

**How has the Covid-19 pandemic impacted e-commerce entry barriers in the
FMCG industry?**

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ABSTRACT

The e-commerce entry barriers illustrate potential bottlenecks for new entrants when entering the e-commerce market. Previous research on the concept of e-commerce entry barriers have established four categories of entry barriers: sustainability, competitive advantage, capital requirements and e-commerce resources. This thesis explores the impact of the Covid-19 pandemic on the relationship between, on the one side, the sustainability entry barriers, the competitive advantage entry barriers and the capital requirement entry barriers and, on the other side, industry profitability in the FMCG industry for e-commerce markets. The findings indicate that these are indeed the entry barriers for the e-commerce markets. The Covid-19 pandemic has made the sustainability entry barrier stronger. No support has been found for the impact of the Covid-19 pandemic on the competitive advantage and capital requirement entry barrier. This thesis contributes to existing literature by combining current research on e-commerce entry barriers and the impact of Covid-19 pandemic on the market structure.

Key words: Entry barriers, The Covid-19 pandemic, E-commerce, FMCG, Industry profitability,

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

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1. INTRODUCTION

Over the recent years, e-commerce has been thriving. According to the Dutch Central Bureau of Statistics, online sales in the Netherlands have increased by 17,5% in 2019 compared to the year before (Centraal Bureau van Statistiek, 2020). E-commerce refers to consumers buying goods from and firms selling goods via the internet (Bloomenthal, 2020). Even though e-commerce is booming and is associated with growth opportunities, there is a huge across-product variation with the adoption of e-commerce in the market (Hortaçsu & Syverson, 2015). Hortaçsu & Syverson (2015) have looked at the development of e-commerce between 2000 and 2014. They found that while sectors like music, books and computer hardware have fully adopted the transfer to e-commerce, other sectors like drugs, health, beauty, and food and beverages are lacking behind.

There are two prominent streams of research in the field of e-commerce, the most research has been carried out in relation to the effect e-commerce has on prices and on the convenience in the shopping experience for consumers. The second prominent stream of research relates to the change in market structures resulting from the rise of e-commerce.

Besides these two prominent streams, some research has also been conducted regarding the impact of e-commerce on the barriers of entry in a market. Entry barriers are defined as elements that restrict competition in an industry or market, while the social optimum would be more competition (Kostios, 2014). To exemplify, Peritt (2000) has shown that the main reason why e-commerce has lower entry barriers is due to lower search costs, the lack of a physical infrastructure and the lower transportation costs. Additional research by Li & Frederick (2019) shows that the lower costs associated e-commerce entry barriers, have allowed smaller firms to pursue higher-value tasks and offer services that they could not provide before.

Entry barriers are often divided into several categories such as natural & technical barriers (Howe, 1978) first- and second-line barriers (Jacobsen & Andreosso-O'Callaghan, 1996) and indigenous and exogenous barriers (Sheppard, 1990). In this thesis, the separation made by the OECD will be used, the OECD identifies structural as well as strategic entry barriers. Strategic entry barriers are created by choices that are made by established firms, while structural entry barriers refer to barriers that are created by exogenous demand which affect the entire industry in a similar matter (Organisation for the Economic Cooperation and Development, 2005).

The model established by Karakaya & Stahl (2009) explores the major entry barriers in e-commerce before and after market entry. Karakaya & Stahl (2009) identify several entry barriers related to e-commerce when looking at the impact on firm performance, such as: competitive advantage, lack of capital, sustainability, and e-commerce resources. Each of these elements contains one or more entry barriers that are relevant for e-commerce. These elements will now be concisely laid-out and will be used in this thesis as the e-commerce entry barriers. First, e-commerce resources refer to e-commerce specific barriers that might cause problems like digital infrastructure, technological knowledge, and the e-commerce learning curve. Second, the competitive advantage refers to entry barriers that generate a competitive advantage for rival firms. Examples of such competitive advantage entry barriers are government subsidies, brand loyalty and a rival firm's ability to lower prices to deter entry. Third, capital requirement refers to barriers related to the willingness of venture capitalists to invest; the capital intensity of the market; and whether there is enough capital for infrastructure. Finally, sustainability refers to barriers that help sustain the firm as well as some uncertainties. For example, this element contains fear of the unknown, consumers fear of the security of data, access to distribution channels and switching costs.

Besides the rapid growth in e-commerce, the business environment of e-commerce has changed as well. The Covid-19 pandemic has resulted in the forced closure of brick-and-mortar stores due to the governmental measures adopted to prevent the further spread of the virus. From January 2020, firms in a whole range of sectors are forced to make the shift to online sales to survive. The fastest-growing sector in e-commerce in 2020 has been food and beverages, which grew by 58 per cent compared to 2019 (Welie, 2020). These forced changes as well as changes in consumer behaviour trends have shifted the importance of certain entry barriers for the e-commerce market for the Fast-Moving Consumer Goods Industry, hereafter FMCG industry.

The FMCG industry has been selected as e-commerce has been growing rapidly in this sector (Hortaçsu & Syverson, 2015). The dataset used in this thesis mainly contains information on the FMCG industries. To generalize the results to a specific industry, only FMCG industries are used.

1.1 Research question

The purpose of this thesis is to find out whether the Covid-19 pandemic has led to changes in the entry barriers of the e-commerce FMCG industry. More specifically, this thesis examines

how changes in both consumer trends as well as industry changes influence the already existing entry barriers of e-commerce mentioned in the paper by Karakaya & Stahl (2009). The first objective of this thesis is to provide additional empirical evidence on the effect of the existing entry barriers for e-commerce markets. Secondly, this thesis aims to create a better view of e-commerce entry barriers and how these have evolved during the Covid-19 pandemic. Thirdly, the impact of the Covid-19 pandemic on the e-commerce entry barriers for FMCG industries specifically are explored. To provide these insights this thesis answers the question:

“How has the Covid-19 pandemic impacted the significance of certain entry barriers in e-commerce in retail industries?”

To answer this question, the sustainability, the competitive advantage, and the capital requirement entry barriers are going to be examined using a moderator variable to resemble the Covid-19 pandemic. The first element explores whether the Covid-19 pandemic has changed the barriers related to sustaining the firm as well as how a firm deals with uncertainties. Secondly, whether the competitive advantages that rival firms enjoy have changed due to the Covid-19 pandemic. Finally, how barriers related to capital requirements and access to capital has changed by the Covid-19 pandemic. Therefore, the following sub-questions are answered: *How have sustainability entry barriers changed compared to pre-pandemic situation? How has the competitive advantage entry barrier changed compared to the pre-pandemic situation? How has the capital requirement entry barrier changed compared to the pre-pandemic situation?*

The findings of this thesis reveal that sustainability entry barriers are impacted by the Covid-19 pandemic. Pre-existing firms are struggling with supply chain issues and this is spilled over to new entrants when looking for distribution channels. Contradicting support has been found for the impact of the Covid-19 pandemic on the competitive advantage entry barrier. Whereas no support has been found for the capital requirement entry barrier. The Covid-19 pandemic does influence entry barriers for the e-commerce sector, but the extend has to be further researched.

The thesis is structured as followed. The next section introduces the concept of e-commerce, the relevant entry barriers, and the impact the Covid-19 pandemic has on these entry barriers. Section 3 presents the used proxies for the entry barriers and the data collection. Then, section 4 presents the results of the thesis. The final section concludes and presents

possible limitations of the research. The remainder of this section discusses the relevance of the research area.

1.2 Academic relevance

As laid-out before, the way how markets are influenced by entry barriers and whether firms should enter the market has already been explored by many researchers. Some have also already aimed to shed a light on the entry barriers to e-commerce. Other researchers have aimed to create insights into the impact of the Covid-19 pandemic and the market structure (Fernandes, 2020). Considering the pandemic and its impact on the economy, it is important to get a better understanding of these effects leading to possible changes in entry barriers. This is especially important as the forced closure of shops has led to a huge rise in online shopping. The theoretical contribution of this thesis is to create a deeper understanding of the effects of the Covid-19 pandemic on e-commerce entry barriers in the FMCG industry.

This thesis has three theoretical contributions. First, this thesis links the e-commerce entry barriers specifically to FMCG industries. Previous research did not focus on a specific sector or did not highlight the differences between industries as well. This research takes a more specific look at six FMCG industries that have been impacted by the Covid-19 pandemic. As a result, there have been changes in consumer behaviour as well as industry trends. Secondly, this thesis contributes to the theory of the impact of the Covid-19 pandemic on industries. Little research has currently been presented about the impact of the Covid-19 pandemic and whether these led to permanent changes. Finally, this thesis provides further empirical evidence for the e-commerce entry barriers identified by Karakaya & Stahl (2009). This thesis highlights the model of Karakaya & Stahl (2009) and applies this model to different industries.

1.3 Managerial relevance

When managers or entrepreneurs are thinking about entering a new market, they need to understand the challenges and opportunities of that market. Especially during rapidly changing time, due to the nature of the Covid-19 pandemic. Additionally, it is important for managers to know how a market would respond to the shift to online sales. The functioning of the online market is different from those of the offline market. A better understanding of how to enter the e-commerce market and what the market challenges are, is therefore, essential for new firms entering the market.

2. THEORETICAL FRAMEWORK

In this section, an in-depth research is conducted on the rise of e-commerce, the model of interest by Karakaya & Stahl (2009) and how the Covid-19 pandemic has impacted the sustainability, the competitive advantage, and the access to capital barriers in the e-commerce market. At the very end of the chapter, an overview of the conceptual framework is given.

2.1 A comprehensive view on e-commerce

To highlight the definition of the e-commerce again, electronic commerce, also referred to as e-commerce, is the act of maintaining relationships and conduct business transactions of both goods and services using telecommunication networks (Zwass, n.d). This definition already suggests that the history of e-commerce is closely linked to the rise of the internet. Most people think of e-commerce as the trading of goods and services via the internet, it also consists of business-to-business and business-to-consumer transactions via email or other telecommunications networks. Therefore, the first notations of electronic transactions can be traced back to 1948-49 when German goods were ordered via telex. However, the introduction of the internet has led to a boost in e-commerce (Santos et al., 2017).

With the rise of smartphones and other electronic devices, it is much easier to access the internet and therefore also e-commerce moved to mobile devices such as smartphones and laptops. As mentioned before, over the recent years, the e-commerce market has had enormous growth rates, with several advantages over regular brick and mortar stores. Such as offering lower prices because e-commerce has lower overhead, lower-taxed and often has a few skips in the supply chain (Peritt, 2000). For consumers, e-commerce has provided many advantages mainly related to convenience in time, price comparison as well as lower transportation costs. These advantages for consumers arise as the costs that are associated with online shopping are considered close to zero for the consumer (Peritt, 2000).

However, consumers also consider some disadvantages associated with e-commerce. The main disadvantage experienced by consumers relates to the fact that it is not feasible to try on products online, therefore retail stores still attract consumers. Additionally, some industries are more suitable for e-commerce than others. An example of such an industry are grocery stores; these are considered as essential stores that would not make the switch to e-commerce. However, recently this industry has also been making the shift to e-commerce as there has been a rise in new online grocery stores such as Picnic and Gorilla. This has been facilitated by the

change in consumer perception, as recently consumers have experienced the ease of online grocery shopping (Kureshi & Thomas, 2019).

The Covid-19 pandemic has forced consumers to do as much shopping online as possible and only going to the store for products that are considered essential. Some initial research has already shed a light on the impact of the Covid-19 pandemic on consumer trends. One of the biggest effects of the Covid-19 pandemic on the business environment for e-commerce firms is the huge rise in the demand of consumers. This rise in demand is mainly because of forced closure of retail stores in a number of countries to prevent the Covid-19 from spreading. Another explanation for the rise in the demand of consumer in the e-commerce sector is the fear of the pandemic (Tran, 2020). Consumer attitudes and behaviour are changed to products that can protect, can be stored and can be bought online (Tran, 2020).

2.2 Karakaya & Stahl (2009) barriers of entry model

As mentioned in the introduction, a number of researchers have look at the entry barriers for a market and even some research has been conducted on the entry barriers for the e-commerce market specifically. What makes the e-commerce market entry barriers different from the offline market entry barriers? The main advantage of e-commerce markets over offline markets is the no need for a physical infrastructure. For example, an e-commerce firm does not have a physical store where consumers can buy the products and the maintenance costs associated with the holding of a store. However, the use of the internet as a source of business also means that other barriers arise such as a stronger need for a technical infrastructure and cybersecurity.

A study by Karakaya & Stahl (2009) used a survey among various e-commerce firms, including online only stores as well as firms that operate both online and offline. In this research, they asked these firms to rate the importance of 27 different entry barriers that they viewed as important for the e-commerce market structure. These 27 different entry barriers are then divided into 4 different barriers related to capital requirement, sustaining a business, the competitive advantage of the rival firms and e-commerce resources. Each of these elements contains one or multiple entry barriers that are relevant for e-commerce.

First, e-commerce resources refer to e-commerce specific barriers that might pose problems like digital infrastructure, technological knowledge, and e-commerce learning curve. These entry barriers for starting an e-commerce firm are still very relevant, many firms struggle with technological issues related to starting an e-commerce firm and this is seen as one of the main issues why e-commerce firms do not succeed (Dubelaar et al.,2005). This view is

supported by Oliviera & Martins (2010) who explored the adoption of e-commerce firms in the tourism and telecommunications industry. They found that technological and organizational readiness was one of the major reasons why companies were failing. Another key e-commerce resources barrier preventing already existing firms to make the switch to online is the reconfiguration these companies need to make in their business model and consider the switch to online to be technically demanding (Tolstoy, Nordman, Hånell and Özbek, 2021). Therefore, these e-commerce resources are seen as an entry barrier for e-commerce markets.

Second, the competitive advantage refers to entry barriers that generate a competitive advantage of rival firms such as government subsidies, brand loyalty and a rival firm's ability to lower prices to deter entry. Another competitive advantage of a rival firm is technology, to be more specific proprietary technology. These technologies are especially important for making the switch to e-commerce and are therefore considered as an important entry barrier. Existing firms that spend a lot of money in R&D have the benefit over new firms in e-commerce (Karakaya & Stahl, 2009). Another entry barrier in the category of competitive advantage is competition. Since the set-up of a firm online requires less work than a physical firm, there is fiercer competition in the e-commerce markets. However, as Oliviera & Martins (2017) also show that competitive pressure could also be positive for the entry barriers and adoption of e-commerce. In their paper, Oliviera & Martins (2017) look at the competitive pressure, the pressure a firm feels from its competitors in the industry. They argue that by differentiating yourself through e-commerce, the firm is changing the rules of the competition, using the innovation to differentiate and create a competitive advantage.

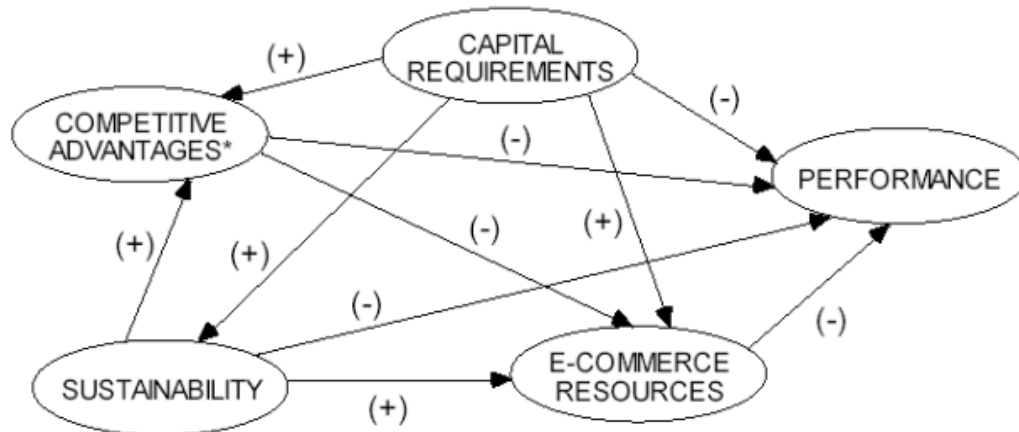
Third, capital requirement refers to the willingness of venture capitalists to invest, capital intensity of the market and whether there is enough capital for infrastructure. According to the article by Karakaya & Stahl (2009), most e-commerce firms fail to enter the market because of the lack of funding to sustain their business. Even though e-commerce firms tend to need less capital compared to physical companies, it still needs funding to keep operating. However, the paper by Karakaya & Stahl (2009), talks about the early 2000s, in the meanwhile twenty years have passed, and e-commerce has become more and more common. Also, other forms of access to capital have risen like crowdfunding and venture capitalist.

Finally, sustainability refers to barriers that help sustain the business as well as how firms are dealing with uncertainties. For example, this element contains fear of the unknown, consumers fear of the security of data, access to distribution channels and switching costs. The fact that new entrants need to secure distribution of their product, online or offline, can serve

as a barrier of entry for e-commerce markets and can give existing firms an advantage over new entrants (Islami et al., 2019). As other researchers have already shown, access to distribution channels is important for entering a market but also for staying in the market and remaining profitable. Many issues for e-commerce firms have been with the access to resources and distribution channels. Considering e-commerce is perceived as its own distribution channel and the growing competition, makes it harder to stand out to both suppliers and customers (Islami, et al., 2019). However, there are also advantages for the relationship with suppliers. Schniederjans et al., (2014) argue that e-commerce allows for more optimized relationships with suppliers as it could help facilitate collaborative planning.

In conclusion, the Karakaya & Stahl (2009) identifies four entry barriers for the e-commerce market: the sustainability barriers, the competitive advantage barriers, the capital requirement barriers, and the e-commerce barriers.

Figure 1: copy of figure 2 Structural Equation Model Showing Relationships between Barriers After Market Entry and Firm Performance (Karakaya & Stahl, 2009).



2.3 Impacts of the Covid-19 pandemic

Some initial research has already shed a light on the impact of the Covid-19 pandemic on both consumer trends and on the e-commerce entry barriers. As mentioned before, one of the biggest effects of the Covid-19 pandemic on the business environment for e-commerce firms is the rise in the demand of consumers, due to forced closure of brick-and-mortar stores as well as changes in consumer preferences for products that are protective, can be stored for a longer time and can be bought online (Tran, 2020).

However, the impact of the Covid-19 pandemic has also led to a drop in the aggregate demand and the aggregate supply (Seetharaman, 2020). On the supply side, the forced closure of business has reduced the aggregate supply. While simultaneously the reduction in consumption and investment has led to a reduction in the aggregate demand. One of the adaptations due to the Covid-19 pandemic is related to product information intensity. As Seetharaman (2020) also argues, that products that have high product information such as retail and banking can more easily adapt to e-commerce as they rely less on physical aspects.

Furthermore, the impact of the Covid-19 pandemic has also impacted the loaning possibilities. For example, in the Netherlands, businesses could loan money from the government if they lost more than 20 to 80 percent of their sales (*Het coronavirus: check hier je regelingen*, June 2, 2021). These firms had to use these loans to continue financing their employees and continue paying their producers. This of course helps the firms that are already in the market but makes the market, in general, less interesting to start a new business.

Additionally, the Covid-19 pandemic has also shed another light on what is considered an essential product. As Seetharaman (2020) argues that there are huge differences in e-commerce products that were considered essential, like food, pharmaceuticals, and banking. To exemplify, in France wine is considered as an essential good and therefore stores selling wine could continue operating during lockdown whereas in India the stores are not classified as essential and were forced to close. These differences in classifying products as essential can lead to differences in demand.

2.3.1 Impact on the sustainability barriers

As previously mentioned, many firms had to close their physical stores due to health measures deployed to contain the spread of the Covid-19 virus. There has also been a rise in demand for protective products, products that can be stored and e-commerce products (Tran, 2020). The rise in demand for certain products does not directly affect the level of entry barriers itself. However, the increased demand does influence the market structure. Entry barriers in the model of Karakaya & Stahl (2009) are influenced by this higher demand through the sustainability barriers. As aforementioned, sustainability barriers relate to remaining in the market and require entrants to have sufficient knowledge on the workings of e-commerce and access to distribution channels. The latter has been impacted by the Covid-19 pandemic.

Firms, especially those operating in manufacturing, have had supply chain issues. This was caused by government regulations, as these have led to the closure of factories, borders, and ports, which has significantly hindered trade (Fernandes, 2020). As a result, there have been shortages of inventory and limited access to raw materials. To exemplify, in the United States, 75 per cent of the firms have reported that they experience disruptions in their supply chains (Fernandes, 2020). These supply chain issues caused by the Covid-19 pandemic, spill over to the sustainability entry barrier regarding access to distribution channels. It follows that when pre-existing firms experience supply chain issues, the probability for new entrants to find distribution channels is significantly lowered.

A research by Hasanat et al. (2020) looked at the impact of the Covid-19 pandemic on e-commerce firms in Malaysia. They argued that when the Chinese production processes are negatively impacted by the Covid-19 pandemic, this would spill over to the Malaysian e-commerce firms, because of their dependence on the Chinese market.

Disruptions in the supply chain impact various industries in different ways. To exemplify, the consumer health industry has a more complex supply chain and requires more access to raw materials compared to the beauty and personal care industry. Consequently, every industry responds differently to the impact of the Covid-19 pandemic on sustainability barriers. This has led to the following hypothesis:

H1: The importance of access to distribution channels entry barrier is strengthened by the Covid-19 pandemic.

2.3.2 Impact on the competitiveness of the industry

The competitive advantage of a rival firm is the next entry barriers that is going to be assessed. One aspect of the competitive advantage of a rival firm is whether a firm exploits all market opportunities (Sigalas et al., 2013). Sharma (2020) examined the impact of the Covid-19 pandemic on the e-commerce market in India. They concluded that pre-existing e-commerce firms respond more flexible to changes in consumer demand. Sharma (2020) argues that this is caused by pre-existing firms benefitting through brand loyalty and pricing strategies.

During the Covid-19 pandemic, brand loyalty heavily impacts the competitive advantage entry barrier. This is highlighted by Payne et al., (2021) who suggest that firms aim to enhance their brand image by looking after their stakeholders. Consumers are loyal to firms

who do not take economic advantages of the Covid-19 pandemic. Therefore, pre-existing firms can use brand loyalty as a tool to deter entry of new firms.

Moreover, the external trade of firms is influenced by demand uncertainties and the closures of national borders. Mead et al. (2020) have explored the impact of the Covid-19 pandemic on the price index in the food industry. On an international level, the closure of national borders has negatively impacted household food consumption, resulting in more volatile prices whereas prices for animal consumption have remained steady. On a domestic level, consumer prices have increased for products with supply chain issues. In contrast, the producer prices for perishable food have decreased because lower demand has led to disposure of excess supply.

In conclusion, the impact of the Covid-19 pandemic has positively impacted pre-existing in the e-commerce sector. This has led to the following hypothesis:

H2: The importance of the competitive advantage of rival firms entry barrier has strengthened by the Covid-19 pandemic.

2.3.3 Impact on the capital requirements

The final entry barrier that is going to be assessed is the capital requirement. This entry barrier relates to how a firm obtains sufficient financial resources to support their operations. The Covid-19 pandemic does not directly affect the capital requirement entry barrier. However, there are significant financial effects resulting from regulations adopted by national governments in response to the Covid-19 pandemic. Several countries have given firms the opportunity to attain financial aid as to prevent a new financial crisis. To exemplify, Canada has provided small- and medium-sized enterprises with a ‘business credit availability program’ to facilitate the transition to e-commerce.

The transition to e-commerce is considered a permanent shift. Therefore, investors are more likely to consider the e-commerce markets as an interesting investment opportunity. Hence, positively impacting the capital requirement entry barrier as firms more likely to attain sufficient finances from investors (Goodell, 2020). To further support the access to financial resources, the interest rate for loans has decreased as well. This makes it less expensive for new firms to access capital (Cochrane, 2020).

In contrast, research on previous financial crises and pandemic have sketch a different picture. Banks and other financial institutions are more reluctant to expedite loans to new firms due to economic uncertainties associated with a pandemic (Goodell, 2020). The location of a

firm does determine the accessibility of capital, firms located in disaster-prone areas have less leverage for a loan. Goodell (2020) further highlights that firms are less likely to pay back their loans as the pandemic becomes more severe, increasing the likelihood of a bank collapsing. This argument is supported by Ghadami et al. (2010) who examined the impact of the 2008 financial crisis on capital availability for e-commerce firms. They found that these firms were mostly impacted by three developments: less credit availability; increased saving rates; and decreased consumption expenditures.

Research by Brown et al, (2020) have explored the effect of the Covid-19 pandemic on entrepreneurial finance in the United Kingdom. They have concluded that there has been a decline in new equity transactions during the Covid-19 pandemic. Additionally, Brown et al, (2020) argue that the mainly seed finance is affected. This has led to the following hypothesis.

H3: The importance of access to capital entry barrier is strengthened by the Covid-19 pandemic.

2.4 The conceptual framework

Figure 2 illustrates the conceptual framework. This framework shows the relationships of interest, which will be analysed in the remainder of the thesis. Table 1 gives an overview of the hypotheses introduced in the previous sections.

Figure 2: The conceptual framework

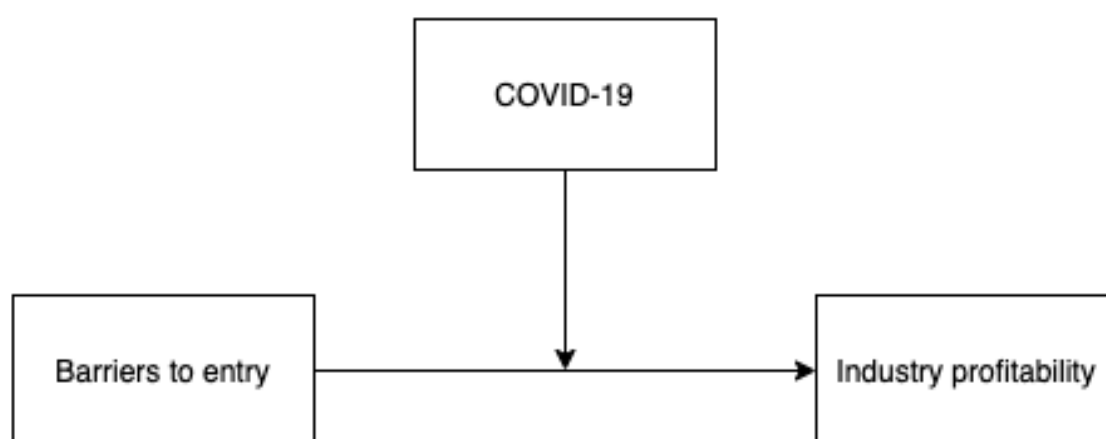


Table 1: Summary of the hypotheses

H1	<i>The importance of access to distribution channels entry barrier is strengthened by the Covid-19 pandemic.</i>
H2	<i>The importance of the competitive advantage of rival firms entry barrier has strengthened by the Covid-19 pandemic.</i>
H3	<i>The importance of access to capital entry barrier is strengthened by the Covid-19 pandemic.</i>

3. METHODOLOGY

This section aims to elaborate on the research methods employed to investigate the conceptual framework of this thesis. First, the proxies used to conceptualise the entry barriers are described. Second, the dataset employed in this thesis is introduced. Third, the inquiry of the used proxies is laid-out. Finally, the specifications of the used model are discussed.

3.1 Conceptual assessment of entry barriers

In general, researchers have had difficulty quantifying entry barriers. This is due to the fact that entry barriers themselves are not easily measurable (Chappell et al., 1983). Chappell et al., (1983) explain that there are two methods used among scholars to quantify entry barriers. The first approach utilises industry data and ad hoc judgements by researchers whether a certain entry barrier is perceived as high, moderate, or low. This method depends on a researcher's personal judgement and is therefore prone to researcher bias. Hence, researchers are more likely to judge the strength of entry barriers in a manner consistent with their initial hypotheses.

The other method described by Chappell et al. (1983) uses proxies for the entry barriers. These proxies can directly enter the regression equation and are less prone to researcher bias. An example of a proxy used for the product differentiation entry barrier is the advertising-sale ratio.

In this thesis, the latter research method is employed, hence proxies are used to quantify entry barriers in the e-commerce industry. By using this research method, this thesis aims to be descriptive rather than causal. To determine proxies for the entry barriers, data from Euromonitor International is used. Euromonitor International is a market research database containing industry data on various products and services from 210 countries in the e-commerce sector. The data that is of interest in this thesis relates to industry profitability, product availability, market concentration, and business dynamics. These proxies are respectively used for the sustainability, competitive advantages, and capital requirement entry barriers. More in-depth analysis of the data collection is found in section 3.3.

3.2 Proxies used to assess entry barriers

The dependent variable employed in this thesis is industry profitability. This outcome variable is often used by other researchers to determine the effect of the entry barriers. Industry profitability is measured in the paper by Cappell et al., (1983) using the price-cost margin. Other measures for industry profitability are gross profits or net profits (Porter, 1980). High-

profit levels in a market might seem attractive for new firms but are often associated with high entry barriers. As existing firms are able to charge significantly above industry average prices (Islami et al., 2019).

The data available at the Euromonitor regarding the industry profitability varies across the different industries. However, the most common measures are volume, Retail Sales Price (RSP) value and Manufacturing Selling Price (MSP) value. With volume, Euromonitor describes the number of units sold of a product over a year. (Euromonitor International, n.d.). The RSP value indicates the total sales of the product, including the mark-up for retailers and wholesalers (Euromonitor International, n.d.). The MSP value excludes the retailers and wholesalers mark-up and represents the sales of the manufacturers.

The ideal proxy for industry profitability would be the retailers and wholesalers mark-up, which can be achieved by subtracting the MSP value from the RSP Value. However, Euromonitor only has data of both the MSP Value and RSP value for the e-commerce industry consumer health. More specifically, the vitamin and dietary supplements; and cough, cold and hay fever remedies subindustries. For better statistical analysis, more observations are preferred.

Instead, the proxy for industry profitability is defined by the *E-commerce RSP value*. Since this does not classify cost, it can pose some problems in the estimations. The E-commerce RSP value illustrates sales of an industry/subindustry and is connected in the theory to the market size and competitive landscape of an industry (Asplund & Sandin, 2003). Bigger markets tend to have more firms and fiercer competition, linking industry profitability to the competitive advantage entry barrier, discussed below. Interpretation of the results could be somewhat over- or underestimated, due to potential reverse causality. Rather than looking at the effect of the competitive advantage on industry profitability, industry profitability also influences the competitive advantage entry barrier. This can lead to biased results (Studenmund, 2017). Even though there is a potential scenario for biased results, the aim of this thesis is merely descriptive and concerns the overall effect and direction of the coefficient.

As a proxy for the sustainability barrier, the *Out-of-stock units* are used. Out-of-Stock units or *Shelf Availability* refers to a situation where the consumer does not find the product on the shelf of a store when the consumer wishes to purchase the product (Moorthy et al., 2015). Or to be more specific, in e-commerce industry, when the product is not available for sale on a retailer's website. Shelf availability is very important for firms because the unavailability of a

product can lead to lost sales and reduced consumer loyalty (Moorthy et al., 2015). According to research by Gruen et al., (2002), the FMCG industry in Europe has an average Out-of-Stock units of 7 per cent, but these numbers vary greatly across industries. The Out-of-stock units are a suitable proxy for sustainability entry barriers because it illustrates whether pre-existing firms have supply chain issues. Higher percentages of Out-of-Stock units indicate that pre-existing firms have less products available to put on a retailer's website. Therefore, Out-of-Stock units represent the accessibility of distribution channels for pre-existing firms. Thus, indicating the accessibility of distribution channels for new entrants.

Another potential entry barrier impacted by the Covid-19 pandemic is the competitive advantage of rival firms. Ideally, the competitive advantage of a firm has a quantitative measure, where several components of a firm are compared to industry averages. To exemplify, Sigalas et al., (2013) have created a quantitative measure based on three elements of the competitive advantage: does a firm exploit all market opportunities; does a firm neutralize all the competitive threats; and does the firm reduce the expenses or revenue/cost ratio compared to the industry average. They use survey questions to determine the strengths of the three elements. A similar measure for the competitive advantage of a firm is presented on Euromonitor, but unfortunately the university does not have access to this data.

Therefore, to set a suitable proxy for the competitive advantage entry barrier, the requirements established by Karakaya & Stahl (2009) are used to determine this entry barrier. Karakaya & Stahl (2009) employ a survey as well, but ask questions related to the number of firms and the market shares held by firms in the market. These questions adequately represent the competitive landscape of the industry.

The *market concentration* is used as a measurement for the competitive landscape. This is defined by the combined market share of the top firms in the industry (Newbery & Kattuman, 1992). To specify, concentration refers to how many small firms make up the total production of the market (Newbery & Kattuman, 1992). Low concentration demonstrates that the top firms are not influencing the market production and the industry is considered as highly competitive. Whereas high concentration indicates that the top firms influence the market production, and these industries are considered a monopoly or oligopoly (Organisation for the Economic Cooperation and Development, 2018). It follows that when a market is highly concentrated, the entry barriers are significantly increased. Therefore, new entrants struggle to enter the market as pre-existing firms have competitive advantages in terms of brand loyalty and market power (Organisation for the Economic Cooperation and Development, 2018). Therefore, the

proxy used for the competitive advantage entry barrier is market concentration. As mentioned before, there is potential bias through reverse causality with the dependent variable E-commerce RSP Value.

As a proxy for the capital requirement entry barrier, the *long-term interest rate* is employed. Ideally, the proxy for the capital requirement entry barrier is the interest rate of a business loan. According to the government website for entrepreneurs in the Netherlands, a new firm can get financial resources through either governmental funding or funding by private investors or banks (Netherlands Enterprise Agency, n.d.). Hence, the interest rate for a business loan indicates the accessibility of financial resources. Higher interest rates are associated with banks being more reluctant to give out loans to firms. Therefore, indicating a stronger capital requirement entry barrier (Organisation for the Economic Cooperation and Development, 2005). Unfortunately, Euromonitor does not provide the average interest rate for a business loan.

As a proxy for the capital requirements entry barrier, the long-term interest rate is used. The long-term interest rate represents the interest rate for a 10-year maturity government bond. Specifically, it illustrates the prices at which these bonds are traded on the financial market. Therefore, it does not directly indicate the interest rate for business loans.

The long-term interest rate is considered one of the determinants of the business environment. Low long-term interest rates are used to encourage businesses to invest in equipment, whereas high long-term interest rates discourage investments in equipment (Organisation for the Economic Cooperation and Development, 2021). Therefore, long-term interest rates determine economic growth by the ease to which a firm can borrow. A lower interest rate indicates easier accessibility to financial resources. This proxy does bring some bias as government bonds is a way of financing a firm but is also used a tool to promote current firms in the market to invest more in equipment.

3.3 Data collection

Data for the proxies is gathered from several datasets on the Euromonitor database. The dataset used is a combined set of (1) the industry dataset, (2) the consumer and annual dataset and (3) the Covid recovery index. Since these datasets contain the same demographics and industry/subindustries, they can effectively be combined. These following paragraphs present an overview of the data sets employed in this thesis.

- (1) The industry dataset focuses on the market sizes, company shares and the distribution of an industry. Euromonitor has established 19 consumer product industries, four service industries and one supply industry in the FMCG sector. As mentioned before, only six industries were selected. For each industry, annual data has been obtained on the market size, company shares, Out-of-stock units pre-Covid pandemic and the distribution to the various outlets.
- (2) The consumer and annual dataset focuses on the business environment of an industry as well as on consumer purchasing behaviour. This dataset has annual observations on the long-term interest rate in a country.
- (3) The Covid recovery index includes daily data on the median prices index and percentage Out-of-Stock. It also forecasts the recovery of consumer demand due to the Covid-19 pandemic. This dataset started on the 1st of January 2020 and is still updated daily.

The combined data set consists of six industries: beauty and personal care, consumer health, home care, hot drinks, pet care, and tissue and hygiene. Each industry exists of multiple subindustries. To exemplify, the consumer health industry has 13 subindustries, including amongst other vitamins and dietary products and eye care. Data limitations in the proxies have resulted in a total of 13 subindustries, belonging to the six industries. Euromonitor identifies industries/subindustries as a category/subcategory, and these are represented in the dataset as a string variable. For ease of the interpretations, the category/subcategory variable is destrunged to a single-digit level. Furthermore, limitations in the Covid recovery index have resulted in data being employed of 19 European countries. These countries are also destrunged to a single-digit level.

To determine whether any changes are occurring in the entry barriers due to the Covid-19 pandemic, a time-period from 2011 to 2020 has been set. Theoretically, the effect of entry barriers on industry profitability is measured using 5-year industry data. Because most data on Euromonitor is annual, an 8-year increment has been chosen. This illustrates the pre-pandemic entry barriers in the e-commerce sector. The pre-pandemic time frame is from 2011 till 2019.

Considering, the Covid-19 pandemic was determined a pandemic per the WHO on March 2020 this thesis uses a Euromonitor dataset which has been daily updated since the 1st of January 2020 (World Health Organisation, 2020). Although the data set is continuously updated, the 31st of December 2020 is considered the final date of this dataset, due to the time limitations of this thesis. Sufficient observations are obtained to create a reliable analysis.

The combined dataset is classified as panel data. For each industry, subindustry and firm, data is available for multiple years. The panel data of the combined dataset is balanced, each unit in the sample has data at each point of time. Table 2 shows that 100 per cent of the observations are classified as complete. To clarify, the pattern shows that for each observation we have data for all variables. When data is missing for a variable, for example the e-commerce RSP value for the year 2013, the pattern of 1s will not be complete and look like 11..11111, where the dots indicate missing information. The model used in the analysis is a cross-sectional time series model because the moderator, the Covid-19 pandemic, is time-sensitive.

Table 2: description of panel data

Frequency	Percent	Cumulative	Pattern
67,020	100.0	100.0	1111111111
67,020	100.00		XXXXXXXXXX

3.4 Primary inquiry of the used proxies

This thesis aims to examine, the effect of the Covid-19 pandemic, on the relationship between entry barriers and industry profitability. Therefore, the dependent variable of the research method is industry profitability; the independent variables are Out-of-Stock units, market concentration and long-term interest rates; and the moderator is Covid-19. In this section, both an in-depth analysis of the proxies, as well as a discussion on the distribution of the data, are provided.

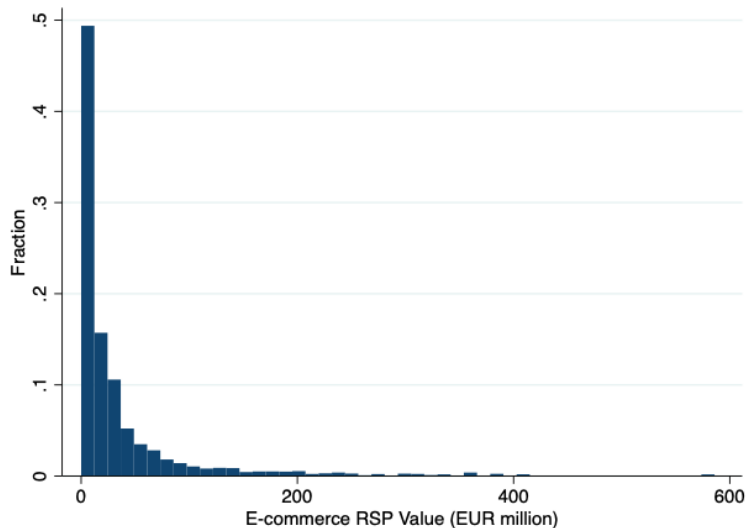
3.4.1 Industry profitability

The dependent variable in this thesis is *industry profitability*, this is measured by the e-commerce RSP value. The e-commerce RSP value is presented in millions of the respective national currencies. To exemplify, the e-commerce RSP Value of Denmark is given in millions of Danish Kroner. The majority of countries in the data set are Member States of the Economic and Monetary Union of the European Union, therefore have the Euro as their national currency. The remaining national currencies have been converted to Euros using year-on-year exchange rates provided by Euromonitor.

Figure 3 illustrates the sample distribution of the e-commerce RSP value. This dependent variable is heavily skewed to the left-side of the histogram. This indicates that most observations present in the dataset have a relatively low e-commerce RSP value. There are

684,690 observations of e-commerce RSP value. An observation of the e-commerce RSP value is defined as a data point of e-commerce RSP value specified by country, industry, subindustry, and year.

Figure 3: Sample distribution of E-commerce RSP Value

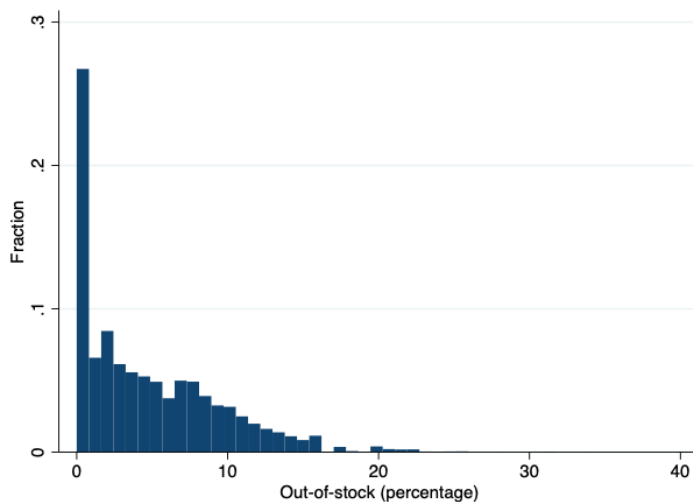


3.4.2 *Entry barriers*

The first independent variable in the model is *Out-of-Stock* units. This is a measure for accessibility to the distribution channels. This variable is presented as a percentage, when this percentage increases, the availability of the respective product diminishes. For the years 2011-2019, annual data is available and therefore the Out-of-Stock variable indicates the average percentage Out-of-Stock over the year. These are the pre-Covid-19 pandemic datapoints. The daily observations for 2020 are put together in a new variable, representing the average Out-of-Stock percentage for 2020 for each country, industry, and subindustry. This is used as the datapoint for the Covid-19 pandemic.

The Out-of-Stock variable has 67,020 observations ranging between 0 and 30.27 and is strongly skewed to the left as well. This indicates that a significant number of markets have a general low Out-of-Stock units percentage. This is in line with the aforementioned research by Gruen et al. (2002), which stated that the average Out-of-Stock units is seven per cent.

Figure 4: sample distribution percentage out of stock

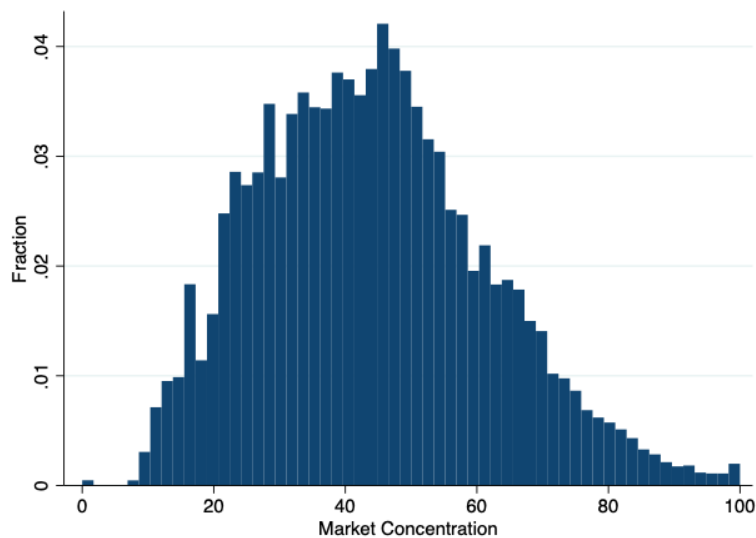


The second independent variable of the model is *market concentration*. This is a measure of the competitiveness of an industry. Considering market concentration is not a variable directly available by Euromonitor, it is illustrated by a firm’s market share. A firm’s market share is calculated by dividing the firm’s e-commerce RSP value by the market e-commerce RSP value. This is presented by Euromonitor as a percentage.

Market concentration is measured by adding the market shares of the top 3-5 firms in the subindustry (Newbery & Kattuman, 1992). In this thesis, market concentration is calculated by using the top three firms in the respective subindustries. This is done because of two reasons: firstly, this is also done by Euromonitor; secondly, not all subindustries contain more than three firms.

Additionally, the data includes a category referred to as ‘others’, representing the remaining firms of which no individual data is provided. This category is excluded when calculating the market concentration. The newly created market concentration variable contains 684,690 observations ranging from 0 to 100. The observations seem to follow a normal distribution and no outliers can be detected.

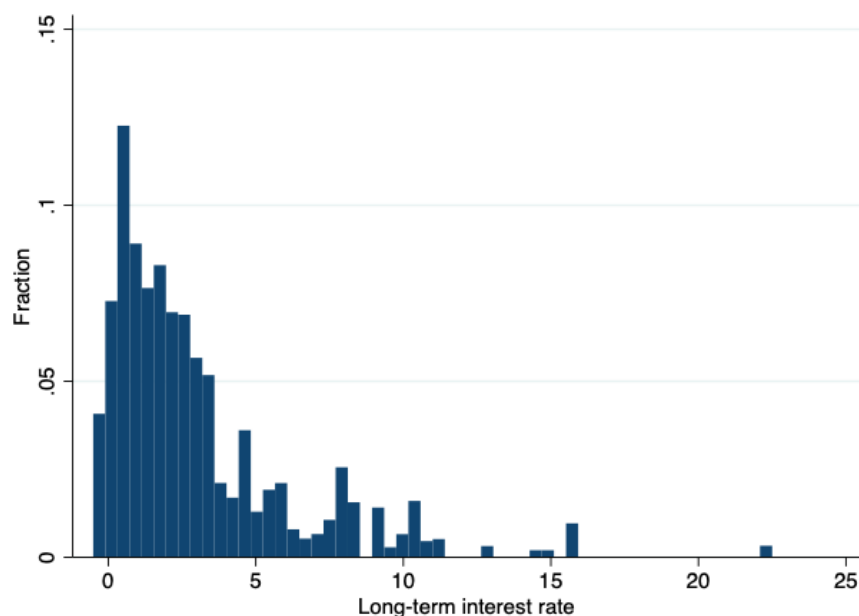
Figure 5: sample distribution of market concentration



The last independent variable of the model is the *long-term interest rate*. This measures the access to capital entry barriers. Euromonitor provides quarterly long-term interest rates. These are used to calculate the annual long-term interest rate by taking the average of the four respective quarters. The long-term interest rate is presented as a percentage and has 484,710 observations ranging from -.5 to 22.4 per cent. Interest rates are usually positive, as it requires payment for borrowing money. However, governments can use negative interest rates to stimulate economic growth (Beers, 2021). Therefore, the negative long-term interest rates are not considered outliers.

Figure 6 illustrates that the distribution of the long-term interest rate is skewed to the left of the histogram. This can be explained as most countries in the dataset are Members States of the European Union. Therefore, they have a common central bank providing comparable financial regulations regarding interest rates (Organisation for the Economic Cooperation and Development, 2021).

Figure 6: Sample distribution of the long-term interest rate.



3.4.3 *The Covid-19 pandemic as a variable*

The moderator variable in the model is *Covid*, a dummy variable. A dummy is used to establish whether the observations belong to the Covid-19 pandemic. To have a clear cut-off for the creation of the dummy and important assumption is made. The World Health Organisation (2020) has classified on March 2020 Covid-19 as a pandemic. This thesis assumes that on 1st of January 2020, the respective countries took governmental regulations to prevent the Covid-19 pandemic from spreading, leading to regional or national ‘lockdowns’. This cut-off date has been selected as Euromonitor only provides annual data for a firm’s shares. Therefore, no clear distinction can be made on the pre-pandemic and the Covid-19 pandemic data in 2020.

3.4.4 *Control variables*

Control variables are added to rule out alternative explanations for the findings of a research (Spector & Brannick, 2010). Control variables are expected to correlate with the independent variable as well as with the dependent variable (Spector & Brannick, 2010). Based on this reasoning, two control variables are included in the regression.

The first control variable is *industry*. An industry is defined as the number of firms that produce products that are considered close substitutes (Sharp et al., 2013). The industry is included as a control variable because it is closely correlated with our dependent variable

industry profitability. Since this thesis looks at it from an industry level, it should be considered when analysing the data. Secondly, it is linked to the variables of interest as industries are differently affected by the Covid-19 pandemic and entry barriers. In this data set there are six industries: beauty and personal care, consumer health, home care, hot drinks, pet care, softs drinks and tissue and hygiene. The number of observations vary across the industries ranging between 4,800 and 23,000 observations. Five out of six industries have more than 10,000 observations. To define a better control variable, the subindustry is used in the analysis. The data includes 13 subindustries which are all part of the industries mentioned before. Appendix I gives an overview of the distribution of the observations over the subindustries.

The second control variable is *country*. This variable is added to account for differences in the consumer responses to the Covid-19 pandemic. Additionally, it controls for the differences in the Covid-19 pandemic governmental restrictions. The data provided by Euromonitor is international, 19 European countries are included in the analysis. 15 countries are Member states of the European Union and ten are Member States of the Economic and Monetary Union of the European Union. Appendix I provides an overview of all the countries included in the analysis and the number of observations.

An important note is that no controls for the entry barrier of e-commerce resources are included. Euromonitor does not contain any data that would remotely represent the e-commerce resource barriers defined by Karakaya & Stahl (2009): *“High learning curve involved in conducting e-commerce, Insufficient technical know-how and Insufficient e-commerce Infrastructure.”*

3.5 Research method

This research uses a pre-post design, we are interested in the change in entry barriers for e-commerce before and after the Covid-19 pandemic. A regression discontinuity design is not possible due to the fact that the moderator the Covid-19 pandemic is not a continuous variable. Another way to test this effect is to use the Covid-19 pandemic as an interaction term. The goal of an interaction effect is that the relationship between one independent variable on the dependent variable is influenced by another variable (Charness et al., 2012). This is a great way for this research as this allows us to create a dummy variable that highlights the relationship between the entry barrier relationship with industry profitability and how this is influenced by the Covid-19 pandemic.

To test whether the entry barriers are also applicable to the e-commerce sector, a multiple linear regression with the main effects is created. The main effects model is presented by equation 1:

$$\text{Industry Profitability}_{ict} = \beta_0 + \beta_1 OOS_{itc} + \beta_2 MC_{itc} + \beta_3 LT_{tc} + \mu_t + v_t + \epsilon \quad (1)$$

Where OOS represents the Out-of-Stock units, the proxy for sustainability entry barrier; MC is market concentration, the proxy for the competitive advantage entry barrier; LT represents the long-term interest rate, the proxy for the capital requirement entry barrier. Furthermore, the variables depend on time (t), this thesis uses time-series data. Finally, country (c) and industry (i) controls are used as fixed effects, represented by μ_t and v_t respectively in the regression. These will be elaborated on later in this section.

To answer the hypotheses, an interaction effect is introduced to the multiple linear regression introduced above. Equation 2 indicates the regression including the interaction effect of the moderator the Covid-19 pandemic.

$$\begin{aligned} \text{Industry Profitability}_{ict} \\ = \beta_0 + \beta_1 OOS_{ict} + \beta_2 MC_{ict} + \beta_3 LT_{ct} + \beta_4 Covid + \beta_5 (OOS_{ict} * Covid) \\ + \beta_6 (MC_{ict} * Covid) + \beta_7 (LT_{ct} * Covid) + \mu_t + v_t + \epsilon \end{aligned} \quad (2)$$

Where Covid is the dummy for the Covid-19 pandemic. The null hypotheses states that the interaction effect does not influence the relationship between the entry barrier and industry profitability. Thus, rejecting the null hypotheses confirms hypothesis that the Covid-19 pandemic has changed the entry barrier of interest.

The first hypothesis argues that pre-existing firms have supply chain issues, resulting in a stronger sustainability entry barrier for new entrants. Since lower entry barriers are associated with lower industry profitability and vice versa, it is therefore expected that the effect of the Out-of-Stock variable (beta 1) is positive. To answer the hypothesis, the coefficient of the interaction term needs to be statistically significant (beta 5). The coefficient of beta 5 is expected to be positive.

The second hypothesis states that companies already present in the market gain a stronger competitive advantage, because of brand loyalty and adaptability to changes in demand. To accept this hypothesis, we need to look at the beta of the interaction effect

between competitive advantage entry barrier and the Covid-19 pandemic (beta 6). It is expected that beta 6 is statistically significant and has a positive effect.

The third hypothesis argues that the capital requirement entry barrier is negatively impacted by the Covid-19 pandemic. To answer this question, the interaction effect between the Covid-19 pandemic and the interest rate is looked at (beta 7).

To increase the reliability of the analysis, control variables are added. These control variables do not change over time. Therefore, a Hausmann test is run to determine whether random or fixed effects are needed in the regression. According to the Hausmann test, there is a systematic difference between coefficients ($\text{Prob} > \chi^2 = .0000$) and the null hypothesis can be rejected. Therefore, a fixed-effects model is going to be used. Possible issues regarding autocorrelation and heteroscedasticity are addressed by adding robust standard errors.

Table 3: Variable overview

Variable	Definition	Variable type
Total RSP Value	Sum of Retail Sales Price, including the mark-up for retailers and wholesalers	Continuous
Out-of-Stock unit	percentage of units unavailable for a specific product over the year.	Continuous
Market concentration	Sum of the top 3 firm market shares	Continuous
Long-term interest rate	Interest rate for 10-year government bonds	Continuous
Covid	Dummy for the Covid-19 pandemic	Categorical (dichotomous)
Country	Country	Categorical
Industry	Industry defined by Euromonitor	Categorical

4. RESULTS

In this section, the results of the research are going to be discussed. First, a descriptive analysis is given for the dataset. Second, the main effects model is discussed. Third, the hypotheses are answered using the interaction effects models. Finally, the robustness of the results are checked.

4.1 Descriptive analysis

Table 4 illustrates the descriptive statistics of the dataset, including the mean, standard deviation, minimum and maximum values. The standard deviations are not equal to zero indicating that the variables change over time and fit with the data analysis of panel data. The values for the mean and standard deviation are in line with the expectations. However, it remains of importance to highlight several other aspects.

The range for e-commerce RSP value is considered large, with a minimum of 0 million euros and a maximum of 585.9 million euros. This variance can be explained as there are big differences between sizes of industries. To exemplify, the consumer health industry is considerably bigger than the pet care industry.

Furthermore, there are large differences between market concentrations. This is not surprising as specific subindustries are more likely to consist of a limited number of firms, as these subindustries tend to have higher entry barriers, limiting the possibilities of access for new firms. To exemplify, within the consumer health industry, firms often obtain patents securing their place in the market.

Moreover, there are also negative interest rates in the dataset. However, as aforementioned, these negative interest rates are not considered outliers. As they have been used in the past to promote economic growth (Beers, 2021).

The minimum and maximum of the categorical variable Covid does not provide any information of importance, as the minimum will always be zero while the maximum will always be one. However, the mean does give some insight into the distribution of the variable. The mean of .0944 suggests that most observations are pre-Covid. This is expected as we only have 1 out of the 10 years of data, which is classified as Covid. The between and within variable comparisons can be found in the appendix.

Table 4: Descriptive statistics (n = 67,020)

Variable	Mean	SD	Min	Max
E-commerce Value RSP	36.2978	65.8158	0	585.9000
Market Concentration	47.1960	17.5786	15.1000	99.5000
Out-of-Stock	4.8991	4.7123	0	30.2788
Long-term Interest rate	2.845236	3.4354	-0.51075	22.49825
Covid	0.1000	0.3000	0	1

Table 5 shows the pairwise correlations between the main variables in the analysis. For all variables, the pairwise correlations are minor, indicating that multicollinearity is not an issue. To verify that the multicollinearity is not an issue, a Variance Influence Factor (VIF) test is conducted. The VIF test is a method to explore the extent to which an explanatory independent variable is explained by another explanatory variable in the regression. In general, for smaller samples, a VIF cut-off value of 5 is taken (Studenmund, 2017, Hair et al., 2017). This has also been set as the cut-off value in this thesis. The conducted VIF test presents VIF values for the variables ranging between 1.05 and 4.59 (Appendix I). Thus, multicollinearity is not an issue.

Table 5: correlation statistics

Variable	E-commerce Value RSP	Market Concentration	Out-of-Stock	Long-term Interest rate	Covid
E-commerce Value RSP	1.0000				
Market Concentration	-0.2138	1.0000			
Out-of-Stock	0.0521	-0.0297	1.0000		
Long-term Interest rate	-0.1696	-0.0564	-0.0002	1.0000	
Covid	0.1656	0.0055	0.1571	-0.1379	1.0000

To indicate the effect of the Covid-19 pandemic on the relevant variables, a pairwise correlation is carried out with the pre-Covid and Covid data. The results indicate that for the various groups the pairwise correlations are minor and not equal to zero (Appendix II & III). Hence, multicollinearity is also not an issue for the separate groups.

4.2 Findings

In this section, the effect of e-commerce entry barriers, influenced by the moderator Covid, on industry profitability is analysed. To answer the hypotheses, several models are created. First,

a basic model without any interaction effect is discussed. Following, for each interaction effect, one model with country fixed effects; one model with industry fixed effects; and one model with both country and industry fixed effects are examined. Finally, a model including all the interaction effects is analysed. To assess the reliability of the models, an analysis of the Wald chi and overall R-squared is done. The coefficients of determination (R^2) should be sufficiently high and is considered weak (.25), moderate (.50) and strong (.75) for the respective values for R-squared (Hair et al., 2017).

4.2.1 Basic model

The first model to be analysed is the independent variables for the various entry barriers without any interaction effect of the dependent variable e-commerce RSP value. The basic model significantly fits the data better than the model without the selected independent variables (Wald chi = 2951.36, $p < 0.000$). The overall R-squared for the basic model without fixed effects indicates that 9.6 per cent of the variance in E-commerce RSP value is explained by the model, which is considered a poor fit of the data (Hair et al., 2017). When adding fixed effects, the R-squared increases to a moderate level where 58.87 per cent of the variance in e-commerce RSP value is explained by the model.

Within the basic model, all variables have a statistically significant effect, and these results are robust. Firstly, the independent variable Covid has a significant positive impact on e-commerce RSP value ($t = 51.04$, $p < .01$). Indicating that the Covid-19 pandemic has on average a stronger positive influence on E-commerce compared to pre-Covid, *ceteris paribus*. This is in line with the theory that the Covid-19 pandemic has forced consumers to buy more products online as physical stores closed.

Secondly, Out-of-stock units have a significant positive effect on the e-commerce RSP value ($t = 19.28$, $p < 0.01$). Meaning that a one per cent increase in out-of-stock units increases e-commerce industry profitability by 0.429 million euros, *ceteris paribus*. This is in line with the theoretical framework, which establishes that when there are more problems with distribution channels, fewer firms enter the market. Thus, industry profitability increases as pre-existing firms have more market power.

Thirdly, market concentration has a significant negative effect on e-commerce RSP value ($t = -8.26$, $p < 0.01$). This indicates that when market concentration increases by one per cent, the e-commerce RSP value decreases with 0.351 million euros, *ceteris paribus*. The magnitude of the coefficient is reduced when industry fixed effects are included. This is not

surprising as the market concentration within industries does not vary much, while it does between industries. The main effect of market concentration is surprising as it is expected to be positive. A higher market concentration of the top 3 firms would suggest that pre-existing firms can exert more market power. Therefore, making it more difficult for new firms to enter the market. However, the results indicate the opposite as a higher market concentration reduces industry profitability. This result could potentially be explained by the reverse causality argument mentioned before. There is a link between market size in terms of e-commerce RSP value and the number of firms in the market and thus creating a biased estimator.

Finally, the long-term interest rate has a significant negative effect on industry profitability ($t = -24.06$, $p < 0.01$). Indicating that a one per cent increase in the long-term interest rate decreases e-commerce RSP value with 2.088 million euros. In terms of entry barriers, this means that when the interest rate increases, the profitability decreases. This is in line with existing literature on pre-existing firms. A higher interest rate costs a pre-existing firm more money and therefore their profitability decreases (Beers, 2021). However, the results contradict with the theory on entry barriers which suggest that higher interest rate should deter entry and thus lead to higher industry profitability. These results could be explained by the fact that some researchers do not consider capital requirements as an entry barrier. They argue that capital cost is not an entry barrier, because capital markets would fund any firm with a well-executed business plan at a fair interest rate (Organisation for the Economic Cooperation and Development, 2005).

Table 6: basic model

E-commerce RSP Value	(1)	(2)	(3)	(4)
Covid	31.59*** (51.13)	31.72*** (51.18)	31.67*** (50.81)	31.84*** (51.04)
Out-of-Stock	0.450*** (20.16)	0.441*** (20.02)	0.449*** (19.93)	0.429*** (19.28)
Market Concentration	-0.627*** (-17.34)	-0.351*** (-7.25)	-0.746*** (-23.15)	-0.393*** (-8.26)
Long-term interest rate	-2.170*** (-25.37)	-2.155*** (-25.61)	-2.095*** (-24.32)	-2.088*** (-24.06)
Constant	66.71*** (31.42)	28.27*** (11.34)	49.42*** (29.35)	6.439** (2.11)
Country fixed effect	No	No	Yes	Yes
Industry fixed effects	No	Yes	No	Yes
Observations	67,020	67,020	67,020	67,020
R ² (Overall)	0.0967	0.2257	0.4658	0.5887
Wald Chi	2951.36***	3636.32***	4641.65***	10298.07***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

4.2.2 Interaction models

Next, the interaction models are analysed by first including each interaction separately for the barriers. Subsequently, a control analysis is carried out with all the interaction effects present. For the interaction effect models, the R-squared is around .59, suggesting that 59 per cent of the variance in e-commerce RSP value is explained by the model, which is considered moderate. Similarly, all the Wald chi values for each interaction effect model is statistically significant, indicating the models with interaction effect significantly fits the data better than the model without the selected independent variables.

To answer the first hypothesis, a model with an interaction effect between Out-of-Stock units and Covid has been created. Again, all main effects of the entry barrier variables are statistically significant for each model. The effect of Covid on e-commerce RSP value is statistically significant and positive ($t = 30.48$ $p < 0.01$). Again, Out-of-stock units have a statistically significant positive effect on e-commerce RSP value ($t = 11.29$, $p < 0.01$). Furthermore, there is a statistically significant and negative effect of market concentration on e-commerce RSP value ($t = -7.76$, $p < 0.01$). Similarly, there is a statistically significant negative effect of long-term interest rate on e-commerce RSP value ($t = -24.21$, $p < 0.01$).

More interestingly, there is a statistically significant interaction effect between Covid and Out-of-Stock units ($t = 16.94$, $p < 0.01$). Compared to pre-Covid, the Covid-19 pandemic enhances the effect of Out-of-stock units on e-commerce RSP value with 1.866 million euros, *ceteris paribus*. This number is undecupled compared to the pre-Covid sustainability entry barrier, meaning that the entry barrier becomes eleven times more important. This is in line with the predicted hypothesis that the effect of Out-of-Stock units becomes more important because there are more difficulties within the distribution channels. This suggests that industry profitability is more positively influenced by a one per cent increase in the percentage Out-of-Stock units. In terms of entry barriers, this is telling us that the sustainability entry barriers are becoming stronger. The results are robust, the effects do not change and are still significant between models.

Table 7: interaction model with access to distribution channels

E-commerce RSP Value	(1)	(2)	(3)	(4)	(5)
Covid	31.84*** (51.04)	18.63*** (29.52)	18.74*** (29.65)	18.93*** (29.95)	19.24*** (30.48)
Out-of-Stock	0.429*** (19.28)	0.181*** (12.45)	0.172*** (11.94)	0.185*** (12.31)	0.168*** (11.29)
Covid * Out-of-Stock		1.919*** (17.12)	1.924*** (17.19)	1.887*** (17.00)	1.866*** (16.94)
Market Concentration	-0.393*** (-8.26)	-0.607*** (-16.90)	-0.315*** (-6.52)	-0.730*** (-22.55)	-0.364*** (-7.67)
Long-term interest rate	-2.088*** (-24.06)	-2.145*** (-25.49)	-2.126*** (-25.73)	-2.071*** (-24.45)	-2.064*** (-24.21)
Constant	6.439** (2.11)	66.91*** (31.51)	27.64*** (11.10)	49.36*** (29.05)	5.533* (1.80)
Country fixed effect	Yes	No	No	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes
Observations	67,020	67,020	67,020	67,020	67,020
R ² (Overall)	0.5887	0.1035	0.2304	0.4685	0.5900
Wald Chi	10298.07***	3279.43***	3995.97***	5062.52***	10440.90***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

The second hypothesis states that already existing firms in the market have a competitive advantage as they can more easily adapt to change in the market due to Covid-19 pandemic. Table 8 shows the regression including an interaction term between Covid and market concentration to answer the hypothesis stated above. Just as in the basic model, there is a statistically significant effects of market concentration ($t = -5.19$, $p < 0.01$), Out-of-stock ($t = 19.30$, $p < .01$), Covid ($t = 38.56$, $p < 0.01$) and long-term interest rate ($t = -24.78$, $p < 0.01$) on E-commerce RSP Value in the model with country, industry and both fixed effects. The coefficients of market concentration are again smaller when industry fixed effects are added to the model.

The variable of interest, the interaction between Covid and market concentration, is statistically significant for all models and has similar magnitudes ($t = -27.35$, $p < 0.01$). The introduction of Covid has enhanced the effect market concentration has on E-commerce RSP Value. The results are in contrast with the hypothesis which expected a positive interaction effect since it the competitive advantage of firms currently in the market is expected to be stronger during the Covid-19 pandemic. However, these results do suggest a change in the entry barrier for e-commerce industries but in the opposite direction. The Covid-19 pandemic has made it easier for new firms to enter the market. One possible explanation is the government support offered to the already existing firms in the market. This allows these firms

to continue paying their employees and not having to change their business strategy. These firms are no longer making the switch to e-commerce or are not extending their services, allowing new firms to enter this market. Another explanation could be that entrepreneurs are willing to take a risk to enter the market. According to the Dutch Central Bureau of Statistics (2021), entrepreneurs are more positive about the business environment, suggesting they are more willing to start a firm or continue as a start-up.

Table 8: interaction model with market concentration

E-commerce RSP Value	(1)	(2)	(3)	(4)	(5)
Covid	31.84*** (51.04)	68.66*** (38.53)	69.19*** (38.57)	68.50*** (38.22)	69.16*** (38.56)
Market Concentration	-0.393*** (-8.26)	-0.490*** (-14.39)	-0.188*** (-3.96)	-0.624*** (-20.23)	-0.241*** (-5.19)
Covid *Market Concentration		-0.790*** (-27.27)	-0.798*** (-27.40)	-0.785*** (-26.97)	-0.795*** (-27.35)
Out-of-Stock	0.429*** (19.28)	0.445*** (20.19)	0.437*** (20.04)	0.445*** (19.95)	0.425*** (19.30)
Long-term interest rate	-2.088*** (-24.06)	-2.199*** (-26.00)	-2.180*** (-26.23)	-2.131*** (-25.03)	-2.124*** (-24.78)
Constant	6.439** (2.11)	60.32*** (30.03)	20.35*** (8.31)	43.46*** (26.91)	-1.431 (-0.48)
Country fixed effect	Yes	No	No	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes
Observations	67,020	67,020	67,020	67,020	67,020
R ²	0.5887	0.1000	0.2302	0.4689	0.5927
Wald chi	10298.07***	3139.21***	3732.73***	5077.74***	10242.25***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Finally, the third hypothesis highlights the access to capital or the capital requirements barriers. This is shown in table 9, by including an interaction term between the long-term interest rate and the Covid-19 pandemic dummy. Just as the regressions before, market concentration ($t = -8.40$, $p < 0.01$), Out-of-Stock ($t = 19.00$, $p < 0.01$), Covid ($t = 45.67$, $p < 0.01$) and the long-term interest rate ($t = -24.43$, $p < 0.01$) are statistically significant, indicating their effect on E-commerce RSP Value. The coefficients of the statistically significant variables are of the same magnitude and direction as the other interaction effect models.

To answer the hypothesis, Covid * Long-term interest rate is going to be looked at. According to table 9 in every model, the interaction term between Covid and long-term interest rate is not statistically significant ($t = 0.44$, $p > 0.1$). This indicates that Covid has not had an impact on the relationship between the long-term interest rate and E-commerce RSP value and the hypothesis is rejected. This result is not surprising as long-term interest rates depict the 10-

year maturity government bonds, which is not directly linked to a specified industry and are therefore not directly affected by changes of the pandemic in the E-commerce industries. Furthermore, the hypothesis compares the effect of Covid-19 pandemic with the financial crisis, assuming that the Covid-19 pandemic has led to a recession. However, governments have imposed several regulations to prevent economic downfall.

Table 9: interaction model access to capital interaction

E-commerce RSP Value	(1)	(2)	(3)	(4)	(5)
Covid	31.84*** (51.04)	31.35*** (45.79)	31.59*** (45.75)	31.39*** (45.23)	31.71*** (45.67)
Long-term interest rate	-2.088*** (-24.06)	-2.182*** (-26.12)	-2.161*** (-26.26)	-2.108*** (-24.74)	-2.095*** (-24.43)
Covid * Long-term interest rate		0.148 (0.77)	0.0820 (0.43)	0.176 (0.92)	0.0835 (0.44)
Market Concentration	-0.393*** (-8.26)	-0.630*** (-17.64)	-0.353*** (-7.37)	-0.748*** (-23.46)	-0.395*** (-8.40)
Out-of-Stock	0.429*** (19.28)	0.452*** (19.87)	0.442*** (19.72)	0.451*** (19.69)	0.430*** (19.00)
Constant	6.439** (2.11)	66.87*** (32.08)	28.40*** (11.55)	49.58*** (29.81)	6.576** (2.18)
Country fixed effect	Yes	No	No	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes
Observations	67,020	67,020	67,020	67,020	67,020
R ²	0.5887	0.0968	0.2257	0.4659	0.5887
Wald Chi	10298.07***	2970.41***	3699.40***	4995.08***	12103.56***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Finally, a model is created using all the interaction effects at once to check whether the results are robust and of similar direction and magnitude. As table 10 indicates, market concentration ($t = -4.68$, $p < 0.01$), Out-of-Stock ($t = 11.73$, $p < 0.01$), Covid ($t = 32.98$, $p < 0.01$) and long-term interest rate ($t = -25.46$, $p < 0.01$) are statistically significant and follow the same direction as the models in the other subsections. When checking the interaction effects and their magnitudes, it can be concluded that the interaction effects of Covid*Out-of-Stock ($t = -26.39$, $p < 0.01$) and Covid*Market Concentration ($t = 16.54$, $p < 0.01$) are still significant and influence the relationship between Out-of-Stock and E-commerce RSP value and the relationship between Market Concentration and E-commerce RSP value. Thus, hypotheses 1 is supported by evidence, while hypothesis 2 has shown the opposite effect. The interaction effect of Covid * Long-term interest rate is still not statistically significant ($t = 1.04$, $p > 0.1$) and therefore hypothesis 3 is not supported.

Table 10: all interaction effects model

E-commerce RSP Value	(1)	(2)	(3)	(4)	(5)
Covid	31.84*** (51.04)	54.83*** (32.62)	55.54*** (32.78)	54.83*** (32.34)	55.91*** (32.98)
Out-of-Stock	0.429*** (19.28)	0.189*** (12.88)	0.179*** (12.36)	0.192*** (12.77)	0.175*** (11.73)
Market Concentration	-0.393*** (-8.26)	-0.479*** (-14.50)	-0.162*** (-3.50)	-0.615*** (-20.30)	-0.221*** (-4.86)
Long-term interest rate	-2.088*** (-24.06)	-2.195*** (-27.09)	-2.168*** (-27.22)	-2.129*** (-25.77)	-2.114*** (-25.46)
Covid * Out-of-Stock		1.863*** (16.76)	1.864*** (16.81)	1.833*** (16.65)	1.807*** (16.54)
Covid* Market Concentration		-0.773*** (-26.22)	-0.782*** (-26.38)	-0.768*** (-25.96)	-0.780*** (-26.39)
Covid* Long-term interest rate		0.278 (1.47)	0.201 (1.06)	0.306 (1.62)	0.197 (1.04)
Constant	6.439** (2.11)	60.99*** (31.19)	20.24*** (8.49)	43.81*** (27.62)	-1.854 (-0.63)
Country fixed effect	Yes	No	No	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes
Observations	67,020	67,020	67,020	67,020	67,020
R ²	0.5887	0.1065	0.2346	0.4714	0.5937
Wald Chi	10298.07***	3472.44***	4188.31***	6500.44***	11719.08***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

4.2.3 Robustness check

Firstly, to check for the robustness of the results, another all-interaction effect model has been created with industry-level dummies instead of subindustry level dummies. Changing the industry level does not affect the significance of the variables of interest as well as the magnitude and direction of the coefficients (Appendix VI).

To further check the validity of the results, a robustness check is done by adding a lag of the dependent variable E-commerce RSP Value. The lag variable is the E-commerce RSP value of year $t-1$. The reason for adding the lagged variable is that the entry barriers are usually determined using five years of data, because these variables are influenced by the industry profitability of the year before (Bourgeois et al., 2014). An industry that has had high profit levels the year before, is expected to have high profit levels this year (Bourgeois et al., 2014). This variable is not added in the original models, because it can lead to dynamic panel bias (Studenmund, 2017). It does not influence the interaction term as this is based on the last year and does not get cancelled by an introduction of a lag of the dependent variable in the previous year.

Introducing the lagged dependent variable, still provides us with a valid model, meaning that the model with the specified variables is significantly different from the model without the specified variables (Wald Chi = 1,780,000, prob > chi2 = 0.00). Furthermore, the coefficient of determination (R^2) has improved drastically to 97.3 per cent of the variance in E-commerce RSP Value explained by the explanatory variables. This result is expected, as this is in line with dynamic panel bias (Studenmund, 2017). The high validity of the model is expected as the correlation between E-commerce RSP Value and the lag is high (corr = .9974) (Appendix VI).

Even though there are differences between the lagged E-commerce RSP Value model and the interaction effect models in the previous section, the results are similar. First, the main effects for Out-of-stock ($t = 3.37$, $p < 0.01$) and Covid ($t = 17.41$, $p < 0.01$) are still statistically significant and follow the same direction, yet there are some changes in the magnitude. In contrast, the long-term interest is no longer statistically significant ($t = 0.48$, $p < 0.01$). This result is not surprising as the long-term interest rate does not tend to fluctuate much between years, and they are used as a tool to invest in equipment which is considered as long-term investments. Interestingly, the market concentration remains statistically significant, but the direction of the coefficient has changed ($t = 7.99$, $p < 0.01$). Market concentration now has a positive effect on industry profitability, even though the effect is very small.

Despite these differences, there is still a statistically significant effect of the interaction term Covid * Out-of-Stock (16.06, $p < 0.01$), further supporting hypothesis 1. There is also additional support for hypothesis 2 as the interaction term between Covid and market concentration is statistically significant and negative ($t = -16.02$, $p < 0.01$). The effect of market concentration on E-commerce RSP Value is negatively enhanced as suggested by hypothesis 2. Finally, the lagged dependent variable model finds support for hypothesis 3. There is now a statistically significant effect of the interaction term between Covid and the long-term interest rate ($t = 7.64$, $p < 0.01$). The impact of long-term interest on E-commerce RSP Value has been enhanced. However, caution should be taken as governments have taken extra measures to enhance economic growth by using negative interest rates.

Table 11: regression analysis lagged E-commerce RSP Value

E-commerce RSP Value	(1)	(2)	(3)	(4)	(5)
Lag E-commerce RSP Value	1.154*** (327.51)	1.155*** (327.19)	1.152*** (329.55)	1.153*** (328.92)	1.152*** (330.34)
Covid	11.63*** (34.91)	10.30*** (29.69)	23.14*** (24.81)	5.643*** (18.99)	14.65*** (17.41)
Out-of-Stock	0.155*** (16.13)	0.166*** (15.88)	0.154*** (16.15)	0.0153*** (2.65)	0.0200*** (3.37)
Market Concentration	0.00315 (0.96)	0.0000386 (0.01)	0.0330*** (8.58)	0.00572* (1.69)	0.0303*** (7.99)
Long-term interest rate	0.0918*** (7.74)	0.0249* (1.96)	0.0751*** (6.59)	0.0966*** (8.34)	0.00599 (0.48)
Covid* Out-of-Stock				0.895*** (15.82)	0.937*** (16.06)
Covid* Market Concentration			-0.244*** (-16.89)		-0.229*** (-16.02)
Covid* Long-term interest rate		0.842*** (6.64)			0.948*** (7.64)
Constant	-3.497*** (-15.32)	-3.139*** (-14.41)	-5.009*** (-18.70)	-3.329*** (-14.52)	-4.335*** (-17.28)
Country fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	6,0318	60,318	60,318	6,0318	60,318
R ²	0.9732	0.9734	0.9736	0.9737	0.9743
Wald Chi	1,780,000***	1,900,000***	1,840,000***	1,540,000***	1,620,000***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

The ideal measure for industry profitability would be the wholesalers and retailers mark-up for the e-commerce industries, which can be obtained by subtracting the MSP value from the RSP value. As mentioned before, there is only MSP value and RSP value data available for the consumer health industry, more specifically the vitamin and dietary products and cough, cold and hay fever remedies subindustries. However, this data can still be used to check whether the results above are valid.

Table 12 presents the results of the analysis with Markup as dependent variable instead of E-commerce RSP Value. This model is again valid, the model with the specified variables is significantly different from the model without the specified variables (Wald Chi = 401854.37, prob > chi2 = .000). The coefficient of determination is strong, 78 percent of the variance in the Markup is explained by the explanatory variables.

The results are in line with the results in section 4.2. Again, Covid (t=21.27, $p < 0.0000$), Out-of-Stock (t=5.49, $p < 0.0000$) and long-term interest rate (t= -16.47, $p < 0.0000$) are statistically significant and go in the same direction as the results in section 4.2. More

surprisingly and in line with the expectations is the statistically significant and positive effect of Market concentration on Markup ($t = 4.44$, $p < 0.0000$). This is in line with the theory, that a more concentrated market by the top 3 firms, allows these firms to have more influence over the total production and profitability. These results suggest that there indeed may be some bias due to reverse causality in the original results.

Regarding the hypotheses, there is partial evidence for the first hypothesis since the interaction effect of Covid*Out-of-Stock is no longer statistically significant in the all interaction effect model ($t = -0.054$, $p > 0.1000$), but is statistically significant and positive in model 2 ($t = 5.63$, $p < 0.0000$). Secondly, there is no evidence for the second hypothesis as the interaction effect between Covid and market concentration is statistically significant, but goes the opposite direction ($t = -15.57$, $p < 0.0000$). Finally, there is also no evidence for the third hypothesis. There is a statistically significant effect Covid*long-term interest rate on the Markup, but the results go in the opposite direction ($t = -11.59$, $p < 0.0000$). The summary statistics and correlations can be found in the appendix VI.

Table 12: regression analysis with dependent variable Markup

Markup	(1)	(2)	(3)	(4)	(5)
Covid	11.23*** (27.98)	9.164*** (24.58)	26.76*** (19.99)	12.89*** (26.03)	29.18*** (21.27)
Out-of-Stock	0.101*** (7.19)	0.0493*** (5.05)	0.0702*** (5.48)	0.0831*** (6.19)	0.0551*** (5.49)
Market Concentration	0.117*** (2.93)	0.125*** (3.10)	0.170*** (4.05)	0.134*** (3.30)	0.188*** (4.44)
Long-term interest rate	-1.919*** (-16.88)	-1.894*** (-16.88)	-1.865*** (-16.75)	-1.797*** (-16.44)	-1.738*** (-16.47)
Covid * Out-of-Stock		0.339*** (5.63)			-0.0303 (-0.54)
Covid*Market Concentration			-0.489*** (-14.83)		-0.504*** (-15.57)
Covid* Long-term interest rate				-1.096*** (-13.77)	-1.147*** (-11.59)
Constant	-0.795 (-0.52)	-0.795 (-0.52)	-2.542 (-1.62)	-1.640 (-1.07)	-3.490** (-2.20)
Country fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	18,480	18,480	18,480	18,480	18,480
R ²	0.7796	0.7798	0.7815	0.7807	0.7827
Wald Chi	404539.35***	393822.83***	614701.75***	210027.05***	401854.37***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

5. DISCUSSION AND CONCLUSION

The e-commerce sector is of interest within management and industrial organisations theory, as digitalisation has been considered one of the biggest market trends (Huang & Bronnenberg, 2020). For management theory, the advantages of easier price comparison, a bigger assortment of products and convenience has changed the consumer decision journey and the marketing strategy (Niranjanamurthy et al., 2013). In contrast, for industrial organisation theory, the lower transaction, search cost and the lack of a physical infrastructure have changed the entry barriers and the market structure for e-commerce markets (Peritt, 2000; Li & Federick, 2019).

Besides the rapid growth in e-commerce, the Covid-19 pandemic has impacted the consumer decision journey and market structure of firms. On the demand side, the consumer's fear for the Covid-19 virus has shifted consumer attitudes to products that can be stored, protected, and most importantly can be bought online (Tran, 2020). Whereas on the supply side, the Covid-19 pandemic has led to sudden drops in aggregate demand and supply, as well as shed another light on the essence of various products (Seetharaman, 2020).

Multiple researchers have explored the effect of entry barriers in the e-commerce sector and concluded that these entry barriers are lower due to less search costs and not needing a physical infrastructure to operate (Peritt, 2000; Li & Federick, 2019; Karakaya & Stahl, 2009; Oliviera & Martins, 2017). More specifically, a model by Karakaya & Stahl (2009) has established four e-commerce entry barriers: the sustainability entry barriers; the competitive advantage entry barriers; the capital requirement entry barriers; and the e-commerce resource entry barriers.

The aim of this thesis is to explore the impact of the Covid-19 pandemic on entry barriers in FMCG industry through the Karakaya & Stahl (2009) e-commerce entry barrier model. To specify, this thesis explores the impact the Covid-19 pandemic has on the relationship between one the one side: the sustainability entry barriers; the competitive advantage entry barriers; and the capital requirement entry barriers; and on the other side the industry profitability.

To test the impact of the Covid-19 pandemic on the relationship between e-commerce entry barriers and industry profitability, three hypotheses have been produced (Table 13). Firstly, the forced closure of borders has led to disruptions in the supply chains of the pre-existing firms in the market. Therefore, it has been hypothesized that it becomes more difficult

for new firms to enter the market as finding distribution channels has become more difficult (Fernandes, 2020; Hasanat et al., 2020).

Secondly, this thesis hypothesizes that pre-existing firms have a bigger competitive advantage as they are more adaptable to changes in demand and have brand loyalty (Sharma, 2020; Payne et al., 2021).

Thirdly, it is hypothesized that it has become more difficult for firms to enter the e-commerce market because banks are more reluctant to lend money to new firms in times of economic uncertainty (Goodell, 2020; Brown et al, 2020).

After establishing proxies and using data from Euromonitor, results have confirmed that the sustainability entry barrier indeed influences the industry profitably in the e-commerce sector. In the basic, interaction and lagged dependent variable models, the results are statistically significant. These results are also economically significant. As the effect of the Covid-19 pandemic has almost doubled the e-commerce RSP value in the industries, whereas the effects on the entry barriers are smaller but still impactful.

The results do reveal opposite effects for the competitive advantage and the capital requirement entry barrier. These outcomes can be explained by possible reverse causality for the market concentration and governmental regulations taken by the respective countries to prevent a financial crisis.

The findings support for the first hypothesis. There is a statistically significant interaction effect of the Covid-19 pandemic on the relationship between sustainability entry barriers and industry profitability. These results are robust and reveal that the effect of the sustainability entry barrier on industry profitability has been undecoupled (11x), indicating a stronger entry barrier.

No support is found for the second hypothesis, the competitive advantage entry barrier. The results indicate a statistically significant effect of the interaction effect, the Covid-19 pandemic, on the relationship between the competitive advantage entry barrier and industry profitability, but in the opposite direction. A possible reverse causality could explain these findings and more research should be done on the advantages rival firms have in the e-commerce market.

Similarly, no support has been found for the third hypothesis, the capital requirements entry barrier. The interaction model, suggest that there is no statistically significant effect of the impact of the Covid-19 pandemic on the relationship between the long term interest rate

and industry profitability. Whereas the lagged dependent variable model suggests that there is a statistically significant effect. Since the long-term interest rate is also influenced by previous years and economic growth, the third hypothesis is not supported.

Hence, to answer the research question “*How has the Covid-19 pandemic impacted the significance of certain entry barriers in e-commerce in retail industries?*” three hypotheses have been used. Based on the theory and analysis, it can be concluded that the pandemic has indeed changed the importance of entry barriers in e-commerce in FMCG industries. Especially, the disruption in the supply chains have led to more difficulties for new firms to find distribution channels. Whereas the competitive advantage of rival firms and the capital requirements entry barriers reveal mixed results.

Table 13: Summary of hypotheses

Hypothesis	Supported
H1 <i>The importance of access to distribution channels entry barrier is strengthened by the Covid-19 pandemic.</i>	Yes
H2 <i>The importance of the competitive advantage of rival firms entry barrier has strengthened by the Covid-19 pandemic.</i>	No
H3 <i>The importance of access to capital entry barrier is strengthened by the Covid-19 pandemic.</i>	No

5.1 Theoretical implications

Existing research has focussed on the entry barriers of e-commerce (Karakaya & Stahl, 2009; Peritt, 2000). Other research has highlighted the implications the Covid-19 pandemic on both the supply chain and consumer attitude (Fernandes, 2020; Tran, 2020). This thesis makes two contributions to existing literature. First, it takes another look at the e-commerce entry barriers established by Karakaya & Stahl (2009). Karakaya & Stahl (2009) take an industry-wide approach, not specifying which sectors of e-commerce they are addressing. This thesis extends their theory on entry barriers, by checking whether the e-commerce entry barriers is also applicable to the FMCG industry.

Second, this thesis combines the impact of the Covid-19 pandemic on market structure and whether this has led to changes in the e-commerce entry barriers. This has not yet been done before. This is relevant as changes in the sustainability entry barrier have been found.

5.2 Practical implications

Besides theoretical implications, this thesis also provides useful insights for managers and entrepreneurs, who consider entering the e-commerce market. The tested relationship between e-commerce entry barriers on industry profitability and how these are influenced by the Covid-19 pandemic helps managers pinpoint possible bottlenecks for entering the e-commerce market. Additionally, it sheds a light on the importance of entry barriers for the e-commerce sector.

These implications are supported as disruptions in the supply chain make it more difficult for new entrants to find suppliers. Managers and entrepreneurs should take this into account when establishing what is important in making the shift to e-commerce or starting an e-commerce firm. Similarly, already existing firms have major advantages in the industry and can competitively respond to new entrants. Therefore, managers and entrepreneurs should be cautious in their pricing and positioning strategies.

5.3 Policy implications

Finally, this thesis is also of interest for policy makers. Currently, there is no clear view on the entry barriers and competitive landscape of an e-commerce market. The Covid-19 pandemic has made the sustainability entry barriers for e-commerce markets stronger, this is important for competition law and policy. Higher entry barriers in the e-commerce sector, can cause reduced competition and overpriced products. Therefore, policy makers should consider these changed entry barriers and try to promote a more competitive landscape. This will lead to lower consumer prices, new investments, more product variety, and innovation (Organisation for the Economic Cooperation and Development, 2012).

5.4 Limitations and future research

Using proxies as a measure for entry barriers provides for a quantitative method, but it also causes some limitations. First, this thesis has based the used proxies on the questions posed by Karakaya & Stahl (2009), literature and available data. Limited data has caused the capital requirement proxy to be the long-term interest rate. This could be considered as a weak proxy, as the long-term interest rate represents 10-year maturity government bonds. A better proxy would have been the interest rate for a business loan. Euromonitor does have a variable called getting credit, representing both aspects of how well collateral and bankruptcy facilitates lending and the accessibility of credit information through public and private credit bureaus.

However, they have created this 'getting credit' variable as a percentile rank, meaning that they rank the accessibility to credit according to country. Therefore, this proxy could not be used in the thesis. Future research could explore the various financial resources and how each is impacted by the Covid-19 pandemic.

Second, the assumption is made that the Covid-19 pandemic started on January 1st, 2020. However, most European countries started to take governmental measures against the spread of the Covid-19 virus from March 2020 onwards, which is also the date the World Health Organisation declared the Covid-19 virus as a pandemic. Therefore, the first quarter of 2020 should be considered as pre-pandemic. Since most data in Euromonitor is annual, this distinction is unclear. Therefore, the results could be slightly over or underestimated.

Third, there are limitations about the time frame. Often, the entry barriers of an industry are determined by either a survey or five-year industry data. While this is not an issue for the determination of the entry barriers pre-Covid, only limited data is available for the true impact of the Covid-19 pandemic on entry barriers. Future research should see whether more data points are available or take a bigger timeframe to establish a more accurate effect. Therefore, the results in this thesis should be taken as descriptive rather than causal.

Fourth, the data of Euromonitor is provided by firms subscribed to the service. While this gives a quite accurate picture of the company data, it also brings about some issues. To exemplify, for the market concentration variable, some industries had a large company share assigned to the category 'others'. This category refers to the remaining firms in the market. However, Euromonitor does not provide information regarding the number of firms in this category, therefore this category is not employed. Furthermore, Euromonitor uses different measurements for industry profitability, therefore limiting the dataset for analysis. Future research could look at different datasets to find further support for these findings.

The final limitation of this thesis lies in the representation and classification of the industries. Euromonitor does not use Standardized Industry Classifications (SIC) and therefore it might be difficult to generalize the results to the specified industry. In the end, only six FMCG industries are used of which the consumer health industry is overrepresented. This can lead to biased results, as the health industry is impacted more by the Covid-19 pandemic than other industries. Therefore, careful considerations should be made when using the results. Future research should try to incorporate more FMCG industries or look at specific subindustries.

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APPENDICES

APPENDIX I: Descriptive statistics

Table I: Variable summarisation

Variable		Mean	Std. Dev.	Min	Max	Observations
E-commerce RSP Value	Overall	36.2978	65.8158	0	585.9000	N = 67,020
	Between		59.7393	0	334.6500	n = 6,702
	Within		27.6299	-115.2722	325.2478	T = 10
Market Concentration	Overall	47.1959	17.5786	15.1000	99.5000	N = 67,020
	Between		17.4266	16.0700	98.0400	n = 6,702
	within		2.3160	35.0060	67.7960	T = 10
Out-of-Stock	Overall	4.8991	4.7123	0	30.2788	N = 67,020
	Between		1.3820	1.8114	8.9383	n = 6,702
	Within		4.5051	-3.8968	28.3730	T = 10
Long-term Interest rate	Overall	2.8452	3.4354	-0.5108	22.4983	N = 67,020
	Between		2.9457	0.2385	10.9682	n = 6,702
	Within		1.7680	-4.6207	16.6058	T = 10
Covid	Overall	0.1000	0.3000	0	1	N = 67,020
	Between		0	0.1000	0.1000	n = 6,702
	Within		0.3000	0	1	T = 10

Table II: Industry distribution

Industry	Frequency	Percent	Cumulative
Beauty and Personal Care	23,200	34.62	34.62
Consumer Health	18,480	27.57	62.19
Home Care	10,540	15.73	77.92
Pet Care	10,000	14.92	92.84
Tissue and Hygiene	4,800	7.16	100.00
Total	67,020	100.00	

Table III: Subindustry distribution

Industry	Subindustry	Frequency	Percent	Cumulative
Beauty and Personal Care	Baby and Child-specific products	5,700	8.50	8.50
	Bath and Shower	7,710	11.50	20.01
	Skin Care	9,790	14.61	34.62
Consumer Health	Cough, Cold and Allergy (Hay Fever) Remedies	7,090	10.58	45.20
	Vitamins and Dietary Supplements	11,390	16.99	62.19
Home Care	Bleach	1,300	1.94	64.13
	Dishwashing	2,720	4.06	68.19
	Home Insecticides	2,020	3.01	71.20
	Surface Care	4,500	6.71	77.92
Pet Care	Cat Food	4,700	7.01	84.93
	Dog Food	5,300	7.91	92.84
Tissue and Hygiene	Retail Adult Incontinence	2,200	3.28	96.12
	Toilet Paper	2,600	3.88	100.00
Total		67,020	100.00	

Table IV: country distribution

Country	Frequency	Percent	Cumulative
Austria	2,720	4.06	4.06
Belgium	3,740	5.58	9.64
Czech Republic	4,200	6.27	15.91
Denmark	3,110	4.64	20.55
Finland	3,540	5.28	25.83
France	3,650	5.45	31.27
Germany	3,880	5.79	37.06
Greece	2,440	3.64	40.70
Ireland	2,840	4.24	44.94
Italy	4,050	6.04	50.98
Netherlands	3,150	4.70	55.68
Norway	3,170	4.73	60.41
Poland	4,580	6.83	67.25
Russia	4,820	7.19	74.44
Spain	3,400	5.07	79.51
Sweden	4,030	6.01	85.53
Switzerland	2,910	4.34	89.87
Turkey	3,190	4.76	94.63
United Kingdom	3,600	5.37	100.00
Total	67,020	100.00	

Table V: Variance influence factor (n = 67,020)

Variable	VIF	1/VIF
Market Concentration	4.59	0.2179
Out-of-Stock	1.05	0.9499
Long-term Interest Rate	4.07	0.2458
Covid	1.10	0.9075
Bath and Shower	2.11	0.4730
Skin Care	2.48	0.4027
Cough, Cold and Allergy (Hay Fever) Remedies	2.32	0.4305
Vitamins and Dietary Supplements	3.46	0.2892
Bleach	1.56	0.6403
Dishwashing	1.71	0.5860
Home Insecticides	1.64	0.6097
Surface Care	1.68	0.5960
Cat Food	1.76	0.568720
Dog Food	1.80	0.556803
Retail Adult Incontinence	1.76	0.568655
Toilet Paper	1.44	0.693393
Belgium	2.30	0.434594
Czech Republic	2.48	0.404003
Denmark	2.06	0.486219
Finland	2.20	0.454093
France	2.25	0.444130
Germany	2.31	0.433571
Greece	2.57	0.389467
Ireland	1.99	0.501675
Italy	2.62	0.381804
Netherlands	2.06	0.484482
Norway	2.09	0.479214
Poland	2.75	0.363597
Russia	4.08	0.245076
Spain	2.20	0.455208
Sweden	2.37	0.421873
Switzerland	2.01	0.496677
Turkey	3.60	0.277819
United Kingdom	2.21	0.452983
Mean VIF	2.31	

APPENDIX II: Descriptive statistics on the pre-pandemic data

Table VI: Pairwise correlation pre-Covid data

Variable	E-commerce Value RSP	Market Concentration	Out-of-Stock	Long-term Interest rate
E-commerce Value RSP	1.0000			
Market Concentration	-0.2167	1.0000		
Out-of-Stock	-0.0143	-0.0293	1.0000	
Long-term Interest rate	-0.1706	-0.0597	0.0414	1.0000

Table VII: Descriptive statistic Covid

Variable	Observations	Mean	Std. Dev.	Min	Max
E-commerce RSP Value	60,318	32.6655	57.7292	0	409.7
Market Concentration	60,318	47.2280	17.5436	15.1	99.5
Out-of-Stock	60,318	4.6524	4.5470	0	22.1168
Long-term Interest rate	60,318	3.0032	3.4145		22.4983

Table VIII: Variable summarisation pre-Covid

Variable		Mean	Std. Dev.	Min	Max	Observations
E-commerce RSP Value	Overall	32.6655	57.7292	0	409.7000	N = 60,318
	Between		54.4512	0	306.7333	n = 6,702
	Within		19.1863	-96.9456	202.9544	T = 9
Market Concentration	Overall	47.2280	17.5436	15.1000	99.5000	N = 60,318
	Between		17.4120	15.9889	98.0222	n = 6,702
	within		2.1537	33.7613	61.0502	T = 9
Out-of-Stock	Overall	4.6524	4.5470	0	22.1168	N = 60,318
	Between		1.4227	1.6671	9.5725	n = 6,702
	Within		4.3188	-4.1805	21.6463	T = 9
Long-term Interest rate	Overall	3.0031	3.4145	-0.4695	22.4983	N = 60,318
	Between		2.9484	0.3208	10.7702	n = 6,702
	Within		1.7224	-3.9783	15.9342	T = 9

APPENDIX III: Descriptive statistics on the Covid-19 pandemic

Table IX: pairwise correlation Covid data

Variable	E-commerce Value RSP	Market Concentration	Out-of-Stock	Long-term Interest rate
E-commerce Value RSP	1.0000			
Market Concentration	-0.2477	1.0000		
Out-of-Stock	0.1886	-0.0292	1.0000	
Long-term Interest rate	-0.0801	-0.0391	-0.1270	1.0000

Table X: Descriptive statistic Covid

Variable	Observations	Mean	Std. Dev.	Min	Max
E-commerce RSP Value	6,702	68.9890	110.1704	0	585.9000
Market Concentration	6,702	46.9077	17.8899	16.8000	98.8000
Out-of-Stock	6,702	7.1200	5,2312	0	30.2788
Long-term Interest rate	6,702	1.4324	3.2942	-0.5108	12.7500

Table XI: Variable summarisation Covid

Variable		Mean	Std. Dev.	Min	Max	Observations
E-commerce RSP Value	Overall	68.9890	110.1704	0	585.9000	N = 6,702
	Between		110.1704	0	585.9000	n = 6,702
	Within		0	68.9890	68.9890	T = 1
Market Concentration	Overall	46.9078	17.8899	16.8	98.8000	N = 6,702
	Between		17.8899	16.8	98.8000	n = 6,702
	within		0	46.9078	46.9078	T = 1
Out-of-Stock	Overall	7.1200	5.5231	0	30.2788	N = 6,702
	Between		5.5231	0	30.2788	n = 6,702
	Within		0	7.1200	7.1200	T = 1
Long-term Interest rate	Overall	1.4239	3.2942	-0.5108	12.7500	N = 6,702
	Between		3.2942	-0.5108	12.7500	n = 6,702
	Within		0	1.4239	1.4239	T = 1

APPENDIX IV: Hausman Test

Table XII: Hausman Test indicating a fixed effect model

Variable	Coefficients			Sqrt(diag(V _b – V _B)) SE
	(b) FE	(B) RE	(b-B) Difference	
Market Concentration	-0.5678	-0.7235	0.1557	0.0356
Out-of-Stock	0.7658	0.7635	0.0023	0.0012
Long-term interest rate	-3.4853	-3.4834	-0.0012	0.0154

b = consistent under H0 and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under H0; obtained from xtreg

Test: H0: difference in coefficients not systematic

$$\text{Chi2}(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 30.76$$

Prob> chi2 = 0.0000

APPENDIX V: Robustness checks

Table XIII: pairwise correlation with lagged dependent variable

Variable	E-commerce RSP Value	Lag E-commerce RSP Value	Market Concentration	Out-of-Stock	Long-term Interest rate	Covid
E-commerce Value RSP	1.0000					
Lag E-commerce RSP Value	0.9974	1.0000				
Market Concentration	-0.1332	-0.1397	1.0000			
Out-of-Stock	0.0521	0.0500	-0.0268	1.0000		
Long-term Interest rate	-0.1061	-0.0985	-0.0069	0.0003	1.0000	
Covid	0.0608	0.0479	0.0036	0.0992	-0.1762	1.0000

Table XIV: robustness check with industry dummies instead of subindustry

E-commerce RSP Value	(1)
Market Concentration	-0.454*** (-10.21)
Covid	55.16*** (32.58)
Covid* Market Concentration	-0.772*** (-26.11)
Out-of-Stock	0.191*** (12.60)
Covid* Out-of-Stock	1.827*** (16.66)
Long-term interest rate	-2.123*** (-25.66)
Covid* Long-term interest rate	0.264 (1.40)
Consumer Health	-12.45*** (-7.45)
Home Care	-27.20*** (-17.67)
Pet Care	-1.400 (-1.22)
Tissue and Hygiene	-25.83*** (-12.80)
Constant	46.01*** (17.18)
Country Fixed effects	Yes
Observations	67,020
R ²	0.4909
Wald Chi	8441.63***

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Table XV Descriptive statistics with Markup as dependent variable

Variable	Observations	Mean	Std. Dev.	Min	Max
Markup	18,480	16.7072	30.9326	0	203.5000
Covid	18,480	0.1000	0.3000	0	1
Out-of-Stock	18,480	31.1108	9.1155	15.1	56.8000
Market Concentration	18,480	4.9606	4.8415	0	25.5289
Long-term Interest rate	18,480	2.5803	2.9867	-0.5108	15.8825

Table XVI: Pairwise correlation with Markup as dependent variable

Variable	Markup	Covid	Market Concentration	Out-of-Stock	Long-term Interest rate
Markup	1.0000				
Covid	0.1366	1.0000			
Out-of-Stock	-0.1016	0.0173	1.0000		
Market Concentration	-0.0056	0.1003	-0.0230	1.0000	
Long-term Interest rate	-0.2708	-0.1378	-0.1063	-0.0484	1.0000

Table XVII: regression analysis with dependent variable Markup

Markup	(1)	(2)	(3)	(4)	(5)
Covid	11.23*** (27.98)	9.164*** (24.58)	26.76*** (19.99)	12.89*** (26.03)	29.18*** (21.27)
Out-of-Stock	0.101*** (7.19)	0.0493*** (5.05)	0.0702*** (5.48)	0.0831*** (6.19)	0.0551*** (5.49)
Market Concentration	0.117*** (2.93)	0.125*** (3.10)	0.170*** (4.05)	0.134*** (3.30)	0.188*** (4.44)
Long-term interest rate	-1.919*** (-16.88)	-1.894*** (-16.88)	-1.865*** (-16.75)	-1.797*** (-16.44)	-1.738*** (-16.47)
Covid * Out-of-Stock		0.339*** (5.63)			-0.0303 (-0.54)
Covid*Market Concentration			-0.489*** (-14.83)		-0.504*** (-15.57)
Covid* Long-term interest rate				-1.096*** (-13.77)	-1.147*** (-11.59)
Constant	-0.795 (-0.52)	-0.795 (-0.52)	-2.542 (-1.62)	-1.640 (-1.07)	-3.490** (-2.20)
Observations	18,480	18,480	18,480	18,480	18,480
R ²	0.7796	0.7798	0.7815	0.7807	0.7827
Wald Chi	404539.35	393822.83	614701.75	210027.05	401854.37

t statistics in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$