle of the industry is more turbulent, in particular because of exogenous events, like the two world wars of the twentieth century. Nevertheless, given its similarity to the car-making industry analysed by Klepper, this case facilitates the comparison. Moreover, this industry has been investigated in a number of similar approaches, which further allows for comparison (Wezel, 2005).

The paper is organised as follows. In section 2 we discuss our hypothesis and back them with theoretical arguments. Section 3 presents the data and methods used in the empirical analysis. Section 4 illustrates the empirical findings of our econometric estimation. In Section 5 the results are discussed and some conclusions drawn.

## 2. Theory and hypotheses

In this section we set out the main hypotheses which will be empirically tested in the empirical analysis of the paper. We will briefly sketch-out the main theoretical arguments behind each hypothesis as follows.

### *Heritage theory*

The heritage theory of Klepper focuses on the spin off process as the main mechanism of knowledge/ routine transmission. The idea behind it is that the set of capabilities of a new venture are strongly shaped by the working experience of the founder, therefore the background of the founder influences the success of a start-up. Klepper in his work identifies four types of backgrounds of founders, which correspond to four types of entrants:

*Spinoffs*, which are firms founded by employees of firms which were already active in the same industry. Spinoffs directly inherit the routines of the parent firm via the founder, so if the parent had superior routines, and accordingly superior performance, also the spin-off is expected to be successful (Klepper, 2007). Empirical evidence shows that more successful firms have indeed higher spinoff rates and more successful spinoffs (Klepper and Sleeper, 2005; Boschma and Wenting, 2007). However, it is reasonable to believe that spinoffs need time to develop the successful routines of the parent, therefore the importance of the spinoff mechanism is expected to be lower at the early stage of an industry (Boschma and Wenting, 2007).

*Experienced firms and entrepreneurs*: these are firms (or entrepreneurs) which enter an industry by diversifying their portfolio of products/activities (Carroll, 1996; Klepper, 2002b; Boschma and Wenting, 2007). Due to the cumulateness of the knowledge production process, innovation and diversification are fundamentally path dependent processes (Dosi, 1982), therefore firms tend to develop new activities around those they are good at. Empirical evidence confirms that the diversification process from related sectors is the main avenue to enter (and succeed) into new economic activities (Boschma et al. 2013; Neffke et al. 2011). In particular, new firms that have a background in closely related sectors should perform better than other diversifying firms.

*Inexperienced firms*: this category includes firms and entrepreneurs who have no prior work experience in the industry or in related industries. Since in most studies it is not always possible to track back the experience of the founder, this category includes also firms whose founders' background is unknown. According to the Klepper's model of entry (Klepper 2002c), these firms

show the lowest R&D productivity because they lack industry specific capability, which results in lower performance at any age and time of entry.

Based on the above arguments the following hypotheses are formulated:

- Hypothesis 1. Spinoffs show the highest survival*
- Hypothesis 2. Inexperienced firms have the lowest survival.*
- Hypothesis 3. Being an Experienced firm positively impact the survival*
  - a. A background in related sectors positively affects survival*
- Hypothesis 4. Spin offs from successful parents show the highest survival*
- Hypothesis 5. As the industry ages, the background has greater influence on survival*

In addition to firm background, the heritage theory argues that the *time of entry* affects the performance of firm. Following the Klepper model of industry life cycle (1997) , three phases of an industry can be identified: emergency phase, when few firms populate the industry, which is characterised by high technological turbulence and rate of innovation. Second, as a technology becomes more diffused, the number of firms in the market grows considerably and a dominant technology will emerge. During the last phase of maturity, a shakeout occurs in the industry, firms with the fittest routine will survive, while the others exit the industry. The industry becomes concentrated. In this model it is argued that early entrance brings an advantage because of increasing returns to R&D. In other words it is assumed that it is easier to enter an emerging industry, rather than a mature industry, since entry barriers grow overtime along with the growing costs of R&D. The above arguments lead to the following hypothesis:

- Hypothesis 6. Early entrance positively affects survival*

#### *Agglomeration theory*

As discussed in the Introduction, firms in clusters benefit from external economies. However, agglomeration economies can arise from various sources and hence differ in nature. A common way to disentangle them is to distinguish between localization and urbanization economies (Henderson et al., 1995), which indicate externalities coming from similar or heterogeneous economic activities respectively.

Localisation economies or MAR externalities<sup>2</sup> (Glaeser et al., 1992) occur when firms from related sectors cluster in space. On the other hand, urbanization economies arise from the diversity of an urban economic structure and the availability of a wide range of collective goods (e.g. educational infrastructure), so it is the advantage of being located in a densely populated area, where many different industries and services are also present (Jacobs, 1969). Based on the above, it can be argued that firms will benefit from agglomeration economies by simply being located in a cluster. However, many empirical studies suggest that the importance of agglomeration economies may vary according to the sector and stage of development of an industry.

For example, a vast bulk of empirical evidence shows that MAR externalities are positively related with the maturity of an industry, while it holds the opposite for Jacobs externalities (Henderson et al., 1995; Glaeser et al. 1992; Boschma and Wenting, 2007; Nefke et al., 2010). These latter findings are consistent with the arguments proposed by the industry life cycle (Abernathy and Utterback, 1978; Klepper, 1997) and the cluster life cycle models (Boschma and Ter Wal, 2007), which suggest that variety is important in the early stages of development of an industry, since the technological environment is highly turbulent. In the mature phase, a technological standard emerges and firms tend to benefit more from knowledge and competences from related industries that allow them to increase efficiency via incremental innovation (Staber, 2001; Boschma and Frenken, 2011). Based on the above discussion, the following hypotheses can be put forward:

*Hypothesis 7. Being in a district positively affects the survival.*

*Hypothesis 8. Localization economies positively affect survival.*

*Hypothesis 9. Urbanization economies positively affect survival.*

*Hypothesis 10. As the industry ages, localization economies have greater influence on survival.*

*Hypothesis 11. As the industry ages, urbanization economies have lower influence on survival.*

#### *Density and Social capital*

The concentration of firms in space might also turn density into an obstacle for further agglomeration if firms perceive too much competition. The idea is that there is an inverted U-shape relation between density and externalities. To benefit from agglomeration economies density has to reach a given critical level, after that point however, the costs due to increasing competition may outweigh the benefits (Staber, 2001). A number of empirical studies indeed provide evidence

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<sup>2</sup> MAR externalities is the acronym of Marshall-Arrow-Romer, the three economists who most contributed in refining the concept.

suggesting that firms' survival in clusters is strongly affected by density (Sorenson and Audia, 2000; Staber, 2001; Cattani and Pennings, 2003). These findings are also in line with the dependence theory by Hannan (1989), who argues that two main forces (i.e. legitimation and density) drive the dynamics of industries. In brief, this latter theory claims that legitimation positively affects survival, since firms with higher legitimation can access more easily resources; on the contrary density reduces survival as firms have to compete more fiercely to obtain such resources.

However, as stressed by Nickel and Fuentes (2004), the dependence theory is contingent to specific features of the population under investigation. On the one side, it has been shown that as an industry becomes mature, both competition and legitimation effects lower their importance. On the other side, specific sector and geographic effects can reduce or amplify the dependence effects. For example, industrial clusters characterized by the presence of thick institutions of governance, density can be associated with embeddedness and cooperation, which enhance (instead of lowering) the survival of firms. Based on the above arguments, the following hypotheses can be formulated:

*Hypothesis 12. Density (competition effect) negatively impacts on survival.*

*Hypothesis 13. As the industry ages, density (competition effect) lower its impact on survival.*

Social capital has featured prominently in the literature of industrial clusters, given its contribution to build trust, social networks and in so doing enhancing cooperation among firms and entrepreneurs. Social capital has been argued to be also an important determinant of entrepreneurship (Sorenson and Audia, 2000), by providing start-ups with higher opportunities for accessing resources (e.g. financial, knowledge). The literature however has also stressed the potential negative effect of too much embeddedness, in terms of over-socialisation in the cluster, which can lead to socio-political and cognitive lock-in (Grabher, 1993). It has been also argued, in line with the dependence theory, that the role of social capital becomes more evident as industry ages. In the early phases, social communities are more conservative and less open to deviant ideas which can be attached to a completely new industry. As the industry becomes mature, it gets more organised and also more influential in the social community, where it gets increasing legitimation and support (De Vaan et al. (2010).

Based on these latter arguments, the following hypotheses on social capital can be formulated:

*Hypothesis 14. The level of social capital positively affects survival.*

*Hypothesis 15. As the industry ages, social capital has a greater influence on survival.*

### 3. Data and methods

The empirical analysis is based on an original dataset of 739 motorcycle companies operating in Italy in the period 1874- 1980. The dataset draws on the information on motorbike companies extracted from the encyclopedias “Moto Italiane, i primi 50 anni 1895 - 1945” (Milani, 1998) and “Enciclopedia della motocicletta” (Wilson, 1996) for the companies founded after 1945. When these sources did not provide the needed information, in particular about the background of firms’ founders, additional search was conducted on various internet sources and databases<sup>3</sup>. Economic and social data on population density, employment have been extracted from statistical publications and database available from the Italian statistical office (ISTAT, 2011) and the Bank of Italy (Nuzzo, 2006).

An illustration of the database is provided in Table 1, where the figures show how firms with different backgrounds are distributed across the two largest motorbikes clusters in Italy (the Lombardia Region and the Emilia Romagna Region), and overtime (we split the different times of entry in order to have an even number of observations in each one).

Table 1. Distribution of type of firms by geographical area and time of entry (row percentages and absolute frequencies)

	<b>Emilia Romagna</b>	<b>Lombardia</b>	<b>Other regions</b>		<b>1874 - 1923</b>	<b>1924 - 1934</b>	<b>1935 - 1980</b>	<b>Total</b>
<b>Spinoff</b>	20.24% 17	45.24% 38	34.52% 29		16.67% 14	47.62% 40	35.71% 30	<b>84</b>
<b>Experienced Entrepreneur</b>	16.79% 22	41.22% 54	41.98% 55		36.64% 48	42.75% 56	20.61% 27	<b>131</b>
<b>Experienced Firm</b>	19.61% 20	41.18% 42	39.22% 40		34.31% 35	26.47% 27	39.22% 40	<b>102</b>
<b>Inexperienced</b>	13.51% 57	34.12% 144	52.37% 221		38.39% 62	31.99% 135	29.62% 125	<b>422</b>
<b>Total</b>	<b>15.70%</b> <b>116</b>	<b>37.62%</b> <b>278</b>	<b>46.68%</b> <b>345</b>		<b>35.05%</b> <b>259</b>	<b>34.91%</b> <b>258</b>	<b>30.04%</b> <b>222</b>	<b>739</b>

<sup>3</sup> The main internet sources used are the websites of Moto Club Storico Conti, Wheels of Italy, Moto di Lombardia, Motorvalley, and the company websites for the most recent firms.

The Cox proportional hazard regression model (1972) has been used to test the survival of firms in our population. This is a standard statistical technique which allows to regress the survival probability of a population (i.e. the hazard function) to a set of explanatory variables. More in details, the hazard function,  $h(t)$ , indicates the probability that an observation will experience a given event (in this case, failure) in a small time interval, which can be interpreted as the risk of failing at the time of entry: therefore, the higher the hazard rate, the lower the probability of surviving. Hence, having  $n$  explanatory variables  $X_n$ , the hazard risk at time  $t$  is expressed as:

$$h(t) = [h_0(t)]e^{(B_1X_1+B_2X_2+\dots+B_nX_n)}$$

The quantity  $h_0(t)$  is the baseline or underlying hazard function, corresponding to the probability of failure when all the explanatory variables are zero. The regression coefficients  $B_n$  of each explanatory variable indicate the proportional change of the hazard rate due to a change in the explanatory variables. The model is based on the assumptions that observations are independent and the hazard rate is constant overtime, hence a constant relationship is required between the dependent variable and the explanatory variables. Moreover, a Cox regression exploits the information of censored cases; that is the observations for which the event of interest occurred after the period of observation; in this case, censored cases are firms that were still active after 1980.

Our empirical analysis tests the effect of a set of explanatory factors (as suggested by the theories reviewed above) on the performance of firms, measured as survival time. The construction of the explanatory variables and the dependent variable closely follows the methodology used in similar studies (Klepper 2002b; 2007; Boschma and Wenting, 2007).

#### *Dependent variable*

The survival of the firm, or firm age, is the dependent variable of the model on which the hazard rate is computed. This is a duration variable computed as the difference between the year of exit (i.e. last year of production) and the year of entry (i.e. first year of production). It is worth noting that take-overs are treated as exit, being the year of acquisition the time of exit. Mergers are treated as exit if the company name disappears, while the firm is treated as continuing if the company name is still in

use. In those rare cases in which a firm changes name for reasons different from merger or acquisition (e.g. when one of the founders exits), the firm is treated as continuing.

### *Explanatory Variables*

#### *Heritage model: Firm Background and time of entry*

The *Firm background* refers to a set of binary variables defined according to the previous experience of the company founder (i.e. *spinoff*, *experienced entrepreneur*, *experienced firm* and *inexperienced firm*). They get value 1 if the founder of the firm falls in one of the background categories and zero otherwise. More in details, an observation is treated as a spinoff if the founder was a previous employee of an incumbent motorbike firm. In case the founder worked for more than one incumbent, the last firm is considered as the parent company. For each spinoff, a performance variable of the parent (i.e. *Parent duration*) has been constructed, and it indicates the years of production of the parent firm. If the parent is a foreign firm, hence it is not included in the dataset, the background is assigned as spinoff and the duration of the foreign parent recorded in the variable *Parent duration*.

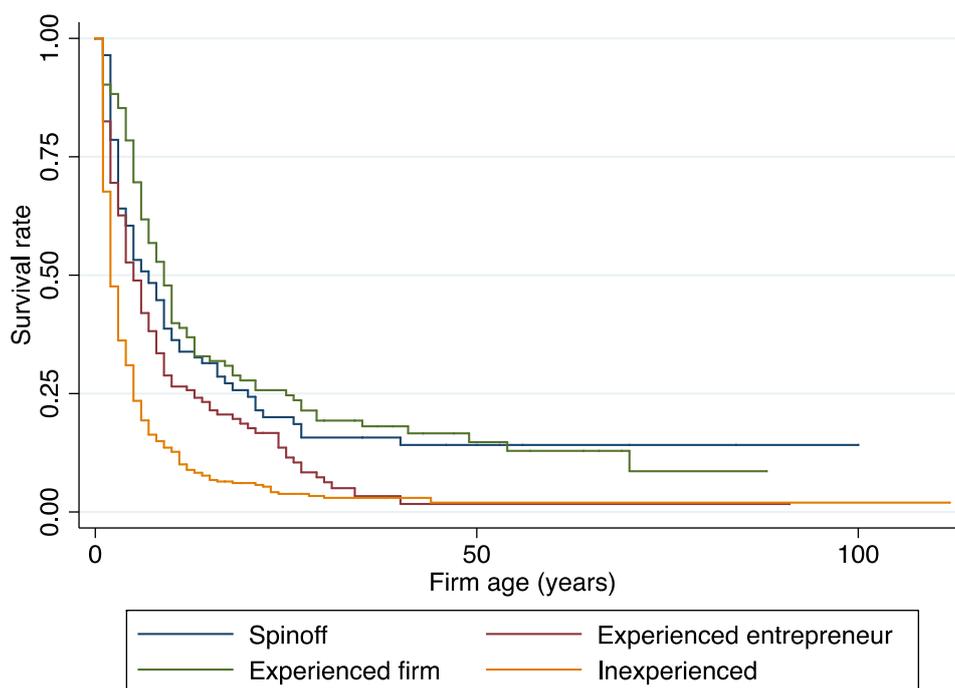
The *Experienced entrepreneur* variable refers to firms founded by individuals who worked in closely related activities, such as technicians in motorbike repair workshops, sellers and importers of foreign motorbike brand, organisers of or riders of motorbike races.

The variable *Experienced firms* refers to firms that diversified in the motorbike industry from related sectors. A large part of them diversified from closely related industries (i.e. automobile, bikes or production of engines), while others less so. Therefore a variable indicating if the sector from which the experienced firm diversified is very close to the motorbike industry has been created (*Experienced firm related*).

The *Inexperienced firm* variable includes all firms for which the founder background is either unknown or unrelated to the sector.

Figure 1 shows the probability of surviving to each age according to the firm background. As suggested by the *heritage model*, the *inexperienced firm* category has the highest mortality rate at each age, instead the *spinoff* and *experienced firm* variables have the highest survival rate.

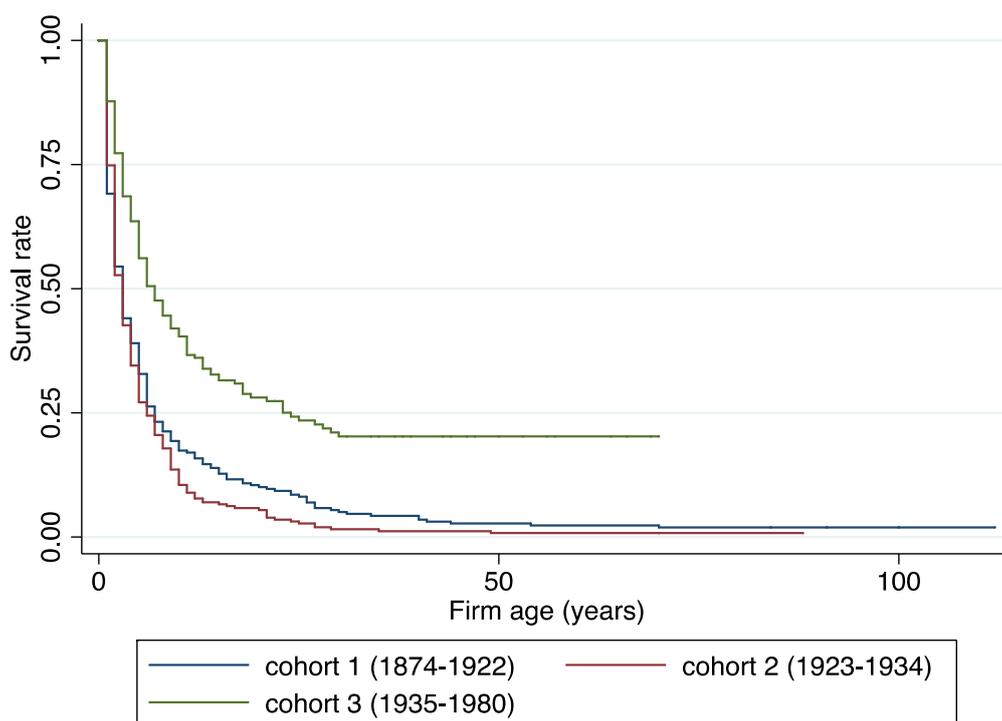
Figure 1. Kaplan-Meier survival estimates: survival rate by firm background



Three cohorts of similar size have been created to build the *time of entry* variables, which indicate at which age a firm/entrepreneur entered the industry. The first cohort includes firms entered between the years 1874 and 1922; the second firms entered between the years 1923 and 1934; the last cohort includes all the firm entered starting from year 1935. Table 1 shows that spinoff dynamics were more prominent in the second and latter phases of the industry, which is in line with the idea that that parent firms spawn more spinoffs as they age. Against the *heritage model* prediction, in the Italian motorbike industry, early entry does not bring an advantage in terms of survival. Indeed, as shown in Figure 2, the last cohort has the highest survival rate at any age.

All the above variables are used to test the *heritage model*.

Figure 2. Kaplan- Meier survival estimates: survival rate by time of entry



#### *Agglomeration economies, firm density and social capital*

The dataset provides information about the region and province where each firm was founded. In order to test the role of agglomeration economies, a dummy indicating if a firm belongs to a densely populated motorbike cluster has been created. As shown in Table 1, the two largest geographical areas of motorbikes producers are the regions of Emilia Romagna and the Lombardia region. We create geographical dummy variables for capturing the cluster effects: *Emilia Romagna area* and *Lombardia area* equal 1 if a firm is located in Lombardia or Emilia Romagna respectively and zero otherwise. The dummy variable *Bologna/Modena area* identifies firms located in the provinces of Bologna and Modena, where is based the Motor Valley– a cluster where companies like Ferrari, Lamborghini, CNH, Ducati and many others were founded and are still operating.

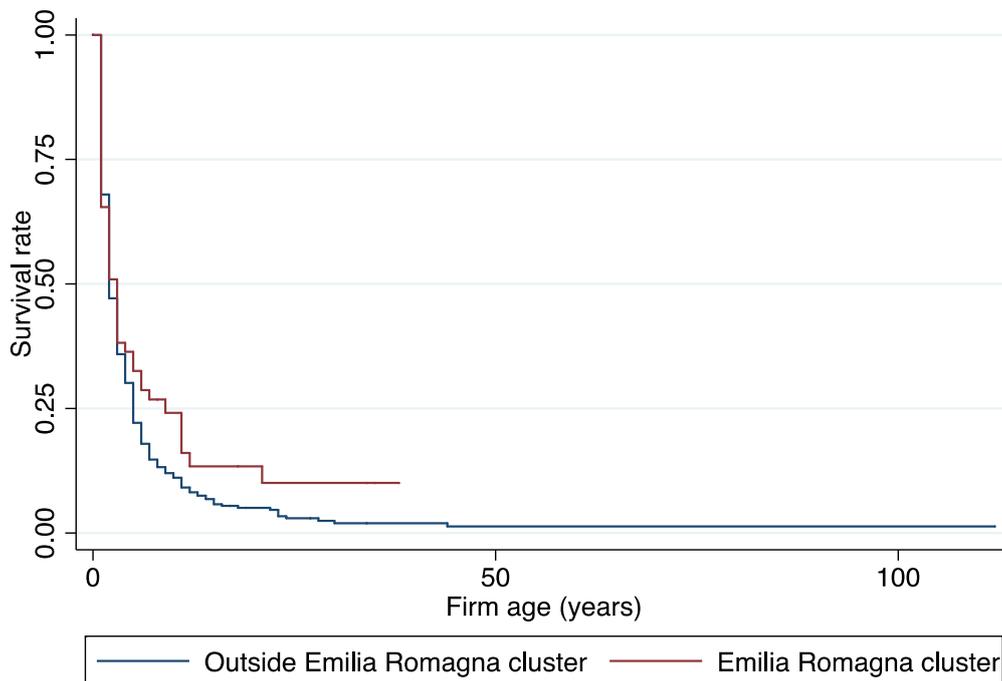
Localization economies effects have been measured using regional employment in the manufacturing sector at time of entry, while urbanization economies has been measured using the population of the region at time of entry (number of inhabitants).

The variable *competition*, constructed as the number of motorbike companies present in a region at the time of entry, has then been used as a proxy for regional density.

In order to test if the explanatory variables affect differently firms within and outside the cluster (i.e. Bologna/Modena area, Emilia Romagna area, Lombardia area), several interaction terms have been created, obtained by multiplying the location dummy with the variable of interest.

As shown in Figure 3, the firms located in Emilia Romagna show the highest survival, suggesting the presence of some locational advantages. To check whether this effect is due to firms' specific factors or rather cluster's externalities, the empirical literature has compared the performance of inexperienced firms inside and outside the cluster (Boschma and Wenting, 2007; Klepper, 2002a): if inexperienced firms perform better inside than outside the cluster, it can be argued that agglomeration economies do play a role in driving the concentration in space of an industry. Our preliminary findings shown in Figure 3 indicates that inexperienced firms in cluster perform better than those outside, suggesting that firms have benefited from the location in that geographical area.

Figure 3. Kaplan-Meier survival estimates: survival rate of inexperienced firms by location (Emilia Romagna cluster)



Notes: only the category Inexperienced is represented in the graph

Social capital concerns a rather complex bundle of social processes which is rather difficult to measure. In order to reduce complexity, an indicator has been constructed following Rupasingha et al. (2006). According to this latter approach, social capital can be described using two different

dimensions: social participation levels, in the form of political participation at the election polls and number of nonprofit entities and trust, completed by using the number of judicial disputes and criminality levels. All the above data are collected according to the time of entry and location of the firm. These variables have then been used to calculate an index of social capital using principal component analysis.

#### 4. Results

The hypotheses set out in section 2 are tested using five regression models. The estimates are presented in Table 2. The *heritage model* is the first tested, following a stepwise procedure the other explanatory factors (ie agglomeration economies, social capital and competition effects) are included and assessed. The estimates presented in Table 2 report the hazard ratios, which indicate the expected increase (or decrease) of the hazard rate for a change in the explanatory variable: a coefficient higher than 1 means that an increase in the explanatory variable lead to a higher hazard rate, so reducing the probability of survival at time of entry.

Model 1 tests the heritage effects - firm background and time of entry – controlling for locational advantage (captured by the *Location* variables, see Table 2). Findings support hypothesis 2, all three firm background variables negatively impact on the hazard rate (the coefficients are lower than 1 and highly significant as compared to the excluded variable, which is *inexperienced firm*). In relative terms, being an experienced firm reduces the hazard rate by a percentage slightly higher (60% reduction of the hazard rate) than a spinoff (approximately a 57% reduction) and substantially higher than an experienced entrepreneur (47% reduction). These latter findings support hypothesis 3, while hypothesis 1 is not confirmed, as the category having the highest survival rate is *experienced firm*; however, it is worth stressing that the coefficients of the variables *spinoff* and *experienced firm* are almost equal.

Differently from the *heritage theory* prediction, hypothesis 6 is not confirmed: early entrants do not perform better than newcomers; actually, our findings suggests the opposite, the last cohort of entrants (1935-1980), which is the excluded category in this model, is the only one showing a positive effect on the survival rate: being in the first cohort (1874-1922) increases the hazard rate by 95% and in cohort 2 (1923-1934) by 134%.

Table 2. Estimates of the survival models (standard errors in parentheses)

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Firm background</i>					
Spinoff	0.432*** (0.059)	0.458*** (0.078)	0.426*** (0.059)	0.426*** (0.059)	0.873 (0.278)
Experienced firm	0.399*** (0.049)	0.425*** (0.095)	0.404*** (0.050)	0.404*** (0.050)	1.108 (0.226)
Experienced entrepreneur	0.527*** (0.057)	0.531*** (0.057)	0.547*** (0.060)	0.547*** (0.060)	1.076 (0.188)
Parent duration		0.997 (0.005)			
Relatedness exp. Firm		0.924 (0.233)			
<i>Time of entry</i>					
Cohort 1 (1874-1922)	1.950*** (0.204)	1.931*** (0.205)	1.717*** (0.259)	1.603*** (0.267)	
Cohort 2 (1923-1934)	2.338*** (0.246)	2.285*** (0.244)	1.632*** (0.249)	1.476** (0.235)	
<i>Location</i>					
Emilia Romagna area	1.274 (0.223)				
Bologna Modena area	0.597** (0.125)	0.740** (0.107)	0.656* (0.146)	0.611** (0.134)	0.842 (0.299)
Lombardia area	1.011 (0.086)				
<i>Agglomeration effects</i>					
Employment industry			1.006 (0.010)	1.000 (0.010)	1.165*** (0.024)
Population level			1.000** (0.000)	1.000 (0.000)	0.999*** (0.000)
Competition			1.010*** (0.003)	1.013*** (0.003)	1.064*** (0.010)
Employment industry*Emilia Romagna area			0.933** (0.027)	0.958 (0.030)	0.444*** (0.059)
Population level*Emilia Romagna area			1.001*** (0.001)	1.000 (0.001)	1.006*** (0.001)
Competition*Emilia Romagna area			0.985 (0.022)	1.013 (0.024)	1.068 (0.060)
<i>Social capital effects</i>					
Social capital				0.954 (0.033)	0.835*** (0.036)
Social capital*Emilia Romagna area				1.572*** (0.213)	1.813 (1.201)
Observations	N=739	N=739	N=739	N=739	N=258

\*Significant at the 0.10 level \*\*Significant at the 0.05 level \*\*\*Significant at the 0.01 level

As far as the cluster effect is concerned, it can be observed that both variables *Lombardia area* and *Emilia Romagna area* are not significant, suggesting that agglomeration economies are very sensitive to the geographical scale, so cannot be detected in relatively large regions. In fact, the variable identifying the province of Bologna and Modena, approximately overlapping with the “Motor Valley” cluster, is significant and reduces the hazard rate of about 40%; it is interesting to notice that such variable remains significant across all specifications (but in model 5).

In Model 2 the *Parent duration* and *Relatedness of experienced firm* variables are included in the model. The coefficients are in the right direction, but not significant, so we cannot support hypotheses 3a and 4. Accordingly, these variables are dropped from the subsequent specifications.

Model 3 and 4 test the impact of agglomeration economies, density and social capital. Some of these variables have been interacted with the variable *Emilia Romagna area*<sup>4</sup>.

Model 3 suggests that agglomeration effects are present only for firms located in Emilia Romagna. In particular localization economies, proxied by the variable *Employment industry*, are significant in the region but not outside, where they have a positive effect on the survival rate consisting in a decrease in the hazard rate of about 7%. Similarly, urbanization economies (i.e. *Population level*) are significant when interacted with the regional variable. Both hypotheses 8 and 9 are confirmed.

Consistent with the prediction of hypothesis 12, competition is significant and has a negative impact on the survival rate. However, interesting to notice that this finding is not confirmed inside the cluster, being the coefficient for the interaction variable *Competition\*Emilia Romagna area* not significant and of opposite sign.

Model 4 includes the variable *social capital*, also interacted with the regional variable *Emilia Romagna area*. Our findings do not support hypothesis 14. The coefficient of the interacted variable is highly significant, but with the wrong sign, indicating that higher social capital in the region entails a 57% increase in the hazard rate. The *social capital* variable alone has the expected sign, but it is not significant. It is interesting also to remark that after the introduction of the social capital variable

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<sup>4</sup> The variable *Emilia Romagna area* is used instead of *Bologna-Modena area*, since the latter generates very few value and data about agglomeration economies and social capital are at a regional level.

the measures of location and urbanization economies inside the region are no longer significant, suggesting that the social capital effect is much stronger.

Model 5 focuses only on the early entrants, and treats all the firms founded after 1922 as right censored cases; in such a way, the model control for time effects, and tests if the effect of the explanatory variables changes along the industry life cycle. Our findings show that all background variables have no impact on survival. As expected, the heritage effects become economically significant after the take-off of the industry. The cluster variable is also not significant, probably because the Motor Valley district started its process of agglomeration later on, after the first half of the century. Hence, hypothesis 5 is confirmed.

Contrary to the predictions of hypothesis 10, localization economies have greater influence on the survival rate during the emergence of the industry. The variable *Employment industry* in model 5 becomes significant and has a negative effect on the survival rate, reducing it of about 16%. The interaction variable *Employment industry\*Emilia Romagna area* stays significant and has a greater and still negative effect on the hazard rate, reducing it of almost 60%.

Hypothesis 11 is confirmed only when considering the whole population of firms; in this case, urbanization economies are significant in the early phases of the industry and have a negative effect on the hazard rate, though small in size (0.1%). In the Emilia Romagna region instead an higher population level implies an increase of 0.6% in the hazard rate.

The competition effect stays the same as in previous models when not interacted (significant and with positive effect on the hazard rate), and not significant in the Emilia Romagna region. However, competition increases the hazard rate slightly more at the beginning on the industry that at later stages, and in the Emilia Romagna region, albeit not being significant, positively impact on the hazard rate in beginning of the industry. Though these latter findings cannot provide a sheer confirmation of hypothesis 13, they suggest a trend towards such direction.

The effect of social capital is significant and with the expected sign (decrease of the hazard of about 16%). However, it is not significant in the region. These findings weakly support hypothesis 15, predicting a lower role of social in the emergence of the industry.

## 5. Discussion and preliminary conclusion

This study investigates the evolution and spatial dynamics of the motorbike industry in Italy since its infancy till 1980. The findings show that the spatial concentration of the industry is driven by different mechanisms, which can be ascribed to both the *heritage theory* by Klepper and the traditional agglomeration theories. Therefore, a general conclusion is that the *heritage theory* is not incompatible with agglomeration, and that industry specificity does play an important role in explaining the spatial dynamics of industries.

Nevertheless, our preliminary findings also show some remarkable differences from both approaches.

As to begin with, spinoffs do not perform better than other background firms at any time. In the Italian motorbike industry experienced firms perform slightly better than spinoffs. The difference between the two is rather small, so it can be argued that the evolutionary argument of routine inheritance still holds, though it also indicates that routines needed to start up a new venture are not necessarily industry specific. This latter argument seems to find additional confirmation by the second remarkable difference from the standard predictions of the Klepper model: the transmission of routines from parent to spin off. Our findings show that more successful parents do not necessarily span out better spin off.

The third difference from the Klepper model concerns the time of entry. Findings show that early entrance does not bring any advantage to firms. Though surprising, this latter outcome finds a theoretical justification in the literature. First, it can be argued that latecomers do not carry the weight of previous investment in outdated technologies, so for them it is easier to jump on new breakthrough when windows of opportunity open up (Perez and Soete, 1988). Latecomers can also free ride on incumbents and imitate at lower costs their technologies (Mitchell, 1991; Bryman, 1997). Second, it has been shown that survival rates are also high for late entrants when the industry is in the mature phase, because it is less crowded and relatively less competition is present than in the early phase of the industry (Agarwal, 1997).

As far as locational factors are concerned, this study shows that being in a cluster does affect the performance of firms, after controlling for heritage effects. The variable capturing the cluster effect, i.e. *Bologna-Modena area*, is always significant, also when agglomeration effects are included. Moreover, to further check the importance of localisation, an interaction variable *Bologna-Modena area \*spinoff* (not included in the models reported in Table 2) was included in the different specifications of the model. Contrary to Klepper (2007), that tested the same effect for Detroit, this

interaction is not significant, while the *Bologna-Modena area* is still significant. This latter finding clearly indicates that there is an important cluster effect, which goes beyond pecuniary externalities and may refer to the presence of important knowledge spillovers in the Motor Valley.

As far as other *location* factors are concerned, interesting to note that competition does not play a role in the Emilia Romagna region, suggesting that the presence of strong institutions, which regulate local markets (in particular the labour market) can reduce sensibly the competition effect.

The result of social capital in the region is negative, which is apparently counterintuitive. However, the role of strong cohesive networks and overembeddedness can indeed result in lower performance.

To conclude, our findings, though very preliminary, indicate that the heritage model can be reconciled with traditional agglomeration arguments in order to account for industry specificity and institutional factors. However, this empirical investigation needs additional robustness checks and present several limitations. First, the analysis is constrained by the availability of data. For example, additional performance measures - next to the firm survival – cannot be included in the analysis. Second, the variable *inexperienced firm* is a residual category in which there is a lot of heterogeneity, which may shadow important heritage dynamics. Last but not least, additional and more refined data on industrial relatedness are needed at regional or cluster level.

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