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Retail strategies and their effects on performance

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Ph.D. Thesis

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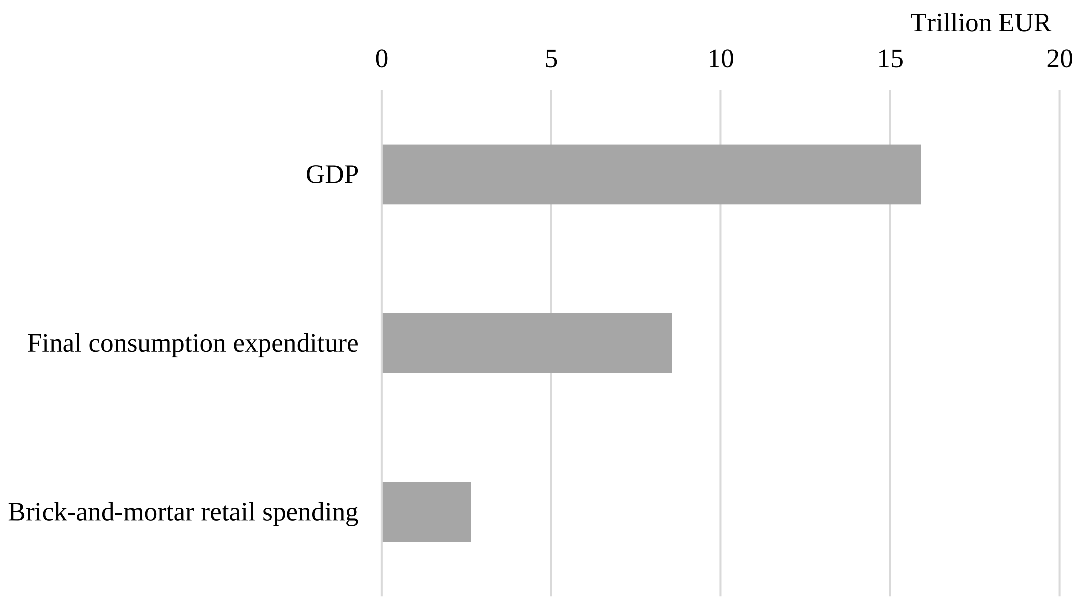
I. INTRODUCTORY CHAPTER

I.1 Research objectives and relevance of the topic

Retailing is an essential service in the 21st century. A large portion of household spending is going through the retail sector as it constitutes the bridge between manufacturers and final consumers. Figure 1 indicates that final consumption expenditure is around half of the GDP of the European Union (EU). Closely 30% of this amount is spent in physical retail outlets in the 28 EU member states according to Schamel et al. (2019). This shows that more than 15% of the GDP is going through the retail sector.

Figure 1. GDP, final consumption expenditure, and retail spending in the EU-28 countries in 2018

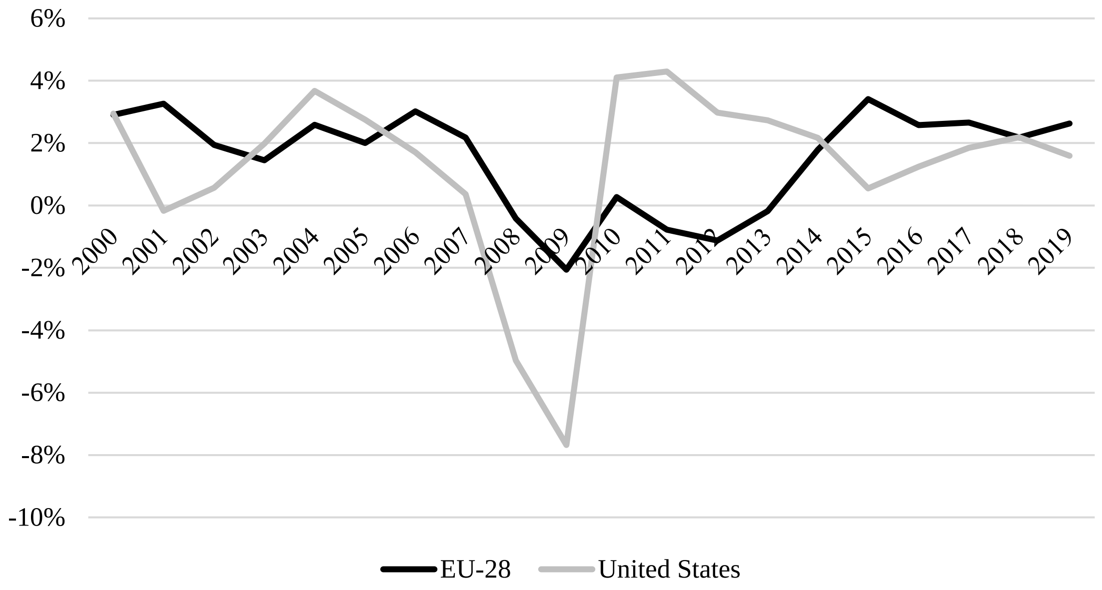


Source: Eurostat and Schamel et al. (2019)

Additionally, the retail sector (including physical stores, online and other formats) is the largest employer in the European Union, accounting for 8.6% of employment in 2018 according to Eurostat. Therefore, retailers not only interact with their shoppers on a daily basis but also directly influence the lives of several million people worldwide.

Due to its importance, the retail sector was affected significantly by the economic crisis started in 2008. Disposable income of the households declined significantly in almost all the developed countries that triggered a rather sizeable decay in retail volume as well (on average −2.1% in 2008 and −3.8% in 2009 in the OECD countries). Figure 2 shows the year-on-year retail trade volume growth in the European Union and in the United States of America (USA). The financial crisis and the years followed can be described by an overall decline in the retail sector.

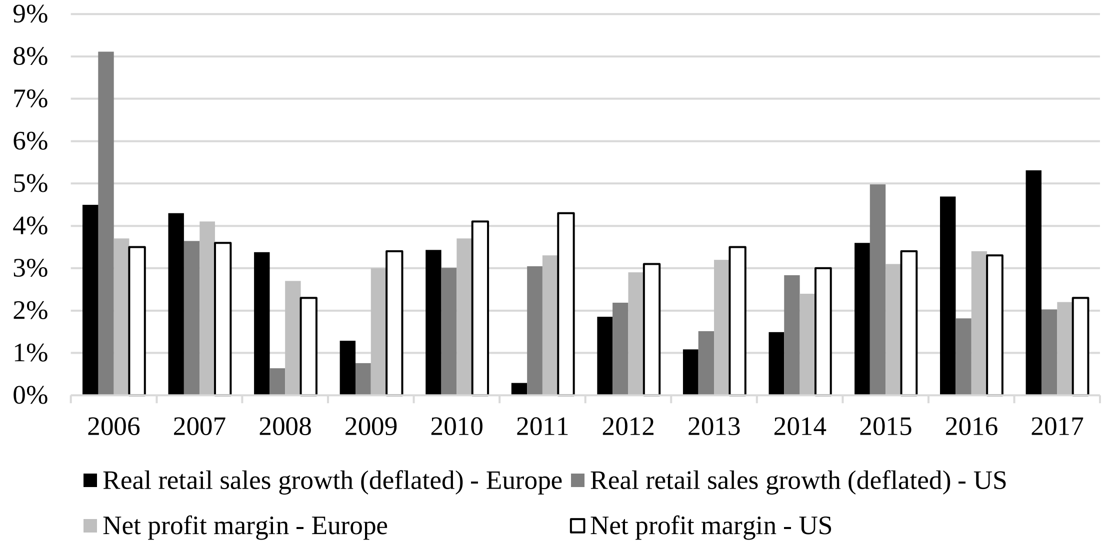
Figure 2. Annual retail trade volume growth



Source: OECD iLibrary

On the other hand, considering the top 250 retail companies worldwide, their turnover and profitability show a brighter picture than the one depicted in Figure 2. Figure 3 indicates that the US- and Europe-based top retailers were able to maintain their sales volume throughout the financial crisis. At the same time, their profitability did not decrease substantially either, indicating that these companies did not have to sacrifices profitability to maintain sales. These data clearly show that retail strategies can make a difference on the corporate level.

Figure 3. Performance of the top European and US-based retailers



Source: Global Powers of Retailing reports and OECD iLibrary

Retail companies reacted to the challenges of the financial crisis in different ways that can be related to their performance. Pederzoli and Kuppelwieser (2015) reviewed the retail publications assessing the reactions of retail firms to market challenges. They identified mechanisms such as organizational capability building, innovation, and geographical diversification to overcome the negative market and economic events. Furthermore, pricing is another key element of the retail mix that can be easily altered to attract shoppers (Ellickson and Misra, 2008; Simon and Fassnacht, 2019), especially in a crisis environment. In my thesis, I focus on three key aspects of retail strategies: innovation, geographical diversification, and pricing. These strategic elements can be related to the performance of the retailers and this is exactly what I am exploring in my thesis.

Academic researchers have shown substantial interest in the performance consequences of geographical diversification (Etgar and Rachman-Moore, 2008; Qian et al., 2008; Qian et al., 2010; Chan et al., 2011; Assaf et al., 2012; Oh et al., 2015; Dimitrova et al., 2019). The retail literature also agrees that geographical diversification might lead to the accumulation of new resources that then influence the strategy of the retailer (Daft, 1982). However, only a few pieces of research have examined the impact of geographical diversification on other strategic areas. For example, Mohr et al. (2014) suggested that geographical diversification creates firm-specific resources that can enhance the innovation and marketing activity of the retailer. Since international retailers must adapt their operations to foreign markets, this adaptation can create organizational knowledge that can be internalized and converted into new retail solutions. However, to my knowledge, the impact of innovations on financial performance has not been tested empirically in the retail literature yet.

To address this research gap, my thesis specifically focuses on retail innovations and empirically analyze how innovation activities of the retailers impact their profitability as well as the role of geographical diversification in this relationship.

While innovation and geographical diversification are long-term strategic elements, short-term adjustments and responses to market challenges are also needed. The pricing strategy (i.e., pricing and promotional activity) of the retailer is one of the most important tools in this case. The identification of pricing strategies applied by the retailers and the importance of pricing strategies in achieving outstanding market performance are heavily researched areas of retailing (Hoch et al., 1994; Lal and Rao, 1997; Bell and Lattin, 1998; Bolton and Shankar, 2003; Chou and Chen, 2004; Shankar and Bolton, 2004; Ellickson and Misra, 2008). However, the identification of successful pricing strategies in a crisis environment is not researched that much. My thesis also advances research on this topic by analyzing Hungarian retailers during the last financial crisis.

The thesis is comprised of three papers published in different journals connected to retail strategies. The first one is about pricing strategies and their success in a crisis environment in Hungary. The second one explores how geographical diversification, retail innovation, and performance are related to each other. Finally, the third paper focuses particularly on digital innovations and their performance consequences.

In this introductory chapter, I focus on the theoretical background and the key terms (retail innovation, geographical diversification, pricing strategy, and performance) of my thesis and introduce them along with a literature review about classifications. This is followed by a short summary of the conceptual frameworks. Furthermore, I also provide a comprehensive methodological background for regression models that I applied during my research.

I.2 Theoretical background

This section aims to introduce the theoretical framework of the thesis and the most important terms and definitions applied in it (retail innovation, geographical diversification, retail pricing, and retail performance). As part of the definitions, I will also elaborate on the different classifications that I considered during my research.

I.2.1 Retail strategy formulation

According to the microeconomic theory of firm, firms aim to maximize their profit that can be distributed among their shareholders. The profit maximization behavior is straightforward in a world of perfect information (Mas-Colell et al., 1995). However, in the reality, there is a great amount of uncertainty regarding the future of the economy and the competitors.

The strategy of the firm is a course of action that aims to gain competitive advantage and achieve above-average profitability. Strategies have to react to the external environment, but also have to take into consideration the resources and capabilities of the firm (Hitt et al., 2017). Teece et al. (1997) reviewed the strategic management literature and identified three paradigms of strategic management and business strategy:

- competitive forces approach,
- strategic conflict approach, and
- efficiency-based approach.

From the point of view of this thesis, the efficiency-based approach is the most relevant one. This indicates that firm-specific capabilities can lead to above-average profitability. The resource-based view suggests that exploiting scare, firm-specific assets is key to be successful on the marketplace. These resources mainly determine the strategic opportunities of the firms (Wernerfelt, 1984).

Since resources and capabilities are essential to be successful and profitable, the acquisition of these (physical and immaterial) assets is also crucial for companies. However, not only the acquisition of valuable assets is needed, but also to create useful capabilities based on them. Hence, Teece et al. (1997) proposed the dynamic capability approach. This approach considers the changing economic environment companies have to operate in and the need to accumulate inimitable resources and develop new, firm-specific capabilities. Companies require continuous adaptation to the market environment to become and remain successful that often requires building new capabilities.

Organizational learning is particularly important in this regard. Learning can contribute to improving existing processes, but also to identify new opportunities. Organizations can learn from their own experience or through the diffusion of the experience of others (Levitt and March, 1988). Zollo and Winter (2002) argued that the origin and development of dynamic capabilities is organizational learning.

In a retail setting, there are different firm-specific resources and capabilities a company might own, e.g., developed procurement system, high quality standards, efficient distribution system, strong private label brands, favorable brand awareness, social media capabilities. The business strategy of a given retailer has to build upon its resources and capabilities. In this thesis, I consider three retail strategies: pricing, geographical diversification, and innovation.

The price level and the price promotional activity of the retailers are bounded by the efficiency of their asset utilization and the negotiation power *vis-á-vis* manufacturers. A more efficiently operated store chain can provide lower prices for its shoppers and can also negotiate better promotions with its suppliers while being profitable at the same time. The chosen pricing strategy of the firm is, hence, connected to the available resources of the retailers (Chou and Chen, 2004).

Additionally, these resources can be further exploited by geographical diversification (Teece et al., 1997). The firm-specific, difficult-to-imitate capabilities substantially contributed to the success and fast penetration of modern supermarkets in developing markets at the beginning of the 1990s (Minten and Reardon, 2008). Geographical diversification is an opportunity for competitive retailers to obtain rents from a larger market.

Geographical diversification can also contribute to organizational learning as the company and its employees, especially managers, get to know other markets and interact with different suppliers and competitors. This organizational learning can enhance the capabilities of retailers through innovations. Innovations can contribute to all aspects of the retail value chain and create dynamic capabilities (Bowman and Ambrosini, 2003). According to the results of Brown et al. (2019), innovation capabilities are particularly important regarding the future of the retail company. However, it should be also noted that dynamic capabilities are essential to enable and enhance innovations (Caniato et al., 2013).

The continuously and rapidly changing market environment requires the adaptation of retail strategies. During an economic crisis as it was the Great Recession in 2008/2009 or the COVID-19 crisis currently, this receives special importance. Although other strategies also exists, pricing, geographical diversification, and innovation are often identified as potential responses to declining demand caused by an economic crisis (Pederzoli and Kuppelwieser, 2015). This motivated me to analyze these retail strategies. In the remaining part of this chapter, I will introduce the four key terms used in my thesis.

I.2.2 Retail innovation

The concept of innovation is closely related to Schumpeter's theory proposing that economic development is driven by discontinuous emergence of new combinations resulting in economically more viable solutions than the previous ones (Schumpeter, 1934). Based on Neely et al. (2001), innovation is the commercial exploitation of new ideas. OECD and Eurostat (2005) gave a more comprehensive definition and framed innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method, inbusiness practices, workplace organization or external relations" (p. 46.).

Innovations can be executed by different actors in a process called innovation activity. This is defined as "all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations" (OECD and Eurostat, 2005, p. 47.). In my thesis, I only analyze the innovation activities of retail companies. Therefore, it is important to note that according to the OECD and Eurostat (2005) innovation should be new to the given firm, but not necessarily to the entire market. This means that the adoption of new practices, products, etc. already existing in the market, but not previously applied by the given company can also be classified as innovation from the firm's point of view.

Reynolds and Hristov (2009) stated that retail innovation differs from other sectors. The distinct characteristics of retail innovations include that these are often easily imitable, mostly non-technological in nature, there are reverse innovation cycles and reveal hybrid characteristics due to vertical integration. The non-technological nature of retail innovation is due to that retailers rather apply new technologies instead of developing them. However, this is changing in time as Pantano et al. (2017) reported that the number of retailing patents increased substantially between 2010 and 2014. The growth was much larger than the overall growth rate of the number of patents. This also impacts how imitable retail innovations are as patents provide some protection against imitation.

The reverse innovation cycle refers to the fact that the majority of the costs of retail innovation is connected to the roll-out phase instead of the development phase. Furthermore, retailers often act as innovation hubs in the supply chain and they communicate consumer needs to the suppliers.

Retail innovations can be classified following different approaches. Marketing and management literature provide some possible classification schemes that will be discussed in this subsection. These existing classification schemes are summarized in Table 1 at the end of the subsection.

I.2.2.1 Classifications based on one attribute

Less sophisticated classifications use only one characteristic of the innovation. Some of the most popular ones are the followings.

- Technological *versus* non-technological innovations. Once the innovation exploits new technologies it is technological innovation (e.g., digital price tags). Non-technological innovations can be, for example, the introduction of a new private label brand or a new store format.
- Radical *versus* incremental innovations. Radical innovation changes the market and often challenges the incumbents via new products and new business models (Christensen et al., 2015). Incremental innovations, on the other hand, have no such a substantial effect on the structure of the market.

These are useful attributes to describe innovations, however, they cannot be used for classification purposes. A typology that reflects a combination of several attributes at the same time is more useful.

I.2.2.2 Literature-driven typology

Harmancioglu et al. (2009) reviewed 238 articles about innovation research to develop a theory-driven typology of innovation. The authors identify two dimensions to differentiate innovation literature. The first dimension is the adoption/diffusion theory *versus* the resource-based view. The adoption/diffusion theory focuses on individual adoption and the theory of reasoned action (Fishbein and Ajzen, 1975) as well as technology acceptance (Davis et al., 1989). This provides a behavioral point of view for innovations. On the other hand, the resource-based view focuses on the firms and their resources and capabilities and how the companies are able to gain a competitive advantage due to them. An extensive amount of literature dealt with the resource-based view in different academic areas.

The second dimensions are perspective (market *versus* firm *versus* both) and level of analysis (product/project *versus* program/firm/business unit). The perspective dimension mainly focuses on the subjects of innovation, whether it is the company or the consumers or both. Considering the level of analysis, one can distinguish whether the analysis (or research) was executed on the product/project level or it had a more holistic view and focused on the company or on a strategic business unit.

Harmancioglu et al. (2009) provided useful insights into the innovation literature and how researchers are thinking about innovation. However, this typology targets the literature of innovation and, therefore, observed innovations (and innovation outcomes) cannot be classified following these dimensions. Due to this, it has lower relevance regarding the research question of my thesis.

I.2.2.3 Generally used innovation classification scheme

OECD and Eurostat (2005) focused on executed innovations and differentiated four types: product, marketing, process, and organizational innovations. Product innovation includes new goods or services that significantly improve intended use and/or product characteristics compared to earlier available products or services. Product innovation can mean newly invented products, but also covers expanding the usability of existing products. However, once only the design is changing, but not the intended use or characteristics of the product, it can be rather considered as marketing innovation. In the retailing industry, product innovation mainly includes private label product development.

Marketing innovation mainly affects the marketing mix (product design or packaging, price, promotion, placement). The aim of these innovations is to re-position a product within an existing market or in a new market utilizing a marketing method, concept or strategy that was not applied earlier. The new marketing method can evolve from internal processes and developments or can be adapted from other market players. The most important attribute of marketing innovations is that it is targeting the consumers and their experience with the product or service.

Process innovation targets product or service creation and delivery. This type of innovation often includes new techniques, equipment or software, i.e., it is in the majority of the cases not visible or only partially visible by the consumers.

Finally, organizational innovation is about new organizational structure, business practices, workplace organization, external relations. The new structure, practice or method should not be solely the modification of the existing set-up, but it has to mean the implementation of something completely new. Naturally, this is the least observable by the consumers.

The OECD and Eurostat (2005) framework is industry neutral, i.e., it can be used in any industry to classify innovations. This is the reason why the Community Innovation Survey (CIS) is applying this framework in its surveys. On the other hand, it is not specifically tailored to any given industry; therefore, it cannot capture the specifics of the retailing industry either. However, this classification scheme has clear definitions, and the Oslo Manual (OECD and Eurostat, 2005) provides details on how to apply it. Furthermore, it is widely applied in academic research.

I.2.2.4 Classification specifically for retailer innovations

Hristov and Reynolds (2015) analyzed specifically retail innovations. They conducted 46 interviews with retail executives and 11 interviews with executives of consulting firms or professional associations. They proposed a retail matrix to categorize retail innovation. One side of the matrix contains the application areas of innovations. Offer- or customer-related innovations are targeting the customers with new product lines, additional services, new store formats or retail channels, etc. Support-related innovations are targeting the operational systems to efficiently deliver retail offers and offer- or customer-related innovations. Finally, organizational-related innovations impact the organizational framework of the company and help to sustain the previous two types of innovations.

The other side of the matrix contains the impact of the innovations. Strategic innovations arise as a combined effort of different business areas and aimed to achieve “step change” in the business with long-term objectives. On the other hand, operational innovations are more specific and short-term ones.

This classification is retail-specific and endogenous in the sense that it was created based on the above mentioned 57 interviews. However, each of the groups is still diverse and contains very different innovations as well; therefore, this also needs to be refined, similarly to the previous one. A further disadvantage is that the definitions and examples for each of the categories are not as detailed as the one in the Oslo Manual (OECD and Eurostat, 2005). This restricts the usability of this classification.

I.2.2.5 A deeper understanding of product innovations

A widely used innovation typology focuses on the newness of innovations from two perspectives, from a market and from a technology (firm) point of view. Johnson and Jones (1957) was the first one that proposed this differentiation among innovations. They identified 8 different types of innovations ranging from reformulation (improved technology for the same market) to diversification (new technology to new markets).

The market-technology typology has several modifications that altered or simplified the approach of Johnson and Jones (1957). Chandy and Tellis (1998) used 4 types only based on customer need fulfillment (low-high) and newness of technology (low-high).

Fornari et al. (2009) analyzed the performance consequences of product innovations for fast-moving consumer goods (FMCG) manufacturers and retailers. They differentiated six product innovations: absolutely new products (i.e., creating a new market), new product lines, integration or extension of existing product lines, improvement of existing product lines, repositioning, and cost reduction (i.e., innovation to manufacture the same product cheaper).

The market-technology framework creates homogenous subgroups for product innovations that can be used for further analyses. Chandy and Tellis (1998) analyzed the driving factors of radical innovations, Fornari et al. (2009) concentrated on the absolutely new product innovations and analyzed their market penetration, and performance. However, the market-technology framework does not cover the whole domain of retail innovations. For example, new marketing methods, like a new loyalty program or a mobile application cannot be classified using this one. This is exactly the case with process and organizational innovations. Since product innovations are less relevant for retailers (it is more applicable for manufacturers), this classification scheme cannot be applied well in the retail setting.

Table 1 summarizes the above discussion by pointing out the strength and weaknesses of the different classification schemes.

Table 1. Review of existing innovation classifications

Authors	Suggested classification	Advantages	Shortages
Harmancioglu et al. (2009)	First dimension: adoption/diffusion, resource-based view Second dimension: perspective (market, firm or both) and level of analysis (product/project, program/firm/business unit)	Provides insight into the innovation literature	This a classification of research articles, not for innovation activities
OECD and Eurostat (2005) (Oslo Manual)	Four categories: product innovation, marketing innovation, process innovation, organizational innovation	Generally applicable to all industries (incl. retailing) and innovation activities	Not specific enough and cannot reflect the very specifics of retail innovations
Hristov and Reynolds (2015)	First dimension: application areas of innovations (offer- or customer-related, support-related and organizational-related innovations) Second dimension: impact of the innovations (strategic or operational)	Retail specific innovation classification	Groups are not homogenous enough, categories are too broad, clear definitions are missing
Johnson and Jones (1957) (later developed by others)	First dimension: market newness (high-low) Second dimension: technology newness (high-low)	Detailed and well applicable for product innovations	Not applicable for other types of innovation (e.g., marketing, process)

I.2.3 Geographical diversification

Hitt et al. (2006) considered geographical diversification as a strategy whereby a firm expands the sales of its goods or services into different geographical locations. Wiersema and Bowen (2011) extended this approach to include all foreign aspects of the firm's value chain. Thus, retailers not only set up stores, but they also establish purchasing, logistics, and other supporting activities (finance, controlling, HR or IT) in other countries or regions.

Academic researchers started to analyze the geographical diversification of the retailers in the late 1980s, early 1990s (Helfferich et al., 1997). However, different patterns arose how retailers expanded their geographical footprint. Therefore, researchers had to create categories and classify the geographical diversification activities of the retailers.

Treadgold (1988) was one of the first authors who aimed to create a categorization based on entry mode and operating strategy. Later on, different classifications emerged and Helfferich et al. (1997) reviewed them and created a clear set of definitions. For this exercise, they also reviewed how geographical diversification is analyzed in the service industry, the models of development stages and how cultural differences impact conducting business worldwide. Helfferich et al. (1997) based their classification on geographic scope, cultural spread and orientation, marketing approach, and management style of the geographical diversification. They differentiated four types of retailers. The first one (called international) has a limited geographical scope within one cultural zone, i.e., these retailers expanded their activities only in the neighboring countries of their home country. This requires a low level of adaptation; hence, retail formats do not have to be altered. The entire company is managed from its headquarter located in the home country.

A global retailer is having a high geographical footprint, but local market adaptation is low, the company is mainly importing its format to other countries. Therefore, centralized control is in place that ensures homogenous operation across the globe. A good example is Aldi or IKEA.

The next type is called the transnational retailer. Companies belonging to this category use resources to understand the differences across markets and adapt to the differences by changing assortment, pricing, and marketing activity. They have a geocentric cultural orientation and the company is managed as a network, i.e., senior managements of the different countries are in touch with each other and managers are frequently relocated across countries.

Finally, multinational retailers are present in several continents and cultural zones and are fully adapting to local differences, they can even have different store formats in different countries. The units (countries or country blocks), therefore, are managed independently.

Alexander and Myers (2000) considered corporate and market-related factors in conceptualizing geographical diversification of the retailers. On one side, the corporate perspective is taken into account that can be ethnocentric or geocentric. The geocentric approach means a global orientation with local market adaptations, while ethnocentricity mainly means applying the domestic mindset even in foreign markets. The other factor is the market extension, i.e., the geographical footprint of the retailer. In this categorization, proximal retailers are present in a few numbers of countries and have an ethnocentric perspective. Multinational retailers still apply the same concepts and mindset in their foreign markets as they do in their home market, but their geographical presence is much wider. Transnational retailers are having a geocentric mindset, but they are present only a few numbers of markets (yet). Finally, global retailers are equipped with a geocentric mindset, i.e., they apply local solutions to different markets. At the same time, these retailers are present in several countries, so they have a wide geographical footprint.

Closely a decade later, Burt et al. (2008) assessed the theoretical approaches of retail internationalization and examined the geographical diversification history of three grocery retail chains. Based on their review, two factors consistently emerged in various theoretical models aiming to classify retail internationalization. The first one is the geographical spread of the retailer, while the second one is the degree of responsiveness to different local market conditions and needs.

However, after examining three large international grocery chains (Ahold, Carrefour, and Delhaize), Burt et al. (2008) concluded that firm level implementations differ across firms, and times and it is sometimes *ad hoc* instead of being planned in detail. Therefore, they argued that geographical diversification is a very complex learning process for the retailer that is almost impossible to classify using simplified schemes.

On the other hand, Burt el al. (2008) indicated that local market adaptation is a need that all the three retailers in their sample recognized. In this case, the extent of adaptation can be important. In this regard, the geographical and cultural distance of the target market from the home market can be an important factor that determines the level of adjustments potentially needed.

The concept of geographical and cultural distance describes the typical pattern of retail internationalization suggesting that companies move first into geographically or culturally close markets. Retailers' geographical diversification within their home region can also serve as a learning ground. Later, as familiarity with international markets and the operational issues involved increases over time, the companies can further diversify their business and enter geographically and culturally more distant markets. Based on this spreading pattern, Qian et al. (2010) identified intra-regional (spreading across countries but within one region) and inter-regional (expanding across regions) diversification. The main reason behind this distinction is that adaptation and coordination costs differ substantially in intra- and inter-regional diversification.

Qian et al. (2010) analyzed manufacturing companies only. Oh et al. (2015) applied the same approach to retailers and differentiated across intra- and inter-regional diversification of retailer companies. Intra-regional diversification means that the given company extends its operation within its home region, while inter-regional diversification is across regions. Regions are roughly continents in this case. Since Oh et al. (2015) analyzed solely European retailers, in their case, home region diversification meant to be within Europe.

Other concepts also emerged in the literature to theorize the geographical diversification of retail companies. Mitra and Golder (2002) introduced the term ‘near-market knowledge’ to assess the companies’ ability to understand new markets based on the knowledge already created by the presence in similar markets. According to this theory, cultural and economic knowledge arising from successful entries increase the probability of entering into similar markets. Their empirical results support this theory, near-market knowledge is significantly impacting market entry decisions, while economic and cultural distance were not significant in their regression model.

Gripsrud and Benito (2005) concluded that retailers start their internationalization process with geographically close markets. Economic attractiveness is getting importance later. However, the internationalization pattern of highly geographically diversified companies shows substantial differences. Gripsrud and Benito (2005) suggested a case-by-case review in these cases.

I.2.4 Retail pricing

Pricing strategy is one of the most important elements of marketing. All the companies producing goods or services apply a particular pricing strategy. Kienzler and Kowalkowski (2017) classified pricing strategy research using 11 categories in their meta-analysis. Pricing strategy can cover individual products or product bundles, but also can have a more holistic view. In this thesis, only store- or chain-level retail pricing strategies are considered. From this point of view, the pricing of the whole store (or chain) is considered, not the particular prices of individual products.

The retail pricing strategy involves decisions on baseline prices and promotional activities, mainly price discounts. Based on these two dimensions, several pricing strategies were proposed in the literature.

According to pioneering empirical research of Hoch et al. (1994), there are two main types of strategies: everyday low price (EDLP) and promotion-oriented pricing (Hi-Lo).

EDLP indicates continuously low prices, therefore, promotion can play only a minor role. Price uncertainty and price variability in an EDLP store is very low, and consumers can anticipate that prices do not change materially between two shopping trips. In contrast, Hi-Lo indicates higher baseline prices coupled with intensive (price) promotion activities. The price of a product sold at a temporary discount can be lower than the price of the same product in an EDLP store.

However, the pricing landscape is far more complex and is time and location dependent. Ellickson and Misra (2008) defined the hybrid pricing strategy as a combination of EDLP and Hi-Lo. Their dataset indicated a wide variety of hybrid pricing, some retailers being closer to EDLP, others closer to Hi-Lo. According to them, pricing strategies should be interpreted at the store- and not at the chain-level. Bolton and Shankar (2003) identified five different store-level pricing strategies (exclusive pricing, premium pricing, Hi-Lo pricing, low pricing, aggressive pricing) in their empirical analysis carried out in five US cities. Surprisingly, EDLP was not on their list and Hi-Lo pricing was adopted by only 9% of the stores. This clearly shows the importance and spread of the hybrid strategies.

I.2.5 Retail performance

Performance is an important construct in marketing, however, there are several measures to operationalize it. Katsikeas et al. (2016) reviewed the conceptual domain of performance in marketing. They differentiate operational and organizational performance. While operational performance is related to the fulfilment of the marketing activities (measured by for e.g., brand equity, satisfaction, customer lifetime value, or market share), organizational performance is related to the company as a whole. This can be measured either by accounting performance metrics (e.g., sales revenue, profit, margin) or by financial market performance metrics (e.g., investor return, equity risk, cost of capital).

Despite performance is having multiple dimensions and not only relate to financial performance, 38% of the empirical studies published in the top 15 marketing journals between 1981 and 2014 used only one measure for performance (Katsikeas et al., 2016). This is also true for the retail literature. The focus of this thesis is on accounting and financial market performance.

The shareholder value creation of a retailer mainly depends on three factors: sales growth, net margin, and asset efficiency. These indicators are often used in business to measure performance in general. Specific projects and business areas might apply different measures as well. Hristov and Reynolds (2015) conducted expert interviews with retail executives and industry experts to understand how retailers measure the success of innovations. They found that UK retailers use both financial and non-financial indicators to track the incremental contribution of innovations. Financial measures include sales and market share, rate of return (e.g., return on sales or return on investment), or profit margin. Non-financial measures are mainly consumer insight measures (e.g., consumer satisfaction, retention, acquisition). There are some time-related measures as well (e.g., speed of market penetration), but these are not widely used among retailers. However, financial measures were more widespread. Additionally, they are also easier to obtain and compare them across firms. Not surprisingly, prior empirical studies used financial related measures to assess firm performance.

There are different concepts of how retail performance can be measured, and academic research applied a wide variety of measures, too. The most straightforward way is to use directly available data. Etgar and Rachman-Moore (2008) used the natural log of sales data, while Gielens and Dekimpe (2001) the deflated sales, however, both can be problematic as firm size shows a large difference in retail. Chan et al. (2011) applied return on investment and five-year compound annual sales growth (CAGR), while several other authors used return on sales (e.g., Mohr et al., 2014; Oh et al., 2015). An important advantage of return on sales is the easy availability of this data.

On the other hand, more complex financial measures can be applied as well. Gielens and Dekimpe (2001) used sales per retail are (m^2). Assaf et al. (2012) estimated cost frontier and assessed how close the individual firms were to the frontier. This cost efficiency measure was used in the regression to estimate the impact of geographical diversification on firm performance. However, the availability of data creates a real burden on the application of this type of financial measures.

I.3 Conceptual framework

In this section, I will introduce a general conceptual framework based on the theories and key terms introduced in the previous section. This section provides only a short overview, the detailed discussions, theoretical backgrounds, and hypotheses can be found in each of the individual studies.

Figure 4. General conceptual framework

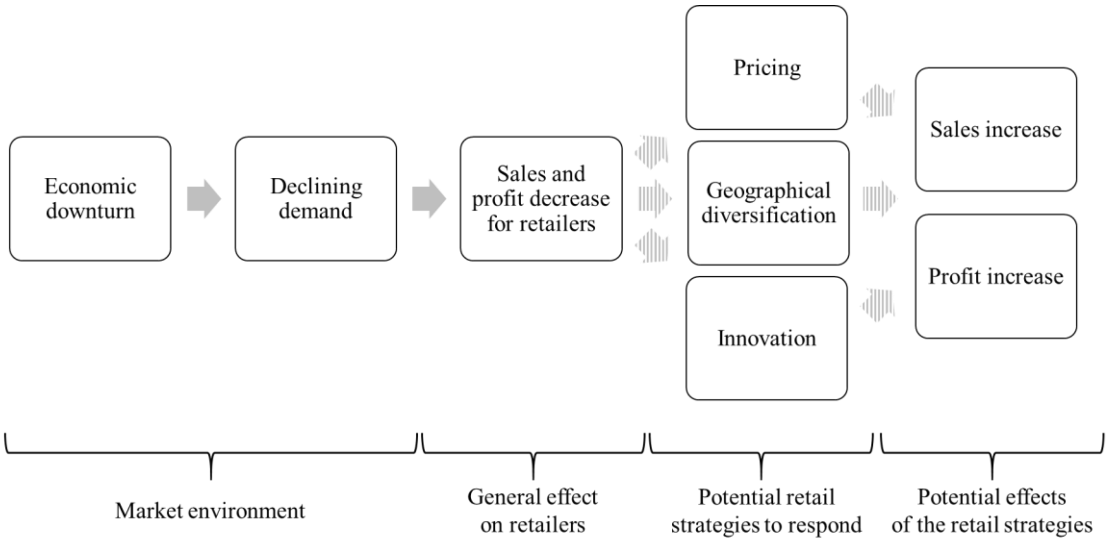


Figure 4 illustrates the general framework of the thesis. An economic crisis leads to a decrease in disposable income that will quickly translate to demand reduction (Figure 2). Lower demand is impacting the majority of the retailers and generally leads to sales and profit decrease (Mann et al., 2015). Despite the fact that crises are usual phenomena in a market economy, there is surprisingly limited research on how retailers can efficiently handle them (Pederzoli and Kuppelwieser, 2015; Mann et al., 2015). Different retail strategies can contribute to overcoming on the negative impacts of an economic crisis. These responses and their success vary across retailers. There are some factors need to be taken into consideration to design with the best possible response:

- First, the time need for execution of the strategies. While some strategies (e.g., pricing) can be altered within days, others (e.g., geographical diversification) need more time to execute.
- Second, strategies can interact with each other and enhance or reduce each other's impact.
- Third, the short- and the long-term performance consequences of the given strategies can be different. A good example is pricing that might lead to favorable short-term effects (e.g., market share growth), but can decrease the profitability of the retailer in the long-run.

- Fourth, different strategies might be combined to avoid the negative consequences of them. A given strategy might improve sales, but decreases profitability, while an other one can help to maintain or even increase profits.

In this thesis, I am analyzing three key strategies that retailers can apply in a crisis environment, namely, pricing, innovation, and geographical diversification. Other strategies, for e.g., altering the business model, the product portfolio, or outsourcing some activities might also happen, but these are out of the scope of this thesis.

Realigning promotion and pricing is the most frequent realignment strategy during an economic crisis in the USA according to Mann et al. (2015). It enables retailers to react quickly to negative market developments, however, changes in pricing can significantly alter the profitability of the retailer. Despite this, there is only a few numbers of studies identifying and analyzing pricing strategies in a crisis environment. The first article of the thesis explores the pricing strategies (baseline pricing and price promotion activities) applied by the Hungarian retailers during an economic downturn and analyzes their financial and market performance effects.

Geographical diversification is another very frequently applied strategy in a recession (Pederzoli and Kuppelwieser, 2015; Mann and Byun, 2017). Once the domestic market environment is challenging and market competition makes it impossible to increase revenues and profit, expanding into other countries is a potential strategy to grow. This is especially relevant for retailers with abundant and efficient resources (Teece et al., 1997). The second article analyzes this strategy and its connection with market performance in the case of the largest European and US-based grocery retailers.

Finally, innovation is a very broad term that can contain major changes in marketing, product offering, organization, and existing processes. Retail innovation covers the majority of product realignment, and operational realignment strategies identified by Mann et al. (2015) as well as product development, service development, strategic partnerships, and CSR initiatives identified by Mann and Byun (2017) as frequently applied responses to an economic crisis. The second article of this thesis focuses on the market performance consequences of different types of retail innovations and how these are related to geographical diversification. The third article specifically analyses the performance effects of digital retail innovations in the case of the largest European and US-based grocery retailers.

The novelty of this thesis is that while prior researches (e.g., Pederzoli and Kuppelwieser, 2015; Mann et al., 2015; Mann and Byun, 2017) rather just identified the strategies applied by retailers in a crisis environment, the studies contained in this thesis also analyzed their performance effects. On the other hand, it only analysis three strategies, not all the available and potentially applied ones.

I.4 Data collection

The three studies in this thesis are based on two unique datasets collected by myself, my supervisor, and my co-authors.

The first study is based on a price observation from 44 modern retail stores in Budapest. This is a 15% representative sample of the underlying population. The data were manually collected by visiting the sampled stores twice. Additionally, price promotion data were obtained from price promotion leaflets of the retailers.

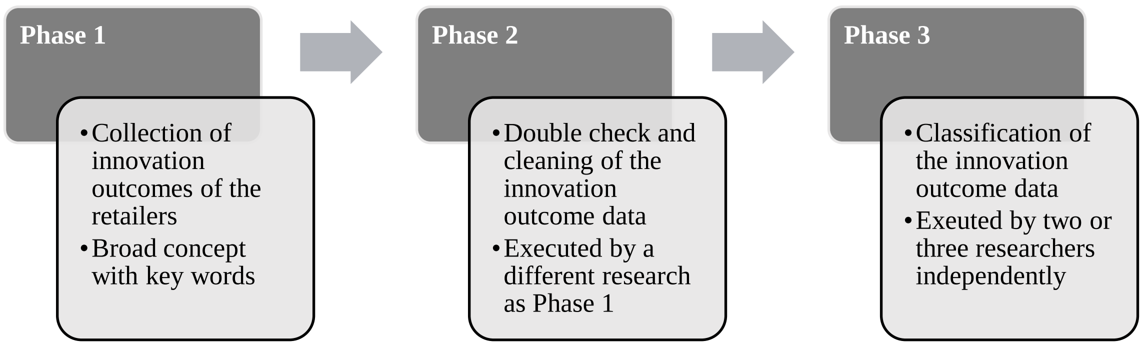
The second and the third studies used the same database. This dataset contains geographical diversification, innovation, and performance measures of the world's largest stock exchange listed FMCG retailers. The list of retailers were obtained from the Global Powers of Retailing reports published annually by Deloitte. Performance and geographical diversification data were collected from Bloomberg. The novelty of this dataset is the inclusion of retail innovation data. Since retail innovation is difficult to measure and there are no readily available datasets for this, a new dataset was created.

This new retail innovation dataset contains the executed innovation outcomes of the companies analyzed. Hence, this dataset provides an overview of the outcomes of the innovation activities of the retailers and not the inputs (e.g., expenditures or employees) of it. Since the data were collected by the authors of the articles, it is coherent across the companies, and free from any misinterpretation of the definitions of innovation that might be a problem in the Community Innovation Survey (Hristov and Reynold, 2007).

Data collection was a complex and time-demanding process. Innovation outcome data were manually collected from different sources for all the companies included in the database. This meant the overview of thousands of articles and corporate publications and identifying the innovations that conformed to the innovation definition of OECD and Eurostat (2005). The collection and classification were executed in three phases (Figure

5). First, relevant sources of information (MarketLine, and Business Source Premier databases, corporate websites, annual reports) were reviewed, and possible innovation outcomes were downloaded. In this phase, a rather broad concept were applied with search words generally related to innovation (“new”, “launch”, “introduce”, “introduction”, “initiative”, “initiate”, “innovate”, “innovation”). In case of uncertainty, the information was included in the dataset. Second, the downloaded files and information were double checked and systematically cleaned by a different researcher. It meant another review and applying the definitions of innovations more thoroughly. Third, this final dataset was classified based on the type of innovation (product, marketing, process, or organizational innovation; digital, or non-digital innovation) by at least two researchers. Intercoder reliability was assessed by Krippendorff’s α using the program of Hayes and Krippendorff (2007). In the second and third phases, detailed discussions took place in case of questions.

Figure 5. Data collection and classification process



I.5 Methodology

In this section, I introduce the different quantitative methods I used in my thesis. Two studies contain regression-based methods where the details are not explained, therefore, I put more emphasis on a thorough introduction of this method here. The third study applies clustering that is a more common and well-known approach, therefore, I avoid the detailed introduction of this method here, only a brief overview will be provided.

I.5.1 Regression-based methods

Regression analysis is one of the most widely applied quantitative research methods nowadays. Regression analysis makes it possible to identify and measure the connection between different variables. The relatedness among the variables of interest can be formulated as

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i,$$

where y is called as the dependent variable and x_js are called as explanatory variables. In this general case, we have one dependent variable and k explanatory variables. A sample of N observations are available to estimate the β_j parameters of interest. The i subscript refers to the observations ($i = 1, \dots, N$).

In the above regression model, our parameters of interests are the β_j parameters. These show the impact of the j's explanatory variable on the dependent variable. The parameters can be estimated using ordinary least squares (OLS). This method minimizes the sum of squared residuals ($\sum_i u_i^2$). In order to get an unbiased estimation for the parameters using OLS, the following assumptions should be met (Wooldridge, 2013).

1. **Linearity**. The model specified above has to be the true model in line with the data generating process. The linearity assumption means that the parameters of the model have to be linear.
2. **Random sample**.
3. **Lack of exact multicollinearity**. Exact multicollinearity among the variables is very rare as it indicates that two or more variables are measuring the same or are linearly connected to each other. A more important issue is the case of high collinearity among the explanatory variables. This reduces the power of the regression estimations, i.e., enlarges the standard errors.
4. **Exogeneity**. The most strict and difficult to check assumption is exogeneity. This states formally that

   $$E(u|x_1, x_2, \dots, x_k) = 0,$$

   i.e., the conditional expected value of the error term given any explanatory variable is zero.

Assumptions 1 to 4 guarantee that the estimated parameters will be unbiased, formally that

$$E(\hat{\beta}_{OLS}) = \beta.$$

However, OLS is not the only possible estimator. Nevertheless, if the homoskedasticity of the residuals also holds, then OLS is the best linear unbiased estimator (BLUE). Homoskedasticity formally states that

$$Var(u|x_1, x_2, \dots, x_k) = \sigma^2,$$

i.e., the variance is constant regardless of the values of any other variables.

OLS is a useful approach to start data analytics; however, the exogeneity assumption very often does not hold causing potentially biased estimators. There can be three main sources behind the failure of the exogeneity assumption:

1. Omitted variables,
2. Simultaneity,
3. Measurement error.

Thanks to the wide reach of available data, the basic regression frameworks are developed continuously, and new methods are emerging in the empirical literature. Several ways are possible considering the specialties of the data. In this part, I will introduce the instrumental variable approach, panel regression models and dynamic panel models that I used in the later part of my thesis.

I.5.1.1 Instrumental variable approach

In the case of endogeneity of an explanatory variable, the estimated parameters in a regression model will be biased. The instrumental variable approach is a potential method for treatment. The endogeneity problem is caused by the fact that the error term and (at least) one of the explanatory variables are correlated, formally, in the regression model

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i,$$

$$Cov(x_j, u) \neq 0.$$

The instrumental variable approach requires at least as many instruments as many endogenous variables we have in the regression. An instrument can be any variable that fulfills the following two criteria (Wooldridge, 2013).

1. **Relevance**. The instrumental variable (z) should be correlated with the endogenous variable:

$$Cov(z, x_j) \neq 0.$$

   This condition can be empirically verified as we can observe both x_j and z. However, once there is only a very small correlation between the endogenous variable and the instrument, this can cause uncertainty in the estimated parameters, i.e., the standard error of the parameters can be very large that makes the estimation results less reliable.

2. **Validity**. The instrumental variable should be uncorrelated with the error term of the regression, formally:

$$Cov(z, u) = 0.$$

   The validity assumption cannot be tested as the error term is not observable. We can only estimate the error term ($\hat{u}$), but this is orthogonal to the explanatory variables due to the OLS estimation method. Therefore, verbal reasoning and formal logic is the only way that can help to verify this assumption.

The two requirements indicate that z should not be a determinant for the dependent variable, it is only affecting it through the endogenous variable. This assures that the endogeneity problem can be mitigated.

Estimation of the instrumental variable regression is possible via the two-stage least squares (2SLS) approach. Assume the following structural model:

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j z_{ij} + \beta_{k+1} x_{ik+1} + u_i,$$

where we have k exogenous explanatory variables (represented by z_j) and one endogenous explanatory variable (x_{k+1}). We have to have at least one instrument for the instrumental variable regression, this will be denoted by z_{k+1}. Assume that z_{k+1} satisfies the validity assumption specified above.

The first stage of the two-stage least squares method is to regress x_{k+1} on all the exogenous variables, including the instrument.

$$x_{k+1} = \delta_0 + \sum_{j=1}^{k} \delta_j z_{ij} + \delta_{k+1} z_{ik+1} + e_i.$$

The assumption of relevance can be tested in this regression. In a single instrument framework, δ_{k+1} should be significant. This can be tested using a simple *t*-test. Once more than one instruments are available, the joint significance of the instruments should be tested using *F*-statistics. Additionally, to avoid weak instrument problems (causing large standard errors), the instruments should be highly significant in explaining the endogenous variable. As a rule of thumb, the *p*-values of the *F*-statistics should be below 1%.

The second stage of the 2SLS estimation requires the estimated values of x_{k+1} from the first stage (denoted by $\hat{x}_{k+1}$). This estimated value should be entered into the model, i.e.,

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j z_{ij} + \beta_{k+1} \hat{x}_{ik+1} + u_i,$$

should be estimated using normal OLS. The estimated $\hat{\beta}_{k+1}$ the parameter will be asymptotically unbiased, hence show the real impact of x_{k+1} on y.

The instrumental variable approach is a useful way to handle endogeneity, however, often valid and relevant instruments are not available. Another option to eliminate endogeneity bias from the results is using panel data.

I.5.1.2 Regression using panel data

Until this point, only cross-sectional data were analyzed, where we had a sample of *N* observations from a given point in time. A panel database is the combination of the same units observed for multiple consecutive time periods. A panel ideally contains the same variables for the same units for multiple periods. There are four commonly applied panel methods (Wooldridge, 2013): pooled OLS, random effects model, fixed effects model, and first difference model. In this subsection, we will introduce these four models.

Pooled OLS is the simplest panel model. From a strict point of view, it is not a panel model as we do not exploit the panel properties. In a pooled OLS regression, we pool all the data together and estimate the model. Time dummies or time trend is often included in the pooled OLS regressions, but we do not exploit the fact that we observe the same units for multiple periods. Therefore, pooled OLS is commonly used for those panels where we observe different units in time. An example can be the labor market survey of the Hungarian Central Statistical Office that is a rolling panel where 1/6 of the units (households) are always replaced in the sample.

The pooled OLS model can be formalized as follows:

$$y_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j x_{itj} + D_t + u_{it},$$

where i refers to the individual ($i = 1, \dots, N$) and t refers to the time period ($t = 1, \dots, T$). D_t represents time dummies. This model can be estimated using a simple OLS method.

The usual panel assumption is that there are unobservable time-independent characteristics of the units that should be taken into consideration. Formally, the model is the following:

$$y_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j x_{itj} + a_i + u_{it},$$

where a_i is the unobserved time-independent effect of unit i and all the other notations are the same as before (the panel can contain time dummies, but it is skipped now for simplicity). Since a_i is unobserved, the error term of the panel model will be a combined error term,

$$e_{it} = a_i + u_{it},$$

that contains a time-independent and a time-dependent element. This might cause serial correlation in the error term even if u_{it} is distributed independently.

Random effect panel models are using this information and estimating a generalized least squares (GLS) model. To ensure the consistency of the random effects model, strict exogeneity of both the explanatory variables (x_j) and a_i is required (Wooldridge, 2002), formally

$$E(u_{it}|x_{i1}, x_{i2}, \dots, x_{ik}, a_i) = 0. \tag{1}$$

Furthermore, the time-independent individual effects have to be strictly exogenous, too, formally,

$$E(a_i|x_{i1}, x_{i2}, \dots, x_{ik}) = E(a_i) = 0.$$

The latter condition is often causing the problems and this assumption cannot be tested either as a_is are not observable. However, we can relax this assumption and, therefore, solve the endogeneity problem by applying fixed effects or first difference estimators.

The basic idea of the fixed effect model is that a_i should be eliminated from the model by subtracting the time-averaged values from all the variables. Let

$$\bar{x}_i = \frac{1}{T}\sum_{t=1}^{T} x_{it}$$

and

$$\ddot{x}_{it} = x_{it} - \bar{x}_i.$$

After this transformation (also known as time-demeaning), the model takes the following general form:

$$\ddot{y}_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j \ddot{x}_{itj} + \ddot{u}_{it}.$$

With this transformation, a_i is eliminated from the model, therefore the endogeneity problem is solved. The equation can be estimated using normal OLS methodology and the parameter estimates will be unbiased. However, it is important to note that the fixed effects model can only handle the endogeneity of time-independent variables, time-dependent endogenous variables cannot be eliminated from the model.

The first difference estimator follows a similar approach as the fixed effect one. In this case, the time-independent individual effects are eliminated by taking the first difference of the variables, i.e.,

$$\Delta x_{it} = x_{it} - x_{it-1}.$$

The formal model is the following:

$$\Delta y_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j \Delta x_{itj} + \Delta u_{it}.$$

This can be estimated using OLS, too.

The cost of time-demeaning and differencing is that all the time-independent (e.g., education in a wage equation) and in time equally growing (e.g., age) variables are removed from the model. Hence, their impact cannot be estimated using these procedures.

The above introduced three panel models are similar in some regards. However, there is clear guidance on how to choose among the models. First, if the strict exogeneity assumption of the time-independent effects holds, then random effects are the preferred model as it is more efficient than the fixed effects or the first difference estimator. Furthermore, it has a favorable property that time-invariant variables can also be included in the model.

If the strict exogeneity assumption fails, then fixed effect or first difference panels have to be used. Hausman (1978) provides a formal test to select the appropriate method. The test compares the random effects parameters to the fixed effects parameters directly. The null hypothesis is random effects model against the alternative of fixed effects model. Define

$$\hat{\mathbf{q}} = \hat{\boldsymbol{\beta}}_{FE} - \hat{\boldsymbol{\beta}}_{RE},$$

and

$$\hat{\mathbf{V}}(\hat{\mathbf{q}}) = \hat{\mathbf{V}}(\hat{\boldsymbol{\beta}}_{FE}) - \hat{\mathbf{V}}(\hat{\boldsymbol{\beta}}_{RE}),$$

where $\hat{\boldsymbol{\beta}}_{FE}$ is the fixed effect and $\hat{\boldsymbol{\beta}}_{RE}$ is the random effect estimates, $\mathbf{V}(\cdot)$ is the covariance matrix of the given parameters. (The hat denotes estimation.) The test statistics is

$$m = \hat{\mathbf{q}}'\left[\hat{\mathbf{V}}(\hat{\mathbf{q}})\right]^{-1}\hat{\mathbf{q}},$$

that follows a χ^2 distribution with k degrees of freedom under the null hypothesis (k is the number of estimated parameters without constant).

The choice between the fixed effects and the first difference method is not as straightforward as both are unbiased if the exogeneity assumption of (1) holds. If we have only two periods (i.e., $T = 2$), then the two models provide the same results (Wooldridge, 2013).

The efficiency of the estimators depends on the serial correlation of the idiosyncratic error term u_{it}. If u_{it} is serially uncorrelated, then fixed effects are the preferred model. If there is some serial correlation in the error term, the first differencing might be more efficient. In this case, Wooldridge (2013) proposes to estimate both models. In the special case when u_{it} follows a random walk, first differencing the error term will result in white noise errors that is a favorable property. On the other hand, if Δu_{it} has a negative serial autocorrelation, fixed effects model is most likely performing better than the first difference.

In the special case of long panels (i.e., small N, large T), the first difference can be better as it helps to avoid spurious regression. Spurious regression can arise by regressing unit root processes. Since the first difference method takes the first difference of the data, the unit root process is transformed into a stationary process (if the original series were integrated in order 1).[1] With this move, spurious regression can be avoided.

Another potential issue is the dynamics of the processes. If the dependent variable depends on its lagged values, the panel models discussed above will provide biased estimations. The next subsection will discuss the specificities of and estimation procedures for dynamic panel models.

I.5.1.3 Dynamic panel models

The usual panel models are useful in separating the time-independent individual effects and eliminating the bias and/or efficiency loss caused by them. However, there are two important issues that need to be further tackled in the panel setting (Roodman, 2009).

1. As time is passing away, longer time series are available for panels, too. This requires taking the dynamics of the time series into consideration. Since the time series are autocorrelated, that is a rather common phenomenon, the model has to account for it.
2. Endogeneity can also arise from time-dependent variables. Fixed effects and first difference panel models cannot deal with this type of endogeneity.

[1] Generally, economic time series are integrated in order 1 (also called as I(1) process). I(2) processes are very rear in practice.

The first problem, serial correlation, requires the estimation of dynamic panel models. The general form of a dynamic panel model is the following:

$$y_{it} = \beta_0 + \alpha y_{it-1} + \sum_{j=1}^{k} \beta_j x_{itj} + a_i + u_{it}, \tag{2}$$

where α represents the first-order autocorrelation of the dependent variable. The potential bias is arising from the fact that the lagged dependent variable (y_{it-1}) is correlated with the unit fixed effect (a_i). Time-demeaning the variables cannot solve this problem. The new error term ($\ddot{u}_{it}$) will contain u_{it-1}, too and this is linearly related to y_{it-1}, hence causing a downward bias in the parameters (Roodman, 2009). If T tends to infinity, this bias is getting less severe, but panels are rarely longer than 10 periods.

The first difference technique is not a good choice either even in the case of independently distributed error terms. This can be shown by

$$Cov(\Delta y_{it-1}, \Delta u_{it}) = Cov(y_{it-1} - y_{it-2}, u_{it} - u_{it-1}) = Cov(y_{it-1}, u_{it-1}) \neq 0,$$

since y_{it-1} is directly related to u_{it-1}.

The main idea is to use the instrumental variable approach to overcome the dynamic panel bias (Haile et al., 2016). It is also favorable to adjust the estimation bias of the other endogenous variables. However, it would be unfair to assume that there are excellent instruments available outside of the dataset. This is often not the case; hence, the instruments have to be created from within the dataset.

Arellano and Bond (1991) suggested estimating the first differenced model with second (or larger) lags of the endogenous variables as instruments. The second lagged (y_{it-2}) endogenous variables are relevant instruments as

$$Cov(\Delta y_{it-1}, y_{it-2}) = Cov(y_{it-1} - y_{it-2}, y_{it-2}) \neq 0,$$

however, they are not related to the future error terms:

$$Cov(\Delta u_{it}, y_{it-2}) = Cov(u_{it} - u_{it-1}, y_{it-2}) = 0$$

since past values of the dependent variable are not helping to forecast the future error terms. Therefore, the second lagged endogenous variables also satisfy the validity assumption.

Furthermore, to increase the efficiency of the estimation, Arellano and Bond (1991) estimated the model by the generalized methods of moments (GMM). This is the reason for calling this procedure as difference GMM estimator.

Further development of the difference GMM estimator was proposed by Blundell and Bond (1998). This is called the system GMM estimator. This procedure requires two additional assumptions.

1. The first differences of the instruments are uncorrelated with the time-independent effects, formally

$$E(\Delta x_{it} a_i) = 0.$$

   For the first look, it does not seem to be a major restriction. However, this new restriction also has to be held for Δy_{it}. If we rewrite equation (2) by subtracting y_{it-1} from both sides, we get

$$\Delta y_{it} = \beta_0 + (\alpha - 1) y_{it-1} + \sum_{j=1}^{k} \beta_j x_{itj} + a_i + u_{it}.$$

   This shows that Δy_{it} contains a_i. Roodman (2009) elaborated on this issue and quoted the argument of Blundell and Bond (1998) on what needs to be true about the data generating process to make this assumption hold. The most important factor is that after controlling for the control variables (x_{itj}), changes in y_{it} and the closeness of y to the steady-state should not be systematically related to each other.
2. The idiosyncratic error term (u_{it}) should not be autocorrelated. In this case,

$$E(\Delta x_{it-1} u_{it}) = E(x_{it-1} u_{it}) - E(x_{it-2} u_{it}) = 0 - 0 = 0.$$

   However, autocorrelation means that u_{it} is related to u_{it-1}, indicating that

$$E(\Delta x_{it-1} u_{it}) = E(x_{it-1} u_{it}) - E(x_{it-2} u_{it}) \neq 0.$$

This would mean that the validity assumption of the instruments would fail.

If these assumptions hold, then there is no need to transform the variables, it is enough to use the lagged differenced instruments (Δx_{it-1}) to eliminate the bias in the level (x_{it}) of the data. This is called system GMM estimation as it builds a system of two equations: the original one and the transformed one.

Dynamic panel GMM methodology is getting more and more popular to study research questions like in my thesis. For e.g., Qian et al. (2008) and Oh et al. (2015) applied this method to analyze the effect of geographical diversification on corporate performance.

The comparison of the two types of GMM methods can shed light on the right choice. The difference between the two estimators depends on the relevance and on the validity of the instruments used. The difference GMM estimator instruments differences with lagged levels. On the contrary, the system GMM estimator instruments levels with lagged differences.

1. **The relevance of the instruments**. To avoid weak instrument bias, namely, large finite sample bias and large sampling errors leading to poor accuracy, the correlation between the instrument and the endogenous variable should be substantially large. The preferred GMM estimator is the one that exhibits a larger correlation.

$$Corr_{diff}(\Delta x_{it}, x_{it-2}) \ ?\ Corr_{system}(x_{it}, \Delta x_{it-1}),$$

where the first variable is the endogenous variable and the second one is the instrument. In the case of unit root processes,

$$Corr(x_{it}, \Delta x_{it-1}) = Corr\left(\sum_{j=0}^{t} e_{ij}\,, e_{it}\right)$$

is high enough (e_{it} is the error term of the process). On the contrary,

$$Corr(\Delta x_{it}, x_{it-2}) = Corr\left(e_{it}, \sum_{j=0}^{t-2} e_{ij}\right) = 0$$

if the error terms are independently distributed. Highly persistent time series behave similarly, therefore, system GMM is the preferred option in this case. For stationary (or less persistent) processes, the choice is not as straightforward.

2. **The validity of the instruments**. The difference GMM estimator removes the time-independent fixed effects (a_i) via differencing, therefore eliminates the endogeneity bias arising from the time-independent variables completely. On the contrary, the system GMM procedure leaves them in the model and assumes that they are independently distributed from changes in the endogenous variables. The violation of this assumption can cause invalid instruments and biased estimation results. In this regard, difference GMM estimator can be a safer choice.

I.5.2 Hierarchical clustering

Hierarchical cluster analysis can be used to group individual units (consumers, companies, countries, stores, etc.) into homogenous subgroups. The idea is to identify how close the individual units are to each other within the sample and to combine the ones that are the closest. There are two ways to employ hierarchical clustering. On the one hand, at the starting point, all the individual units can constitute an individual cluster and the closest ones can be grouped until the whole sample is combined into one group. The second way is going in the opposite direction, i.e., starting from one group that can be divided into smaller ones. The question is always the same, where to stop the procedure to get the best grouping available (Malhotra, 2019).

To execute a cluster analysis, two important methodological decisions have to be made. First, it has to be determined how to calculate the distance between the units. There are several potential distance definitions. The most frequently applied one is the Euclidean distance, but Manhattan or Chebychev distances are also well-known (the calculation details are available in Szüle (2016)).

Second, the choice of the clustering method is another important question. Once distance calculation is already decided, it has to be determined how to measure that distance in case of groups. This is an interesting question as groups contain more than one unit, hence, different ways are possible to define distance between two groups. The very basic methods are the nearest neighbor or the furthest neighbor where the closest or furthest two units across the groups are considered and used for distance calculation. Additionally, Ward’s method is frequently applied, too, as it aims to minimize within group variance, hence, keep the groups as homogenous as possible (Szüle, 2016; Malhotra, 2019).

After having the distance definition and the clustering method, the number of clusters has to be determined. This can be based on analyzing how the within group variance changes during the procedure and once it increases substantially after combining two groups, the procedure should be stopped. The number of clusters is equal to the number of groups remaining.

II. THE PRICING STRATEGIES OF HUNGARIAN FOOD RETAIL CHAINS DURING THE LAST RECESSION*

II.1 Introduction

The purpose of this paper is to analyze the pricing strategies and their effects on the market and financial performance of retail chains in a time of recession in Hungary. This is a relevant research area considering that consumer habits changed rapidly during the economic downturn. As stated succinctly by the market research institute GfK Hungary (2011, p. 1.), "[t]he economic crisis has served as a catalyst for the development of new consumer trends in Hungary. As a result of the fact that customers have become more price-sensitive and conscious, it can be seen that shopping occasions have also become more planned. The role of gathering information before shopping has increased, which can also be seen in the fact that more and more people read through the leaflets of the retail chains. This trend is equally true of the social strata with higher income."

The volume of retail sales of food, beverages, and tobacco has significantly declined. In 2012, sales volumes were close to those of 2004. However, since 2004, two new retail chains have entered the Hungarian market (Lidl and Aldi) and others have also opened new stores. Competition has become stronger.

Changing consumer habits inevitably causes changes in retail chains' marketing policies. The most important element of these marketing policies is the pricing strategy. Pricing and promotional activity are key elements in (at least) maintaining the turnover and profitability of a chain/store. The paper identifies the currently applied pricing strategies and evaluates their effects on market and financial performance indicators.

The structure of this paper is as follows. Section 2 reviews prior studies on retail pricing. Section 3 offers a short introduction to the Hungarian food retail sector. Section 4 describes the methodology and the dataset. Section 5 presents the results and discussion. Concluding comments are presented in Section 6.

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II.2 Literature review

Various tools of marketing (e.g., pricing policy, TV advertisements, and loyalty programs) are used by retailers to increase their turnover and profit. In this section, the basic ideas of retail chains' pricing and price promotion as well as pricing strategies typically applied in a recession economy are introduced.

II.2.1 Retail pricing strategies

Retail stores can compete in many aspects, but pricing strategy is the most important element of their marketing toolkit (Levy et al., 2004). A pricing strategy involves decisions on baseline prices and promotional activities, mainly price discounts. According to Hoch et al. (1994), there are two main types of strategies: everyday low price (EDLP) and promotion-oriented pricing (Hi-Lo).

EDLP indicates continuously low prices, therefore promotion can play only a minor role. Price uncertainty in an EDLP store is very low, and consumers can anticipate that prices do not change materially between two shopping trips. In contrast, Hi-Lo indicates higher baseline prices coupled with intensive (price) promotion activity. The price of a product sold at a temporary discount can be lower than the price of the same product in an EDLP store.

In reality, however, the pricing landscape is far more complex. Ellickson and Misra (2008) defined the hybrid pricing strategy as the combination of EDLP and Hi-Lo. Their dataset indicates a wide variety of hybrid pricing, some retailers being closer to EDLP, others closer to Hi-Lo. According to them, pricing strategies should be interpreted at the store- and not at the chain-level. Bolton and Shankar (2003) identified five different store-level pricing strategies (exclusive pricing, premium pricing, Hi-Lo pricing, low pricing, and aggressive pricing) in their empirical analysis carried out in five US cities. Surprisingly, EDLP was not on their list. However, the most general type, low pricing (found in 43% of stores), is defined as a combination of low prices and low promotional activity, with medium price variation. They observed that Hi-Lo pricing is adopted by only 9% of stores. On the other hand, exclusive and premium pricing – a combination of high prices and low or medium promotional activity – are more widespread than Hi-Lo.

The success of a pricing strategy can be determined by many factors. The experiments conducted by Hoch et al. (1994) provided the conclusion that Hi-Lo is significantly more profitable than EDLP. Conversely, EDLP chains regularly outperformed Hi-Lo chains with regard to profitability. Lal and Rao (1997) gave an explanation for this phenomenon using a game theoretical approach. Their main idea was that consumers' opportunity cost for travel time differs. Some consumers are willing to visit both EDLP and Hi-Lo stores to make a bargain, while others always visit only one store. The total basket of goods is cheaper in an EDLP store, therefore a higher ratio of the latter consumer group will prefer EDLP stores. This can cause a higher profit rate. The above-mentioned contradiction in research findings can be clarified assuming that consumers have different preferences. Bell and Lattin (1998) pointed out that "large basket" shoppers prefer ELDP stores, while others prefer Hi-Lo.

Other studies (Shankar and Bolton, 2004; Ellickson and Misra, 2008; Volpe, 2011) indicate that the demographic characteristics of the trade area (e.g., monthly income, family size) as well as the pricing strategy followed by rivals have the most important effect on the pricing strategy of a retail shop. In addition, the studies claim that pricing strategies are strategic complements (i.e., if the neighboring store plays EDLP, then it will be worth playing it for the store in question as well) rather than substitutes.

The empirical results presented above suggest that there is no single successful way to go. Whether a pricing strategy will succeed or not depends largely on the market situation and the macroeconomic environment.

II.2.2 Pricing strategies in recession

When internal demand falls, the importance of pricing will increase due to the diminishing purchasing power of households. Shama (1978) examined changes in the marketing mix during stagflation (i.e., recession plus inflation). His results show that pricing changed considerably.

Chou and Chen (2004) analyzed the success of pricing strategies during recession in Taiwan. Their analysis partially supported the hypothesis that for retail companies with abundant resources operating in a market where consumers are price sensitive, a predatory pricing strategy leads to higher market performance. Predatory pricing means that firms try to use the lowest prices to gain market share. Therefore, they also join price wars. Market share and turnover increased immediately due to this strategy; however, long-term consumer satisfaction and net profit suffered, indicating that the sustainability of this strategy is questionable.

Rao et al. (2000) claimed that price reduction can be the easiest and fastest reaction to recession, but the profitability of the company can decrease dramatically. According to a McKinsey study, a 1% price increase can raise the profit of the firm by 11% (Cram, 2004). Piercy et al. (2010) called attention to the long-run effects of these decisions. Even in a recession environment, pricing decisions have a long-term influence on the success of a company.

Jankuné Kürthy et al. (2012) found that Hungarian retailers reacted in several ways. They reduced the variety of goods sold, introduced new private label products, and tried to reduce the costs of store operation (for example, by opening smaller stores than before).

II.3 The Hungarian food retail sector[2]

Following the economic and social transition in the early 1990s, previously state-owned retail stores were privatized in Hungary. After the privatization period, two types of food retail chains emerged: multinational and domestic retail chains.

In the early 1990s, several international retail chains entered the market, e.g., Tengelmann (Plus, Kaiser's), Louis Delhaize (Profi, Match, Cora), ASPIAG (Spar, Interspar), and acquired stores through privatization. Similarly to other transition economies, the market share of multinational chains rose rapidly in Hungary (Minten and Reardon, 2008). The first entrants were soon followed by other multinational chains (e.g., Tesco, Auchan, and Rewe/Penny Market). After Hungary joined the European Union in 2004, Lidl, a German hard discount chain, began to expand in Hungary. Finally, Aldi entered the Hungarian food retail market in 2008.

These chains have several types of stores: hypermarkets, supermarkets, and discount stores. The main difference between them is assortment and size of retail area. Discount stores mainly sell private label products, while hypermarkets offer full lines of fast-moving consumer goods (FMCG).

[2] This section is based on Euromonitor (2010).

Domestic food retail chains such as CBA, Coop, and Reál have embraced independent retailers in the form of buying groups and franchise systems. In consequence, these chains have a much more heterogeneous structure compared to multinational chains. The store portfolio of domestic chains mainly covers traditional shops, but also modern supermarkets (like CBA Príma stores).

The increasing number of entrants and the decreasing internal demand led to intense competition. The market started to consolidate in 2008, through acquisitions and market exits; thus, concentration increased. Spar acquired the entire Plus network and Plus stores were converted into Spar supermarkets. The Louis Delhaize Group (the owner of Cora hypermarkets, Match supermarkets, and Profi discount stores) also left the Hungarian market in 2011–2013. Cora hypermarkets were taken over by Auchan at the end of 2011; however, Match and Profi were operated by Louis Delhaize Group until the end of 2012. Therefore, at the time of the empirical research, Match and Profi were active in the Hungarian retail market.

II.4 Methodology and data collection

The research methodology included in-store observations, the analysis of price promotion leaflets, and interviews. The in-store observations and leaflet analysis were carried out in two phases (at the end of 2011 and at the beginning of 2012).

II.4.1 Baseline prices

Baseline prices were collected using in-store observations. Stratified probability sampling was used to draw a 44-store sample out of the stores of 11 food retail chains (Aldi, CBA Príma, G'Roby, Interspar, Lidl, Match, Penny Market, Profi, Spar, Tesco, and Tesco Expressz) in Budapest. Table 2 shows the summary statistics of the survey.

Table 2. Retail chains in Budapest (on 20 December 2011) and the distribution of the sample

Retail chain	Number of stores	Proportion, %	Stores in the sample	Sample proportion, %	Difference
Hypermarkets	22	7.4	3	6.8	-0.6 pp
Interspar	6	2.0	1	2.3	0.2 pp
Tesco	13	4.4	2	4.5	0.2 pp
Auchan	3	1.0	0	0	-1.0 pp
Supermarkets	207	69.9	32	72.7	2.8 pp
Spar	97	32.7	15	34.1	1.3 pp
G'Roby	5	1.7	1	2.3	0.6 pp
Match	41	13.9	6	13.6	-0.2 pp
CBA Príma	37	12.5	6	13.6	1.1 pp
Tesco Expressz	27	9.1	4	9.1	0.0 pp
Discount stores	67	22.6	9	20.5	-2.2 pp
Lidl	22	7.4	3	6.8	-0.6 pp
Aldi	15	5.1	2	4.5	-0.5 pp
Profi	14	4.7	2	4.5	-0.2 pp
Penny Market	16	5.4	2	4.5	-0.9 pp
Total	296	100.0	44	100.0	0.0 pp

Source: homepages of the retail chains and author's own calculations

In every store, baseline prices of 15 well-specified products were collected.[3] Following Minten et al. (2010), high-frequency purchased goods were chosen. Branded products sold in every retail chain were selected. Should a product not be sold by a retailer, the prices of similar products were used to estimate the price of the unavailable product. Half of the products represent manufacturer brands, while the other half is made up of private labels. Summary statistics for the observed products and prices are presented in Table 3.

[3] If a product was part of a price promotion at the time of the data collection, baseline (i.e., non-promotional) price was collected, too (these often appeared on the shelves).

Table 3. Summary statistics from the in-store observations of prices

Product	Number of observed prices		Number of estimated prices		Average observed price (HUF)	
	December 2011	January 2012	December 2011	January 2012	December 2011	January 2012
manufacturer branded products						
Soproni lager bier (0.5 l)	44	44	0	0	208	212
Coca-cola (2 l)	44	44	0	0	335	346
Füstli wiener sausage (350 g)	38	38	6	6	649	701
Vénusz sunflower oil (1 l)	41	41	3	3	470	475
Vénusz margarine (450 g)	36	32	8	12	435	446
Kinder Surprise (1 piece)	44	44	0	0	208	212
Pöttyös Guru milk dessert (38 g)	43	43	1	1	104	106
Douwe Egberts Omnia coffee (250 g)	42	42	2	2	891	963
private label products						
100% orange juice (1 l)	44	44	0	0	289	295
Bread (1 kg)	44	44	0	0	238	241
half fat UHT milk (1 l)	44	44	0	0	195	193
‘Parisian’ cutlet (1 kg)	44	44	0	0	502	495
Sugar (1 kg)	44	44	0	0	300	307
Wheat flour (1 kg)	44	44	0	0	123	123
Canned corn (340 g)	44	44	0	0	168	166

Notes: the estimated prices are based on prices of similar, branded products

Similarly to the research design of Cataluña et al. (2005), stores were visited twice: first between 27 and 30 December 2011, and second between 22 and 24 January 2012. There was an increase in VAT in Hungary from 1 January 2012. The date of visiting was chosen so that the introduction of the VAT increase (a cost shock) falls between the two visits. If the distribution of the prices is similar before and after the tax shock, the results can be deemed more reliable.

Altogether, 1,320 prices of products were collected. To make the prices comparable, scaled prices were used. According to Fertő and Bakucs (2009), scaled prices are calculated by dividing the prices of a product by their mode. The analysis was performed with these transformed prices.

Drawing conclusions from a relatively low number of products is not a unique phenomenon in the relevant literature. Györe et al. (2009) graded store formats analyzing the prices of only 10 products. Monteiro et al. (2012) compared the price levels of large supermarket chains and small independent supermarkets using the prices of 22 products.

To compare the structure of the baseline prices of the stores, average price levels and price variations were compared using analysis of variance (ANOVA). Identical variation of prices in several stores is a prerequisite for ANOVA according to Füstös et al. (2004). The Levene statistic was applied to control for the homogeneity of group variances. Cataluña et al. (2005) and Bolton and Shankar (2003) used the same statistical tool to compare the price levels of several shops.

First, the validity of the "law of one price" was examined. This law states that homogeneous products should be sold at the same price in different stores that are relatively close to each other. The reason behind this is as follows: if a store charges higher prices, consumers will go to its rival and buy the product there. However, empirical evidence almost never verifies the "law of one price" (Zhao, 2006). Based on the in-store observations, there are significant differences in baseline price levels among Hungarian retail stores.

Second, the variation and mean values of baseline prices were compared for stores belonging to the same chain. A separate analysis was carried out for prices collected in December 2011 and in January 2012. Then, means and variations of (scaled) prices were compared across the stores to identify whether there is a difference between the December 2011 and the January 2012 data. Due to the relatively small sample size, high critical values were used. The null hypothesis was rejected if the significance level was less than 10%.

Table 4. Mean and variation of scaled prices at retail chains

Retail chain/group	Mean of scaled prices	Variation of scaled prices
Aldi	1.006	0.156
CBA Príma 1	1.213	0.491
CBA Príma 2	1.111	0.168
G'Roby	1.173	0.452
Interspar	0.973	0.043
Lidl	0.989	0.154
Match	1.108	0.136
Penny Market	0.988	0.108
Profi	1.059	0.147
Spar	0.974	0.039
Tesco	0.939	0.094
Tesco Expressz	1.059	0.109

The results of these analyses show that almost every retail chain adopts similar prices in its stores. The only exception is CBA Príma. This is a franchise brand, therefore retailers determine prices individually. Two different types of CBA Príma stores were identified. Table 4 shows the detailed results. The price manager of Tesco also suggested in an interview that multinational retail chains determine the prices at their headquarters, therefore the variation of prices among stores is very low.

II.4.2 Price promotion activity

The pricing strategy is also influenced by the price promotion activity of a retailer. Price promotions are communicated in retailers' promotion leaflets. The importance of price promotions is even greater in a time of recession. According to GfK Hungary, 61% of the population who receive price promotion leaflets regularly study promotional prices (Élelmiszer, 2011).

Price promotion leaflets published between December 2011 and January 2012 were collected during a 5-week period. This investigation was carried out at chain-level as price promotion leaflets are published by the headquarters of the chains and are valid in every store. All the food and beverage products published in price promotion leaflets were analyzed, not only the 15 chosen for the baseline price analysis.

The price promotion activity of a retail chain can be analyzed using several factors. Following Bolton and Shankar (2003), the depth, the duration, and the frequency of price promotions were measured. The analysis was based on three transformed measures. The depth of promotion was assessed by the difference (in percent) between baseline and promotional prices. This difference was calculated for every food and beverage product appearing in any of the price promotion leaflets in the examined 5-week period. The sample average of these differences (in percent) was used as the indicator of the depth of the promotion (hereinafter referred to as "average discount").

Instead of the duration of price promotions, I used the average number of promoted products. This indicator was calculated using the following formula for the 11 examined retail chains:

$$\frac{length\ of\ promotion\ (day) \times products\ sold\ at\ discount\ (number)}{length\ of\ the\ observed\ period\ (day)},$$

where length of promotion means for how long the price promotion was valid for the products sold at a discount; length of the observed period is the total number of days of the ca. 5-week period (it varied across chains because the validity of the price promotion leaflets differed from chain to chain). All the price promotion leaflets published in the ca. 5-week period were used to calculate this indicator. This transformation was necessary because some discount chains (such as Aldi or Lidl) run price promotions valid for different time periods at the same time (e.g., discounts only on a Sunday / a weekend, or discounts valid for a whole week). The higher the value of this indicator, the more active the promotional activity of the given chain.

Finally, the frequency of price promotions was quantified as the quotient of advertised promotion periods (number in the observed time period) and the length of the observed period (in days). This quantifies how often the given retail chain advertised a new price promotion period (e.g., the value for Aldi, 0.43, means that on 43% of days, i.e., a new price promotion period began on almost every second day).

The average discount and the average number of promoted products as well as the frequency of price promotions were calculated for every retail chain. Table 5 displays the results of the survey.

Table 5. Measurements of price promotion activity at retail chains

Retail chain	Average discount	Average number of promoted products	Frequency of price promotions
Aldi	22%	32	0.43
CBA Príma	25%	173	0.24
G'Roby	19%	21	0.17
Interspar	24%	118	0.41
Lidl	26%	58	0.48
Match	23%	66	0.08
Penny Market	21%	108	0.38
Profi	26%	91	0.14
Spar	33%	109	0.35
Tesco	24%	219	0.18
Tesco Expressz	24%	30	0.18

To verify the results of the in-store observations and leaflet analysis, interviews were conducted. The interviews took place after the analyses of the baseline prices and price promotions.

The aims of the interviews were to expose the trends in the Hungarian food retail industry as well as to obtain detailed information about the pricing strategies of the given firm and its rivals. The interviews also enabled me to check the validity of the empirical findings. Furthermore, they highlighted the retailers' point of view on the role of pricing during the economic crisis. The information gathered from the interviews is used in Section 5 to illustrate the developments in the Hungarian food retail industry in recent years.

II.5 Results and discussion

The aim of this paper is to identify the pricing strategies of the Hungarian food retail sector and evaluate them with regard to market and financial performance measures during a time of economic crisis. Based on the baseline prices and price promotion activities (Table 4 and Table 5), I used hierarchical cluster analysis to identify the currently applied pricing strategies. In this section, the results of the cluster analysis are presented.

To make the variables suitable for cluster analysis, I carried out data transformations as suggested by Füstös et al. (2004). As baseline prices and promotional activities are equally important components of a pricing strategy, pairs of variables regarding baseline prices and promotional activities were used. Therefore, a new variable (intensity of promotion) was created as the average of the frequency and number of promoted products. Moreover, all the variables (except the mean of scaled prices) were centered around their sample mean.

II.5.1 Identified pricing strategies

Taking into account the distance between the chains that belong to the same cluster, three clusters were created. Table 6 contains the values of the four relevant variables (mean of scaled prices, variation of prices, average discount, and intensity of promotion) for every group as well as the retail chains that belong to the given cluster. ANOVA was performed to test the differences of the mean values of the variables. The critical values of the tests are very low, indicating significant differences among the groups. Only the average discount is the same among the clusters. The three clusters represent different pricing strategies, which I labelled as aggressive pricing, premium pricing, and Hi-Lo pricing.

Table 6. Identified pricing strategies and the average of the relevant centered variables

Variable	Cluster No. 1	Cluster No. 2	Cluster No. 3
Name	Aggressive pricing	Premium pricing	Hi-Lo pricing
Members	Tesco, Interspar, Spar, Penny Market, Lidl, Aldi, CBA Príma 2	Tesco Expressz, Profi, Match	G'Roby, CBA Príma 1
Mean of scaled prices	0.997	1.075	1.193
Variation of prices	0.568	0.382	1.801
Average discount	1.030	1.002	0.906
Intensity of promotion	1.265	0.576	0.891

Notes: CBA Príma is a franchise brand, therefore the pricing strategy varies significantly across stores (there are two different types of stores). It is not true for the rest of the chains

The members of the first cluster play the aggressive pricing strategy. These chains operate with low prices, medium high price variation, and very intense price promotion activity. This strategy is a hybrid, where low prices are combined with frequent price promotions. In addition, this is the most general pricing strategy, as 61% of the stores pursue it. It is interesting that Chou and Chen (2004) found a similar pricing strategy in Taiwan in a recession environment (they called it predatory pricing).

However, this is a very mixed group containing super- and hypermarkets as well as discount stores. The presence of Spar, a rather high category supermarket in this cluster is very surprising. Before the economic crisis that started in 2008, Spar positioned itself as a premium retail brand. However, with close to 400 affiliates, Spar is the fourth biggest food retail chain in Hungary. After 2008, customers became more and more price sensitive due to the reduction in their income. Spar had to respond to the fast market penetration of discount stores. The results of the cluster analysis clearly show that Spar has begun to use the same pricing strategy as the discount stores.

Premium pricing (cluster 2) can be described as using higher prices than the aggressive pricing strategy, but less intense price promotion activity. This is again a hybrid strategy, but it is more widespread in Hungary compared to other empirical findings. Bolton and Shankar (2003) identified a similar pricing strategy (called exclusive pricing), but only 2.3% of the stores were playing it. In Hungary, more than 27% of stores belong to this category, an extremely high proportion. Profi and Match are good examples of the premium pricing strategy.

Profi and Match are retail chains with a long history in Hungary; they acquired most of their stores during the privatization of the retail sector between 1990 and 1993. Their stores can be found in the most frequented locations of Budapest and in Hungary's biggest towns. On the other hand, Tesco Expressz is the most recent store format (convenience shop) in Hungary, located in frequented localities in cities. The research results suggest that these chains did not adopt the pricing strategy of the previous group.

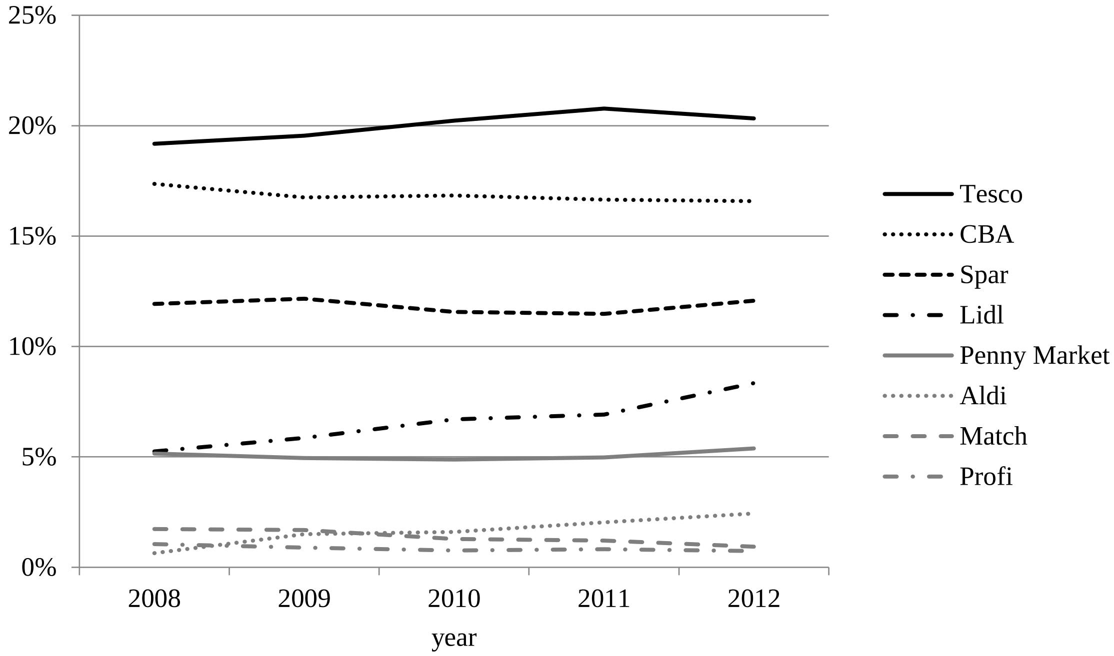
Finally, Hi-Lo pricing (cluster 3) denotes high baseline prices with very high price variation. This means that even though prices are high, one can sometimes make a bargain. In fact, this may well happen, since the high prices are supported by medium high price promotion activity. However, this strategy is not widespread at all, with only 11% of stores playing it (e.g., some CBA Príma stores).

II.5.2 The relationship between pricing strategy and market performance

Several measurements are able to show the market and financial performance of a retail chain. In this paper, the change in market share, turnover per store, and net operating profit are studied, respectively. The additional advantage of using several variables is that it makes it possible to take into account that different chains may have different targets (e.g., a profit target for a product category, a profit target for the whole shop or a market share target).

Figure 6 represents changes in market share from 2008 to 2012. Retail chains belonging to the first group gained market share from other stores. For example, Lidl, which used the aggressive pricing strategy from the beginning, increased its market share by more than 50%. Premium pricing shows the poorest performance. Profi's market share decreased by 30%; Match's market share decreased by 45%. Aldi, which entered the Hungarian market in 2008, passed Profi in 2009 and reached the combined market share of Profi and Match by 2011.

Figure 6. Market shares in the Hungarian food retail sector



Notes: the market share of G'Roby is very small compared to the other chains
Source: ACNielsen

The market share of CBA, which operates as a franchise chain with a heterogeneous store network, has stayed approximately the same over the past few years. According to Attila Fodor, the communications leader of the CBA franchise firm, the market share of CBA Príma had increased slightly.

Market shares might change for two reasons. First, expansions can increase the market share, but this growth strategy varies sharply across retail chains. Second, pricing strategy might boost the market share by increasing the turnover of the extant stores. Therefore, turnover per store is also an interesting indicator. Table 7 shows a partly different picture compared to Figure 6. The most glaring difference is in Tesco's performance. This measure indicates a 20% loss in the turnover per store from 2008 to 2012. The reason behind this may at least partially be the fact that the proportion of hypermarkets among stores decreased from 60% to 55% and supermarkets generally underperform hypermarkets in terms of turnover. Another explanation may be that Tesco increased the number of stores by 50% in this time period, and this inevitably causes some reduction in this variable. Except for Tesco, turnover per store supports the conclusions based on the change of market share: aggressive pricing and Hi-Lo pricing were successful, while premium pricing performed poorly.

Table 7. Turnover per store (2008 = 100%)

Retail chain	2008	2009	2010	2011	2012
Tesco	100.0	89.2	79.9	81.8	80.7
CBA	100.0	99.9	100.7	102.4	100.0
G'Roby	100.0	109.8	105.4	129.0	114.4
Spar	100.0	104.3	99.9	104.7	112.6
Penny Market	100.0	95.1	90.5	93.4	102.9
Lidl	100.0	99.9	104.4	101.1	118.9
Match	100.0	101.9	78.2	77.8	80.8
Profi	100.0	87.6	75.8	84.8	77.9
Aldi	100.0	189.5	161.3	198.0	221.3

Source: ACNielsen, Profit and loss statements (G'Roby)

Finally, it is worth discussing the size of net operating profits. Turnover and market share can be increased by price reductions, but these steps will considerably damage profitability. Table 8 gives an overview of net operating profits from 2008 to 2012.

Profi and Match, the dominant members of the second cluster, generated negative operating profits every year. Moreover, the loss rose over the years. All three performance measures indicate that premium pricing was not successful in the time period under review.

Aggressive pricing (i.e., the first cluster) shows ambiguous results. Some chains (Lidl, Penny Market, Tesco) achieved positive operating profits almost every year. On the other hand, Spar and Aldi realized huge losses. Spar was a premium brand, but it has repositioned itself during the crisis, which required heavy investments in marketing to change consumers' perceptions of the chain. Aldi may need more time to reach an efficient operating size. The research findings support this explanation since operating losses have steadily decreased over the years.

Table 8. Net operating profit (million HUF)

Retail chain	2008	2009	2010	2011	2012
Tesco	11,991	10,906	4,899	8,163	841
G'Roby	22	58	10	45	63
Spar	6,829	-8,750	-14,092	-19,840	-17,095
Penny Market	2,367	705	404	671	1,245
Lidl	6,614	5,898	6,398	3,211	-4,009
Match	-606	-2,394	-2,798	-3,140	-8,129
Profi	-207	-927	-966	-1,341	-3,723
Aldi	-9,278	-10,099	-7,561	-7,066	-5,315

Notes: net operating profit is not available for CBA Príma which is a franchise brand with many retailers
Source: profit and loss statements of the companies

It is difficult to evaluate the performance of Hi-Lo pricing. This is a premium segment for chains with only a few stores, usually in the middle of a city or in an affluent neighborhood of Budapest. Nevertheless, the available data and the interviews suggest that these stores could defend or even increase both their market position and financial performance.

Table 9 summarizes the results discussed above. Surprisingly, the most successful strategy (aggressive pricing) is very similar to the predatory pricing strategy found by Chou and Chen (2004), according to whom net profit decreased in Taiwan. Even more interesting is that the consequences of these strategies are quite similar in Taiwan and in Hungary. The aggregate profits of the members of the first cluster also shrank in Hungary from one year to the next (see Table 8).

Table 9. Comparison of the three identified pricing strategies

Variable	Aggressive pricing	Premium pricing	Hi-Lo pricing
Store types	discount stores, hyper- and supermarkets	discount stores and supermarkets	supermarkets
Average baseline prices	low	medium	high
Variation of baseline prices	medium	low	very high
Average discount		does not vary across strategies	
Intensity of promotion	very high	low	medium
Market share	increasing or weakly decreasing	significantly decreasing	unchanged
Turnover per store	increasing or weakly decreasing	significantly decreasing	increasing or unchanged
Net operating profit	positive in general	negative in general	positive in general
Importance of the group	very important	diminishing, but still important	not important

It also appears that pricing strategies are strategic complements in Hungary. The market and financial performance of the chains playing the aggressive pricing strategy were at least partially favorable, while chains adopting premium pricing achieved extremely bad results. Róbert Ruga, the marketing director of Profi explicitly mentioned in an interview that they have avoided employing the same pricing strategy as their rivals (Hőnyi, 2011). This behavior has led to poor market performance. Many other studies (e.g., Ellickson and Misra, 2008; Volpe, 2011) came to the same conclusion with regard to other countries.

II.6 Conclusion

The goal of this paper was to identify and evaluate the pricing strategies of 11 Hungarian food retail chains in a time of recession characterized by decreasing demand. The findings clearly indicate that there were three distinct types of pricing strategies (aggressive pricing, premium pricing, and Hi-Lo pricing). The most widespread of the three, aggressive pricing, is a hybrid strategy with low baseline prices (like EDLP) but medium price variation and very intense price promotion activity (like Hi-Lo). Premium pricing is a hybrid strategy as well. These chains operate using higher baseline prices (like Hi-Lo), but not supported by strong price promotion. On the contrary, the price promotion activity of these chains is very weak (a common feature with EDLP). Hi-Lo pricing is less widespread in Hungary. Only few shops adopt this strategy that provides high prices and medium price promotion. The empirical research could not identify retailers using a pure EDLP strategy.

Based on the empirical results and the interviews, the link between pricing strategy and market performance was identified. Several market performance measures (market share, turnover per store, and net operating profits) indicate that the aggressive pricing strategy (i.e., low prices, but intensive price promotion) was the most successful. Conversely, the premium pricing strategy (i.e., medium prices and low price promotion) was a complete failure. The chains applying it lost market share from year to year, and, on top of that, their net operating profits were negative in every year from 2008 to 2012. Chains adopting the Hi-Lo pricing maintained their market and financial positions, but this segment comprises only a small part of the total market.

Nevertheless, the most successful strategy revealed disadvantages as well. The profitability of the firms decreased, which indicates that changes are needed in the long run. Bachl et al. (2010) reviewed the big price war in Germany in 2009. Following the price war, market shares remained unchanged, but profits decreased significantly. This indicates that the price war was not an effective tool in gaining market share. They established that it is time for a paradigm change by reverting back to EDLP or Hi-Lo. In my opinion – based on my findings – retail stores should reduce price promotions, but also operate with lower prices in the future. This means that pricing strategies would be more similar to EDLP.

The main limitation of the research is the relatively small set of price data used to determine the baseline prices of the retail units. It would be interesting to repeat the research using a larger dataset. It may also be a fruitful research area to analyze the changes in pricing strategies after the recession period. Future research may provide an answer to whether pricing strategies will move in the direction of EDLP, Hi-Lo or other hybrid strategies.

III. THE IMPACT OF INTERNATIONAL DIVERSIFICATION ON THE INNOVATION ACTIVITY AND PERFORMANCE OF LEADING FMCG RETAILERS*

A strong geographical diversification had been noticeable in the retail sector since the end of the 1980s (Treadgold, 1988). It was typical especially for European retailers that they expanded their retail networks to other countries. German- and French-based retailers generate nearly 40 percent of their revenues in foreign markets (Deloitte, 2016).

According to management theory approaches, geographical diversification provides multiple kinds of advantages for enterprises: for example, access to new resources, the development of innovation capabilities, as well as the reduction of market risks (Hitt et al., 2006). The performance consequences of geographical diversification had been analyzed profoundly by the management and retail literature (Gielens and Dekimpe, 2001; Qian et al., 2010; Chan et al., 2011; Sohl, 2012; Oh et al., 2015). However, leading European retailers are characterized not only by geographical diversification but also by intensive innovation activities (the establishment of R&D laboratories, supporting new technologies) (Deloitte, 2015). Despite the above, very little research has been carried out about how the geographical diversification influenced the innovation activity of retailers (Hitt et al., 1997; Michalache, 2015).

In this field of research, this article seeks to answer the question of how geographical diversification influences retail innovations and identify the performance consequences that geographical diversification and retail innovation have in the case of the leading grocery retailers. The research contributes to the retail literature in two important ways. First, we analyze the effect of geographical diversification on innovation. Second, with the use of quantitative measures, we estimate the performance consequences of retail innovation. We use a panel database collected from various secondary sources for the analysis.

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The article has the following structure. First, we review the literature on geographical diversification and retail innovation. Then, the research concept and the hypotheses are explained. Following the description of the methodology, we present our research results in detail. Finally, we summarize our most important findings and the academic and managerial implications of the results.

III.1 Literature overview

III.1.1 Geographical diversification

According to Hitt et al. (2006), geographical diversification is a strategy in course of which the enterprise extends the sale of its products and services to other geographical locations (countries, regions). Wiersema and Bowen (2011) went even further, and they considered the extension of the whole corporate value chain (purchasing, production, sales) to foreign markets as geographical diversification. Geographical diversification may increase the international competitiveness of the enterprise (Rugman et al., 2012), owing to economies of scale and selection, the knowledge gained in foreign markets, as well as risk reduction. In other respects, costs might increase due to the coordination and controlling of the activities extending beyond the domestic markets.

The geographical diversification of European retailers was motivated by numerous factors. Retail enterprises often met legal obstacles in their domestic markets, mainly during the construction of shops with large floor spaces. On the other hand, due to the stagnation of internal demand, enterprises searched for markets that showed larger growth. It is also important for retailers to achieve economies of scale in purchasing and the supply chain. Finally, entering developing markets is often required less effort since the enterprise may gain significant competitive advantage through its already established management and retail methods (Deloitte, 2009).

Burt et al. (2008) reviewed the theories of geographical diversification in retailing. In their opinion, two typical approaches can be found in most of the models. One of the approaches concentrates on the significance of the geographical and cultural distance from the domestic market, while the other approach concentrates on the extent of adjusting to the foreign markets. In fact, these two approaches take their effect in interaction with one another. Retailers enter those markets first which are situated close in terms of geography and culture, and which do not require any substantial change to be made to the business model. Over time, the enterprises gain a more profound knowledge of the functioning of the new markets, and then, with the help of the experience gained, they expand geographically and culturally more remote markets (Oh et al., 2015). This pattern of geographical diversification was taken as a starting point by Qian et al. (2010) who made a distinction between intra-regional (countries situated within the same region) and inter-regional (regions which are situated farther from each other geographically and culturally) diversification. In the course of inter-regional diversification, the retailer may face a very different competitive situation, resources, customer behavior, and supplier network. As a result, the enterprise has to adapt to the local market conditions to a large extent, i.e., the adaptation need is high.

The rate of adaptation shows the extent to which management reacts to the functional differences of the foreign market. Retailers have to decide on the extent to which they will standardize their purchasing, marketing, and operative activities. If economies of scale are given priority, then the enterprise will aim at greater standardization in terms of retail formats, assortment and private retail brands, which is aided by the strong central control and the vertical integration of the value chain. In this case, the retailer endeavors to implement a rather comprehensive, general strategy. In the opposite case, the retailer applies a multiregional approach, in course of which the foreign market concerned determines its retail activity (Salmon and Tordjman, 1989).

III.1.2 Retail innovations

The concept of innovation is closely connected to Schumpeter’s (1934) theory, which assumes that economic development is influenced by such new solutions appearing from time to time, which prove to be more viable economically compared to the previous ones. The concept of innovation is a complex phenomenon which depends on the circumstances (Neely et al., 2001). According to Hristov and Reynolds (2007), research into retail innovation is still in its early stages. Based on expert interviews conducted in the UK retail sector, the authors showed that innovation in retail – as opposed to innovation in other industries – is realized in vertical cooperation in most of the cases. Namely, retailers are present in the supply chain as intermediate actors between the manufacturer and the consumer, i.e., their innovative solutions are often realized in cooperation with the suppliers, the customers and other partners (Brondoni et al., 2013). Moreover, reverse innovations cycles are common in retailing that means that in the first part of the cycle expenses are relatively low, however, the investment costs are high upon the market introduction of the innovation (Hristov and Reynolds, 2015).

Some studies (Medina and Rufín, 2009; Reinartz et al., 2011; Brondoni et al., 2013; Hristov and Reynolds, 2015) had already explored the characteristics of retail innovation, however, none of these studies defined retail innovation. Taking into consideration the characteristics of retailing, we consider all changes related to the retail value chain which lead to a new or significantly improved solution and which are utilized for business purposes as retail innovation.

Retail innovation may appear in countless forms, including for example, the introduction of new retail formats or private label brands, significant changes in assortment, the improvement of the customer experience, information technology development, use of new media, payment and ordering methods (Reinartz et al., 2011). Several researchers have attempted to grasp the main types of retail innovation. One of the possible classifications is making a distinction between technological and non-technological innovations. Niemeier et al. (2013) called retailers technological companies since in the case of large companies, technological development plays a central role. However, it is worth mentioning that retailers adapt the new technological solutions mainly from other industries (Pantano, 2014). Technological innovation in retail is driven firstly by the developments of the info-communication industries, and secondly by the fast technology acceptance of the consumers (Pantano and Viassone, 2014).

Hristov and Reynolds (2015) distinguished offer- or customer-, support-, and organizational-related innovations in retailing. Offer- or customer-related innovations are intended to reach the final consumers, while support-related innovations include the technologies and systems related to the functioning of offer-related innovations. Finally, organizational-related innovations mean the introduction of strategic and operative solutions that help intra-corporate communication, or which automate processes in order to increase efficiency.

One of the most commonly applied (e.g., Drejer, 2004; Cascio, 2011; Dellestrand, 2011; Inauen and Schenker-Wicki, 2012; Hassan et al., 2013) innovation typology is the Oslo Manual developed by OECD and Eurostat (2005) is which makes a distinction among product, marketing, organizational, and process innovations.

The development and introduction of the new or significantly improved product and/or service may be considered as a product innovation (Neely et al., 2001). Product innovation alters the functionality of the product or the service so that it represents higher added value to the consumer (OECD and Eurostat, 2005). In the case of retailers, product innovations mostly mean the development and introduction of new private label products. Fornari et al. (2009) identified multiple sub-types bases on the novelty value of the product: completely new product, new product line, extension of product line, development of current product, re-positioning and cost reduction. Marketing innovation was defined as a new method by Levitt (1960) first, which is designated to satisfy the consumer needs identified by the management or market research. A much more specific definition is used by OECD and Eurostat (2005), which includes product design, as well as changing the packaging, product placement, pricing, promotion, and positioning strategy provided that it carries significant novelty to the customers and is intended to increase the sales of the company.

Shopper marketing contains countless tools that can be the target of marketing innovation activities, and that include all marketing activities influencing the path of the consumers (Shankar et al., 2011). Such innovation can be the introduction of a new pricing model (e.g., dynamic pricing) or a new promotional tool (e.g., digital coupons) (Grewal et al., 2011). Another popular area of marketing innovation is the development of new retail concepts (Shankar et al., 2011). New retail formats mean a more complex form of marketing innovation (Reynolds et al., 2007) as they include all retail elements (assortment, pricing, communication, services, design of the location and sales area). Chen (2006) made a distinction between two types of marketing innovations. The first type includes those innovations which are able to improve the efficacy of marketing activity of the retailers through investment in new information technology. Innovations belonging to the other category aim to decrease the transaction costs of the consumers through development of new commercial procedures, retail formats, as well as retail channels.

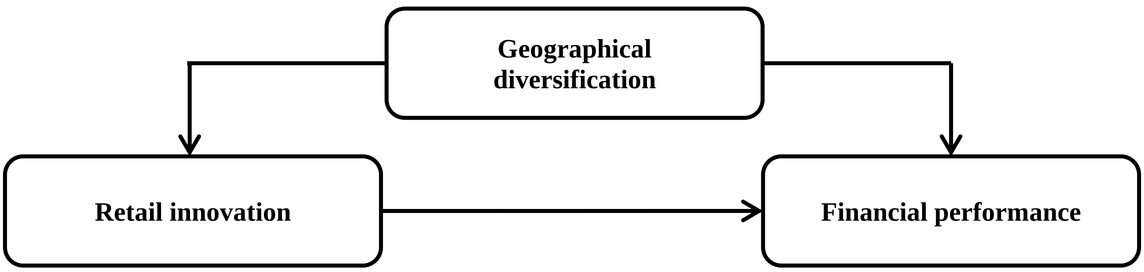
The opinions of researchers are mixed regarding organizational innovations. For example, Cascio (2011) considered both marketing and process innovation as organizational innovation. However, OECD and Eurostat (2005) handled this type more narrowly: it defined organizational innovation as the new method of external and workplace relations. Such organizational solutions can materialize as new forms of knowledge management, new work processes, new solutions of organizing external relations that the retailer had not used before and which were established based on the strategic decisions of the management.

Process innovations comprise of those methods through which products or services reach the consumers in a new or significantly improved way. Process innovations focus on improving the effectiveness and efficiency of the internal organization (Damanpour et al., 2009). Process innovations of the retailers are partly of technological nature – such as radio frequency-based identification (RFID), 3D printing, voice-based warehouse controlling –, and partly mean the introduction of new distribution processes, such as a new trade channels (mobile or community trading).

III.2 Research approach

The purpose of our research is to examine the effect of geographical diversification on retail innovations, as well as to quantify the effect of geographical diversification and innovation on the financial performance in the case of the leading European grocery retailers. Figure 7 gives an overview of the assumed relationship among geographical diversification, retail innovation, and financial performance.

Figure 7. Hypothesized relationships among geographical diversification, retail innovation, and financial performance



III.2.1 The effect of geographical diversification on retail innovation

Although leading retailers are present on the international stage for a long time, the retail literature did not discuss the relationship between geographical diversification and innovation. In the absence of this, we reviewed the researches to be found in the management literature, in which a few researchers examined the association of geographical diversification and innovation activity (Castellani and Zanfei, 2007; Frenz and Ietto-Gillies, 2007; Siedschlag and Zhang, 2015; Xie and Li, 2015). A significant portion of the researchers assumed a positive relationship between innovation and geographical diversification, i.e., stronger presence in foreign markets entail more intensive innovation activity. Filippetti et al. (2013) lined up numerous arguments in support of the positive relationship. On the one hand, geographical diversification allows for a larger market presence, which helps enterprises in reducing market risks and gaining higher return on innovations. Consequently, geographical diversification encourages investments which facilitate innovation (Hitt et al., 1997). Zahra et al. (2000) proved that geographical diversification broadens and deepens the organizational and technological learning necessary for the innovation activity. Furthermore, as a result of geographical diversification, companies have to operate in a more and more diverse market environment and competition that enrich organizational knowledge as well. Organizational learning is especially supported if foreign subsidiaries share their experience gained on their various markets with each other (Filippetti et al., 2013). Not only through internal organizational processes but external relations may also lead to the realization of innovative ideas (Dellestrand, 2011).

Hitt et al. (1994) also pointed out that the relationship between geographical diversification and innovation is not necessarily linear. The geographical diversification of the company has a positive influence on the innovation activity only until a certain point, since above a certain threshold the coordination costs of the company increase substantially, and fewer resources are left for the innovation activities. This assumption was also supported by the research of Michalache (2015) who found a negative quadratic relationship between geographical diversification and innovation, i.e., geographical diversification positively influences innovation first, and after a certain point the relationship turns around, and the negative effects will dominate. Based on the above discussion, we established the following hypothesis:

> H_1: Geographical diversification has a negative quadratic effect on retail innovation.

However, the strength of the effect may be different for each type of innovation. Geographical diversification may have a stronger effect on market and marketing innovations, while organizational and process innovations are less culture and market-dependent (Bauer and Carman, 1996).

III.2.2 The effect of geographical diversification on financial performance

Numerous researchers have examined the performance effects of geographical diversification. Hitt et al. (2006) reviewed the publications in this domain. Sohl (2012) thought that geographical diversification has a non-linear effect on corporate performance. Intra-regional diversification has a positive effect on the profitability of the enterprise, meanwhile, inter-regional diversification increases the complexity of the operation, and it relates to a negative quadratic relationship with performance. Oh et al. (2015) proved with econometric methods that geographical diversification has an *S*-shaped relationship with financial performance. More remote markets require larger scale adaptation, which makes the operation of the retail network more costly, and therefore the enterprises realize smaller profits. Numerous European retailers expanded within their home region first, i.e., to countries that differ less from their domestic markets (e.g., Central and Eastern Europe), and they entered new regions (e.g., Asian markets) only afterwards. As a result of the above, our second hypothesis is the following:

> H_2: The effect of geographical diversification on firm performance is not linear; it has an *S*-shaped effect.

III.2.3 The effect of retail innovation on financial performance

The main purpose of the innovation activities of the companies is to increase their competitiveness, and thereby to achieve better corporate performance. Successful innovations lead to higher product quality and service standards (Hitt et al., 1994; Neely et al., 2001), which has a positive effect on corporate performance. Hassan et al. (2013) assumed the increase of market and financial performance in the case of all innovation types. Siedschlag and Zhang (2015) thought similarly, i.e., they described the relationship of product, marketing, process, and organizational innovations and corporate productivity with a linear, positive correlation. They showed that organizational and process innovations contribute to the productivity the most. Conversely, Cascio (2011) found a non-linear correlation between marketing innovation and organizational performance in several industries. In his opinion, in the first phase marketing innovations contribute to performance more because companies execute low-risk innovations first. Later, enterprises execute higher-risk innovations, too, which lead to a lower return. However, this is not necessarily typical for retail enterprises, since they are also engaged in multiple innovations of different risks simultaneously.

Regarding return on innovations, we assume that they have lagged effect on the profitability of the enterprise since the market requires time to embrace the innovative solutions. Therefore, the effects appear in profitability later (Geroski et al., 1993; Hitt et al., 1994). Our third hypothesis is the following:

> H_3: Retail innovation has a positive lagged effect on the financial performance of the companies.

III.3 Research methodology and operationalization of the variables

We analyzed the hypotheses related to the relationship among geographical diversification, retail innovation and market performance among the leading European retailers which distribute fast-moving consumer goods. We selected the retailers included in the research from the Global Powers Retailing top 250 list, which is published annually by Deloitte.[4] We identified 50 grocery retail companies in total that have a headquarter in Europe,[5] and we collected data about their geographical diversification, innovation activity, and performance from various sources (Global Powers of Retailing reports, annual reports, business news).

The changes in geographical diversification over time, as well as the lagged effects of innovation on firm performance, required the collection of a panel database. In determining the period, we took into consideration that the global financial crisis affected the performance, the innovation activity and also the geographical diversification of the retailers. For example, as a result of the crisis several retailers saw growth opportunities in geographical diversification (Pederzoli and Kuppelwieser, 2015). In our research, we collected data for the period between 2008 and 2013, thus for the period both during and after the crisis. During data collection, the innovation and/or geographical diversification data of several companies were missing, therefore the dataset finally contained six years data for 37 enterprises, in total 222 data points.

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[4] https://www2.deloitte.com/global/en/pages/consumer-business/articles/global-powers-ofretailing.html.
[5] At least 50 percent of the annual turnover was generated by the sales of fast-moving consumer goods.

We operationalized the variables included in the model as follows. We measured geographical diversification with the number of those countries in which the company carried out retail operations in the year concerned. As opposed to Oh et al. (2015), we did not divide geographical diversification into intra- and inter-regional parts, since the separation of this is problematic. Intra-regional diversification is understood as expansion towards close and known countries. The determination of these countries for each retailer is debatable. For example, in the case of a French retailer, does geographical diversification to a former colony (e.g., Algeria for the French-founded Carrefour) belong to this scope or not? Oh et al. (2015) carried out the categorization on a continental basis, however, this is not always accurate. For this very reason, we did not divide geographical diversification into intra- and inter-regional parts.

We collected information about the innovation activity of the retailers from the websites of the companies, their annual reports, and business news (i.e., from secondary data sources). We reviewed all the news that were published on the corporate websites during the period studied, while in the case of annual reports and business news, we used search words characteristic for retail innovation (e.g., “new”, “introduction”). We categorized the concrete innovation outputs according to the typology established by the OECD and Eurostat (2005), and then we coded the four innovation types (product, marketing, process, and organizational innovation) with the help of dummy variables (per company and per year). If the dummy variable marking the innovation type concerned had the value of 1 in the year concerned, then it means that the given retailer executed that innovation type in that year. If no such innovation had occurred, then the value of the dummy variable was 0. The methodological approach is very similar to the measure used by Eurostat during the Community Innovation Survey (CIS).

In line with the Global Powers of Retailing annual reports, we used the consolidated profit and the net profit rate of the companies as performance indicators. Since the relationship examined can be influenced by numerous other variables as well, we used the size of the company (logarithm of the annual sales revenue), the previous five-year compound annual growth rate of the company, the logarithm of households final consumption expenditure in the home country of the retailer, as well as the growth rate of this expenditure as control variables. In addition, we controlled for common macroeconomic events not examined specifically with year dummy variables.

In estimating the econometric model, we exploited the panel structure of the data in order to deal with the endogeneity potentially arising. We tested the three hypotheses with different models, however, we stayed in the fixed effect model framework in order to be able to filter out the time independent firm-specific fixed effects.

The testing of hypothesis H_1 required discrete data modelling. Frenz and Ietto-Gillies (2007) used – among others – probit model for analyzing the third wave of the Eurostat Community Innovation Survey database. At the same time, in the fixed effect model framework, the logit model is suitable for consistent estimation according to the Neymann–Scott principle (Hsiao, 2014). Other researchers (e.g., Chen and Daito et al., 2014; Selim, 2016) – along the same lines of thoughts – also decided to use the logit model when applying discrete dependent variable panel models. The estimated model was the following in the case of marketing innovations:

$$\begin{gathered} Pr(\,Marketing_{it} = 1|Countries_{it}, X_{it}, D_t, c_i) = \\ G(\beta_1 Countries_{it} + \beta_2 Countries_{it}^2 + \Gamma X_{it} + D_t + c_i), \end{gathered} \tag{3}$$

where $Marketing$ is a dummy variable referring to marketing innovation, $Countries$ is the number or countries in which the retailer was present in the year concerned, X contains the corporate and macroeconomic control variables, D marks the year dummy variables, and $G(\cdot)$ is the logistics distribution function.

Since we examined four different types of innovations, in this case, we created four models. In the case of product, process, and organizational innovations, we estimated identical models to equation (3), only the dependent variables were modified to the dummy variables marking product, process, and organizational innovations. [Therefore, the dependent variables of the models were $Pr(Product_{it} = 1)$, $Pr(Process_{it} = 1)$ and $Pr(Organizational_{it} = 1)$]. According to our expectations, the sign of the β_1 parameter is positive, while the sign of the β_2 parameter will be negative, therefore geographical diversification increases the likelihood of executing different innovations at a diminishing rate.

We examined hypotheses H_2 and H_3 with traditional fixed effect models. Sohl (2012) used fixed effect models for the analysis of retail diversification as well. Oh et al. (2015) applied dynamic GMM panel model, however, they received consistent results when they used fixed effect model as well. In both cases, the net margin ($NetProfit$) of the retailers was the dependent variable, which is the quotient of the profit after tax and the sales revenue.

The model used for the testing hypothesis H_2:

$$\begin{aligned} NetProfit_{it} = {} & \beta_1 Countries_{it} + \beta_2 Countries_{it}^2 + \beta_3 Countries_{it}^3 \\ & + \Gamma X_{it} + D_t + c_i + u_{it} \end{aligned} \tag{4}$$

Finally, in the course of the analysis of hypothesis H_3, we estimated model (5):

$$\begin{aligned} NetProfit_{it} = {} & \beta_1 Product_{it-1} + \beta_2 Marketing_{it-1} + \beta_3 Process_{it-1} \\ & + \beta_4 Organizational_{it-1} + \gamma_1 Product_{it-2} \\ & + \gamma_2 Marketing_{it-2} + \gamma_3 Process_{it-2} \\ & + \gamma_4 Organizational_{it-2} + \Gamma X_{it} + D_t + c_i + u_{it}, \end{aligned} \tag{5}$$

where $Product$, $Marketing$, $Process$, and $Organizational$ are the dummy variables referring to product, marketing, process and organizational innovations, respectively (exactly the same ones as we used on the left-hand side of the equations when testing hypothesis H_1). In our model, we allowed no more than two-year delay for the appearance of the profit effect of the innovations.

III.4 Results and findings

Our database contains the largest European based grocery retailers. The companies selected were present in average 6.8 countries in the eight years studied, however, significant heterogeneity is observable. Some companies were represented in only one country, while others in up to 52 countries. Having examined the geographical diversification of the companies, it can be said that the average number of countries increased year by year, however, at the same time the standard deviation increased as well; therefore, it was not a universal process. Approximately 20 percent of the companies expanded intensively (entered three new countries per year on average), while in the case of the others, no substantial inter-country diversification was noticeable between 2008 and 2013.

The average profit rate was 2.3 percent (during the period between 2008 and 2013), however, significant differences are noticeable among the companies. During the period analyzed, 2008 was the weakest year for the industry, while 2012 was the most successful one in terms of profitability.

With regard to innovations, product innovations proved to be the most popular; a retailer executed some kind of product innovation approximately every second year on average (57 percent relative frequency). This group included mostly the introduction of new or renewed private label brands. At the same time, other innovations could be found as well, such as customized products and services, the introduction of bio, gluten-free, lactose-free, vegetarian private labeled products, the development of new packages and biodegradable packaging, the introduction of products intended especially for children.

Marketing innovations are slightly less popular; however, the relative frequency was around 41 percent in this case as well. Different types of innovations are included in this category, starting from rechargeable gift cards, through the issuance of themed magazines, up to the most various mobile applications. Several enterprises (e.g., Sainsbury, Rewe, Migros) launched new sustainability initiatives (e.g., a mobile application that warns the customer to bring a shopping bag; consistent food labelling), which we classified also in this innovation type. This group included also the launch of new loyalty programs and co-branded bank cards, or the establishment of a charging station for electric cars in front of the retail units.

Process innovations occurred with 36 percent relative frequency among the companies included in the panel. In this case, mainly the introduction of new technologies was typical, such as the establishment of self-service cash desks, the establishment of the electronic billing systems, or the introduction of digital price boards. At the same time, great emphasis was taken on the development of the distribution system, developments based on info-communication technology, as well as environmental protection (e.g., the introduction of sustainable shipping methods and energy-efficient systems, green buildings).

Organizational innovation was the least frequent in the sample (17 percent relative frequency). This group included, for instance, training for employees (organization of various trainings and workshops), facilitating the communication of managers with the employees, the introduction of new systems (such as SAP). Observation distortion is the strongest in this innovation type since the observation of organizational innovation based on secondary data is problematic. These innovations often proceed in the background, and less information can be found about them from public sources.

The results of the panel models are summarized in Table 10.

Table 10. Results of the panel regressions (unstandardized regression coefficients)

Variables	H_1				H_2	H_3
	Product	**Marketing**	**Organiza-tional**	**Process**	**Net profit rate**	**Net profit rate**
Countries	0.1404	-0.1781	-0.3741	0.4381**	0.0045**	
Countries^2	-0.0017	0.0051	0.0337	-0.0158**	-0.0001*	
Countries^3					1.08e-06	
Product$_{t-1}$						0.0144*
Marketing$_{t-1}$						0.0250***
Organizational$_{t-1}$						-0.0009
Process$_{t-1}$						0.0107
Product$_{t-2}$						0.0095
Marketing$_{t-2}$						0.0118
Organizational$_{t-2}$						-0.0008
Process$_{t-2}$						0.0149*
No. of obs.	188	176	111	185	173	104
No. of firms	32	30	19	31	31	30
Pseudo R^2	0.11	0.09	0.21	0.09	-	-
Within R^2	-	-	-	-	0.13	0.32

Notes: every regression contained year dummy variables, company specific (log revenue, revenue growth in the past 5 years) and macro level control variables (home country final consumption expenditure of the households, home country final consumption expenditure growth of the households)
* significance level < 0.10; ** significance level < 0.05; *** significance level < 0.01

Based on the results, hypothesis H_1 is partially acceptable. Geographical diversification has an inverted *U*-shaped effect on process innovation; however, in the case of the other three types of innovations, no significant correlations were found. The likelihood of realizing a process innovation reaches the maximum in the case of 14 countries, and then it turns around and starts to decrease.

Results imply that in the case of marketing and product innovations, the synergy caused by the presence in multiple countries is smaller, therefore these can be described typically as country-specific innovations. However, process innovations are moved to the forefront exactly then, when the company concerned is already present in multiple countries, therefore the advantage originating from the innovation is larger, and the need for the standardization and renewal of the processes increases as well. The reason behind the inverted *U*-shaped effect may be that in the case of being in several countries the coordination becomes so complicated that process innovations covering such a high number of countries are very rare.

With regard to hypothesis H_2 (the effect of geographical diversification on performance), we can reject the existence of the *S*-shaped relationship with high certainty, while – considering the *U*-shaped and the completely linear relationship – the *U*-shaped relationship can be accepted at 10 percent significance level.

Results indicate that there is a turning point at 23 countries, but only at 7% of the cases was a retailer present in more than 23 countries. The results show that geographical diversification to a few countries is profitable. Those companies that are present in only a couple of countries (such as Migros, Systeme U, X5 Retail, El Corte Inglés) expanded either towards the neighboring countries or the former colonies, therefore they preferred the known markets. Overseas or Asian expansion is a characteristic of those retailers that are present in more countries. In this case, the enterprises entered less known and very different markets. The fact that the quadratic terms are significant on only a 10 percent level implies that some retailers adapted to more remote markets successfully, while for other ones the adaptation costs decreased or even completely swallowed the profit arising from the expansion. These findings are consistent with the theory of Qian et al. (2010).

In the case of hypothesis H_3, we find a significant relationship between profitability and marketing innovation. If the retailer concerned has executed some kind of marketing innovation in the year concerned, then it was expected to count on a profit rate higher by 2.5 percentage points in the following year, which is very close to the average profit rate of the retailers analyzed. This implies a rather substantial return on marketing innovations. The effect is smaller and less significant in the case of product innovations. A product innovation (e.g., the rollout of a new private label product line) is expected to increase the profit rate of retailer by 1.4 percentage points in the year following the introduction of the innovation.

In the case of process innovations, the substantive effect is noticeable in the second year only, which implies that these innovations require more time to mature. We found no significant correlation in the case of organizational innovations, which could be influenced by the more significant observation bias already mentioned.

According to our findings, the different types of innovation have different profit impacts. Several factors may be behind this.

While marketing and product innovations are visible to the consumers right away, and therefore their effect appears fast, the development and transformation of processes require more time, and the savings or revenue increase to be expected from them can be realized slower as well. Product innovations are easier to copy for the competitors, since the rollout of a private label product line may happen fast after the selection of the suppliers. Moreover, in the case of this innovation type, the larger part of the costs is incurred at the supplier level (e.g., product development, purchasing new production line), thereby making the realization of product innovations easier for the retailers. As opposed to product innovations, marketing innovations are much more unique, for example the development of a loyalty card system or mobile application requires more time and larger capital. These innovations are more difficult to copy, and the higher costs may be reasons for the higher expected return as well.

III.5 Summary and conclusions

In this research we examined how geographical diversification affects the market performance and the innovation activities of the largest European grocery retailers, as well as to what extent the different innovations influence the profitability of companies.

We found an inverted *U*-shaped relationship between geographical diversification and profitability, which implies that expansion has an optimum (at 23 countries), above which the increase of the costs incurred is larger than the incremental profit increase arising from the diversification. The non-linear relationship between the two variables is consistent with previous research findings (Hitt et al., 2006; Sohl, 2012; Oh et al., 2015), at the same time, different results were achieved with respect to the exact shape of the relationship (inverted *U* or *S*). This may be caused by the fact that – as opposed to Oh et al. (2015) – we did not divide geographical diversification into intra- and inter-regional parts. The reason for this is that expansion towards the former colonial countries which are outside Europe but are still close to the home country in terms of culture due to their historical relations was the expansion strategy of several European retailers.

Based on our findings, it is reasonable to separate the different types of innovations. Geographical diversification has no significant effect on the realization of marketing innovations, which can be explained by the different habits and cultures of the various countries. The same is true for advertising campaigns, loyalty programs or mobile applications. If they are successful in one country, this is might not be the case elsewhere. For this very reason, the synergies across countries are limited. On the other hand, marketing innovations have an exceptionally favorable profit effect as early as one year after the introduction; marketing innovations are expected to increase the net profit rate of retailers by 2.5 percentage points. This may be related to the fact that marketing innovations are more difficult and slower to copy.

We did not discover any connection between geographical diversification and the likelihood of realizing product innovations (which mostly means the development of private label products) either. At the same time, the financial effect of product innovations is rather favorable as well; the net profit rate of the retailer is expected to increase by 1.4 percentage points in the year following the innovation. In evaluating this effect, it shall be taken into consideration that we analyzed the time period from 2008 to 2013 in our research. Demand for private label brands increased substantially during and after the crisis, and the supply expanded as well. Retailers usually achieve higher margin and profit on the private label brands compared to manufacturer branded products (Dunne and Lusch, 2008); this process, therefore benefited the retailers.

Geographical diversification has a positive effect solely on process innovations; the effect reaches its peak at 14 countries. A retailer which is present in multiple countries that are mostly close to each other can exploit the synergies arising from the proximity of the countries through various process developments. The positive profit effect of process innovations can arise from this reason that at the same time will appear only two years after the execution of the innovation. Our findings support that innovations concerning the logistics, shipping and distribution areas may be favorable investment opportunities.

Finally, we were unable to show any significant effects in the case of organizational innovations. One reason behind this may be that these innovations (e.g., knowledge management, maintaining contact with external stakeholders, internal training systems) have a less direct effect on the profitability of the retailers compared to for example a marketing or product innovation. On the other hand, the observation of organizational innovations from secondary sources is the most problematic one. The distortion arising from observation bias is the largest in case of this innovation type.

There are several opportunities to exploit our findings for academic or management purposes. From an academic point of view, the examination of retail innovations, as well as the analysis of the correlations thereof with geographical diversification and financial performance is considered as a lesser studied field. In our opinion, the reason behind this is that in most cases retail innovations are based on vertical cooperation, and for this reason it is difficult to find appropriate data for measuring innovation. In addition, it is useful for retailers to know the return on innovations and the relationship thereof with geographical diversification. This may help in the preparation of the future strategy of the retailers and in the harmonization of different (e.g., geographical diversification and innovation) objectives. Our findings show that it is advisable to make the decisions on marketing and product innovations on the national level, while in the case of process innovations, the synergies occurring in the international markets shall be exploited. Considering that based on our findings the realization of marketing innovations is the most rewarding, a retailer that is present in the markets of only a couple of countries shall pay attention to this innovation type the most. While in the case of lager retailers that are present in several countries, it is advisable to consider process innovations as well.

The limitations of the research are related primarily to the use of secondary data and the measuring of innovation. In the course of secondary data, a complete observation of the target population is not possible. Observation biases appear in the case of all innovation types, this, however, is the most problematic in the case of organizational innovations. The measuring of innovation activities using dummy variables requires further development in order to allow us to obtain even more detailed and robust results. Several directions appear for the continuation of the research. On the one hand, it may be worth comparing the grocery retailers with retailers specialized in other product categories. On the other hand, it can be interesting to examine any of the innovation types in a more detailed way and to analyze the patterns appearing.

IV. THE IMPACT OF DIGITAL INNOVATIONS ON GROCERY RETAIL PERFORMANCE*

Technological development and digitalization have had a significant impact on the retail sector in the recent years. This effect goes way beyond the emergence of online trade, and it affected the traditional physical channels as well. Consumers distinguish the channels less and less, rather the combination of these is noticeable. According to the findings of the Deloitte Digital influence survey, in 2016, in the USA already 56% of the spending occurring in physical retail units were affected by some kind of digital interaction (laptop, tablet, smartphone, other portable device, in-store digital device), and this number is increasing year-by-year (Deloitte, 2018).

The largest European and North American grocery retailers are the front-runners in the exploitation of the opportunities provided by technological development and in the digital transformation (Reinartz et al., 2011; Deloitte, 2015). The changes affected all aspects of their operations, from the launch of e-commerce, through the digitalization of loyalty programs and the introduction of personalized digital coupons, up to the development of the most diverse mobile applications and the appearance of mobile payment solutions. In addition to the above, virtual shops appeared, consumers are getting an ever-increasing say in product development and assortment, as well as retailers appeared in social media as well. Naturally, all these transformations and developments were not homogenous across the companies; retailers executed various digital innovations and allocated different amounts of resources (financial and human resources) to this area.

The ultimate goal of investments is to improve the performance (particularly the financial performance) of the retailers. According to Kumar et al. (2017), innovation will be a key contributor to the profitability of retailers. Despite all of the above, relatively few academic research has been carried out to analyze the relationship between retail innovation and profitability (Hristov and Reynolds, 2015), and the number of researches applying empirical, quantitative methods are even less (Agárdi et al., 2017). This applies especially to the field of digital innovations. For this reason, in our research, we examined the digital innovations executed by the retailers, and we also analyzed the effects on

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corporate performance (profitability) with the help of dynamic panel models. We sought to answer the fundamental question of how digital innovations affect the profitability of the retailers.

The most important reason behind the lack of empirical research lies in the particularities of retail innovations. Retail innovations are usually executed in cooperation with suppliers or other partners, and they rarely result in patents but rather exploit and apply existing technologies. In addition, innovations are often proceeding fast, and the majority of the costs appear at the end of the innovation cycle, during the implementation phase, contrary for example to manufacturing innovations (Hristov and Reynolds, 2007).

Due to the specialties of retail innovations, commonly applied innovation indicators, for example, the number of patents or the amount of R&D expenditures, are not suitable for measuring innovation activities in retailing. Eurostat's data collection method for the Community Innovation Survey (CIS) may be partially suitable for measuring commercial innovations since this is based on the companies' own data provisions; however, two main problems emerge. On the one hand, often retailers themselves are uncertain what is considered innovation and what does not, which then decreases the quality of the data and the consistency of the data across companies. On the other hand, the CIS is conducted every second year, and innovation is measured by indicator variables, i.e., the survey shows the proportion of companies executed a given type of innovation in the preceding two years. However, the survey does not reveal the number of innovations executed by the given company; therefore, very innovative and less innovative companies cannot be differentiated based on the CIS data. Furthermore, CIS data does not provide an opportunity to explicitly identify digital innovations either as both digital and non-digital innovations are possible in all four categories distinguished by the CIS (product, marketing, process and organizational innovations).

For this reason, we used an alternative approach in our study, and we measured the innovation activities of the retailers by the number of executed innovation outcomes. This approach allowed us to evaluate the innovation activity of each retailer, the changes over time, and allowed us to connect all these to the performance of the companies. Thereby we had the opportunity to analyze the relationship between digital innovations and corporate performance in the retail sector as well.

Since different innovation activities and focuses are noticeable in the case of each product category, we examined exclusively grocery retailers in our research. The world's largest grocery retailers are quite active in the field of innovations and digital innovations as well, and they also have the financial and human resources necessary for that (Deloitte, 2015).

IV.1 Literature overview and the development of hypotheses

The first appearance of digitalization in retailing dates back to the 1970s when barcode appeared. At the same time, upon the appearance of the Internet, the use of digital technologies increased significantly and became more and more widespread (Hagberg et al., 2016). Initially, e-commerce activity was identified as digitalization, however, later this area widened, and by now it may be found in almost every areas of retailing: applications and devices used in shops (e.g., scan & go), various payment methods (e.g., Apple Pay), loyalty programs (e.g., electronic loyalty card, customized digital coupons), applications with expanding functionality (e.g., recipe finder), and the use of social media (e.g., Pinterest campaign) are just some of the examples (Ström et al., 2014; Groß, 2015; Pantano and Priporas, 2016). Agárdi (2018) provides a good overview of the role of digitalization in retailing, as well as of the related international literature.

The purpose of innovation (and particularly digital innovation) activity is to increase the competitiveness of the retailers in order to maintain and increase their profitability (Hristov and Reynolds, 2015; D'Ippolito and Timpano, 2016; Inman and Nikolova, 2017). Hristov and Reynolds (2015) conducted expert interviews to examine the performance indicators used to evaluate the success of retail innovations. Based on their findings, retailers used both financial and non-financial indicators. However, the relevance of financial indicators is higher; 97% of the retailers had mentioned that they evaluated the performance of the innovation activities with financial indicators as well. Among these, the majority of the indicators analyzed sales and market share developments, the return on costs and investments, as well as the changes in the margins.

The relationship between innovation and performance can be due to several factors. On the one hand, the number of innovations is connected to the corporate competences, which are good proxies of the financial performance in the case of service providers according to the research of Anning-Dorson (2017). In addition, marketing innovation competences also substantially increase the general competitiveness of the companies (Gupta et al., 2016). All these are related to the strategic resources of the companies, which have special importance in establishing sustainable and long-term competitive advantages, even in the case of enterprises in the Fortune 1000 list (Cho and Pucik, 2005).

On the other hand, Calantone et al. (2002) traced back the innovativeness of companies to organizational learning. While having examined the largest Spanish enterprises, Aragón-Correa et al. (2007) proved that more learning-oriented organizations have higher innovation performance, which positively impacts the financial indicators of the companies. Organizational learning is aimed at the creation and use of knowledge throughout the entire organization. Such knowledge includes information about consumer needs, actions of the competitors or new technologies (Hurley and Hult, 1998). Companies committed to organizational learning have more information about the new technological solutions and pay higher attention and react better to the changes in market demand since they constantly monitor and understand consumer needs (Damanpour, 1991). Customers demand various innovations – and within that, the innovations related to digital technologies – at an ever-increasing rate during their purchases. In order to be able to stay successful and profitable, retailers have to conform to consumer expectations (Pantano et al., 2018). Since retailers have a direct relationship with the consumers, and since they have rich data about the customers through their loyalty programs or online stores, these often serve as a basis for the development of new solutions. In addition, numerous retailers (e.g., Tesco, Carrefour) established research laboratories, where they examine the retail application of the new technological solutions in cooperation with technological partners.

Therefore, in line with the implications of prior literature, we assume that digital innovations influence the performance of retailers positively. Our first hypothesis is related to this:

> H_4: Digital innovations introduced by retailers positively influence their profitability.

However, the shape of the relationship between innovations and financial performance is not necessarily linear; the marginal return of innovation is decreasing in several cases if the enterprises execute more and more innovations. Non-linear relationships were identified by empirical analyses carried out in other industries as well.

Several researchers have argued that the relationship between innovation and performance is not constant. Cheng et al. (2005) identified an inverted *U*-shaped relationship between the intensity of corporate R&D expenditures[6] and the financial performance in the case of the 1,000 most significant enterprises of Taiwan. In the case of the Taiwanese IT and electronic companies, Yeh et al. (2010) also identified an inverted *U*-shaped relationship between the intensity of corporate R&D expenditures and financial performance. And based on these, they determined the optimal R&D intensity which maximizes the performance of the enterprise. Hervas-Oliver et al. (2018) concluded similar findings using the data of the Spanish CIS survey. They took both technological and management innovations into consideration; therefore, they also examined the effect of less tangible and quantifiable innovations such as the introduction of new management methods, the renewal of the organizational structure, or the reorganization of internal processes.

All these imply that the positive performance effect of innovations is diminishing, and it may be even negative after a certain point. At the same time, other authors (e.g., Mishra, 2017) modelled the relationship between innovation and performance with logarithmic functional form, where the principle of decreasing yield prevails, but the financial return of innovations never turns negative.

As far as we know, no empirical analysis has been carried out in retailing in order to examine the way and extent innovations affect the performance of the companies. Based on the literature reviewed, we expect the effect to be decreasing:

> H_5: Digital innovations introduced by the retailers increase their profitability at a diminishing rate.

IV.2 Data

In our research, we analyzed the digital innovation activities of the world's largest retailers between 2007 and 2017. The list of retailers was obtained from the top 250 lists published in the Global Powers of Retailing annual reports compiled by Deloitte. The Global Powers of Retailing annual reports have been used in several other studies (e.g., Etgar and Rachman-Moore, 2008; Etgar and Rachman-Moore, 2011; Mohr and Batsakis,

[6] The intensity of R&D expenditures is defined as R&D expenditures divided by net sales revenue.

2014) as data are collected using a well-established methodology and from reliable sources (corporate data and Planet Retail database) every year.

In our analysis, we considered only FMCG (fast-moving consumer goods) retailers to avoid the potential bias of different product categories. Out of the world's largest 250 retailers, around 130 was involved in FMCG retailing (at least 50% of their revenue was generated by FMCG sales). As a next step, we restricted our sample to include only European and US-based grocery retailers. The reason behind this selection had a cultural, but also an information collection element. The operation of the companies, their organizational structure as well as market demand might show significant differences in culturally very different countries that can distort the results of an aggregated model. On the other hand, we could not process annual reports or news published in Japanese, Chinese or other Asian languages. These data sources were very important to assess the innovation activities of the retailers.

Finally, we only analyzed stock exchange listed companies. This criterion was applied as public companies have to publish annual reports that often include innovation data as well. (These sources of information were essential in our research.) Furthermore, public companies are in general more transparent, communicate more to the public about their operations and innovations than other companies do.

After applying all these filters, our sample contained 36 retailers. Out of this, 18 companies had European, 1 company had Russian and 17 companies had US-based headquarters. (The list of the retailers is available in the appendix.)

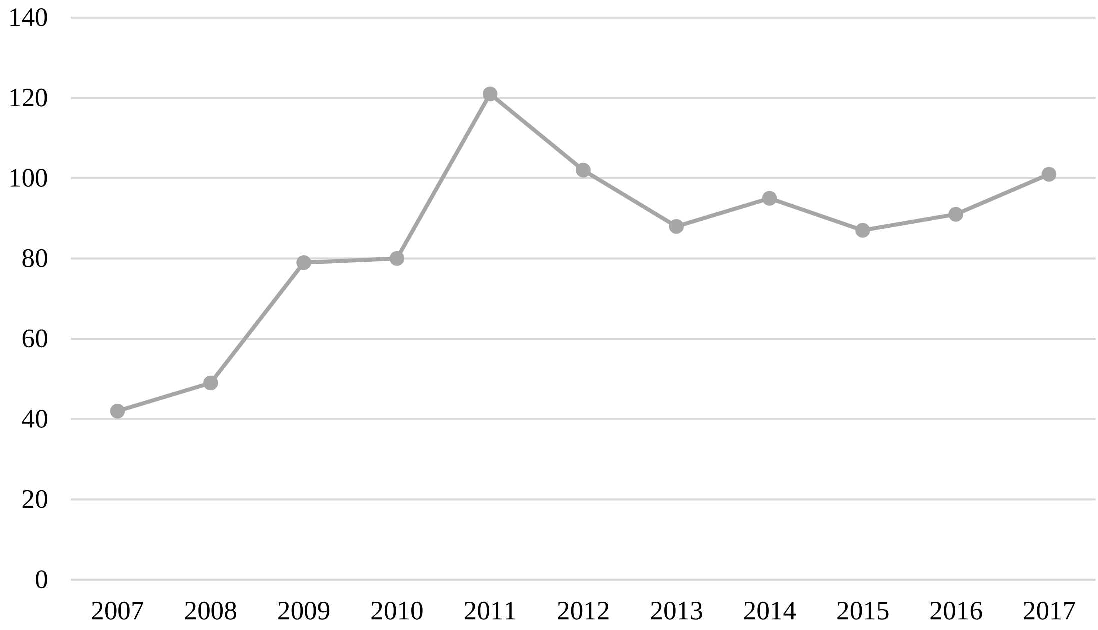
Data were obtained from several sources. Digital innovation activities of the retailers were measured using the number of innovation outcomes executed by the given retailer in the given year. Innovation outcome data were collected from different databases. First, we reviewed corporate websites and annual reports, then we searched for innovation outcomes in business journal databases (MarketLine and Business Source Premier). Searching options were exploited using keywords often appearing in news about innovations ("new", "launch", "introduce", "introduction", "initiative", "initiate"). The keywords were derived based on the definition of innovation (OECD and Eurostat, 2005) and prior studies (Chen and Chiang et al., 2014; Hanson and Yun, 2018) and were refined by pre-tests.

Observation bias is an important issue in this type of data collection. This can arise as some companies might actively communicate that will result many innovation outcomes, while other companies might be less communicative, therefore, the observed number of innovation outcomes might be lower. This problem was addressed during data collection in two ways. First, we analyzed solely stock exchange listed companies that are in general more transparent and provide more details to the public regarding their operations. Second, we used multiple data sources to obtain innovation outcomes as one database rarely contains all the innovation data needed. Combining datasets can help to create a full picture about the digital innovation activities of the retailers.

All the observed innovation outcomes were separately assessed by two researchers whether they can be classified as digital innovation. After the classification process, they compared the results. The majority of the classifications were similar, the small number of differences were discussed case-by-case. In case of a disagreement, other researchers were involved to come to a final conclusion.

The search and the classification resulted around 1,000 digital innovation outcomes. Digital innovation activity was measured as the number of observed digital innovation outcomes of a retailer each year. This variable is ranging from 0 to 15 with an average of 2.5 and a median of 2 (per retailer per year). Figure 8 shows that the total number of digital innovations was quite low in 2007, but it increased continuously until 2011. It was followed by a slight decline and stabilized around 90–100 digital innovation outcomes per annum.

Figure 8. Total number of digital innovations implemented per year by the 36 retail companies in the sample



Financial data were sourced from Bloomberg database. We used annual sales revenue and EBITDA (earnings before interest, taxes, depreciation, and amortization) in our analysis. We controlled for the geographical footprint of the companies, too. For this, we downloaded home market sales data from Bloomberg database.

Finally, since home market is having a special importance for the majority of the retailers, we controlled for the annual sales volume growth in the retailer's home market (Berry and Kaul, 2016). Data were obtained from OECD (Organization for Economic Co-operation and Development) iLibrary database. Table 11 contains the descriptive statistics of the variables.

Table 11. Descriptive statistics for the variables

Variable	N	Average	St. dev.	Minimum	Maximum
EBITDA margin (%)	366	6.41	3.47	-19.64	18.35
Digital innovations (#)	369	2.5	2.5	0	15
Foreign revenue share (%)	369	16.70	23.83	0.00	79.57
Annual revenue (million euro)	369	34,469	62,972	116	440,056
Annual revenue growth (%)	367	12.68	120.76	-54.32	2,304.68
Retail volume growth in the home market (%)	369	1.01	3.43	-9.95	16.09

Source: own data collection, OECD iLibrary, Bloomberg

IV.3 Methodology

The panel structure of the data allows us to deal with both the potential endogeneity and the autocorrelation within the dependent variable via the use of dynamic panel models. Dynamic panel models are built on two principles. On the one hand, longer and longer panel data series are available nowadays, and these call the attention to the problem of autocorrelation. In our case, the dependent variable of the regression is the EBITDA margin of the retailer, which has inertia; its first-order autocorrelation is 0.73, which can be considered high. In order to treat this autocorrelation, the lagged dependent variable should be included on the right-hand side of the regression, however, this correlates with the firm-specific effects, hence, distorts the parameter estimates (Roodman, 2009). Neither the fixed effect transformation nor the first difference regression model solves this problem since both include the error term, as well as the lagged dependent variable on the right-hand side of the regression.

The instrumental variable approach seems to be the most appropriate one for treating the distortion (Haile et al., 2016). Another advantage of this is that the potential endogeneity of the other explanatory variables can also be managed using instruments. Simultaneity or reverse causality may be present with regard to retail margin and digital innovations, i.e., the margin and the number of digital innovations might be determined at the same time since better-performing retailers have more resources at their disposal that they can dedicate to innovations. Through the application of the dynamic panel model, these problems can be manageable as well.

Two types of dynamic panel models became common in practice. Arellano and Bond (1991) suggested estimating the first difference model using the second or larger lags of the level variables as instruments. The assumption behind this model is that the changes are related to the initial level of the variables (therefore, the instrument is relevant), however, the current values of the variables do not correlate with the future error terms. Therefore, the exogeneity assumption is satisfied. Arellano and Bond (1991) carried out the estimation of the model using the generalized method of moments (GMM), therefore it became commonly known as the difference GMM estimator.

In the case of the difference GMM estimator, the validity of the instrument is fulfilled if the correlation between the level and the change of the variable is sufficiently large. This will not be fulfilled for random walk-like variables, since in that case the growth is independent from the current value of the process. Blundell and Bond (1998) further developed the estimation procedure in order to manage this problem, which was called as the system GMM estimator.

Two aspects are worth taking into consideration when selecting between the two estimators. First, the persistence of the time series.[7] In the case of strongly persistent time series, the system GMM estimator is preferred since the correlation between the level and the changes of the time series is usually weak (the data series are similar to random walk). Analyzing the relationship between profitability and geographical diversification of retailers, the system GMM estimation is prevalent (Qian et al., 2008; Oh et al., 2015), since geographical diversification is also a strongly persistent process.

The other aspect is the validity of the instruments used. In the case of the difference GMM estimator, the first difference panel model is estimated; therefore, the fixed effects were already eliminated from the regression. On the contrary, in the system GMM estimator, the fixed effects do not fall out from the model. As a result, the estimation will be bias-free only if the permanent, firm-specific fixed effects are not related to the differences of the explanatory variables (i.e., the instruments). This is a relatively strong assumption (Roodman, 2009).

In our case, the main explanatory variable is the number of executed digital innovations, which is a less persistent time series and due to its structure, it cannot be a random walk. At the same time, the number of innovations, and sometimes also the change of it can be related to the firm-specific fixed effects, for example to management or to the number of innovation centers owned by the company. For this reason, we decided to use the difference GMM estimator in our analysis.

During the estimation, in the case of the digital innovations, we applied a one-period delay (Hitt et al., 1994), similarly to all the other explanatory variables (Oh et al., 2015). In accordance with hypothesis H_5, in the case of the digital innovations we allowed quadratic effects as well, i.e., the marginal rate of return of the digital innovations can be diminishing. The estimated equitation is the following:

[7] Persistence means to what extent the current value of the time series is determined by the historical values. In the case of high persistence, the current values are mainly determined by past values, the change between time periods (years) is low.

$$Margin_{it} = \alpha + \beta Margin_{it-1} + \gamma_1 DigInnov_{it-1} + \gamma_2 DigInnov_{it-1}^2 + \Gamma X_{it-1} + D_t + \nu_i + u_{it},$$

where $Margin_{it}$ marks the margin of retailer i in year t, while $DigInnov_{it}$ marks the number of digital innovations executed by the retailer in year t, and X_{it} contains the control variables (the quadratic effect of geographical diversification, the size of the company, its growth rate, as well as the growth of the trade volume of the retailer's home country). D_t marks the year fixed effects, and finally, ν_i marks the firm-specific fixed effect of retailer i, while u_{it} is the error term, which – according to the assumptions – follows a normal distribution with zero mean. As we apply the difference GMM estimator, the firm-specific fixed effects fall out, therefore, all the time independent (constant during the 9 years examined) factors are filtered out from the model.

The diminishing return specified in hypothesis H_5 may, however, be estimated using logarithmic models as well (Mishra, 2017). Accordingly, we included log $(DigInnov_{it-1} + 1)$ in one of the model specifications instead of the quadratic terms.

IV.4 Results and discussion

Hierarchical regression was used to estimate the model. The estimation results are shown in Table 12. Column (1) contains only the control variables. The purpose of this is to validate the model and the database used. This shows that previous year's margin has a significant positive effect on the margin of the present period. This is consistent with the findings of Oh et al. (2015) as well. Geographical diversification has an inverted *U*-shaped relationship with the margin of the retailers, which is also consistent with the findings of several previous researches (Qian et al., 2008; Assaf et al., 2012; Berry and Kaul, 2016). It reaches the maximum if approximately one-fourth of the retailer's sales revenue is originated from foreign markets, and three-quarters is originated from the domestic market. In almost 75% of the cases less than one-quarter of the sales revenues were originated from foreign markets, therefore, based on the results, for the majority of the retailers it is advisable to further expand geographically.

Table 12. Estimation results

Independent variables	Estimation results (1)	(2)	(3)	(4)
Margin$_{it-1}$	0.463***	0.420***	0.407***	0.412***
	(0.173)	(0.140)	(0.121)	(0.148)
Number of digital innovations$_{it-1}$	-	0.125**	0.158	-
		(0.063)	(0.138)	
Number of digital innovations$_{it-1}^2$	-	-	-0.005	-
			(0.011)	
log(Number of digital innovations$_{it-1}$ + 1)	-	-	-	0.397
				(0.252)
Foreign revenue share$_{it-1}$	0.094*	0.148**	0.132*	0.148*
	(0.057)	(0.072)	(0.077)	(0.077)
Foreign revenue share$_{it-1}^2$	-0.002*	-0.002**	-0.002*	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
log(Revenue$_{it-1}$)	0.097	0.195	0.363	0.183
	(0.584)	(0.420)	(0.375)	(0.467)
Revenue growth$_{it-1}$	-0.002	-0.002	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Home market retail volume growth$_{it-1}$	-0.022	-0.057	-0.043	-0.057
	(0.050)	(0.059)	(0.059)	(0.061)
Number of observations	290	290	290	290
Number of firms	36	36	36	36
Wald Chi^2	2,307***	4,188***	4,536***	4,404***

Notes: robust standard errors in parenthesis. All the regressions contained a constant and year fixed effects
* significance level < 0.10; ** significance level < 0.05; *** significance level < 0.01

Column (2) already includes the number of digital innovations as an explanatory variable, however, only the first-order term, therefore we may assume linear effects in this case. The effect of digital innovations is significant at 5%, which indicates that digital innovation activity contributes to the performance of the retailers. The value of the Wald test – which shows the explanatory power of the model – increased significantly as well, which also implies the same. The entire estimated model is shown in column (3), in which we also allowed quadratic effect for digital innovations. Results do not show any significant quadratic effect; therefore, the hypothesis of diminishing return is not applicable to digital innovations.

Finally, column (4) shows the results of the model where the diminishing return of innovations was captured by the logarithmic explanatory variable. Similarly to the quadratic effect, the results again support that no diminishing return is noticeable in the case of digital innovations.

According to the findings, digital innovations contribute to the profitability of the retailers, therefore hypothesis H_4 can be accepted. An additional digital innovation increases the EBITDA margin of the retailer by 0.125 percentage points in the year following the introduction of the innovation. Considering that the retailers included in the sample executed 2.5 digital innovations per annum on average, this represents a margin growth of roughly 0.31 percentage points. Compared to the average margin (6.4%, see Table 11), this increase is large enough not to ignore it. At the same time, it is also evident that several factors jointly affect the margin of these retailers, among which digital innovations are only one. Additionally, the results point out two more important conclusions.

On the one hand, innovation activity has only a temporary effect on the profitability of the retailers, which is consistent with the expectations of Hitt et al. (1994). The digital innovations executed in a given year will increase profitability in the following year, and then its effect fades away slowly. Due to the autoregressive nature of the EBITDA margin, innovation outcomes are having longer effects than one year. The marginal impact of a digital innovation on the EBITDA margin is 0.125 percentage points one year after execution, and merely 0.053 percentage points two years later. In the third year, the effect amounts to only 0.022 percentage points, while it decreases to an insignificant level from the fourth year.

Therefore, outstanding corporate profitability requires continuous and intense digital innovation activity. This can be observed in the case of the global grocery retailers examined. Most companies are constantly developing various applications for smartphones and smartwatches (e.g., shopping list creation, recipe finder, store location finder, applications helping navigation within the shop), are digitalizing their loyalty programs, are offering customized coupons, as well as the fully automated (e.g., Auchan Minute, Zaitt) or completely virtual retail units are expanding as well.

Knowing the profit impact of digital innovations helps retail managers in specifying the innovation budget and determining the appropriate size of this budget. Of course, the estimated impact shows only an average effect, while the profit impact of a specific innovation will differ from that. However, an appropriate estimate in this regard is not necessarily available in advance, before executing the digital innovation, therefore the knowledge of an average effect is useful at least for on orientation.

On the other hand, in light of the results, no diminishing return is observable regarding the profit impact of digital innovations, at least not in the range examined. Based on this, we cannot accept hypothesis H_5. In 75% of the cases, a retailer executed three or less digital innovations per annum, and in 90% of the cases, it was six or less. At this level, it is not noticeable that the various digital innovations would cannibalize each other. Therefore, merely for maximizing the profits arising from digital innovations, it is not worth postponing the introduction of a digital innovation that is ready to launch.

At the same time, once the linear effect is evaluated, it cannot be disregarded that in the majority of the cases the retailers executed a relatively low number of digital innovations annually. Therefore, the linear effect is valid in this range. If the retailer is considering executing more innovations than that, the assumption of linearity might not be valid anymore. Thus, we are unable to decide on the validity of hypothesis H_5 in those cases where a large number of innovations would be executed. In these cases, it might be worth postponing the execution of an additional digital innovation by one year, however, this decision mainly depends on the market circumstances and the position of the company. A more detailed analysis of this question can be subject to future research.

IV.5 Conclusion

Our research aimed to examine the effect of digital innovations on the financial performance of the largest European and US-based grocery retailers. In our study, we analyzed 36 stock exchange listed companies between 2007 and 2017 using the dynamic panel model approach developed by Arellano and Bond (1991).

Our results confirm that digital innovations linearly and positively impact the financial performance of the companies at least in those cases where we companies execute only a small number of digital innovations annually. The effect prevails on the short- and medium-run and is negligible four years after execution.

Our study considered only grocery retailers. It would be worth examining retailers active in other product categories, too. Different characteristics and different consumer habits might cause different types of digital innovations for other products categories that can lead to different financial returns.

Our research has two important limitations. First, we did not differentiate across digital innovations. Therefore, the estimated effect can be interpreted as an average affect. The profit consequences of different types of digital innovations might differ. The classification of digital innovations can, therefore, answer interesting questions in future research. Second, we analyzed only 36 stock exchange listed retailers. Replication of the analysis using a larger sample can reinforce the results.

IV.6 Appendix

The 36 grocery retailers analyzed:

- Alliance Boots GmbH
- Auchan Holding S.A.
- Axel Johnson AB
- Big Lots, Inc.
- BJ’s Wholesale Club Holdings, Inc.
- Carrefour S.A.
- Casey's General Stores, Inc.
- Casino Guichard-Perrachon S.A.
- Colruyt Group
- CVS Health Corporation
- Delhaize Group S.A.
- Distribuidora Internacional de Alimentación S.A. (Dia S.A.)
- Dollar General Corporation
- Dollar Tree, Inc.
- Family Dollar Stores, Inc.
- ICA Gruppen AB
- J Sainsbury Plc.
- Jerónimo Martins, SGPS, S.A.
- John Lewis Partnership Plc.
- Kesko Corporation
- Koninklijke Ahold N.V.
- Marks and Spencer Group Plc.
- Publix Super Markets, Inc.
- Rite Aid Corporation
- Roundy's, Inc.
- Safeway, Inc.
- Sonae, SGPS, S.A.
- SuperValu, Inc.

- Tesco Plc.
- The Great Atlantic & Pacific Tea Company, Inc.
- The Kroger Co.
- Walgreen Co.
- Wal-Mart Stores, Inc.
- Whole Foods Market, Inc.
- Wm Morrison Supermarkets Plc.
- X5 Retail Group N.V.

V. IMPLICATIONS AND CONTRIBUTIONS

My thesis analyzed three retail strategies, geographical diversification, innovation, and pricing, that are often applied by retailers to boost market performance. According to the results, all these three strategies can significantly contribute to the market performance that is also a valuable finding for retail managers, especially during and after the current COVID-19 pandemic and the economic crisis caused by it.

Retailers can easily modify their pricing strategy by lowering prices and/or increasing the frequency and/or depth of price promotions. However, this can result in a sizeable decline in profitability. During economic downturns, a price reduction might be successful to maintain sales volume and market share. However, a price war is costly. These are reinforced by my research which showed that a hybrid pricing strategy was the most successful one in Hungary during the 2008/2009 recession. This was a combination of low prices and intense price promotion activities. Other researchers analyzing retailers in a crisis-setting came to similar conclusions (e.g., Chou and Chen, 2004; Bachl et al., 2010).

Results verified that this hybrid pricing strategy performed well in tough market conditions, but the long-run sustainability is in question as the profitability of the retailers declined. To reverse it, retailers have to use other strategic elements besides pricing to attract shoppers and to increase sales and profitability at the same time.

Pederzoli and Kuppelwieser (2015) analyzed the geographical diversification patterns of retail companies during and after an economic downturn to understand how companies behave and to identify best practices. This is an important question as several previous papers (e.g., Etgar and Rachman-Moore, 2008; Evans et al., 2008; Chan et al., 2011; Oh et al., 2015) indicated that geographical diversification affects retail performance. Therefore, a potential way to improve profitability after the crisis can be done by focusing on geographical diversification. The second article in my thesis dealt with this question.

Results confirmed that geographical diversification is having a negative quadratic effect on net margin in the after-crisis period. This proves that geographical diversification positively impacts profitability. However, this effect is not linear and there is a threshold for geographical diversification, and after the threshold is passed, further geographical diversification will decrease profitability. This result is supported by some prior studies (e.g., Qian et al., 2010) as well.

The novelty of the second article is that geographical diversification not only affects profitability, but also the process innovation activities of the retailers. Retailers with geographically diversified operations should be aware of this additional positive effect, which stems from the synergies between geographical diversification and process innovation. This can arise from gaining knowledge on how business is done in other parts of the world and retailers might re-apply this knowledge within their organization to improve and update processes.

However, the effect is not linear, but negative quadratic again, therefore, retailers must carefully balance their resources devoted to geographical diversification and process innovation. Once a retailer is not expanding geographically, it can draw back its process innovation activities due to the lack of new knowledge accumulation. However, geographical diversification that is too intense can reduce the attention and resources devoted to process innovations, which is another unfavorable effect.

At the same time, product, marketing, and process innovations have a positive impact on the profitability of the retailers. This finding provides empirical verification for the positive profitability impact of different types of innovations. This was theoretically supposed by prior literature (e.g., Geroski et al., 1993; Hitt et al., 1994; Bowen et al., 2010; Hristov and Reynolds, 2015), but it had not yet been empirically tested for retailers.

Nevertheless, it is important to note that innovations affect the profitability of retailers with time delay. New retail solutions (e.g., new store formats, new loyalty programs, new mobile applications, online store developments), processes, and private label products need time to penetrate the market and, thus, be able to have a significant impact on the retailers' bottom line. This knowledge can contribute to a more precise evaluation of innovations and when to expect the gains to arrive.

Since geographical diversification has an influence on both process innovation and the profitability of the retailers, we identified an indirect effect of geographical diversification on retail performance through process innovations. This effect can come from the efficiency increase that retailers can obtain by getting to know other ways business processes are organized in other countries.

Product and marketing innovations also positively impact profitability, but these are not enhanced by geographical diversification. A reason behind this phenomenon can be that product and marketing innovations are customer-specific, therefore, best practices in one country might not be popular in other ones. This is not the case for processes that are internal within the company and customers do not confront them in the majority of the cases.

These findings imply that well-balanced resource allocation between geographical diversification and innovation can lead to superior value creation by maximizing the positive return from both strategies.

Finally, since digitalization is unavoidable these days, retailers also answered the challenges by introducing digital innovations to the market. Digital innovations mean that retailers develop, apply, or use new digital solutions that were developed directly for the retail sector or, often, for other industries. These innovations can be both product, marketing, process, or organizational innovations, hence, can impact all aspects of the retail activity and all stakeholders of the companies.

Increased innovation activity can be another surviving strategy for retailers and digital innovations are especially important in this regard. This was the reason why I started to analyze retail digital innovations and the way they impact profitability. The third article in this thesis specifically analyzed the digital innovations in retailing. A further novelty of this paper is that innovation was measured using a new way that enabled me to identify the marginal effect of digital innovations on performance. The applied measurement is similar to the number of patents, which has been often used in the innovation literature (e.g., Atanassov, 2013; Mishra, 2017). However, the number of patents is not an adequate measure for retailers because they typically apply new technologies but do not develop them; hence, the number of patents held by retailers is low (Pantano, 2014; Hristov and Reynolds, 2015). Additionally, the number of patents correlates with technological development, but a patent is not always commercialized in the business environment. Therefore, the number of patents is an incomplete measure for innovations (including digital innovations) since there is no direct and one-to-one relationship between a patent and a commercialized innovation.

Digital innovation was, therefore, operationalized as executed digital innovation outcomes by the given retailer in the given year. Using this variable and applying dynamic panel models, the research verified that digital innovations are having a positive impact on the profitability of the retailers. However, the effect is lagged in time, but linear which means that executing several digital innovations in the same year (by the same retailer) does not reduce the marginal profit impact of the individual innovations. This has an important consequence for retail managers, namely, that it is not worth delaying the market introduction of digital innovations once they are ready to launch.

To summarize the findings of my thesis, retailers have multiple ways to improve their performance. While pricing can help in the short-run, geographical diversification and innovation can be beneficial on a longer time horizon. The latter strategies are, furthermore, partially reinforcing each other that can lead to even better firm performance. Corporate managements need to balance these strategies and find the optimal mix for their company. Short-run challenges and the characteristics of the given company (e.g., geographical footprint) can help to identify the right combination. What is especially important is that short- and long-run strategies and the continuity of the activities have to supplement and reflect on each other.

The most important academic contributions and managerial implications of my thesis are the followings.

1. The empirical identification of retail pricing strategies in a crisis environment and analyzing their performance consequences in the short- to middle-run. Only a very few numbers of prior studies exist in this domain (Chou and Chen, 2004; Bachl et al., 2010; Mann et al., 2015; Mann and Byun, 2017) and the results can help retail managers during the next recession to minimize negative impacts.
2. Analyzing the interaction between geographical diversification and retail innovation and the combined effect of these strategies on firm performance. Despite the fact that geographical diversification was studied in the retail setting earlier, no empirical studies were found regarding the role innovation can play in this relationship. The analysis of retail innovation can shed light on the mechanisms geographical diversification can contribute to performance. Additionally, it also showed how different types of innovations are affected by geographical diversification. Since process innovations were positively related to geographical diversification, retailers can improve their efficiency (and profitability) by learning via geographical diversification.

3. Proposing a new measurement for retail innovation that is specific in several aspects. The number of executed innovation outcomes can help to estimate the innovativeness of the retailers and to compare companies, furthermore, this is more specific to retail operations and makes more sophisticated econometric modeling possible. These are important advantages compared to previously applied measurements like CIS or patent data (e.g., Cainelli et al., 2004; Mansury and Love, 2008; Ghisetti and Rennings, 2014; Pantano et al., 2017).
4. Estimating the profit impact of (digital) retail innovations based on empirical data from the world's largest grocery retailers. Results indicate a positive and linear effect. Therefore, retail professionals can gain better insights into the financial rewards of innovations, and particularly, digital innovations. These results can function as a guide for retail managers towards a more precise evaluation of (digital) innovations that can lead to an excellent optimization of the available resources and tailoring of innovation activities. Furthermore, results can help to assign the appropriate budget to support (digital) innovation activities of the retailers.

However, the thesis has some limitations as well that future research might address. First, I examined only grocery retailers. Future studies can be conducted in other merchandise categories to show similarities and differences among retail segments regarding strategies, their interactions, and their benefits. Second, I analyzed only a limited number of retailers, and thus, a larger sample might be useful to further verify the results. Third, retail innovations were classified using the Oslo Manual (OECD and Eurostat, 2005). A more refined classification scheme could help to identify the profit impacts of different subcategories of (digital) retail innovations that can shed light on the differences not visible in the aggregated data.

As these lines are written, the second wave of the COVID-19 pandemic just approached Europe and the whole world. The pandemic changed consumer habits and behaviors quickly and intensively. Hall et al. (2020) showed that the grocery retail sector experienced a very heavy increase at the beginning of the crisis in New Zealand that can be connected to stockpiling. When the lockdown started, spending decreased also in this category, but it returned to its normal value after two weeks. On the other hand, average spending per transaction went up by closely 30%.

At the same time, online retail gained momentum and overall grocery spending in retail increased partially due to the closure of restaurants and canteens (Martin-Neuninger and Ruby, 2020). This was also reinforced by Dannenberg et al. (2020) based on German data where online retailing was often used for panic buying. However, Dannenberg et al. (2020) argued that the short-term effect of the pandemic might not lead to a long-term shift towards online retailing. There are mainly three reasons behind. First, online grocery delivery often did not meet demand due to lack of capacity. Second, home delivery might not be as easy and convenient as it was during the lockdown when people are working as normal and spend less time at home. Third, hygiene will not be so important after the pandemic is over, but the cost of online retailing (mainly delivery) will remain that might discourage several potential shoppers.

Pantano et al. (2020) called the attention that the pandemic might have an impact on store preference. Closer stores might become more important and liked as well as those stores that managed their inventory and supply chain better and had higher assortment availability. Price can be an important factor, too, but it lost from its importance at the beginning of the pandemic. Pantano et al. (2020) indicated that retail strategies during the pandemic are completely different as during an economic crisis. The ethical behavior of the retailers, putting people before profit instead of profiting from the pandemic by increasing prices of basic groceries and hygienic products can largely influence customer behavioral after the pandemic.

The period of the pandemic is special in several regards and the ‘next normal’ is not well known yet. Retailers executed several innovations related to e-commerce (Dannenberg et al., 2020) in the past months, but their impact on performance and the future importance of online retail need additional research after the pandemic is over. However, since an economic crisis is also foreseeable (almost all countries already reported a decline in GDP and increase in unemployment), retailers need again strategic responses to increase or at least maintain their revenue and profitability (Gregg et al., 2020). The strategies analyzed in this thesis (pricing, geographical diversification, and innovation) proved to be successful in this and it is important for retailer managers to apply them in the right way and at the right time. Despite the limitations of the research presented in this thesis, I believe that the results can give a hand for retail managers in this job.

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