Survival of the fittest?

Research into the effect of the product strategy in the survival duration of motorcycle manufacturers in the downfall of the industry

Research master thesis

Human Geography

Lourens Pel

Utrecht University

6189652

Universiteit Utrecht

Colophon

Survival of the fittest?

Research into the effect of product strategy on the survival duration of motorcycle manufacturers in the downfall of the industry.

Version:	Final
Date:	12-07-2019
Institution:	Universiteit Utrecht
Master:	Human Geography
Faculty:	Geosciences
Track:	Business & Location
Author:	L.D. Pel
Student number:	6189652
Student email:	l.d.pel@students.uu.nl
	lourenspel@gmail.com
Supervisor:	dr. Andrea Morrison

Original cover picture by Mike McQuade (2018)

Preface

This thesis is the final result of a year of hard work for the master Human Geography. The process of writing the thesis was interesting throughout with the implementation of aspects from a wide variety of scientific fields such as Economics, Management and Econometrics. I learned a lot during this period, not only about my thesis subject but also about methodological choices and the implementation of Survival analysis in the case of industrial evolution. A special thanks to my supervisor dr. Andrea Morrison who provided me with great and inspiring feedback throughout this process. The original suggestions helped getting a broader view of the subject to analyse it from different perspectives. Also, a special thanks to dr. Pierre-Alexandre Balland for the suggestions during the midterm presentations.

Enjoy reading,

Lourens Pel
12-07-2019

Abstract

The motorcycle industry is an interesting topic to research the survival of manufacturers. Throughout the history of the industry, the Industry Life Cycle depicted by Klepper (1997) could be observed with several decline phases. The decline phase between 1950 and 1980, in comparison to other declines of the industry, is particularly interesting since it was enforced by differences in product strategy rather than external shocks, such as the World Wars. Yet, even though the product strategy has been stated to be an explanatory part of firm survival in this specific phase, very little research has been carried out to examine the variables on the product level.

This research therefore built further on existing theories regarding the survival of manufacturers with the inclusion of several product level variables as proxies for the coinciding strategies. Three case counties were selected, which all played a vital role in the industry at some point in time. The manufacturers which were active in the period between 1950 and 1980 have been analysed on four different levels: Country, Cluster, Manufacturer and Product in order to find the effect on the dependent variable Age, with the use of a Cox Regression Analysis.

The results partially support the main existing theories regarding the cluster effect, the heritage model and the time of entrance in an industry, yet with notable differences between the separate case countries. The results on the product level also show that product variety helped in manufacturer survival and the focus on low-complexity products increases the hazard rate, contrary to the current literature.

Keywords: Economic Geography, Manufacturer Survival, Kaplan Meier, Cox Hazard Model, Management Theory, Product Strategy.

Table of contents

Colophon **1**

Preface **2**

Abstract **3**

1. Introduction **5**

1.1 Scientific relevance 7

1.2 Societal relevance 9

1.3 Thesis outline 9

2. Theoretical overview **10**

2.1 The industry life cycle 10

2.2 The role of agglomeration economies and clusters 11

2.2.1 The motorcycle clusters in Great Britain 15

2.2.1 The motorcycle cluster in Germany 16

2.2.1 The motorcycle clusters in Italy 17

2.3 Flexible specialization 18

2.3 Related Variety 18

2.4 Product innovation in relation to the industry 19

2.5 Background of the firm 20

2.6 Strategies of manufacturers 21

2.7 Conceptual model 23

3. Methods **26**

3.1 Gathering data 26

3.1.1 The sample 27

3.2 Variables and operationalization 28

3.2.1 The dependent variable 28

3.2.2 Independent variables 29

3.3 Descriptive statistics 34

3.4 Model assumptions 42

4. Results **44**

4.1 Differences among case countries 47

4.2 Synthesis 50

5. Conclusion and discussion **51**

7. Reference list **53**

1. Introduction

The motorcycle industry in Europe is thriving nowadays. The European sales of motorcycles have increased during 2017 and 2018. 1.004.063 motorcycles have been registered in 2018 in Europe which is an increase of 9.9% compared to 2017. The sales increases in Europe have been a continuous trend since 2013 according to Antonio Perlot, director of the motorcycle association ACEM (Nieuwsmotor, 2018) and are expected to increase further in 2019. The largest share of the motorcycles which are sold are produced by a selective group of manufacturers namely BMW, Yamaha, Kawasaki and Honda. The dominance of this relatively small group of manufacturers is interesting since BMW, for example, once had over 180 competitors (Wezel, 2005). The established manufacturers somehow managed to survive multiple shocks over time, while the industry itself almost vanished in Europe.

The motorcycle industry started growing rapidly from the early 20th century onwards due to simplification of the production process, but was heavily impacted by external shocks such as the First World War, the Great Depression and eventually the Second World War. In particular the Great Depression led to the disappearance of a large number of motorcycle manufacturers. The majority of the manufacturers in the beginning of the 20th century were smaller family shops, which were not able to survive the high frequency and impact of the industrial shocks (Wilson, 1995).

However, more interesting were the events after the Second World War which took place between 1950 and 1980. A major turning point for the European motorcycle industry, and ultimately the motorcycle industry overseas, was the entry of Asian manufacturers in the 1960s. The first line of products of Asian manufacturers were relatively low quality. The Japanese economy had to recover from the war until 1955. The Asian industry was characterized by imitation products with limited focus on quality improvement, which changed after the economic recovery. As a result, products became technologically comparable to the western standard, yet for a lower cost (Yamamura et. al, 2005). The price-based competition almost let to the disappearance of the European motorcycle industry. In particular the established companies struggled due to high fixed costs. The global market opened up for Asian manufacturers which claimed nearly half of the global market share in 1980 (Cenzatti, 1990).

Whilst the British industry was severely impacted by the Japanese opposition due to inadequate investments in improved products and production facilities, the impact for the Italian industry was partially prevented by import tariffs to protect the national manufacturers (Wilson, 1995). The entry of Asian manufacturers in the 60s seem to have caused the crisis of the European motorcycle industry, yet Cenzatti (1990) argues that the successful entry was a result of the crisis.

The earliest signs of a potential crisis in Europe surfaced well before the appearance of Asian manufacturers. The Italian industry suddenly shifted towards mopeds and lightweight motorcycles and the European import numbers in the United Kingdom increased up to three times the export number in 1960. Thus, the motorcycle crisis in Europe seemed to be a starting point for the Asian manufacturers, rather than the contrary (Cenzatti, 1990).

The shift in consumer usage of the motorcycle has been closely linked to the crisis of the motorcycle industry (Cenzatti, 1990; Wezel, 2005). Automobiles were regarded as a safer, weatherproof first mean of transport, whilst the motorcycle became a leisure product (Wezel and Lomi, 2009). The automobile industry has been restructured multiple times which facilitated an efficient production line, lowering production costs. The decreasing consumer price of automobiles paired with economic recovery resulted in growth of the automobile industry at the cost of the motorcycle industry. The motorcycle industry was not able to match the productivity gains of its competitor in time (Cenzatti, 1990).

Moreover, the decline of larger capacity motorcycle sales was a consequence of the rise of the scooter. Scooters were appealing for people who could not afford an automobile or did not hold a driver's license. The scooter became a second mean of transport, in particularly in heavily congested areas (Cenzatti, 1990). The Italian motorcycle industry was able to tap into this market quickly which started the scooter boom led by Lambretta and Vespa. Manufacturers in the United Kingdom retained their focus on larger capacity motorcycles (Wilson, 1995).

The Asian market condition was contrary with a growing demand for motorcycles. The large market ultimately enabled Asian manufacturers to form a basis to reach out for the western market, strengthening their global market position (Wilson, 1995).

Conclusively, the previously mentioned events established a noticeable difference in market evolution between the European countries. This begs the question if the differences in national market evolution is solely affected by the role of geography or has a deeper underlying cause. For instance, the main reoccurring theme in all of the shocks seem to be product related: the European products were either too expensive or lacked technological sophistication and the consumer demand towards low capacity was not met or too late. This study therefore aims to find the importance of product strategy in the survival of motorcycle manufacturers, which leads to the following main research question:

What was the effect of the product strategy on the survival of motorcycle manufacturers in Germany, Great Britain and Italy between 1950 and 1980?

Although the research question itself primarily focusses on the product strategy of manufacturers, ‘the role’ or effect is compared to the national, regional and firm characteristics, further explained in chapter 3.

The main research question is disaggregated into five sub-questions:

1. What is the general pattern of firm survival in the evolution of an industry?
2. To which extent does this pattern match or differ from the motorcycle industry?
3. What is the role of geography in the firm survival within an industry?
4. What is the role of the firm characteristic in the survival within an industry?
5. What are the differences in product strategy between motorcycle manufacturers?

The first two questions serve as a basis of general understanding of the larger industry dynamics and the survival of manufacturers. The effect of geography and firm characteristics are important since these variables will be compared to the effect of the product strategy. The fifth research question is used to form measurable variables out of the theoretical findings of the product strategy. All of these questions will be answered in the theoretical part and serve as a basis for both the decisions in data gathering and the eventual analysis. The findings from the theoretical framework will be compared to the empirical results of the survival analysis.

1.1 Scientific relevance

There is a great interest in the subject of industrial development since the work of Gort and Klepper (1982). The coinciding theories of Klepper have been revisited multiple times focussed on different industries such as the US automobile industry (Boschma, 2007; Klepper, 2007; Von Rhein, 2008) and the motorcycle industry (Morrison and Boschma, 2017). The application of the survival analysis in this matter has been carried out extensively which touches upon different factors affecting survival duration such as the effect of spin-offs and cluster effects (Morrison and Boschma, 2017), financial characteristics of manufacturers such as turnover or the debt-equity ratio (Lobos and Szewcyk, 2012) and characteristics such as entry size (Audretsch, 1991).

However, the theoretical gap in this case is the product strategy of firms (Muffato and Panizzolo, 1996) which has been scarcely touched upon in order to research survival of firms. Since the product line and strategy of Asian manufacturers caused such a disruption of the market (Cenzatti, 1990; Wilson, 1995,), it is interesting to investigate the reaction of European manufacturers or lack off. The addition of the manufacturer’s characteristics on a national level, regional level and manufacturer level (Klepper, 2007; Morrison and Boschma, 2017) also provides an insight in the isolated role of the product strategy in the survival.

Another aspect of the theoretical gap lays within the case selection. A large share of researches focussing on the industrial evolution with the addition of the survival method, tend to examine only one case country. However, since the heterogeneity of the industry on a national level is stressed by Wezel and Lomi (2009) and Wilson (1999), it is remarkable that a comparative survival analysis involving multiple European countries has not been carried out yet, in particular for such a volatile industry.

For this reason, this research will focus on 3 countries namely Germany, Great Britain and Italy. Germany and Great Britain are chosen because they once were the leading exporters of motorcycles before the downfall of the industry in Europe after which they both slimmed down drastically. The Italian industry is chosen since it was impacted at a similar scale, yet managed to recover quicker and more frequent (Wezel, 2002). The recovery of the Italian industry may have been a result of the protectionist measures taken by the government in the form of tariffs (Cenzatti, 1990), however, other countries such as France adopted similar policies with differencing outcomes (Wezel, 2002). Thus, the various phases of recovery of the Italian motorcycle industry cannot be pinned down on government interference alone.

The time-perspective in this field of research is of importance as well as mentioned by Muffato and Panizzolo (1996). Previous studies have a broad timeframe, commonly from the first years of the consumer good until the late 90s or 2000s. This research will primarily focus on the period from 1950 until 1980. This specific timeframe is chosen since the research of Wezel (2005) mentioned a second big downfall after the Great Depression at the start of the ’50s in Europe, overall this trend lasted until the ’80s.

This research may ultimately add to the general understanding of the evolutionary dynamics of industries by filling up these theoretical gaps and provide a new perspective on the existing theory of industrial evolution, based on the product strategy.

1.2 Societal relevance

Large industries like the motorcycle industry may play a vital role in the composition of a national and regional economic composition. The eventual downfall of such an industry therefore could have a large impact.

The most common example is the case of Detroit and the dependency on the automobile industry. This automobile cluster was not able to revitalize itself once external shocks hit the automobile industry. The city declined at a rapid pace and is still facing economic problems resulting in vacancy and deterioration. The city ultimately has been declared bankrupt in 2013. Five years after the declaration, the city is recovering but only with the help of federal aid (Lobosco, 2018).

Nonetheless, industrial clusters remain a popular subject in Europe (European Commission, 2017) and are even seen as the engines of innovation in the Netherlands:

"A province without a cluster in this day and age would be unthinkable"

(Platform 31, 2015). The theoretical chapter on the other hand shows that clusters do come with a risk of decline and regeneration is a difficult task.

Thus, this research is of importance since it looks into the factors influencing firm survival on multiple levels including the product level. The motorcycle industry showed that even though clusters failed there are still manufacturers which survived, so the lessons from their product strategy may be of importance for other manufacturers or even industries.

1.3 Thesis outline

This thesis starts with a brief theoretical overview. The topics that will be discussed are sorted from broad theories such as the Industry Life Cycle to detailed theories such as the role of geography and eventually the firm and product level. The following chapter will discuss the used research methods. A lot of considerations for both the data gathering and selection were made, thus, it is important to highlight these specifically. The fourth chapter starts with the descriptive statistics and the model's assumptions, the second part will be the results of the analysis itself. The final two chapters are the conclusions and the discussion parts.

2. Theoretical overview

2.1 The industry life cycle

Klepper introduced the Industry Life Cycle in 1997, which provides a better understanding of the evolution of industries as a whole. The model explains the typical development over time by using the number of firms in an industry as a measurement explained by innovation, entry and exit behaviour. The model heavily relies on the Product Life Cycle since Klepper argues that the industry is dependent on the product it produces, thus the industry itself can be assessed by the product evolution. The Industry Life Cycle consists out of 5 phases (Klepper, 1997).

The first is the introduction stage: it introduces a new product as a result of radical innovation (Neffke et. al, 2008) which buyers are unfamiliar with. Prices are high since there is no scale economy yet. This phase is characterized by low entry and exit rates. (Klepper, 1997)

In the growth stage, demand expands rapidly. Prices fall due to upcoming scale economies and advanced distribution channels are being developed. The number of entrants increases rapidly due to the unexploited innovation opportunities, associated with high profits (Neffke et. al, 2008). Later on, entrants are starting to become a threat to the earlier entries (Klepper, 1997), which could be witnesses in the motorcycle industry the 19th century once engines and parts could be obtained more easily (Wezel, 2005). Younger firms mainly compete on the basis of the characteristics of their product in this phase (Neffke et. al, 2008)

The shakeout stage is the turning point in the industry, resulting in a fall of the number of firms within the industry. There are few first-time buyers and the first price wars result in the bankruptcy of the inefficient companies. A dominant design takes shape, which enables firms to exploit the economy of scale (Neffke et. al, 2008). Regarding the motorcycle industry, the dominant design led to the competition based on lowered production costs instead of technical innovation, resulting in a wave of bankruptcy among manufacturers (Wezel, 2002).

The maturity stage is characterized by market saturation. Demand is now only limited to replacement; therefore, the market growth is either low or zero. Oligopolies form and there is an increasing barrier for new entries. Companies avoid price wars and the total number of firms remains constant. (Klepper, 1997).

The decline stage is the last phase in the cycle. In this phase, the industry experiences decline and international competition and rivalry increases. The number of firms drop at a rapid pace and there is a technological substitution, meaning that there is a need for alternative products (Klepper, 1997). This phase could be witnessed during the rise of the automobile (Cenzatti, 1990).

The depicted phases resemble the motorcycle industry but differ between the backgrounds of the countries, which has been mentioned in the introduction. In practice, the Industry Life Cycle and the description of the industrial phases remain highly stylized and not universal (Neffke et. al, 2008). The general critique on Klepper's model is the overemphasis of the industry structure as a determinant of firm performance and the lack of focus on the role of geography (Broekel, 2018). For example, although the industrial evolution may be observed on a global or European scale, the outcomes differed per country.

Moreover, Klepper also neglects the importance of the time aspect in the Industry Life Cycle. Agerwall et. al (2007) found that the entrance in the maturity stage results into significantly higher mortality rates than the entrants in the growth phase. However, the entrants in the growth face suffer from increased mortality rates once they transition into the maturity phase. Therefore, the newness of firms does not play an important role in the growth phase due to favourable knowledge regimes, however, reinforces once the maturity phase begins (Agerwall et. al, 2007)

2.2 The role of agglomeration economies and clusters

The motorcycle industry in Germany, Great Britain and Italy was characterized by spatial concentrations of manufacturers (Cenzatti, 1990; Wezel, 2005). Boschma and Wenting (2007) argue that such concentrations of firms in a region might bring advantages for the individual firm. They describe two types of agglomeration economies, the Urbanisation and Localisation Economies. The Urbanisation Economies, the MAR Externalities, occur regardless of the industries the concentrated firms belong to, contrary, the Localisation Economies arise due to the concentration of related economic activities. Urbanisation Economies are based on a diverse industry mix which stimulates the recombination of knowledge, the Jacobs externalities (Neffke et. al, 2008). Localisation Economies take form in the so-called Marshallian externalities namely: labour market pooling, the creation of specialized suppliers and the emergence of knowledge spillovers (Frenken et. al, 2005).

The Industry Life Cycle and the importance of timing could also be linked to the separate agglomeration externalities. For instance, the high factor costs associated with urbanization externalities will have a negative impact on matured industries since they compete on price.
On the other hand, the younger firms are less affected by these costs and mainly compete on the characteristics of their product, which are improved by a better access to knowledge. The mature industries benefit particularly from the MAR externalities due to the cost savings (Neffke et. al, 2008)

A cluster is an example of a concentration of firms from the same or related industry located in geographical proximity (Bell, 2005), Porter's description (2000, p.15):

"Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate."

Porter's (2000) definition puts emphasis on collaboration. Accordingly, a cluster is more than a singular industry but also includes suppliers and providers of specialized infrastructure. In the example of a motorcycle cluster, this means that besides the presence of motorcycle manufacturers, tire producers or machinery services are located in proximity, however, it is also possible that educational research organizations are part of a cluster.

Industries located in such clusters experience employment growth and patenting growth (Delgado et. al, 2014) Coinciding, firms within these clusters are generally more innovative since they benefit from agglomeration economies such as a nearby supplier network, thus they are able to directly observe competitors and exploit collective knowledge. The firms located in clusters also have a better access to information and industry-specific knowledge than non-clustered firms (Bell, 2005).

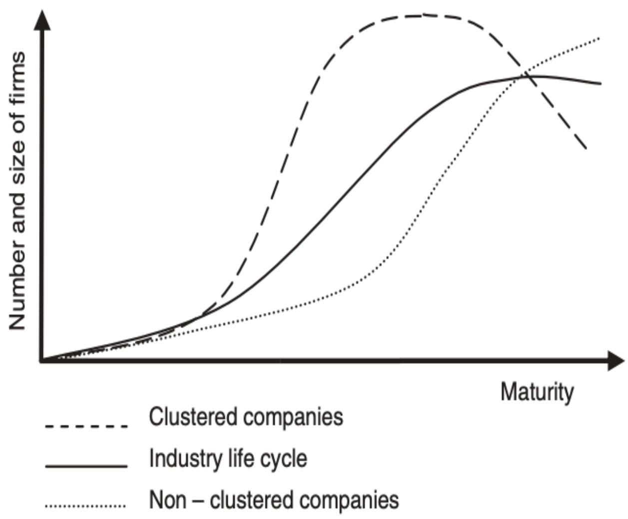

Figure 1: A comparison of clustered and non-clustered companies (Menzel and Fornahl, 2007)

Other benefits consist out of the supply of specialised trained workers and improved infrastructure in the cluster compared to other areas. The close linkages to buyers, suppliers and institutions, affect the competitive advantages through productivity and productivity growth (Porter, 2000). In general, companies within clusters perform better in the beginning in comparison to the non-clustered companies but perform worse near the end of the cycle as can be seen in *Figure 1* (Menzel and Fornahl, 2007).

Porter (2000) stresses that there are four interrelated conditions as sources of locational competitive advantage, namely the Context for Firm Strategy and Rivalry, Demand Conditions, Related and supporting industries and Factor Conditions.

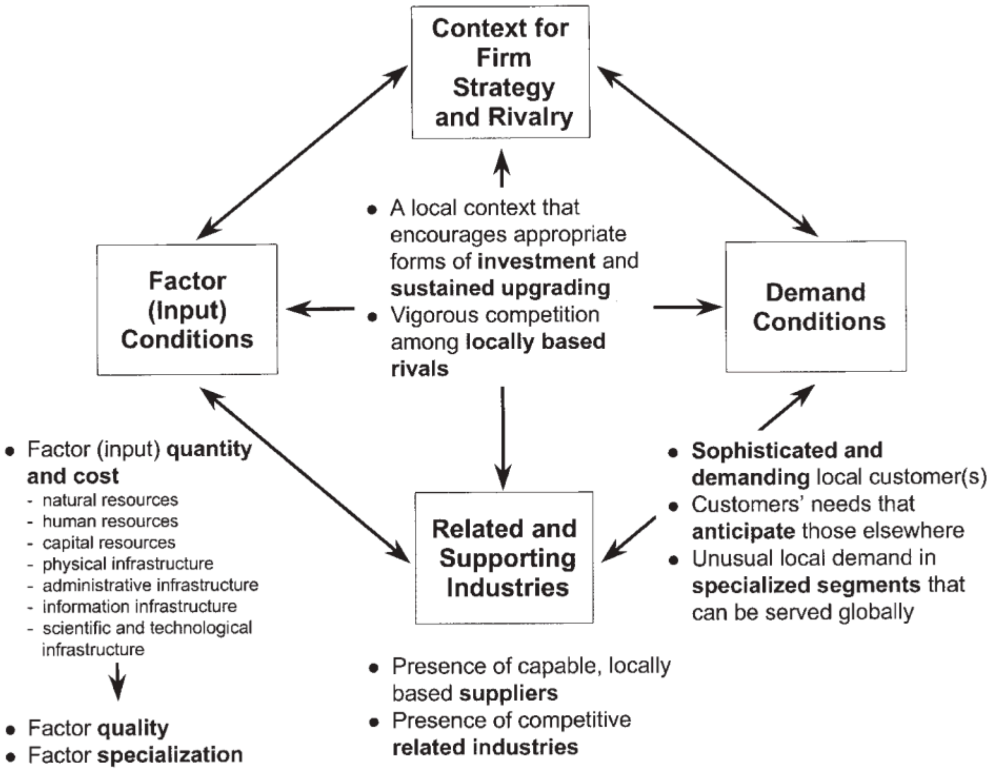

Figure 2: The diamond model of conditions for clusters (Porter, 2000)

Knowledge spillovers, the Marshallian externalities (Frenken et. al, 2005), are an important mechanic behind the growth of clusters. Firms in clusters might benefit from the investments in R&D from others due to their geographical proximity. Krugman (1991) described these knowledge flows as non-exclusive and non-rivalrous.

Audretsch (2017) argues that there are geographical boundaries to knowledge since high context and vague knowledge, such as tacit knowledge, is best-transmitted face-to-face which requires geographical proximity. This is contrary to codified knowledge with a singular meaning, which is easier transmittable. The geographical localization is also mentioned by Jaffe et. al (1993) arguing that, although knowledge spillovers and flows are hard to capture and may seem invisible, they still leave a trace in the form of patents, which are geographically localized. In essence, it is therefore beneficial to locate a firm in a related cluster to capture these localised knowledge spillovers.

The evolution or life cycle of clusters is a complex mechanism. For example, contrary to what may seem logical, the evolution of clusters does not follow the same path as their respective industry. Once an industry has multiple clusters, each of them may have different growth paths (Menzel and Fornahl, 2007). The subject of cluster evolution has been researched extensively by scholars. For instance, Martin and Sunley (2003), depicted an evolutionary path for clusters which was criticized since their cluster life cycle ended with lock-in and decline, excluding the possibility of an eventual regeneration (Menzel and Fornahl, 2007).

Menzel and Fornahl (2007) describe the life cycle of a cluster in a different manner. According to them, there are several ways a cluster might emerge, for instance, due to historical accidents or start-up and spin-off processes. Spin-offs are smaller starting firms which originate from a larger parent firm. Former employees of the parent firm may transfer vital knowledge or routines which helps the firm's performance and survival rate (Klepper, 2007). Klepper (2001) argues that the emergence of a cluster is firm-specific. Larger successful companies pass on their routines onto their spin-offs which, on its turn, grow at a faster pace. Therefore, clusters form in regions where companies are settled with better routines (Menzel and Fornahl, 2007). The emergence phase could end in two ways, it either becomes a growing cluster once the firm's performance succeeds that one of non-clustered ones. Spin-offs are of importance in the first growth period due to the absolute increase of the number of firms, but also by enhancing the collaboration in the cluster. The other emergence path is that the region loses its potential to form a functional cluster because of mass loss due to bankruptcies or relocation of firms.

The second phase is the growth stage characterized by an increase in firms and employment. The growing density of firms and institutions within the boundaries of the cluster also creates possibilities for innovation networks, which form a positive climate for both existing firms and start-ups. The growth stage ends whenever the growth of the cluster adjusts to the average of the industry, although with higher productivity. The main explanation for this stagnation is the decreasing diversity within the cluster due to firm shakeout (Menzel and Fornahl, 2007).

Equilibrium takes place in the sustaining phase of the cluster. There is limited to no growth of firms and employment, nor a remarkable decline, once there is, it remains cyclical. It is predominantly the task of connections outside the cluster to obtain new knowledge and maintain the established networks, to ultimately prevent a lock-in. Once the lock-in sets in, it follows the life cycle towards the decline phase. Another possibility is that the cluster manages to take a step back through the regeneration of heterogeneity and revert back into the growth stage. Regeneration via this route is in practice only achieved after a big crisis, thus still after a decline phase (Menzel and Fornahl, 2007).

The decline phase itself is characterized by a decrease in the number of employees and firms. The lock-in is not only because of the exhausted regional trajectory, but also due to the existing closed and homogeneous networks. Therefore, the cluster loses its ability to diversify or adapt to changing conditions. After the decline stage, there are three possible outcomes. The first one describes the eventual end and disappearance of the cluster. The second is the regeneration of new but related technologies from different locations. Finally, the possibility involves a completely new path with a transition to new fields and thus new actors (Menzel and Fornahl, 2007).

2.2.1 The motorcycle clusters in Great Britain

The theories mentioned above are in line with empirical cases such as the formation of the CBW area (Coventry-Birmingham-Wolverhampton). The CBW area had established an ideal setting for the start of a motorcycle industry since 70% of the national cycle industry was concentrated in the Midlands. The eventual boom and interest in cycle production resulted in a shift from seasonal industries, such as gun manufacturers, towards the production of bicycles. The favourable industrial climate enforced once the automobile industry started in the region (Wezel, 2005). The spin-off process was an important factor in the growth of the CBW motorcycle cluster and in particularly in the knowledge transfer process. Family firms would often start multiple spin-offs themselves, such as the Lloyd brothers, which started 5 separate firms in the region (Marr, 2012).

The emergence path is clearly visible in the CBW cluster and coincides with the theory of Menzel and Fornahl (2007) arguing clusters emerge out of a historical accident, in this case, the presence of the cycle industry and the shift from unrelated industries towards cycle production. The growth path is distinguishable and can be described by the theory of Klepper (2001) stressing the role of spin-offs in the growth of the cluster both in firm number and knowledge transfer.

The rapid industrial growth of the West Midlands and the presence of successful manufacturers shaped a preferable climate for relocation and entrance of motorcycle manufacturers. The Greater London area was in some degree comparable to the CBW area in terms of concentration of manufacturers. The main difference in comparison to the West midlands was the poor performance of manufacturers and lower survival rate within the region (Marr, 2012).

However, the sustainment phase did not follow in the CBW cluster as the Cluster Life Cycle prescribes. In this case the Cluster Life Cycle of the CBW cluster followed the same route as the general motorcycle Industry Life Cycle. Due to the changing consumers demand combined with the Great Depression, the CBW cluster transitioned directly into the decline phase. Contrary to the theory of Menzel and Fornahl (2007), the cluster did follow the same path as the respective industry in this instance. A similar event could be observed after the Second World War. Instead of the previously mentioned decline, this period restored the growth of the motorcycle industry itself including its related clusters. Motorcycle production was relatively stable during the war since many motorcycle manufacturers produced technical equipment for the military. Afterwards, it was generally simple to shift back to manufacturing consumer products, contrary to the transition of the automobile industry which took longer and needed more investments. Combined with the lower wages directly after the war, it created an ideal market for the motorcycle industry (Cenzatti, 1990). The growth of the cluster in the '50s therefore was not specifically down to the renewal or transformation of the cluster itself, but rather that of the industry.

The rebirth of the automobile industry several years later partially explains the second decline phase, yet it is also due to a certain kind of lock-in. Consumer demand in Europe changed rapidly to lower capacity motorcycles. The established manufacturers in the CBW agglomeration did not actively transition towards mopeds and smaller capacity motorcycles. A lack of flexibility or adaptability may have obstructed the CBW cluster to shift back into the growth stage. However, even though start-ups in the Greater London region did tap into the new moped market, the results were still poor (Marr, 2012), thus the transition towards mopeds alone was not a guarantee for survival.

The differences between the CBW agglomeration and the Greater London Area became more apparent after the 1950's. Manufacturers started to disappear in a rapid pace, beginning in the non-clustered areas and quickly also in the Greater London Area. This process took 20 years before it eventually hit the CBW agglomeration in 1970 (Marr, 2012).

2.2.1 The motorcycle cluster in Germany

In comparison to Great Britain, very little research has been carried out to investigate German motorcycle clusters. The city of Bielefeld in the Bundesland Nordrhein-Westfalen is only mentioned by Brenner (2006) as a motorcycle cluster. Bielefeld has always been the biggest machine making city in Germany, partially due to the railway connection to Köln, which provided low-cost coal. The transition towards mechanical production opened up a new market for steel machining and thus bicycle manufacturing. Bielefeld quickly became the leading bicycle manufacturing city of Germany. Just as in the West Midlands in Great Britain, this industrial background, and in particularly in bicycle manufacturing, provided a solid basis for the motorcycle industry (Bielefeld, 2019).

2.2.1 The motorcycle clusters in Italy

The spatial distribution of the Italian motorcycle manufacturers changed over time. In the earlier phase of the industry, production was primarily concentrated around the north-west region of Italy in the industrial triangle of Milan, Turin and Genoa. These regions had the same characteristics which made the CBW cluster a success such as the early presence of the cycle industry and manufacturers familiar with steel products. Over time, the entrants dispersed around the central region of Italy and began to concentrate around Bologna (Cenzatti, 1990). Eventually, this saw the beginning of the Motor Valley cluster in the Emilia Romagna region (Morrison, 2017).

The industrial triangle is a clear example of the Cluster Life Cycle. It follows the same path in all phases as the CBW cluster in Great Britain until the decline phase. The Industrial Triangle managed to successfully renew the cluster by integrating new actors and producers to enhance growth and heterogeneity, mainly the moped mass producers (Cenzatti, 1990). The Motor Valley emerged out of different reasons.

Technological changes made it possible to decentralize the production processes in the motorcycle industry. The smaller suppliers of, for example, motorcycle frames would locate in Bologna or Padua because of the lower labour costs and more flexible workforce. In particular the flexible workforce was of importance for these smaller manufacturers since it would enable them to increase or decrease labour without conflict with unions. Craft-oriented motorcycle manufacturers located increasingly in the motor valley due to the spatial proximity to part suppliers. The cluster itself differentiated from the older Industrial Triangle since it had a stronger focus on the social characteristics of the area and the collaboration between suppliers and small firms (Cenzatti, 1990).

Although the external shocks had an effect on both of the clusters, the eventual outcomes differed. Arguably, the Menzel and Fornahl (2007) theory, stating that the Life Cycle of clusters is not linked to the industry per se, could be debunked in the case of the CBW. The Italian examples showed the opposite, manufacturers and clusters needed to follow the industrial trend towards heterogeneity in the form of low capacity motorcycles or craft-motorcycles, in order to survive. The role of flexibility and related variety in the case of Italy was essential and should therefore be highlighted.

2.3 Flexible specialization

The motorcycle industry, particularly in the Motor Valley, could be characterised by flexible specialization, which is an alternative to mass production and enables manufacturers to respond quickly to changes in the market and consumer demand. Within the motorcycle industry, multiple diversification opportunities remained unexploited for a long period of time, such as the motocross (Cenzatti, 1990). On the one hand, there was a larger transition from big capacity motorcycles towards mopeds in the industrial triangle. On the other hand, there was a flexible specialization towards craft-motorcycles which enhanced growth in the Motor Valley even though these manufacturers were generally smaller in size (Cenzatti, 1990).

2.3 Related Variety

There is a long-lasting debate whether specialization or diversity in economic activity is more beneficial. Frenken et. al (2007) linked the theory of related variety to economic growth by conceptualising it using the portfolio theory. The core concept is that variety reduces risks of high losses, but on the other hand also the probability of high profits. The portfolio effect is linked to the matter in which the individual products are correlated. For instance, a motorcycle manufacturer which diversifies its racing line with different engines and so forth, will still be affected once the racing category in its entirety falls into decline, despite the differentiation of the individual products.

Contrary, manufacturers which diversify their portfolio with uncorrelated activities reduce risks since the downfall of one product automatically means the rise of another. Car manufacturers which diversified into motorcycle manufacturers could therefore reduce risks since the fall of motorcycle sector almost directly leads to the growth of the automobile sector and vice versa.

The same theory applies on a regional scale with firm diversification. Related variety in this sense enable regions to tap into new markets. Yet the question arises why particular regions succeed into diversifying and others lock-in. The basis of related variety of regions lies within the ability of regions to recombine pre-existing capabilities, thus is path-dependent (Boschma et. al, 2017). Related variety has an overall positive effect on regions since it promotes the innovative output (Audretsch, 1999) and enhances employment growth (Frenken et. al, 2007).

2.4 Product innovation in relation to the industry

As mentioned earlier, clusters are favourable to locate in because of the knowledge spillovers and other advantages which might lead to product innovation. The motorcycle itself underwent a lot of changes throughout its history, which is an important factor since technological innovations can be seen as a key determinant of industrial evolution, which on its turn may change the organizational structure of the industry (Wezel, 2009).

There are two main lines of thoughts on how technology affects the industry. The first mentions that size, resources and experiences are giving the incumbents a competitive advantage that new and smaller rivals are not able to compete with. Incumbents will use their extensive resources to innovate and thus compete with new entrants (Wezel, 2009).

Contrary, the second line mentions that established firms are more vulnerable to new and innovative rivals with their 'creative destruction' as depicted by Schumpeter (1975). The accumulated competitive advantages from incumbents will slowly decrease over time and redirect to the new rivals.

Wezel (2009) builds further on the basis of the model of Tushman and Anderson (1986) which is important to highlight. It stresses the differences between two types of innovation namely competence destroying and competence enhancing. Competence destroying innovation creates a completely new product, as in this research an automobile, which changes the primary function and usage of a motorcycle. Yet it could also replace the existing product in a subtle manner, corresponding to the historical transition from a steam engine to a gasoline engine. This particular type of innovation leads to a higher entry-to-exit ratio within the industry.

On the other hand, there is competence enhancing innovation, which is particularly focussed on price-quality improvements, or enhancing the performance of the existing product. This way it still utilizes the knowledge acquired during the previous product line. The incumbent organizations are more likely to develop this kind of innovation to strengthen their competitive advantages and market share.

Empirical evidence suggests that new entrants tend to outperform the incumbents since they heavily rely on radical innovation (competence destroying) and are less constrained by their organizational routines. Yet at the same time, there is also evidence that in the long term, the incumbents have a better survival rate due to the innovations, which have been introduced by the new entrants. Besides, incumbents are more likely to implement competence enhancing innovation in their production line. This way it seems that there is a complex relationship between incumbents, new entrants and the innovation rate within the industry (Wezel, 2009).

2.5 Background of the firm

Since Klepper (1997) only takes the industry structure for granted in the firm's survival, it is also important to examine the characteristics at the firm level. The background of a firm is an important factor in the survival rate within an industry. The background of the firm is a broad subject and has been researched extensively.

As been mentioned before, Audretsch (1991) found that the entry size of firms mattered and smaller companies have lower odds of surviving, however, this depends on the industry and time of entry (Audretsch, 2017). The age of a firm is of importance as well in the firm dynamics. The probability of firm failure, growth and variability all decrease as firm age increases (Evans, 1987). Therefore, older firms have a higher probability of succeeding than the younger ones (Stearns et. al, 1995). The relationship between age and the other factors which influences firm survival, change corresponding with the age of the firm, which holds a complex relation. Overall, the geographic and industry-specific factors have a larger impact on start-ups in comparison to incumbents. On the other hand, the advantages that come with the firm's experience seem to diminish over time (Baldwin et. al, 2000).

Klepper (2007) categorized firms depending on their background using the heritage model in the research on the US automotive industry. Klepper's first step was to identify the firms which diversified in the automobile from other industries. The problem arose that firms which may seem diversifiers on first sight were actually incumbents in a related industry but sold the firm before starting a new automotive firm. These firms were labelled as related entrepreneurs to capture the existing related background. The other category was the diversifier which were existing firms from an unrelated industry which shifted towards the production of automobiles.

The step towards diversification of the portfolio is a path dependent process compromising out of accumulated knowledge production and innovation. In general, firms develop new activities based on their existing expertise (Morrison and Boschma, 2017).

The remaining firms which could not be classified were marked as inexperienced. Klepper eventually found that experienced entrepreneurs, diversifiers and spin-offs had a lower hazard rate than the inexperienced firms (Klepper, 2007).

The survival chances of spin-offs are improved by the post-entry knowledge (routines), which they inherit from their parent firms. In contrast, the innovative knowledge has no influence on the hazard rate, which would indicate that successful parents pass on efficient routines to their spin-offs. The same routines which impact the survival of the parents affect the survival of the spin-off as well (Von Rhein, 2008).

Klepper's theory was confirmed in the research of Morrison and Boschma (2017), but there was also evidence of the Marshall theory. Being either a spin-off, experienced entrepreneur or diversifier had a positive effect on survival, however, the location inside a cluster had a positive effect as well, which could not be found outside the region.

However, experience could also be firm specific in the case of re-entries. Multiple motorcycle manufacturers which closed after a severe shock tried to re-enter the market in a later stage. The manufacturer remains to do business under the same name and often utilizing the same assets. Metzger (2006) found that entrepreneurs benefit from the human capital theory, in this matter previous managerial experience. However, this effect is outweighed if the previous firm has failed, leading to a negative exit. The re-entries also perform worse in terms of employment growth than experienced entrepreneurs.

2.6 Strategies of manufacturers

A subject which has been neglected in a large share of the firm survival studies is the individual product strategy of firms, even though the role of the product in the survival of firms is stressed by Agarwal and Gort (2002). Muffato and Panizzolo (1996) made a clear distinction between the different strategies of motorcycle manufacturers based on multiple key characteristics.

The engine capacity is a clear indicator of, not only the complexity of the engine itself, but also the motorcycle as a whole. The share of high capacity models within a model range therefore provides a clear overview of the focus on innovation of a manufacturer (Muffato and Panizzolo, 1996). The complexity of the products has a general negative impact on the firm survival (Agerwall, 1998), which is particularly affecting smaller firms. The evolution of this effect is a complex system which is altered by the product itself, the size of the firm and the age.

Scooters, on the other hand, are generally produced in higher volumes and are therefore more likely to be linked to the characteristics of a mass producer. In first instance, the technological sophistication in terms of performance are an important variable in product development. Moreover, the design and appearance of motorcycles became increasingly important, particularly in the case of scooters (Muffato and Panizzolo, 1996).

Given the previous variables, Muffato and Panizzolo (1996) categorized manufacturers in three classes namely Volume Producers, Specialists and Niche Specialists. The Volume Producers are characterized by the large number of products they launch and the scale on which they operate. In general, the focus is on low capacity models since they are less complex to produce which enables a sped-up production process. The Specialists produce a smaller number of products in absolute numbers and have a smaller product line. The products are more expensive and focus on the high capacity range. The Niche specialists are a mixture between the first two categories. They focus on medium-low capacities with higher prices and a focus on the sport category.

Product variety is an important factor to provide better understanding of the competition within the industry. The product variety contains strategic choices in the number of separate products differing engine wise, fairing or aesthetics. Italian firms, for example, are expanding their basic range more frequent whereas Japanese firms are maintaining their basic range (Muffato and Panizzolo, 1996). However, variety inside an industry also reduces potential firm risks as mentioned earlier by Frenken et. al (2007) and expanding in different product categories is tested to be beneficial to firm performances (Cotrell and Nault, 2004).

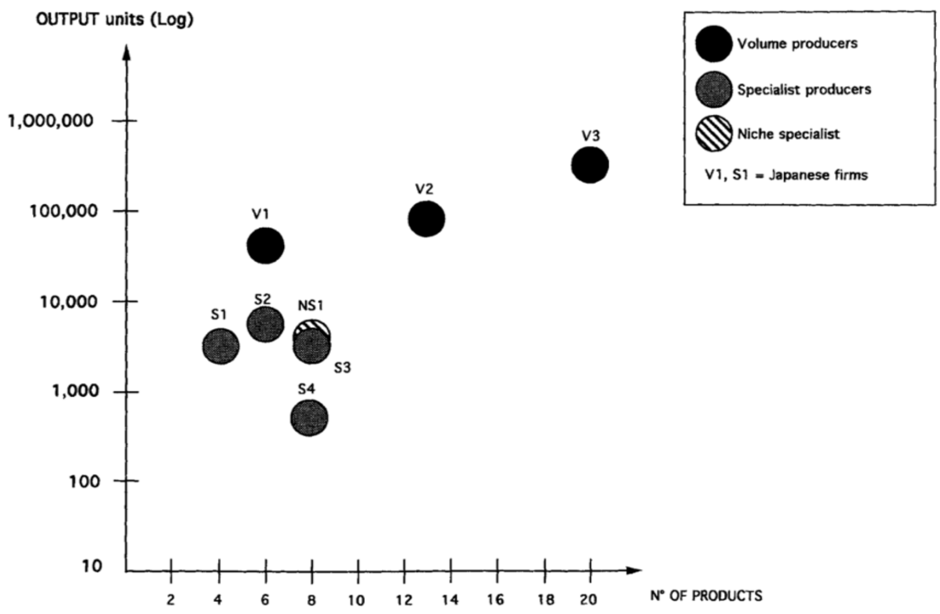

Figure 3: The relationship between the output in total units and the number of products, or in other words, range of the product line. (Muffato and Panizzolo, 1996).

2.7 Conceptual model

The theoretical chapter is summarized in the conceptual model below. As can be seen, the model itself contains a multitude of interconnected terms which need further explanation.

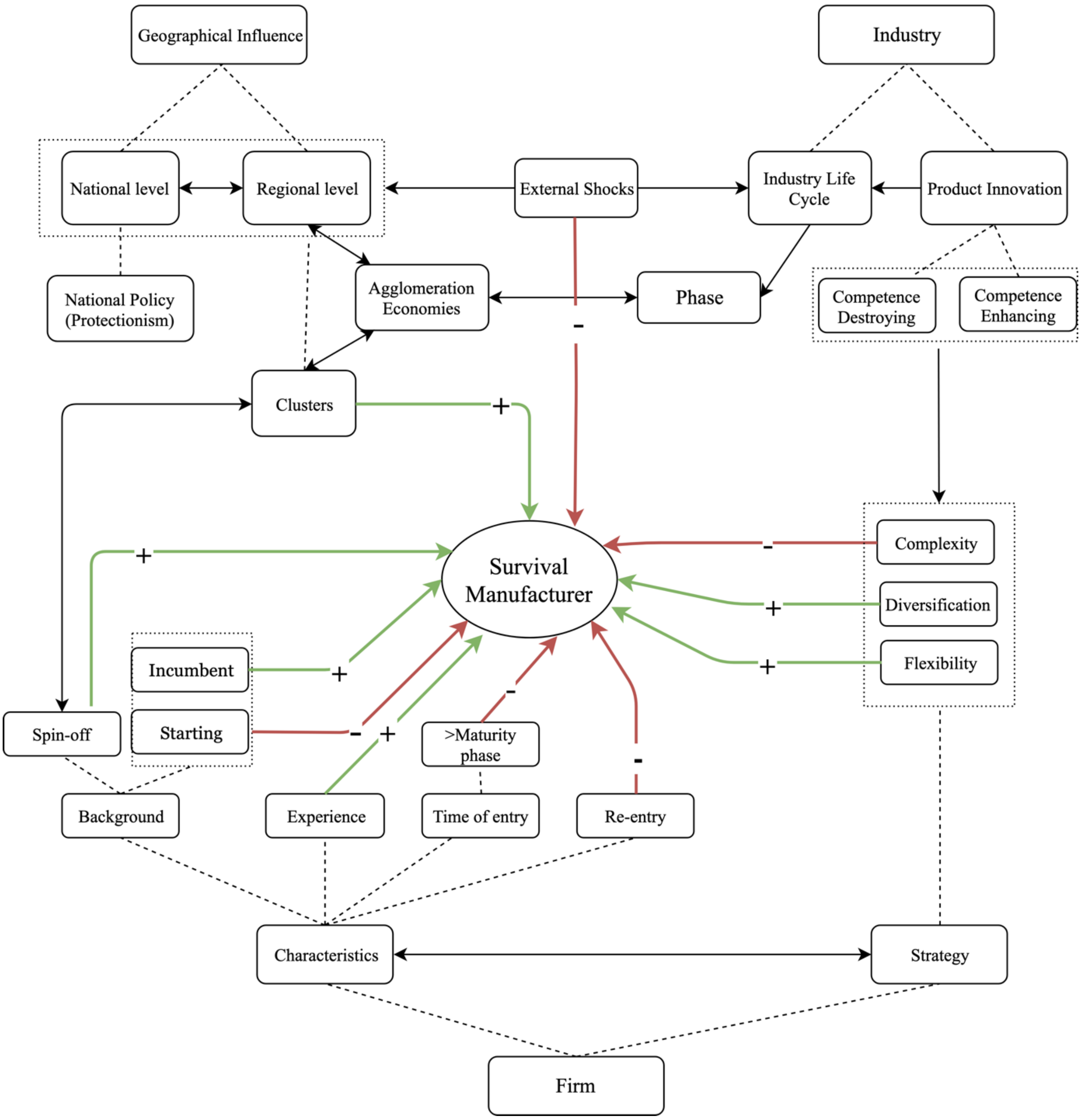

Figure 4: Conceptual model derived from the theory

The model starts off with the division of 3 separate levels which affect the *Survival of the Manufacturer* namely the *Geographical Influence*, *Industry Level* and the *Manufacturer Level.* The first mentionable link is the one between the *Geographical Influence* and *Industry*.

The National Level has a two-way connection with the *Regional Level* because national economic performance could stimulate regional growth and the vice versa. The *External shocks* are in between the *Regional level* and the *Industry Life Cycle. The Regional Level* and the *Industry Life Cycle* do not possess a two-way connection since Menzel and Fornahl (2007) argue that Life Cycle at a regional level does not follow the same path as the *Industry Life Cycle.*

Another important part of the conceptual model is the role of *Clusters.* The *Clusters* are linked to the *Agglomeration Economies* which have a link with the phase of the Industry Life Cycle as stressed by Audretsch (2017). Furthermore, the presence in clusters has a positive effect on the *Survival* (Morrison and Boschma, 2017).

Spin-offs positively affect the growth of *Clusters (*Menzel and Fornahl, 2007, Klepper, 1997, 2007). *Spin-offs* are therefore linked to the *Clusters* and originate out of *the Firm Background.* The spin-offs perform better than their counterparts and therefore have a positive effect on the *Firm Survival.*

Being an *Incumbent* has a positive effect on survival, while being a *Starter* is considered to have a negative effect on *Survival* (Wezel, 2009). *Experience*, in particular related, as part of *Firm Background* has a positive effect on *Survival* (Klepper, 2007). *Re-entries* or the restart of a previous existing company has an effect on the survival of a manufacturer yet this depends on the reasoning behind the previous exit. Forced and negative reasoning behind a previous exit results into a negative impact on the eventual *Survival of the Manufacturer* (Metzger, 2006). Finally, the *Time of entrance* has a negative effect on firm survival once the maturity phase has begun (Agerwall et. al, 2007)

The concepts from the *Strategy* have mixed effects on the firm. Cenzatti (1990) for instance argued that the *flexibility* played a profound role in the formation of the Italian clusters and contributed to the enhanced survival path. Frenken et. al, 2007 argued that the diversification via the portfolio theory has a positive effect on survival, acknowledged by Cotrell and Nault, 2004. Lastly, Agerwall (1998) stated that high complex activity has a negative impact on firm survival.

The analysis in chapter four provides an additional insight in the eventual role of the different levels (National, Cluster, Firm and Product).

The extensive theories and literature regarding the survival of firms are based on several case-studies. The general ideas of these studies are narrowed down to several specific hypotheses in order to examine if these still hold in the case of the motorcycle industry.

National level:

Hypothesis 1: The hazard rate differed between the case countries

Cluster level:

Hypothesis 2: Presence in clusters lowered hazard rate

Manufacturer level:

Hypothesis 3: Entrance in the period 1950-1980 increased the hazard rate
Hypothesis 4: Re-entries encountered a higher hazard rate
Hypothesis 5: The spin-offs had the lowest hazard rate in the heritage model
Hypothesis 6: Experienced manufacturers had a lower hazard rate than inexperienced competitors

Product level:

Hypothesis 7: Variety in model engine capacity led to a lower hazard rate
Hypothesis 8: A focus on high capacity led to a higher hazard rate
Hypothesis 9: A focus on low capacity led to a lower hazard rate
Hypothesis 10: Variety in model categories led to a lower hazard rate
Hypothesis 10: The direction of the hazard rate on the product level is the same across the three case countries

3. Methods

This research is carried out by using a quantitative approach for the analysis. The main reason for this decision of research is because the research is about firm duration and it would be difficult to gather qualitative information about the firms which did not survive long. Particularly since most of the short-lasting firms were small family shops and the timeframe goes 69 years back in time. A consideration would be to interview the surviving firms as Muffato and Panizzolo (1996) have done, yet this would only offer a one-sided perspective and the information regarding product strategy is sensitive.

This research makes use of a survival analysis. The method is used to define the variables and corresponding hazard which lead to a specific event further in time. The event in this research is the closure of a manufacturer. First off, the Kaplan Meier procedure is used for the descriptive statistics to examine the distribution of time-to-event variables. This method is non-parametric, thus has no assumptions about the shape of the hazard function. The model tests uncensored cases (*the exit has occurred*) and the censored cases (*the exit has not occurred yet)* (Bian, 2019).

Finally, The Cox Proportional Hazard model was used. A semi-parametric test which enables to examine multiple variables, in comparison to the Kaplan Meijer analysis which only allows one explanatory variable at a time. Another advantage of the Cox model is the information regarding the increase or decrease in the hazard. The statistical output of this test is the hazard rate (Bian, 2019).

3.1 Gathering data

Besides the general information retrieved from Google Scholar for the theoretical basis of this research, the analysis itself was conducted by using the data from The Encyclopedia of the Motorcycle by Hugo Wilson (1995). The encyclopedia offers a list of manufacturers per country with the corresponding year of entry and exit which was used to identify all the cases in the sample.

The website Bikez.com (2019) was used for the specific technical motorcycle model information since it offers filtering options based on brand, category and production year. This information was used to build the variables for the product strategy. The information on the website is added and verified by a large and active community.

On the other hand, a large and in-depth dataset about the Italian industry was already provided by Morrison which was used in the research about the Italian motorcycle industry (Morrison and Boschma, 2017). The main differences between the dataset of Morrison and the new dataset were the addition of enriched firm and product-specific variables and the filtering of Morrison's dataset for manufacturers which were active between 1950 and 1980. The geographic variables were changed from region and province to Nuts level 1, Nuts level 2 and Nuts level 3. Comparing the regions of Germany, Great Britain and Italy became difficult since the provinces and regions differed heavily in size per country. The same reasoning also applies to the clusters, the Italian Emilia Romagna is an entire region while the German Bielefeld is a smaller city. Differences in results regarding the Italian cases are the result of the case filtering. Morrison built a sample including all manufacturers stated by Wilson (1995), while this research solely focusses on the manufacturers which were active between 1950 and 1980.

The information from both The Encyclopedia of the Motorcycle and Bikez.com as well as the dataset of Morrison had to be transformed into a new dataset. More detailed or missing information about the smaller manufacturers was retrieved from the site Cyber Motorcycles (2019) if needed. Cyber Motorcycles was used to gather information focussed on the background and location of the manufacturer rather than model information. This site uses The Encyclopedia of the Motorcycle and other comparable sources.

Data	Sources
List of German and British manufacturers for the sample including year of entry and exit	*The Encyclopedia of the Motorcycle (Wilson, 1995)*
Models per manufacturer including technical information	*Bikez (2019)*
Background information regarding manufacturers	*Cyber Motorcycles (2019*
List of Italian manufacturers including background	*Morrison (2017)*

Figure 5: Table overview of used sources

3.1.1 The sample

The sample is built to capture the second industrial shock from the 50s until the 80s by counting all firms which were active in Great Britain, Germany and Italy. This means that firms may have been active from the early 20s and stopped in the early 50s, or firms which started in the late 70s and are still active.

Only the official marquees of The Encyclopedia of the Motorcycle were used for the sample since the un-official marquees lacked information. A lot of firms that went bankrupt in the 30's tried to re-enter the market in a later stage. This experience in years has not been added up to their final age, but has been acknowledged by a dummy variable 're-entry'.

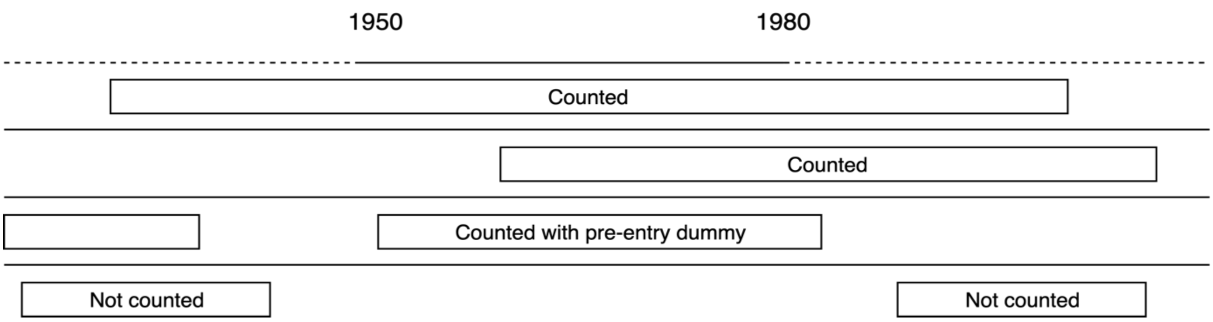

Figure 6: The sample selection of Britain, Germany and Italy.

The sample of the three case countries exits out of 333 cases, the largest share of which are Italian cases.

	Germany	*Great Britain*	*Italy*	*Total*
Number of cases	*78 (23,42%)*	*79 (23,72%)*	*176 (52,85%)*	*333 (100%)*

Figure 7: The sample selection of Britain, Germany and Italy.

The large share of Italian manufacturers in the sample is the result of the timeframe filtering. Wilson (1995) listed every official manufacturer over time per country, which is distributed differently in comparison to this research. Overall, Great Britain noted the highest number of manufacturers (687), followed by Germany (667) and lastly Italy (567). The explanation for the differences in distribution for the period 1950-1980 are be the result of the historical background. As mentioned in the literature, most of the British and German manufacturers were active in the early phase of the industry which diminished due to the first industrial crisis while the Italian motorcycle industry remained relatively stable (Wezel, 2005).

3.2 Variables and operationalization

This section provides an overview of the used variables and the operationalization. The chapter starts with a brief theoretical link to the variable and ends with a summary of the operationalization.

3.2.1 The dependent variable

The dependent variable in all of the cases is the age (duration) of a manufacturer. The age is measured in years from the start of a manufacturer until the exit in the case of failure due to financial reasoning or the takeover of a manufacturer.

3.2.2 Independent variables

The independent variables are structured on various levels namely the National, Cluster, Firm and Product level. The influence of the separate levels on the age of manufacturers will be compared in the results chapter, with an emphasis on the effect of the Product Level.

The national level

The effect of the National Level is of importance as has been mentioned in the theoretical chapter and the introduction (Wezel and Lomi, 2009, Cenzatti, 1990). The National Level was measured by using a dummy variable to spot whether the age of the manufacturer was affected by its corresponding home country (Great Britain, Germany, Italy)

The cluster level

The addition of the cluster effect might add a spatial explanation to the research (Morrison and Boschma, 2017) since firms tend to perform better in a cluster (Klepper, 2007). But the clusters themselves also differ heavily from each other as can be noted in chapter two (Cenzatti, 1990). The clusters were added as dummy variables into the analysis to examine whether the presence in clusters did have a positive effect on the survival rate and to look whether there are notable differences between the clusters per country (Bielefeld, CBW, Emilia Romagna).

The Manufacturer levels

The background of Manufacturers

The background of a firm could also play a part in the eventual age of a firm, to measure this, 5 classes have been created. These classes are based on 'The Heritage Model' (Klepper, 2007; Morrison and Boschma, 2017). Spin-offs are the first category since they play an important role in the dynamics of cluster growth but could also tell something about the firm characteristics and its effect on the eventual firm age. For example, spin-offs tend to outperform other starting firms due to the gathered knowledge and routines of the parent firm (Klepper, 2002). The other categories make a distinction between starting entrepreneurs and firms. In order to measure this, four extra classes have been created namely: *the starting manufacturer with an experienced background, the starting manufacturer with an inexperienced background, the incumbent diversifier with an experienced background* and *the incumbent diversifier with an inexperienced background.*

The Klepper (2007) and the Morrison and Boschma (2017) researches merged the two variables of inexperienced starters and incumbents together as an inexperienced firm variable. This research specifically mentions the two separated since Wezel (2009) stressed the importance of the differences between starters and incumbents. The background of the entrepreneurs and incumbent firms have been thoroughly investigated to examine if their previous activities were related to the motorcycle industry. In general, all activities regarding the manufacturing of motorcycles, bicycles, cars, engines and so forth are regarded as related with the inclusion of a history in motorcycle racing.

Time of entry

Agerwall et. al (2007) stressed the importance of the time of entrance of firms and the effect on survival, stating that entrants in the maturity stage have a high probability of mortality. In order to measure this, dummy variables were created to count the manufacturers which started their activities between 1950 and 1980.

Re-entries

Metzger (2006) argued that the human capital in the form of previous managerial experience was of importance, yet only if the previous firm did not fail or exited out of a negative reasoning. A restarted company therefore does not always perform better. The backgrounds of the manufacturers have been analyzed to look whether the manufacturers were active in a previous stage, this data has been transformed into a dummy variable.

The product-level:

The variables on the product-level are used to explain the underlying strategies of the manufacturers. Muffato and Panizzolo (1996) already have done extensive research into classifying motorcycle manufacturers using several indicators in order to examine the product development strategies via a questionnaire.

The downside is that they also used incredibly specific data such as sales numbers, which are difficult to obtain for the other case studies in this research. The variables which were used enabled Muffato and Panizzolo to classify their respondents in 3 groups: *The Volume Producers, the Specialists* and *the Niche Specialists*. Categorizing the sample in the exact same way as Muffato and Panizzolo would be too complex since a lot of the group characteristics are linked to the sales numbers of manufacturers. However, it was still possible to use the underlying individual variables.

Range Capacity

The first variable of the Product Level is the range of the engine capacity of the models. Muffato and Panizzolo (1996) argue that the engine capacity of the models can be seen as a measurement of product complexity, not only of the engine but also of the model as a whole. A high value for this variable would implicate that the manufacturer is able to produce complex products. Yet, it could be possible that a manufacturer focusses solely on high capacity engines, which would lower the variable value. Likewise, manufacturers only focussing on lower capacity engines would obtain a similar value. Thus, the variable would be of more use to indicate the diversification of the model range. This variable is measured in the number of cc.

Share High Capacity

A more distinct variable to measure the technological sophistication of manufacturers is the share of high-capacity models within the model range. There is no universal classification for 'high' capacity motorcycles in the literature and in practice this number changes throughout the years and per country.

A few decades ago 800cc may seemed much, nowadays this is called a heavy middle-weight. For this research the 900cc+ models are classified as 'high capacity'. One may argue that the engine size alone would not be an ideal measurement of complexity of the model. There are for instance 300 cc motorcycles which are able to outperform 500 cc motorcycles due to their better weight-capacity ratio (Department of State Growth, 2014).

Although this holds true, complexity in this case is more than solely the performance and rather a balance between the reliability, durability and so forth. These factors are firm-specific and define their character and that of their products. The variable measures the number of models with a +900cc engine capacity within the total model range of a manufacturer. The number is expressed in a percentage share of the total number of models for a better comparison between manufacturers.

Share Low capacity

The research of Muffato and Panizzolo (1996) touched specifically upon the debate about the addition of the moped category (>50cc-250cc) since the lower capacity models are produced in a larger number and in a faster process than the high capacity models. However, since scooters contributed to the sales numbers, particularly for Italian manufacturers (Cenzatti, 1990), they were added to the dataset. The variable measures the share of models up to 250 cc within the model range, the same way as the 'Share High Capacity' variable does.

Tapped Categories:

Cenzatti (1990) argues that the manufacturer's flexibility towards model variety was vital in the restructuring of the motorcycle industry and Frenken et. al (2007) argued that variety reduces risks which enhances the survival rate of firms. The integration into previously excluded market segments could on its turn create new demand which may boost the performance of the manufacturers (Cenzatti, 1990). To measure this, the models of each firm can be categorized into 14 categories namely:

Sport	*Sport touring*	*Touring*	*Cruiser*	*Trial*
Enduro	*Cross*	*Supermotard*	*Naked*	*Classic*
Scooter	*All-round*	*Minibike cross*	*Minibike sport*	

Figure 8: Total number of motorcycle categories (Bikez, 2019)

Once a manufacturer produces a model in a new category, the share of the 'tapped categories' increases. For example, manufacturers which produce models in 5 categories have a share of (5/14) 35,71%.

The table below shows a summary of the operationalization of the mentioned variables.

Name	**Indicator**	**Measurement**	**Values**
Dependent variable:			
Age	*Age of a manufacturer*	*Continuous*	*Age in years*
Independent variable: National level			
Nationality	*Home country of the manufacture*	*Categorical*	*1=Britain* *2=Germany* *3=Italy*
Independent variable: Regional level			
Cluster	*The presence in an industrial cluster*	*Categorical*	*0= not located* *1=located*
Independent variable: Manufacturer Level			
Background	*What is the heritage of a manufacturer*	*Categorical*	*1=Spin-offs* *2=Starter Inexperienced* *3=Starter Experienced* *4= Incumbent Inexperienced* *5= Incumbent Experienced*
Time Entry	*Entry in the decline phase of 1950-1980*	*Categorical*	*0= no entry* *1= entry*
Re-Entry	*The restart of an exited manufacturer*	*Categorical*	*0=no re-entry* *1= re-entry*
Independent variable: Product Level			
Range Capacity	*The total range in engine capacity of models. Max cc – Min cc*	*Continuous*	*Numbers cc*
Share High	*The share of high capacity models within the model range*	*Continuous*	*Percentage of share within the total number of models*
Share Low	*The share of low capacity models within the model range*	*Continuous*	*Percentage of share within the total number of models*
Tapped Categories	*The share of model categories which were produced by a manufacturer out of the total existing number of categories*	*Continuous*	*Percentage of share within the total number of categories*

Figure 9: Table overview of the variables

3.3 Descriptive statistics

This chapter starts off with a brief overview of the number of cases per variable as portrayed in *figure 10* including brief statistics for the continuous variables. Afterwards, more in-depth statistics will be provided per variable.

The table below illustrates the distribution per variable for the three case countries combined. A separated table with the information per country is provided afterwards.

Name	*Value*	*Number of cases*	*Mean*	*SD*
Age	*Years*	*333*	*17,86*	*20,896*
Nationality	*1=Britain* *2=Germany* *3=Italy*	*78 (23,42%)* *79 (23,72%)* *176 (52,85%)*	*x*	*x*
Cluster	*0= not located* *1=located*	*244 (73,27%)* *89 (26,73%)*	*x*	*x*
Background	*1=Spin-offs* *2=Starter Inexperienced* *3=Starter Experienced* *4= Incumbent Inexperienced* *5= Incumbent Experienced*	*39 (11,68%)* *29 (8,68%)* *115 (34,43%)* *11 (3,29%)* *140 (41,91%)*	*x*	*x*
Time Entry	*0= no entry* *1= entry*	*108 (32,43%* *225 (67,57%)*	*x*	*x*
Re-entry	*0=no re-entry* *1= re-entry*	*281 (84,38%)* *52 (15,62%)*	*x*	*x*
Range Capacity	*Number of cc*	*333*	*180,92 cc*	*280,88*
Share High	*Share high capacity models*	*332*	*2,73%*	*12,46%*
Share Low	*Share low capacity models*	*332*	*84,99%*	*30,65%*
Tapped Categories	*Share tapped categories*	*333*	*14,13%*	*13,02%*

Figure 10: table overview of the descriptive statistics of the variables

Name	***Britain** (Mean, SD)*	***Germany** (Mean, SD)*	***Italy** (Mean, SD)*
Age	*(19.33, 25.11)*	*(16.05, 18.93)*	*(17.99, 19.68)*
Clustered *Non-clustered*	*28 (35,44%)* *51 (64,66%)*	*15 (19,23%)* *63 (80,77%)*	*46 (26,14%)* *130(73,86%*
Spin-off *Starter Inexp.* *Starter Exp.* *Incumbent Inexp.* *Incumbent Exp*	*8 (10.5%)* *2 (2,6%)* *29 (38.2%)* *4 (5.3%)* *33 (43,4%)*	*2 (2,6%)* *2 (2.6%)* *22 (28.2%)* *6 (7.7%)* *46 (59%)*	*35 (10.6%)* *29 (8.8%)* *110 (33.4%)* *15 (4.6%)* *140 (42.6%)*
No entry *Entry*	*31 (39.2%)* *48 (60.8%)*	*40 (51.3%)* *38 (48.7%)*	*37 (21%)* *139 (79%)*
No Re-Entry *Re-Entry*	*66 (86.8%)* *10 (13.2%)*	*59 (75.6%)* *19 (24.4%)*	*152 (86.9%)* *23 (13.1%)*
Range Capacity	*(214, 346.82)*	*(212.53, 322.19)*	*(151.88, 220.72)*
Share high	*(3.92, 14.96)*	*(2.96, 13.76)*	*(2.09, 10.51)*
Share Low	*(69.81, 41.10)*	*(85.94, 28.88)*	*(91.39, 22.72)*
Tapped Categories	*(14.261, 12.22)*	*(12.89, 11.75)*	*(14.628, 13.90)*

Figure 11: table overview of the descriptive statistics of the variables

Dependent Variable: Age

As can be seen in *figure 10,* the average age of the manufacturers in the three case countries combined is 17.86 years. However, the average age differs between the separate countries as can be seen in *figure 12*.

	Germany	*Great Britain*	*Italy*	*Total*
Average age	*16.05*	*19.33*	*17.99*	*17.86*

Figure 12: The Mean age of manufacturers in Germany, Great Britain and Italy.

Independent Variable: Nationality

Figure 13 shows the survival rate of motorcycle manufacturers per country over the age span. The mortality rate of Italian manufacturers is the lowest in the earlier years of the manufacturer age, yet this changes around the 30-year mark. Afterwards the mortality rate stabilizes in contrast to the manufacturers from Great Britain which note a reduction in mortality rate in between the 30- and 50-years mark. In the final phase, the Italian manufacturers note the lowest mortality rate. There seems to be little differences in the survival rate of German and British manufacturers in the first 10 years of age, afterwards the probability intersects multiple times.

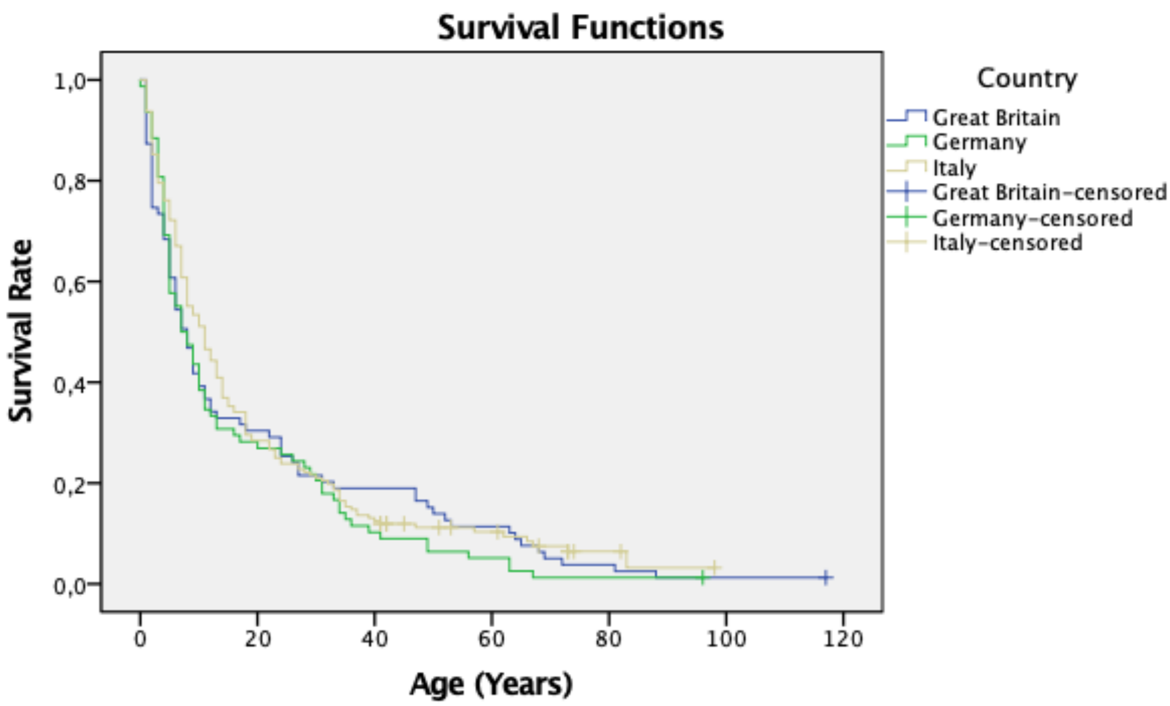

Figure 13: Kaplan-Meier analysis: survival of manufacturers per country

Independent Variable: Cluster

89 cases of the total 333 in the sample were located in an industrial cluster (Bielefeld, CBW, Emilia Romagna). The differences in the distribution of this variable per country is highlighted in *figure 14*.

Country	*Manufacturers located in a cluster*	*Manufacturers not located in a cluster*
Germany	*15 (19,23%)*	*63 (80,77%)*
Great Britain	*28 (35,44%)*	*51 (64,66%)*
Italy	*46 (26,14%)*	*130 (73,86%)*

Figure 14: The distribution of manufacturers located in a cluster per country

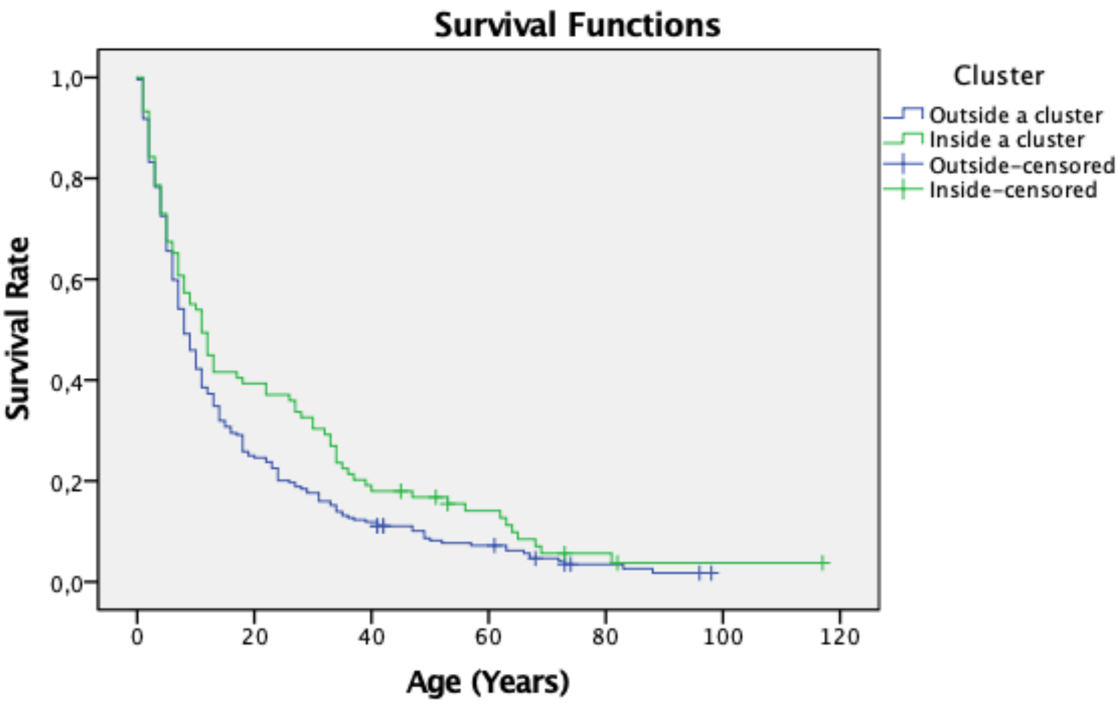

Figure 15: Kaplan-Meier analysis: survival of manufacturers based on the cluster effect.

Figure 15 shows the survival rate of manufacturers in the total sample (N=333) and the effect of their location within a cluster or outside. As can be seen, the presence in a cluster results in a lower mortality rate throughout the age span of the manufacturers. The differences are the most notable between the age of 10 and 70 years. The results were based on the average survival for the total sample. However, the average ages differ per cluster as can be seen in *figure 16*.

	Germany		*Great Britain*		*Italy*	
Location	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*
Average age	*16.3*	*15*	*14.75*	*27.68*	*16.67*	*21.48*

Figure 16: Mean age of manufacturers in the corresponding country and clusters.

An interesting finding from *figure 16* is the difference between the average age of German manufacturers within a cluster and those outside. Contrary to the theory of Morrison and Boschma (2017), the manufacturers in Bielefeld did not survive longer than the manufacturers outside Bielefeld. However, the cluster effect is particularly visible in Great Britain where manufacturers in a cluster survive 87,66% longer than the manufacturers outside the cluster and in Italy the clustered manufacturers survive 28.85% longer than non-clustered counterparts.

Independent Variable: Background

Figure 17 shows the spin-off effect as described by Klepper (2007) and Morrison and Boschma (2017), once it becomes visible after the age of 38. The probability of the manufacturer surviving after this age is the highest if the firm is a spin-off. In line with Wezel's theory (2009), the differences in survival between the starting manufacturers and incumbents is also visible. The incumbents maintain to have a relatively high survival rate while the probability of survival for all starting firms, regardless of experience, decreases rapidly in the early age of the manufacturers.

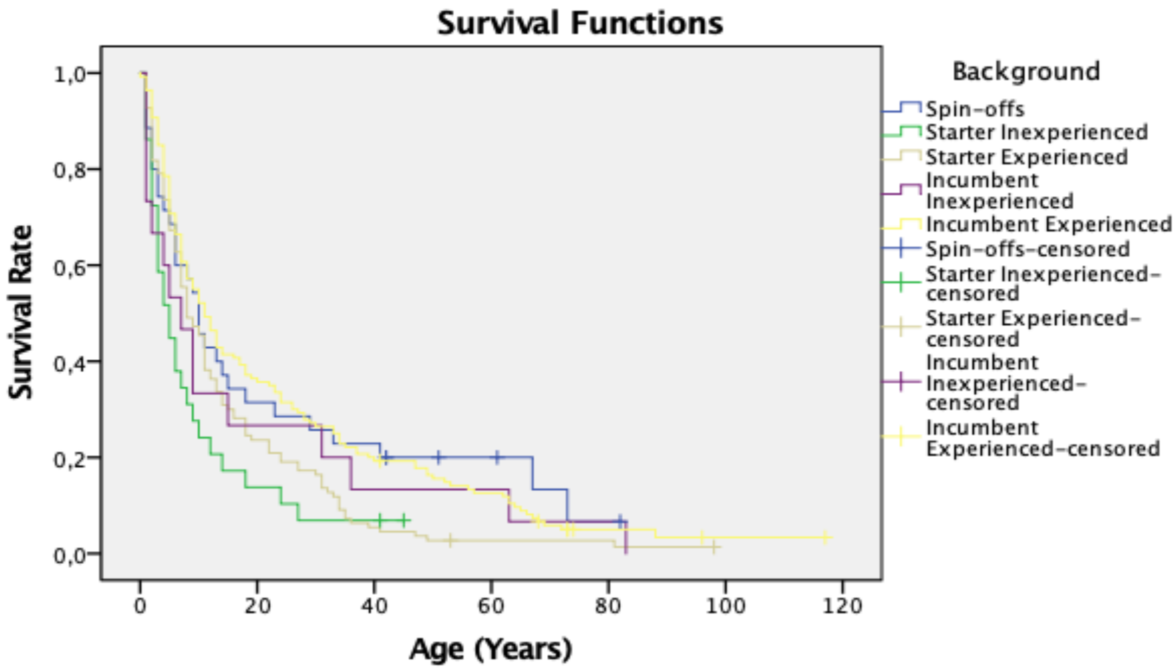

Figure 17: Kaplan-Meier analysis: survival of manufacturers based on background.

Independent Variable: Time Entry

Figure 18 illustrates the effect of entrance before 1950 and within the decline period of 1950 until 1980. As can be seen, the entrants before 1950 note a higher survival rate throughout the entire age span. The results of *Figure 15* could be partially explained by the sample selection. Entrants before 1950 had to be active in 1950-1980 which automatically dismisses a large share of failed manufacturers. The average age and therefore survival probability increase due to the selective sampling. Another possible explanation could be that the manufacturers in the sample already absorbed multiple external shocks over time, thus became more resilient. A third explanation could be related to the Wezel (2009) theory that the incumbents (entrants before 1950) had accumulated more resources and vital knowledge to withstand the period of 1950 until 1980 than new entrants.

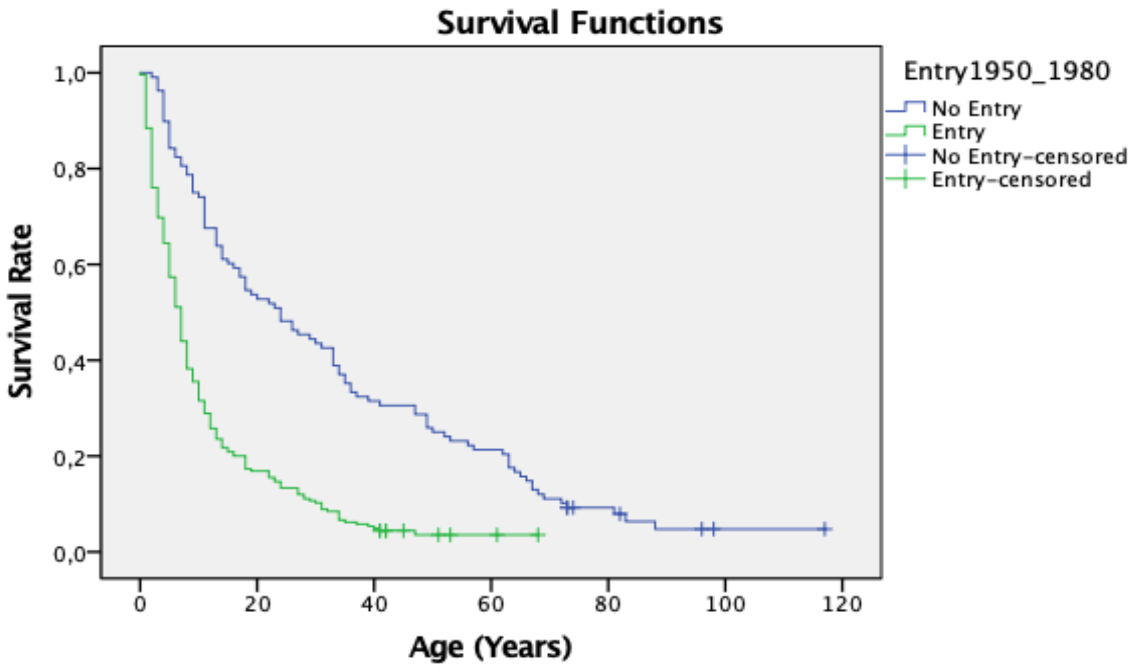

Figure 18: Kaplan-Meier analysis: survival of manufacturers based on time of entry

Independent Variable: Re-entry

As shown in *figure 19,* the experience of the previous running time of the manufacturer only seems to be beneficial in the starting years of the manufacturers. The beneficial effect vanishes after the first 10 years after which the mortality rate among these manufacturers increases.

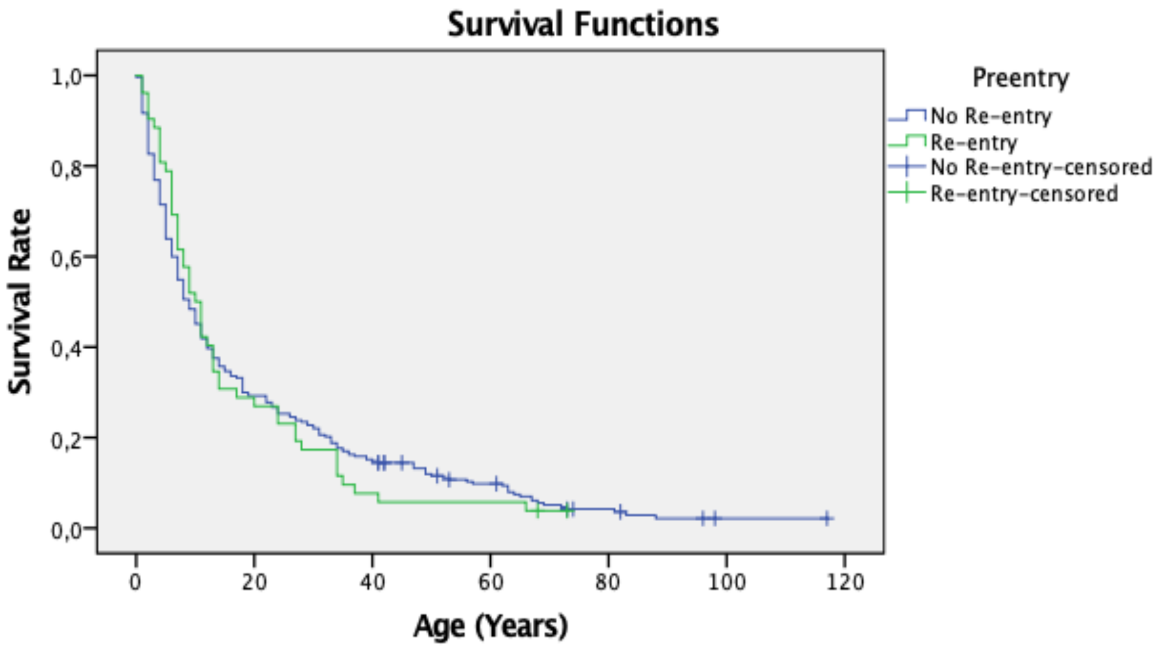

Figure 19: Kaplan-Meier analysis: survival of manufacturers based on re-entries.

The general results of this test do not necessarily confirm the theory of Metzger (2006) stating restarted firms perform worse than the experienced counterparts. Even though the cases are acknowledged with a re-entry dummy, the reasoning behind the previous exit remains unknown. Restarting manufacturers which exited out of personal reasoning might perhaps still perform better than other experienced counterparts.

Independent Variable: Range Capacity

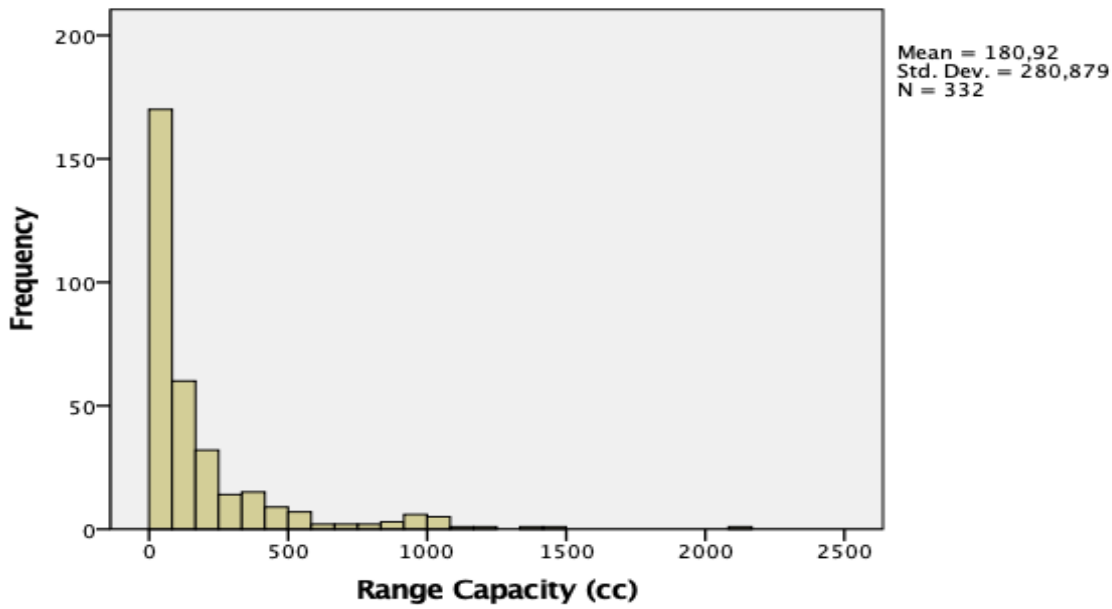

Figure 20: The distribution of Range Capacity of manufacturers in Britain, Germany and Italy

Figure 20 shows the distribution of the variable Range Capacity in the amount of cc for 332 cases. The Histogram shows a right-skewed distribution, which could be explained by the tendency towards low capacity engines in the period 1950 until 1980.

	Germany		*Great Britain*		*Italy*	
Location	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*
Average Range Capacity	*231.8 cc*	*132.9cc*	*172.5 cc*	*291.9*	*151.2 cc*	*153.8 cc*

Figure 21: The differences in average Range Capacity per country and corresponding cluster

The variety in the capacity of the models is the highest in the CBW agglomeration in Great Britain. The differences in Italy on the other hand are rather small. Germany again has contradicting results in comparison to the other countries with a lower variety of capacity in the Bielefeld cluster in comparison to the non-clustered region.

Independent Variable: Share High

Figure 22 portrays the differences in focus on high capacity motorcycle per country and the corresponding clusters.

	Germany		*Great Britain*		*Italy*	
Location	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*
Mean Share of high capacity models	*3.69%*	*2.6%*	*4,64%*	*2,6%*	*1.48%*	*3.82%*

Figure 22: The differences in Share of High Capacity models per country and corresponding cluster.

The manufacturers outside the CBW were more focussed on the high capacity models while the theory hinted the contrary. This result needs nuance since the high capacity is measured from 900cc upwards, differences in classification might play a role.

Italy is in this case the only country where the manufacturers in the Emilia Romagna cluster focussed more on high capacity models than the manufacturers outside the cluster.

Independent Variable: Share Low

Figure 23 portrays the differences in focus on low capacity motorcycle per country and the corresponding clusters.

	Germany		*Great Britain*		*Italy*	
Location	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*
Mean Share of low capacity models	*82.98%*	*98.15%*	*67.44%*	*74.99%*	*91.37%*	*91.43%*

Figure 23: The differences in Share of Low Capacity models per country and corresponding cluster.

Coinciding with the previous results of *Figure 22,* the focus on low capacity motorcycles in the CBW cluster is higher in comparison to the non-clustered regions. This difference could, again, be the result of a difference in measurement. Marr (2012, p. 174) stated that manufacturers outside the CBW actively pursued low capacity motorcycles, with an emphasis on mopeds and scooter production), which is only a small segment of the low capacity class. Marr's definition of 'low capacity' is unknown and might be based on the <50cc class which would explain the contrasting results. In conclusion, the combined share of low capacity in Great Britain is much lower in comparison to the Germany and Italy, which both note the highest focus inside the clusters.

Independent Variable: Share Tapped Categories

Figure 24 shows the differences between the clusters in terms of tapped categories. The CBW cluster notes the highest Mean and largest difference compared to the outside regions, while Germany scores the lowest within clusters and outside. In general, the manufacturers in clusters diversified their product line more in comparison to those outside clusters.

	Germany		*Great Britain*		*Italy*	
Location	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*	*Non-cluster*	*Cluster*
Mean Share of low capacity models	*12.38%*	*13.04%*	*12.05%*	*18.37%*	*14.34%*	*15.53%*

Figure 24: The differences in Share of Tapped Categories per country and corresponding cluster.

3.4 Model assumptions

The Cox regression is a semi parametric test (Bian, 2019) with the assumption of proportionality of the covariates. Many variables which were tested in the previous chapter do not hold the assumptions since their Kaplan Meier curves intersected at one point in time, suggesting that the Hazard Rate differs per group per time interval. If the Cox regression still acknowledges the proportional effect for a variable, it is likely that one group in the test has a continuously better performance, which ultimately influences the average for the variable.

Another potential problem for setting up a Cox Regression model is possible multicollinearity, correlation between the predictive variables. Diagnosing this possible correlation is realized by testing the VIF value (figure 25).

Variable name	*VIF result*
Entry1950_1980	1,246
Country	1,248
Preentry	1,030
Background	1,138
Cluster	1,034
RangeCapacity	2,461
ShareHigh	1,468
ShareLow	1,855
TappedCategories	1,867

Figure 25: VIF analyses among the predictive variables

The ideal range for the VIF value lies between 1 and 3, therefore there is no sign of multicollinearity between the variables.

The final point of interest is the Correlation of the variable Age with the predictive variables.

Correlation with Age

		Cluster	*Entry1950-1980*	*Preentry*	*Range Capacity*	*Share High*	*Share Low*	*Tapped Categories*	*Age*
Age	Pearson Correlation	,130*	-,473**	-,032	,676**	,317**	-,460**	,631**	1
	Sig. (2-tailed)	,018	,000	,557	,000	,000	,000	,000	
	N	333	333	329	332	332	332	333	333

Figure 26: VIF analyses among the predictive variables

Figure 26 illustrates that Age highly correlates with some variables. The correlation with the variable *Entry 1950-1980* is self-explanatory since a high age reduces the possibility of a manufacturer starting from 1950 onwards. More interesting is the high association with the Product variables since *Age* associates with a higher *Range capacity*, a higher share in *High capacity* and *Tapped categories* and a lower *Share Low Capacity*. This would indicate that the older a manufacturer gets, the more it diversifies into model categories and model capacity in un upward trend.

4. Results

This chapter will discuss the final model which tests the variables using the Cox Regression Analysis. The results of the Cox model are split up in four separate regression models based on the different levels, as illustrated in *figure 9* (National, Cluster, Manufacturer and Product). The table below indicates the corresponding hazard ratios per variable. The base value of the hazard rate is 1, meaning that an increase of the variable results in a higher hazard rate. Ultimately, this increases the probability of an earlier exit.

	Model 1	*Model 2*	*Model 3*	*Model 4*
National level				
Great Britain (1)	*1,084*	*1,125*	*1,7073 ****	*2,153 ****
Germany (2)	*1,234*	*1,205*	*1,680 ****	*1,817 ****
Italy (3) (r)				
Cluster level				
Cluster		*0,793**	*0,737 ***	*0,683 ****
Manufacturer level				
Re-entry			*0,984*	*0,946*
Time entry			*3,104****	*2,32 ****
Starter Inexperienced (r)				
Spin-off (1)			*0,507***	*0,747*
Starter Experienced (2)			*0,654**	*0,909*
Incumbent Inexperienced (3)			*0,655*	*0,856*
Incumbent Experienced (4)			*0,561***	*0,786*
Product level				
Range Capacity				*0,999 ****
Share High				*1,003*
Share Low				*1,008 ****
Share Flexibility				*0,962 ****
	-2LL: 3144,87	*-2LL: 3141,34*	*-2LL: 3011,19*	*-2LL: 2871,60*
**Significant at the 0.10 level **Significant at the 0.05 level ***Significant at the 0.01 level*				

Figure 27: Cox Regression Analysis

Model 1 solely tests the country effect which is not significant, suggesting that Hypothesis 1 could be rejected. The coefficients on the other hand do hint that the presence in Germany and Great Britain as a manufacturer in comparison to Italy increases the hazard rate.

Model 2 includes the *Cluster variable* to find support for the prescribed cluster effect. The findings suggest a significant negative effect from the presence in an industrial cluster within Germany, Great Britain and Italy. Throughout the three case countries, the presence in a cluster results in a lowered hazard rate of 20,7% for the manufacturers, consistent with Hypothesis 2.

Model 3 contains the information on the Manufacturer level. The first notable finding is the positive significance of the variable *Time of Entry*. A manufacturer which started in the period between 1950 until 1980 thus holds a substantially higher hazard rate than its competitors starting before this period, supporting Hypothesis 3.

No evidence has been found to support Hypothesis 4 regarding the effect of *Re-entries* in model 3, throughout multiple models.

The results of the interpreted heritage model suggest that the *Spin-offs*, *Experienced Starters* and *Experienced Incumbents* all have a significantly lower hazard rate in comparison to the reference category (*Inexperienced starters*). The *Spin-offs* note the lowest hazard rate, a decrease of 49,3%, and highest significance in this case, as in line with Hypothesis 5. The coefficients for the *Incumbent Inexperienced* suggest a decrease in hazard rate, however holds no tested significance, therefore the differences in exit probability between experienced and inexperienced manufacturers could not be supported such as stated in Hypothesis 6. Surprisingly the differences between the decreased hazard rate of the *Spin-offs* (49,3%) and the *Experienced Incumbents* (43,9%) are rather small and remain consistent throughout the multiple models.

The *Country effect*, the difference between the effect of the country Italy and the countries Germany and Great Britain, became highly significant in model 3 once the *Manufacturer* variables were added, this effect is visible with the *Cluster* dummy as well. The observation is called negative confounding. Confounding is described as "*a variable related to two factors of interest that falsely obscures or accentuates the relationship between them*" (MacKinnon,2000, p.174), yet, does not imply a causal relationship among the variables in all cases. The effect in the case of this study could be explained by the mediation model: *Total Effect= Indirect Effect + Total Effect* (MacKinnon, 2000, p.174). The non-significant *Country* variable was mediated by the excluded *Manufacturer* variables and portrays the relation between the effect of the *Manufacturer* variables beside the variable's own effect. Once added, the *Country* variable no longer holds the partial effect, mediated by *Manufacturer* variables, but gains significance and reveals its clear effect on the dependent variable *Age*. In contrast to the first model, the differences in comparison to Italy have risen substantially. Great Britain shows an increase in hazard rate of 70,7% while the German hazard rate has increased to 68%.

Model 4 includes the Product level variables into the model. The *Country effect* in this model remain the same level of significance, yet the coefficients have risen. The *Cluster effect* gained significance and tampered the hazard rate, the *Time of Entry* holds the same level of significance but also notes a decreased hazard rate.

The background of the manufacturers in the form of the heritage model lost significance due to the addition of the product variable, contrary to the Country and Cluster variable which gained significance. This suggests that the variables of the Heritage model held a relationship with the *Product* variables and absorbed their effect. Once the product variables were included, the significant effect of the *Product* variables on the dependent variable *Age* became visible at the cost of the heritage model, called confounding (MacKinnon, 2000, p.174).

The first significant product level variable is the *Range capacity* which has a negative impact on the hazard rate. Since the variable is measured in the number of cc's, it means that for every cc the hazard rate decreases with 0,1%. This finding supports hypothesis 7.

Hypothesis 8 regarding the manufacturers focus on *High Capacity* models has not been tested significant and could therefore not be supported. Surprisingly, the focus *on Low Capacity* models has tested significance with an increase in hazard rate of 0,8% for every percent share of a low capacity model in the total model range of a manufacturer, rejecting hypothesis 9.

Lastly, the Share Flexibility has tested significantly negative. For every percentage of tapped categories within the product line of a manufacturer, the hazard rate decreases by 3,8%. This finding is in line with hypothesis 10 stating that variety in model categories leads to a higher survival probability.

The overall quality of the model significantly improved with the addition of the variables on several levels. The largest decrease in -2Log Likelihood is noted by the addition of the Product level variables, yet this is only a slight difference of 10 -2LL in comparison to the Manufacturer level variables. The effect of the product level variables as a whole is difficult to investigate due to the differences in measurements scale in comparison to the other variables.

4.1 Differences among case countries

In order to test the differences in the significance of the explanatory variables and the corresponding hazard rate, three separate models have been tested., starting off with Great Britain.

Great Britain			
	Model 1	*Model 2*	*Model 3*
Cluster level			
Cluster	*0,629**	*0,793*	*0,912*
Manufacturer level			
Re-entry		*0,774*	*1,226*
Time entry		*7,633****	*5,604****
Starter Inexperienced (r)			
Spin-off (1)		*0,271*	*0,673*
Starter Experienced (2)		*0,156***	*0,244**
Incumbent Inexperienced (3)		*0,327*	*0,341*
Incumbent Experienced (4)		*0,124****	*0,176***
Product level			
Range Capacity			*0,997****
Share High			*1,012*
Share Low			*1,006*
Share Flexibility			*0,958***
**Significant at the 0.10 level **Significant at the 0.05 level ***Significant at the 0.01 level*			

Figure 28 Cox Regression Analysis for Great Britain

Model 1 illustrates the *Cluster* effect in Great Britain which is negatively significant. The cluster effect as depicted in hypothesis 2 seems to be supported in the individual case of Great Britain leading to a 37,1% lower hazard rate. However, in comparison to *figure 27*, the variable loses significance once other variables are added.

Model 2 included the Manufacturer level variables. No evidence has been found to support the effect of *Re-entries*, yet the *Time of Entry* variable is positively significant with a substantial increase of the coefficient in comparison to *figure 27*. The entry of a manufacturer between 1950-1980 in Great Britain increased the hazard rate the most of the three countries.

Interestingly, the *Incumbent Experienced* noted the lowest significant hazard rate out of the background roles, whilst this was the case for the *Spin-offs* in *figure 27*.

Model 3 adds the product level variables. The variables show no specific difference in direction of the effect, yet lacks significance for the *Share Low* variable. The *Range Capacity* in Great Britain shows the strongest negative effect out of the three case countries.

The following model illustrates the Cox Regression Analysis for Germany.

Germany			
	Model 1	*Model 2*	*Model 3*
Cluster level			
Cluster	*1,149*	*1,123*	*0,810*
Manufacturer level			
Re-entry		*1,09*	*1,192*
Time entry		*2,049****	*1,213*
Starter Inexperienced (r)			
Spin-off (1)		*0,573*	*0,321*
Starter Experienced (2)		*0,391*	*0,280*
Incumbent Inexperienced (3)		*0,286*	*0,377*
Incumbent Experienced (4)		*0,369*	*0,245*
Product level			
Range Capacity			*0,998****
Share High			*1,014*
Share Low			*1*
Share Flexibility			*0,938****
**Significant at the 0.10 level **Significant at the 0.05 level ***Significant at the 0.01 level*			

Figure 29 Cox Regression Analysis for Germany

The first point which differs from the previous models is the different direction from the *Cluster* variable coefficient which hints at an increase in the hazard rate form the presence in a cluster in Germany, even though the variable is insignificant. This effect was already hinted in the descriptive statistics since Germany was the only country where manufacturers in a cluster noted a lower average age than their counterparts outside clusters.

Model 2 illustrates the same level of significance for the variables *Re-entry* or *Time of entry,* yet with lower coefficients in comparison to *Figure 27* or *28*. The main difference in model 2 is the lack of significance for the background roles of the heritage model.

Model 3 shows no remarkable differences in the coefficients or significance of the product variables in comparison to the previous models.

The final model illustrates the Cox regression analysis for Italy

Italy			
	Model 1	*Model 2*	*Model 3*
Cluster level			
Cluster	*0,787*	*0,629***	*0,539****
Manufacturer level			
Re-entry		*1,047*	*1,176*
Time entry		*2,263****	*2,328****
Starter Inexperienced (r)			
Spin-off (1)		*0,415****	*0,789*
Starter Experienced (2)		*0,8*	*1,202*
Incumbent Inexperienced (3)		*0,889*	*1,586*
Incumbent Experienced (4)		*0,573***	*0,838*
Product level			
Range Capacity			*0,998****
Share High			*1,010*
Share Low			*1,022****
Share Flexibility			*0,961****
**Significant at the 0.10 level **Significant at the 0.05 level ***Significant at the 0.01 level*			

Figure 30 Cox Regression Analysis for Italy

The *cluster* effect in model 1 is not immediately apparent in Italy, yet increases significance and strength once other variables are added. The cluster effect therefore is a negative confounder and behaves in the same manner as in *Figure 27*.

The *Re-entry* and *Time of Entry* hold the same effect as in the previous models. The results for the background roles differ since the Spin-off is only significant in Italy. *Spin-offs* note a 58,5% decrease in hazard rate.

The direction and significance of the product variable in model 3 do not differ from the ones in *figure 27*.

Hypothesis 10, regarding the effect of the product level variables could therefore be partially supported. The separate country models, including *figure 27*, show the same direction for the variables, however, only Germany and Great Britain lack the significance of the *Share Low Capacity*.

4.2 Synthesis

The table below summarizes the results based on the stated hypotheses and serve as a synthesis of the chapter.

Hypothesis 1: The hazard rate differed between countries	*Rejected*
Hypothesis 2: Presence in clusters lowered the hazard rate	*Supported*
Hypothesis 3: Entrance in the period between 1950-1980 increased the hazard rate	*Supported*
Hypothesis 4: Re-entries encountered a higher hazard rate	*Rejected*
Hypothesis 5: Spin-offs had the lowest hazard rate in the heritage model	*Supported*
Hypothesis 6: Experienced manufacturers had a lower hazard rate than inexperienced competitors	*Rejected*
Hypothesis 7: Variety in model engine capacity led to a lower hazard rate	*Supported*
Hypothesis 8: A focus on high capacity led to a higher hazard rate	*Rejected*
Hypothesis 9: A focus on low capacity led to a lower hazard rate	*Rejected*
Hypothesis 10: Variety in model categories led to a lower hazard rate	*Supported*
Hypothesis 11: The direction of the hazard rate on the product level is the same across the three case countries	*Supported*

Figure 31: synthesis of the hypotheses

5. Conclusion and discussion

This chapter will conclude the most important results of the research and answer the main research question. The research investigated the effect of the product strategy of motorcycle manufacturers as an addition to existing firm survival theory. The findings from this research partially confirm the existing theories in the case of the motorcycle industry.

First of all, the *National level* solely had no significant effect on the hazard rate of the manufacturers. However, the country effect became active once the variables from other levels were included, the same effect occurred on the *Cluster* level. The negative confounding of the two variables suggests that a relation with the *Manufacturer* level and *Product* level variables, besides the relation with the dependent variable. The addition of the omitted variables significantly increased the explanatory power of the Country and Cluster variables. The explanation of eventual manufacturer's age thus differs per country as suggested by Cenzatti (1990). The highest increase in hazard rate was noted for Great Britain followed by Germany as a reference to Italy.

The *Cluster* variable was significant upon entrance in the model and gained significance throughout. The immediate cluster effect was most prevalent in Great Britain with a large reduction of the hazard rate, in line with Marr (2012) who stated that the eventual loss of manufacturers took decades longer in the CBW cluster than outside. In conclusion, the theory of Porter (2000) also applies to the case of the downfall of the motorcycle industry.

The *Time of Entry* in the period of 1950 until 1980 remains significant throughout the model resulting in an increase in the hazard rate for manufacturers starting in this period, coinciding with the theory of (Agerwall et. al, 2007). The negative effect of entrance between 1950-1980 on the manufacturer's survival was the strongest in Great Britain.

No evidence has been found to support the effect of *Re-entries*, presumably since the motivation of the previous exits has not been examined. A more precise test could have been carried out if the variable had been split up into a negative and positive exit reasoning, however available data for this measurement was scarce.

The modified Heritage Model shows that *Spin-offs*, *Experienced Starters* and *Experienced Incumbents* have a significantly lower hazard rate in comparison to the reference category *Inexperienced Starters*. These results support two theories, on the one hand it supports the main theory of Klepper (2007) stressing the improved performance of spin-offs, the spin-offs in the case of the motorcycle industry noted the lowest significant hazard rate. On the other hand, it supports the theory of Wezel (2009) arguing that *Incumbents* perform better than *Starters*.

Related experience of the manufacturer regarding motorcycles resulted in a lowered hazard rates in the case of both the *Starters* as the *Incumbents*. Italy was the only separate country which noted a significant effect of Spin-offs which reduced the hazard rate. In Great Britain, the experienced manufacturers noted the highest reduction in hazard rate.

Lastly, it is vital to answer the main research question: *What was the effect of the product strategy on the survival of motorcycle manufacturers in Germany, Great Britain and Italy between 1950 and 1980?* In general, a few points can be concluded. A wider range in engine capacity significantly lowers the hazard rate, meaning that a focus on a singular engine segment hurts the survival probability, as was the case in all three countries. Likewise, the diversification via tapping into other motorcycle categories also lowers the hazard rate. This ultimately supports the diversification theory of Frenken et. al (2007) based on the portfolio.

A surprising finding is the increasing hazard rate for the focus on low-capacity engine models. Cenzatti (1990) for instance, argued that the moped/scooter category was vital in the restructuring of the Italian motorcycle industry. On the contrary Marr (2012) stated that although some regions in Great Britain transitioned rapidly into this new segment, it ultimately was no guarantee for success. As been mentioned in the theoretical section, the scooter market in Europe was mainly dominated by relatively few manufacturers such as Vespa and Lambretta (Cenzatti, 1990), both established manufacturers. Competing on a market with oligopolistic characteristics as a new manufacturer could be too difficult, particularly since it is proven in this research that the characteristics of new entrants (as a background role) and starting in 1950-1980, both substantially increase the hazard rate. The combination of fierce competition and an unfavourable entrance climate led to a large number of exits which resulted in the positive significance of the variable *'Share Low capacity'*.

In conclusion, the findings of this research point out that the product level plays an important role in the survival of manufacturers. However, there is also room for additional research in this matter. First of all, the case selection is based on the period of industrial downfall and therefore is selective in sampling. For instance, the inclusion of the scooter category might change the results of the hazard rate since scooters again became increasingly popular from 2000 onwards. A broader time frame could provide an even better insight into the role of the product strategy. Finally, the financial level is neglected in this research due to data limitation but could also have a large explanatory power. Debt equity ratios, turnover, government aid and so forth could play a vital role in the decision making for the product strategy and thus be of great importance in the later stages of the manufacturer.

7. Reference list

Agarwal, R. (1998). Small Firm Survival and Technological Activity. *Small Business Economics*, *11*(3), 215–224. https://doi.org/10.1023/A:1007955428797

Agarwal, Rajshree, & Audretsch, D. B. (2001). Does Entry Size Matter? The Impact of the Life Cycle and Technology on Firm Survival. *Journal of Industrial Economics*, *49*(1), 21–43. https://doi.org/10.1111/1467-6451.00136

Agarwal, R., & Gort, M. (2002). Firm and Product Life Cycles and Firm Survival. *American Economic Review*, *92*(2), 184–190. https://doi.org/10.1257/000282802320189221

Agarwal, R., Sarkar, M. B., & Echambadi, R. (2002). THE CONDITIONING EFFECT OF TIME ON FIRM SURVIVAL: AN INDUSTRY LIFE CYCLE APPROACH. *Academy of Management Journal*, *45*(5), 971–994. https://doi.org/10.2307/3069325

Audretsch, D. B., & Feldman, M. P. (2004). Chapter 61 Knowledge spillovers and the geography of innovation. *Handbook of Regional and Urban Economics*, 2713–2739. https://doi.org/10.1016/S1574-0080(04)80018-X

Bell, G. G. (2005). Clusters, networks, and firm innovativeness. *Strategic Management Journal*, *26*(3), 287–295. https://doi.org/10.1002/smj.448

Baldwin, J., Bian, L., Dupuy, R., & Gellatly, G. (2000). *Failure Rates for New Canadian Firms: New Perspectives on Entry and Exit*. Retrieved from https://EconPapers.repec.org/RePEc:stc:stcb5e:stcb5e

Bian, H. (2019). Survival Analysis Using SPSS. Retrieved May 1, 2019, from http://core.ecu.edu/ofe/StatisticsResearch/Survival%20Analysis%20Using%20SPSS.pdf

Bielefeld. (n.d.). Bielefeld - Fahrradindustrie. Retrieved June 19, 2019, from https://www.bielefeld.de/de/pbw/mub/dms/dmof/fai.html

Bikez.com. (2019). Motorcycle catalog with 32 000 motorcycles. Retrieved March 19, 2019, from https://bikez.com/main/index.php

Boschma, R. A., & Wenting, R. (2007). The spatial evolution of the British automobile industry: Does location matter? *Industrial and Corporate Change*, *16*(2), 213–238. https://doi.org/10.1093/icc/dtm004

Boschma, R., & Frenken, K. (2009). Technological relatedness and regional branching. *Papers in Evolutionary Economic Geography*. Retrieved from http://econ.geo.uu.nl/peeg/peeg.html

Brenner, T. (2006). Identification of Local Industrial Clusters in Germany. *Regional Studies*, *40*(9), 991–1004. https://doi.org/10.1080/00343400601047408

Broekel, T. (2018, February 28). Spin-offs and agglomeration [Presentation]. Retrieved April 1, 2019, from https://uu.blackboard.com/webapps/blackboard/execute/content/file?cmd=view&content_id=_2849482_1&course_id=_111378_1

Cenzatti, M. (1990). Restructuring in the Motorcycle Industry in Great Britain and Italy until 1980. *Environment and Planning D: Society and Space*, *8*(3), 339–355. https://doi.org/10.1068/d080339

Cottrell, T., & Nault, B. R. (2004). Product variety and firm survival in the microcomputer software industry. *Strategic Management Journal*, *25*(10), 1005–1025. https://doi.org/10.1002/smj.408

Cyber Motorcycle. (2019). Classic Motorcycles. Retrieved March 19, 2019, from https://cybermotorcycle.com/

Evans, D. S. (1987b). The Relationship Between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries. *The Journal of Industrial Economics*, *35*(4), 567. https://doi.org/10.2307/2098588

Delgado, M., Porter, M. E., & Stern, S. (2014). Clusters, convergence, and economic performance. *Research Policy*, *43*(10), 1785–1799. https://doi.org/10.1016/j.respol.2014.05.007

Dencker, J. C., Gruber, M., & Shah, S. K. (2009). Pre-Entry Knowledge, Learning, and the Survival of New Firms. *Organization Science*, *20*(3), 516–537. https://doi.org/10.1287/orsc.1080.0387

Department of State Growth LAND TRANSPORT SAFETY DIVISION. (2013, January 14). Fact Sheet Introduction of LAMS (Learner Approved Motorcycle Scheme) ***Power to Weight Ratio for Motorcycles***. Retrieved April 30, 2019, from https://www.transport.tas.gov.au/__data/assets/pdf_file/0009/108477/MR42_10_14_fact_sheet_LAMS_approved_motorcycles.pdf

Evans, D. S. (1987). The Relationship Between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries. *The Journal of Industrial Economics*, *35*(4), 567. https://doi.org/10.2307/2098588

European Commission. (2017, August 9). EU Cluster Portal - Internal Market, Industry, Entrepreneurship and SMEs - European Commission. Retrieved March 30, 2019, from http://ec.europa.eu/growth/industry/policy/cluster_en

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *The Quarterly Journal of Economics*, *108*(3), 577–598. https://doi.org/10.2307/2118401

Frenken, K., van Oort, F. G., Verburg, T., & Boschma, R. A. (2005). Variety and Regional Economic Growth in the Netherlands. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.871804

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *The Quarterly Journal of Economics*, *108*(3), 577–598. https://doi.org/10.2307/2118401

Gort, M., & Klepper, S. (1982). Time Paths in the Diffusion of Product Innovations. *The Economic Journal*, *92*(367), 630. https://doi.org/10.2307/2232554

Klepper, S. (1997). Industry Life Cycles. *Industrial and Corporate Change*, *6*(1), 145–182. https://doi.org/10.1093/icc/6.1.145

Klepper, S. (2001). Employee Startups in High-Tech Industries. *Industrial and Corporate Change*, *10*(3), 639–674. https://doi.org/10.1093/icc/10.3.639

Klepper, S. (2007). Disagreements, Spinoffs, and the Evolution of Detroit as the Capital of the U.S.

Automobile Industry. *Management Science*, *53*(4), 616–631. https://doi.org/10.1287/mnsc.1060.0683

Krugman, P., (1991), Geography and Trade, (MIT Press: Cambridge)

Labrador, R. C. (2019, January 24). Venezuela: The Rise and Fall of a Petrostate. Retrieved June 19, 2019, from https://www.cfr.org/backgrounder/venezuela-crisis

Łobos, K., & Szewczyk, M. (2012). Survival analysis: A case study of micro and small enterprises in Dolnośląskie and Opolskie Voivodship (Poland). *Ekonomická Revue - Central European Review of Economic Issues*, *15*(4), 207–216. https://doi.org/10.7327/cerei.2012.12.01

Lobosco, K. (2018, July 19). Five years ago Detroit was bankrupt. Now it's coming back. Retrieved April 10, 2019, from https://edition.cnn.com/2018/07/17/us/detroit-bankruptcy/index.html

MacKinnon, D. P. (2000). Equivalence of the Mediation, Confounding and Suppression Effect. *Prevention Science*, *1*(4), 173–181. https://doi.org/10.1023/a:1026595011371

Morrison, A., & Boschma, R. (2018). The spatial evolution of the Italian motorcycle industry (1893–1993): Klepper's heritage theory revisited. *Industrial and Corporate Change*, *28*(3), 613–634. https://doi.org/10.1093/icc/dty019

Muffato, M., & Panizzollo, R. (1996). Innovation and product development strategies in the italian motorcycle industry. *Journal of Product Innovation Management*, *13*(4), 348–361. https://doi.org/10.1016/S0737-6782(96)00034-3

Marr, P. (2012). The Geography of the British Motorcycle Industry, 1896–2004. *The Journal of Transport History*, *33*(2), 163–185. https://doi.org/10.7227/TJTH.33.2.2

Martin, R., & Sunley, P. (2003). Deconstructing clusters: chaotic concept or policy panacea? *Journal of Economic Geography*, *3*(1), 5–35. https://doi.org/10.1093/jeg/3.1.5

Menzel, M.-P., & Fornahl, D. (2007). Cluster Life Cycles - Dimensions and Rationales of Cluster Development. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1025970

Metzger, G. (2006). Afterlife - Who Takes Heart for Restart? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.908212

Neffke, F., Henning, M., Boschma, R., Lundquist, K. J., & Olander, L. O. (2008). Who Needs Agglomeration? Varying Agglomeration Externalities and the Industry Life Cycle. *Papers in Evolutionary Economic Geography, Urban & Regional Research Centre Utrecht, Utrecht University, 2008*. Retrieved from http://econ.geo.uu.nl/peeg/peeg0808.pdf

Nieuwsmotor. (2019, February 12). Motorfiets verkopen Europa in 2018 9,9% gestegen. Retrieved March 15, 2019, from https://www.nieuwsmotor.nl/motorbranche/24105-motorfiets-verkopen-europa-in-2018-9,9-gestegen

Platform 31. (2015, January 1). Platform31 kennis- en netwerkorganisatie voor stad en regio - Cluster Governance. Retrieved April 2, 2019, from https://www.platform31.nl/publicaties/cluster-governance

Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global

Economy. *Economic Development Quarterly*, *14*(1), 15–34. https://doi.org/10.1177/089124240001400105

Stack Exchange. (2015, July 5). Negative confounders. Retrieved June 19, 2019, from https://stats.stackexchange.com/questions/160026/why-does-an-insignificant-regressor-become-significant-if-i-add-some-significant

Stearns, T. M., Carter, N. M., Reynolds, P. D., & Williams, M. L. (1995). New firm survival: Industry, strategy, and location. *Journal of Business Venturing*, *10*(1), 23–42. https://doi.org/10.1016/0883-9026(94)00016-N

Tushman, M. L., & Anderson, P. (1986). Technological Discontinuities and Organizational Environments. *Administrative Science Quarterly*, *31*(3), 439. https://doi.org/10.2307/2392832

Von Rhein, K. (2008). Heritage and Firm Survival - An Analysis of German Automobile Spinoffs 1886-1939. *Economics Bulletin*. Retrieved from https://core.ac.uk/download/pdf/6310108.pdf

Wezel, F. C., & Lomi, A. (2002). *Different trajectories of industrial evolution:demographical turnover in the European motorcycle industry, 1885-1993*. University of Groningen.

Wezel, F. C. (2005). Location Dependence and Industry Evolution: Founding Rates in the United Kingdom Motorcycle Industry, 1895-1993. *Organization Studies*, *26*(5), 729–754. https://doi.org/10.1177/0170840605051823

Wezel, F. C., & Lomi, A. (2009). 'Built to last 'or 'new and improved'? Trajectories of industrial evolution in the European motorcycle industry, 1885–1993. *European Management Review*, *6*(2), 107-119.

Wilson, H. (1995). *The Encyclopedia of the Motorcycle*. Dorling Kindersley.

Yamamura, E., Sonobe, T., & Otsuka, K. (2005). Time path in innovation, imitation, and growth: the case of the motorcycle industry in postwar Japan. *Journal of Evolutionary Economics*, *15*(2), 169–186. https://doi.org/10.1007/s00191-004-0239-3