



Diversification and Firm Performance in the Digitalization Era

Examining the Role of Internal
Capabilities and Board Capital

Master Thesis

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Executive Summary

The thesis investigates the impact of external board capital, i.e. the social capital of external directors serving in the board of a company, on its diversification strategy. It is argued that through that network of contacts firms can overcome complexities and uncertainties in their environment when contemplating entering new markets. Additionally, it is hypothesized that the current performance might also motivate the choice to diversify in a sense that when it is unsatisfactory, firms are more prone to pursue new businesses, whereas this motivation declines as performance increases. Companies diversify with the prospect of improving profitability through spreading risks and creating synergies. However, since the strategy entails quite some costs, diversifiers should strive for an optimal fit with their internal capabilities which act as mediators in the diversification-performance mechanism in order to ensure profitability. The analysis has been done on a sample of 119 IT firms for a 10-year period. The findings indicate that board capital is a powerful driver for diversification while the diversification-performance relationship is not so straightforward. There are some indications of non-linearity and mediation. Based on the analysis future research directions and recommendations for practitioners are derived.

Introduction

The IT sector has been in the centre of digitalization for decades bringing about changes in traditional industries and business models. The ubiquitous interconnectedness of devices has blurred industry boundaries and redefined products or services previously associated with a certain type of industry (Nicholls-Nixon & Jasinski, 1995). IT companies, however, do not merely enable this process but actively grasp new business opportunities that arise with it. According to the IT industry outlook for 2018 (Comptia, 2018), today's technological landscape allows for almost anything to be offered as a service. In light of these trends the IT sector has expanded its array of activities tremendously moving beyond traditional hardware and software. Large international companies such as Cisco or IBM, for example, have stepped in new business lines such as business services, financing, networking, etc. It can be argued that IT companies are increasingly diversifying into new markets undergoing digital change. Recent research suggests that instead of specializing, incumbent firms in the semiconductor industry are indeed becoming more vertically integrated through diversification (Kapoor, 2013). There have also been several disruptions in the industry such as Cloud technologies, IoT, 5G, etc. (Newman, 2017) that have affected IT giants core businesses prompting them to step into new markets. Diversification is one of the means for companies to continue growing while reducing their risk exposure. Yet it requires substantial resource outflows without any guarantee of return. Therefore, diversification is quite paradoxical in nature and its effect on firm performance depends on this cost-benefit interplay.

Research on the relationship between diversification and firm performance has been predominantly based on examining that link on a general superficial level. For instance, the early empirical studies often use multi-industry samples from the 70s and 80s (e.g. Palepu, 1985; Rumelt, 1974). There has been a lack of research in the recent digitalization era, and more precisely how ICT has enabled firms to broaden their scope (Ahuja & Novelli, 2016). The very few more recent papers that have examined the effect of IT on diversification and performance have concluded that new technologies enable and facilitate the process (e.g. Chari, Devaraj, & David, 2008; Ray, Xue, & Barney, 2013). This is especially relevant since diversification entails not only benefits in terms of synergies (e.g. Amit & Livnatt, 1988; Helfat & Eisenhardt, 2004; Miller & Yang, 2016; Puranam & Vanneste, 2016) or spreading systematic risk (e.g. Barton, 1988; Bettis & Mahajan, 1985; Dimitrov & Tice, 2006) but also costs associated with coordination and transfer of knowledge, technology, labour onto a new line of business (e.g. Hill & Hoskisson, 1987; Leonard-Barton, 1992; Zenger, 2016; Zhou, 2011). As a result the effect of performance depends on whether benefits outweigh costs or vice versa. Thus, scholars have begun to acknowledge the complexity of the relationship and have discovered that

it is not linear (e.g. Ahuja & Novelli, 2016; Hashai, 2015; Palich, Cardinal, & Miller, 2000). Therefore, it is important for strategic management literature to discover the contingencies under which diversification is optimal and leads to superior performance. Previous studies have tackled the issue by looking at large multi-industry samples which prevents them from considering firm and industry heterogeneity that might influence how substantial the benefit from diversification is (e.g. Ahuja & Novelli, 2016; Mackey, Barney, & Dotson, 2017). Therefore, this thesis aims to fill this gap by focusing on a smaller sample of IT firms that are at the forefront of digitalization, and investigating the contingency factors that might positively or negatively influence the relationship in that context. Digitalization is an all-encompassing phenomenon that has changed the nature of corporate diversification bringing new types of opportunities and risks, and thus it should be thoroughly researched. To do so this thesis will examine internal firm capabilities along with external board capital and in this way will provide an updated nuanced view.

With diversification outcome being so complex to grasp both by practitioners and academia, it is important to note what drives companies to diversify in the first place. According to Ansoff (1957), it is one of the ways to adapt to the hypercompetitive environment by undergoing periods of change and growth. Previous empirical research on the relationship between diversification and firm performance has determined that diversifying firms exhibit higher levels of profitability (e.g. Palepu, 1985; Rumelt, 1982). Other studies suggest that there is an optimal limit to a firm's diversification after which it becomes detrimental (Markides, 1995). More recent research, on the other hand, has focused on investigating the factors that would lead to a successful diversification, i.e. the firm prerequisites in terms of capabilities, technology, experience, etc. (Chen, Williams, & Agarwal, 2012; Eggers & Park, 2018; Helfat & Lieberman, 2002). This is especially relevant when the organization engages into a new industry. New business opportunities are facilitated by the continuous technological changes but they also entail a high degree of uncertainty and risk since strategic resources should be leveraged (O'Brien, David, Yoshikawa, & Delios, 2014). Diversifying firms draw their advantages from integrative capabilities and transformational knowledge which are necessary for entering a new market. Integrative capabilities are fundamental for defining industry structure and boundaries since they allow firms to vertically integrate over time (Helfat & Campo-Rembado, 2016). Another pre-condition for a successful diversification is the technical capabilities of the entrée. These entail technical expertise that can be reconfigured to match the new industry setting (Moeen, 2017).

It can be concluded that diversifying companies will perform better if they possess both integrative and technical capabilities when engaging in new business ventures. In the continuous digitalization it can be argued that large IT companies given the on-going technological progress are

endowed both with relevant capabilities, knowledge and experience to be able to successfully diversify in any industry that is undergoing such a change. The IT industry setting itself is characterized by high velocity of change which has made companies reactive to new business opportunities that arise in other markets. Thus, IT giants have the motivation and capabilities to enter new businesses. Their external social network might further facilitate the process.

In doing business with other actors companies are under the influence of exterior factors that affect their actions. According to the resource dependence theory the firm's survival depends on its ability to procure critical resources from its external environment by tactically restructuring its interdependencies (Casciaro & Piskorski, 2005). An example of such interdependencies can be relationships with other organizations embedded in a network, powerful suppliers or buyers that cause power imbalance over the control of resources (Hillman, Withers, & Collins, 2009). Resource dependence theory has been widely applied in the context of M&A, joint venture and strategic alliance literature (e.g. Barringer & Harrison, 2000; Casciaro & Piskorski, 2005; Haleblian, Devers, McNamara, Carpenter, & Davison, 2009). What these studies have in common is the assumption that firms build partnerships of any kind in order to limit their exposure to resource interdependence. This thesis, however, argues that interconnectedness with other players in the industry might not be a liability for the company when it comes to diversification. As it was established diversification requires investment without any guaranteed success. The social capital that the board of directors brings through interlocks (e.g. Hillman & Dalziel, 2003; Haynes & Hillman, 2010; Wincent, Anokhin, & Örtqvist, 2010), however, can be seen as a means to overcome complexity and uncertainty in the environment maximizing the benefits from diversification. Therefore, the aim of this thesis is to investigate the role of board capital when companies consider entering a new market along with the relationship between firm diversification and performance. The main research questions are:

How does board capital influence firm diversification?

How does diversification affect firm performance?

Insight and connections with other industry players might not be a sufficient condition for a company to enter into a new business venture. Recent research (e.g. Eggers & Kaul, 2018; Eggers & Park, 2018; Miller & Yang, 2016) suggests the idea that that prior or current performance below a certain aspiration level might motivate firms to pursue new sources of growth such as undertaking radical innovations and adapting to technological changes. Thus, if a company's core business is in decline lowering its profitability, it might be an additional stimulation to diversify. As a result,

motivational factors will be incorporated in the analysis as a boundary condition along with the other internal organizational capabilities in order to capture the true complexity of the relationship.

The sample of firms included in the analysis comprises of the top worldwide IT companies as derived from the list of the world's biggest public companies for 2017 (Forbes, 2017). The research context is the IT industry which has been marked by high degrees of growth and change in recent years due to the overall technological progress and digitalization. Consequently, it will be insightful to examine how successful these companies are in their expansion to other industries that undergo digitalization. The sample is diverse enough to include companies affected in a different way by the new industry trends. For instance, incumbents such as IBM, Cisco and Oracle are at the forefront of these industry changes whereas other companies such as Nokia are lagging behind. Having in mind the on-going blurring of industry boundaries attributed to phenomena such as globalization, deregulation and digitalization, it will be a valuable contribution to literature to examine how industry convergence might be affected by a firm's own internal capabilities and its relationships with other players.

The structure of the thesis is as follows: in the second chapter a theoretical framework will be presented based on literature review. The relationship between diversification and firm performance will be analysed through the lenses of the board capital and motivational factors. Additionally, the tested hypotheses along with the conceptual model will be introduced. Chapter three will give an overview of the methods – data sources, operationalizing variables and constructing the conceptual model. Chapter four will focus on the empirical results and the analysis. Finally, chapter five will discuss the results, and the last section will conclude and provide limitations.

Theoretical Background

In this thesis, diversification is defined as expanding firm activities into new markets. The focus of the research is the expansion of IT firms into new markets which are other industries undergoing digitalization and how it is reflected on firm's performance.

Board Capital as a Driver for Diversification

The first step in the diversification process involves making the necessary investment in the new market. This suggests taking a risk and outflowing funds without any secure return. If the organization faces too much uncertainty in its environment or is too dependent on it, then this might be a barrier to diversify. The Resource Dependence Theory (RDT) (Aldrich & Pfeffer, 1976; Pfeffer & Salancik, 1978) suggests that the behavior of organizations is dependent on their external environment, and to some extent it is beyond their control. In that sense organizations act as an open system interacting with other actors in their environment to acquire resources and dispose outputs. This creates an interorganizational network of power emerging from the systems of exchanges that may have its influence on the company. Another premise of the theory is that organizations selectively comply with those environmental demands which have more relative power over them (Pfeffer, 1987). Power in that context refers to the control of scarce and valuable resources essential for firm survival (Pfeffer, 1978). The complexity of obtaining these resources from other organizations is generating uncertainty prompting firms to enter into some form of commitment relationships such as partnerships, joint ventures, coalitions, etc. to minimize that uncertainty (Provan, Beyer, & Kruytbosch, 1980; Ulrich & Barney, 1984). Consequently, RDT has had a wide application in explaining why organizations would engage in M&A (e.g. Galbraith & Stiles, 1984; Hillman et al., 2009; Pfeffer, 1976); joint ventures and other types of partnerships (e.g. Auster, 1994; Harrigan & Newman, 1990). Considering that the strategic choice to enter a new market is driven by similar considerations, RDT can be relevant for diversification literature as well.

This study will apply another perspective of the theory focusing inside the organization to analyze how external connections might facilitate diversification. The board of directors' composition and size has been preferred as a tool by both academia and practitioners. This is because this type of arrangement is associated with the most retain of power and control within the organization (e.g. Hillman & Dalziel, 2003; Zahra & Pearce, 1989) unlike M&A, JVs, and alliances that require legal and financial arrangements. Thus, through board linkages companies simultaneously account for environmental complexity and preserve their autonomy (Drees & Heugens, 2013). The ultimate goal of companies is to secure stable resource flows from their environment (Oliver, 1991) which can be achieved in the most efficient way through the higher management level. It has long been established that the board of directors might play a limited role in strategic management, but it can actually be a tool used against external dependencies (Boyd, 1990). Board members bring expertise, social capital and linkages to other organizations in the ecosystem which can be used to manage interdependencies (e.g. Dalton, Daily, Johnson, & Ellstrand, 1999; Ellstrand, Tihanyi, & Johnson, 2002). There are

several activities that directors can do to provide the necessary resources such as serving as the public image of the company (Selznick, 1949), linking the organization to crucial stakeholders and institutions (Hillman, Keim, & Luce, 2001) and facilitating access to capital markets (Mizruchi & Stearns, 1988). To additionally restrain environmental contingencies firms utilize board interlocks. Interlocks consist of the CEOs of constraining suppliers or major customers invited to serve as members of the board of directors, and in that way giving them a vested interest in the dependent organization (Davis & Cobb, 2010). Research has shown that board composition has been associated with superior firm performance overall (e.g. Daily & Dalton, 1993; Dalton et al., 1999), higher degree of internationalization (e.g. Sanders & Carpenter, 1998), and better dealing with environments of high uncertainty and political risk (e.g. Ellstrand et al., 2002). More recent research has also acknowledged the importance of diversified management teams and board compositions bringing more expertise and external connections (e.g. Bear, Rahman, & Post, 2010; Kor & Leblebici, 2005; Wong, Ormiston, & Tetlock, 2011). In fact, Pfeffer (1972) suggests that board size and composition is a rational response to the external environment, and is not determined at random. In the framework of the research context, it can be concluded that external board members are a type of capital for the company that can be applied when diversification is pursued. The insights, partnerships and competences that external directors bring contribute to understanding better the company's ecosystem, and thus minimizing the risk of diversification while maximizing the benefits.

The presented discussion so far has emphasized the number of ways in which the firm can manage its external environment with the board capital being the most widely administered tool. As the number of product markets the company is active in increases, so do its environmental complexities (e.g. Kang, 2013; Su & Tsang, 2015). In any case diversification implies an optimal fit between the external and internal organizational contingencies (e.g. Hoskisson & Hitt, 1990; Wan, Hoskisson, Short, & Yiu, 2011) which include both primary and secondary stakeholders encountered across markets (Su & Tsang, 2015). Such networks of interrelations are a source of uncertainty and complexity since they involve various actors that might exert pressure. Literature has already reached a consensus that companies manage such intertwined webs of relationships by having external directors serving as board members. Additionally, it can be also argued that board capital reduces the risks associated with doing business in a new market. The expertise and linkages to other industry settings that external board members bring to the table might aid companies to obtain vital resource, gain insights into the workings of the new market in order to ensure successful entry and consequent performance.

Hypothesis 1: Board capital has a positive effect on diversification.

Board capital is a necessary condition for diversification, but it might not be a sufficient one. Companies might get embedded too much in their established markets and thus lack the drive or ambition to disrupt their patterns. Such dependencies, however, could be overcome with the right motivation. A strong perception of threat in terms of a new disruptive technology, which would lead to a declining performance if the company does not react to it, might be the necessary push to overcome dependence and inertia (Gilbert, 2005; Huff, Huff, & Thomas, 1992; Lant, Milliken, & Batra, 1992). Expansion in new markets may be motivated also by the limited opportunities in the current markets (e.g. Penrose, 1959). The so-called performance gap showing a discrepancy between a firm's current and expected performance (Duncan & Weiss, 1979) might prompt managers to start searching for new sources of growth beyond the scope of the firm (Miller & Yang, 2016). Therefore, the poorer the performance, the more the company is motivated to pursue diversification. As already outlined in the discussion so far, the IT industry is characterized by on-going technological disruptions such as Cloud, Big Data Analytics, 5G, etc. which imply erosion of IT incumbents' mature core businesses. That process of ubiquitous digitalization produces a variety of new opportunities for IT companies to explore. Subsequently, IT incumbents are threatened of losing new sources of revenue if they do not act upon this. Threat perception and a drop in the growth rate are motivational factors that might help firms overcome their inertia and enter new markets. Therefore, it might be concluded that motivation would even further strengthen the positive effect that board capital has on diversification. Companies would then have the proper linkages, resources and insights to diversify stimulated by the attractiveness of new business opportunities given that their existing markets are maturing.

Hypothesis 1a: Motivation has a moderating effect on diversification strengthening board capital.

Given the complexity of diversification as a phenomenon, the possibility of a U-shaped effect of motivation on a company's aspirations to enter new markets has been acknowledged in recent literature (Eggers & Kaul, 2018). In the mentioned study it was established that organizations have the strongest motivation to take risk when performance is moderately below some aspiration level, after which the effect dampens as performance declines further or improves significantly. In other words, companies are stimulated by their declining revenue to undergo diversification while still being financially vital and able to make the necessary investments, while this motivation decreases if they continue to decline.

Hypothesis 1b: Motivation has a U-shaped relationship with diversification.

Motives for Diversification

The profit potential of entering new markets and overcoming growth stagnation are powerful motives for diversification. As organizations evolve through time they exploit growth opportunities until a point is reached when growth cannot occur in an organic way. However, it is essential for organizations to retain their market position through continuous growth. Therefore, they should keep pace with their environment and adapt to it at least *twice as fast* (Ansoff, 1957). Diversification is one alternative that ensures continuous growth in an inorganic way. There are two major diversification strategies for firms – either in related or unrelated businesses (Amit & Livnat, 1988). Regardless of the linkages between existing and new firm activities, in any case diversification requires the development of new technologies and skills leading to a change in organizational structure and processes (Ansoff, 1958). More recent research has in fact discovered that no matter the type of diversification strategy (related, unrelated or focused) chosen by the firm it ultimately results in creating value as long as it is an optimal fit with the firm's resources and capabilities (Mackey et al., 2017).

Historically, the reasons why firms would enter new markets have been associated with economic, political, and international trends along with potential for improving company performance and consolidating its market position through decreased manufacturing costs (Ansoff, 1958). And indeed, early empirical work does suggest that diversification leads to higher profitability (e.g. Christensen & Montgomery, 1981; Montgomery, 1982; Rumelt, 1982). These studies discover several explanations for this phenomenon. Firstly, it is argued that being active in various lines of business gives organizations the opportunity to diversify their exposure to risk. In fact previous literature has emphasized the importance of the risk-return trade-off for diversifying firms (e.g. Bettis, 1981; Bettis & Hall, 1982; Bettis & Mahajan, 1985). Additionally, Montgomery and Singh (1984) have empirically verified that related diversification has a lower mean systematic risk than unrelated one. In another study Palepu (1985) also concludes that firms with predominantly related diversification show significantly better profit growth than those with predominantly unrelated diversification. And this relationship is found to be persistent over the long run. Secondly, what these studies argue is that the linkages between business lines allow for exploiting synergies which in turn is necessary for the long term performance of the firm. For instance, integrating companies, that are members of a vertical supply chain, is a better source of economies of scale and cost reduction than an entry into an unfamiliar horizontal market. Additionally, research has documented the relative advantages that vertically integrated firms enjoy in sustaining their competitive advantage (e.g. Ethiraj, Levinthal, & Roy, 2008; Pil & Cohen 2006). More specifically, within-industry diversification is found to bring

about synergies such as economies of scope, premiums from mutual forbearance as a result of multi-market competition along with other efficiencies from market structuration (Li & Greenwood, 2004).

More contemporary literature has examined the diversification-performance relationship uncovering other driving factors. First of all, the revised fundamental early work was conducted on large multi-industry samples which overlook any firm or industry heterogeneity. Thus, there is no “superior” diversification mode as long as it creates value and is motivated by the right reasons. Both related and unrelated diversification can bring synergies to the firm in the form of economies of scope in terms of sharing resources, capabilities, costs, etc. (e.g. Hashai, 2015; Helfat & Eisenhardt, 2004; Mackey, et al., 2017; Miller & Yang, 2016) or financial synergies in terms of spreading risks (e.g. Gopalan & Xie, 2011; O’Brien et al., 2014). Therefore, firms need to pinpoint the potential for synergies when contemplating diversification. One source of these is the knowledge and human capital applicability. Firms are better able to leverage their knowledge which is embedded in routines and transfer it through its workforce if it is also applicable in the new business setting (e.g. Chang, 1996; Miller & Yang, 2016). Additionally, the knowledge and experience that the firms have accumulated through their relations with clients have naturally created relational assets and commitments that can eventually lead to client-driven diversification (Mawdsley & Somaya, 2018). In that sense it is implied that the motives for diversification may also stem in the firm’s external environment, and are not solely determined by its internal capabilities and resources. Diversification driven by such considerations also brings about synergies. For instance, complementarities between the client-supplier (Cottrell & Nault, 2004; Nayyar, 1993), familiarity and intimacy (Akçura & Srinivasan, 2005) and facilitated transactions (Chatain & Zemsky, 2007). The established connection between a supplier and its clients might facilitate market entry and minimize the risks associated with diversification due to the accumulated specific knowledge about that market. This alternative explanation for diversification might prove to be increasingly prevalent in the digitalization and servitization era (Mawdsley & Somaya, 2018).

In the research context of this thesis it can be argued that IT firms might be encouraged by similar considerations in their diversification strategies since they are starting to enter their vertical markets (IDC, 2015). The IT industry is incrementally transforming itself (Comptia, 2018), thus it is expected that incumbents would take advantage of the business opportunities the new era brings which would inevitably result in blurring of boundaries. For example, the IT giants have been increasingly diversifying the array of services they offer – from hardware and software to consultancy, financial services, networking, education, healthcare, etc. (IDC, 2015). There is evidence in the literature that IT companies have started to diversify their activities through vertical integration (Kapoor, 2013).

Moreover, another driving factor is the higher velocity of change in the industry and hypercompetition that according to Ansoff (1957) are motives for diversification. Previous empirical investigations on the link between diversification and performance has been focused on the manufacturing sector predominantly but taking into account recent trends companies in the IT sector also have opportunities to expand. Diversified companies are more profitable due to reaping synergies that would make them more competitive and efficient while minimizing their risk exposure. Accumulated knowledge and excess of resources can be applied to more productive use in new markets. Additionally, established relationships with other actors in the firm's network that bring about social capital and complementarities might be another motive to facilitate entry. In any case diversification ultimately results in synergies and therefore it is expected to be translated into improved firm performance.

Hypothesis 2: Diversification leads to better firm performance.

From the discussion so far it can be concluded that firms diversify with the goal to obtain sustainable competitive advantage translated into superior performance. This is predominantly attributed to synergies, decreased costs of production, risk spread, higher revenue in a new sector or a decline in the core business. The relationship, however, is not that straightforward. Diversification is not necessarily linearly translated into improved financial performance. Scholars have begun to acknowledge the non-linearity of the relationship suggesting that there is an optimal degree of diversification (e.g. Hashai, 2015; Markides, 1992; Palich et al., 2000). It might be argued that this is due to the initial costs and risks associated with the new lines of business. Thus, synergies might be outweighed by coordination and adjustment costs hampering performance until the company has built some degree of diversification, and established synergies that could generate returns (Hashai, 2015). The overall effect on performance depends on the trade-off between the risks associated with diversification and the benefits that synergies bring about, and whether the company has already build some degree of diversification. In line with previous literature this thesis would take into account the possibility of non-linearity.

Hypothesis 2a: Diversification has a U-shaped relationship with firm performance.

Internal Firm Capabilities

It can be said that companies can increase their chances of successful diversification and consequently improved performance if they achieve optimum fit between their diversification goals and internal capabilities which would create value instead of destroying it (Mackey et al., 2017).

While firms might differ in their motives to diversify, they definitely need to have in check certain prerequisites for diversification. Companies should possess the adequate core capabilities to be able to successfully diversify. Core capabilities are defined as unique, distinctive, difficult to imitate and superior to competition. But they may also refer to the set of skills, knowledge, routines and assets that the company owns giving it sustainable competitive advantage (Leonard-Barton, 1992; Teece, Pisano, & Shuen, 1990). Therefore, these capabilities come into play when firms start competing on new markets. More specifically, there should be a match between firm capabilities and the market entry since the greater the similarity between firms' resources and those required in the new industry, the greater the chances for success (Helfat & Lieberman, 2002). Core capabilities is a broad term, hence this section will examine two sets of capabilities, integrative and technical, that have been found to be of importance in current empirical investigations with regard to market entry in a new business (e.g. Moeen, 2017). Moreover, adaptation of incumbent firms to a technological change or vertical integration entails assembling bundles of resources and technologies that are reconfigured (Sirmon, Hitt, Ireland, & Gilbert, 2011) and transferred within the firm (Eggers & Park, 2018) for which purpose capabilities come into play. Diversifying firms should possess these abilities in order to benefit from synergies between their new and old businesses.

Technical capabilities refer to the firm's accumulated knowledge, expertise and technological resources over time. Past literature has already documented that technical capabilities help firms to reconfigure its existing resources in order to match their new industry setting. To broaden their technological capabilities companies must exploit R&D undertaken in diverse but complementary fields ensuring a better match with the product diversification strategy (Argyres, 1996). Thus, it can be argued that this is especially relevant for integrated firms – first they diversify their R&D before pursuing diversification itself (e.g. Miller, 2004). It implies that they have more technological breadth than specialized firms. Considering that different industries require different areas of expertise, having a substantial initial stock of knowledge guarantees successful diversification (Lee, 2008; Nerkar & Roberst, 2002). For the context of the IT industry it can be said that knowledge of related technical fields would be essential for vertical integration. Since the aim of the thesis is to examine how successful IT firms are in entering new markets undergoing digitalization, it can be argued that they already possess the necessary knowledge stock having in mind that they are at the forefront of digitalization. Furthermore, the sample consists of large incumbent firms, which are well-equipped with relevant resources and knowledge in various technological areas used to commercialize new products and services (Agarwal & Audretsch, 2001; Eggers & Park, 2018). Technical capabilities are essential condition for diversification since they increase the chances of successful market entry and improved performance. Therefore, it can be argued that technical capabilities mediate the relationship

between diversification and performance since they are the necessary building blocks on which the firm can exploit new business opportunities. The company knowledge and technology should have an application in order to generate profits.

Hypothesis 2b: Technical capabilities mediate the relationship between diversification and firm performance.

The other internal building block influencing how diversification affects performance is the firm's integrative capabilities. A company may be well equipped with assets and resources but they need to be reconfigured properly in order to match the new market and reap synergies from integration. These capabilities are predominantly internal and involve communication and coordination as well as efficiency (e.g. Helfat & Campo-Rembado, 2016; Verona, 1999). Integrative knowledge allows for balancing different activities, capabilities, and products in one or more vertical chains. Additionally, it enables coordination within or between vertical chains obtaining continuous feedback from various actors (Helfat & Raubitschek, 2000) and in that way the whole process is reinforced as a loop. A company can also achieve economies of scale and scope through recombining resources and minimizing costs especially in related diversification settings (Helfat & Eisenhardt, 2004). Integration, however, also entails costs which might jeopardize the diversification process. The firm might inefficiently transfer and adapt resources to its new markets while at the same time face challenges in coordinating the linkages between its segments (Hashai, 2015). Additionally, the company's human capital and tacit knowledge should have its productive use in the new market setting (Miller & Yang, 2016) otherwise it will bring about inefficiencies.

Firms might smooth the integration process if they develop the appropriate coordination and communication channels. This can take place naturally with the pace of time when individuals work and interact together, or it can be stimulated through the formal structure – e.g. via cross-disciplinary teams or managerial incentives (Moeen, 2017). Organizational linkages going through the middle management connect actors with different job responsibilities within and between organizational units and allow them to share information, align plans and make consistent decisions (Taylor & Helfat, 2009). The development of integrative capabilities is a continuous process of organizational learning and first-hand experience in which routines have been adjusted accordingly to offset the costs of staying integrated (Zollo & Winter, 2002). Previous research has indicated that diversified firms do indeed put in practice those integrative mechanisms. For instance, vertically integrated incumbents in the semiconductor industry leverage the broader access to resources and markets and reconfigure their boundaries to be competitive (Kapoor, 2013). Therefore, it can be argued that if a firm is already diversified into several business lines, then it has successfully developed and applied its integrative

capabilities in terms of middle management level, routines, information sharing channels and coordinating mechanisms. Moreover, it implies that they have accumulated experience reconfiguring those capabilities when necessary. As it was already established a firm’s experience with expanding its technological breadth to adapt it to new business opportunities (e.g. Cattani, 2005; Franco, Sarkar, Agarwal, & Echambadi, 2009; Furr & Snow, 2015) also increases the likelihood of performing well on the new market (Eggers & Park, 2018). Accordingly, integrative capabilities contribute to the success of diversification which in turn improves performance.

Hypothesis 2c: Integrative capabilities mediate the relationship between diversification and firm performance.

Conceptual Model

The derived relationships between variables based on the theoretical background are combined in a model exhibited in the figure below.

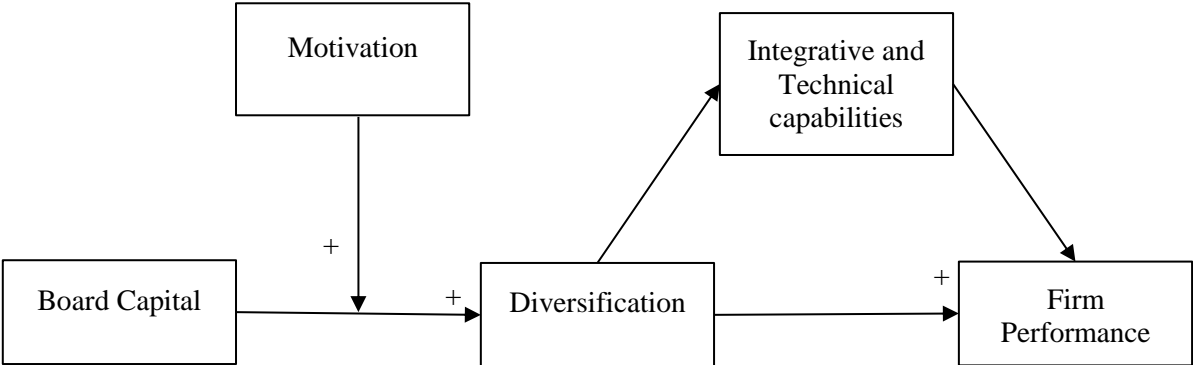


Fig.1. Conceptual model

The conceptual model outlines the links between the hypotheses in order to answer the research questions. Firstly, the mechanism begins with model 1 testing the relationship between board capital and diversification and then continues with model 2 investigating the link between diversification and firm performance based on fundamental past literature. Several moderating and mediating relationships have also been derived from more recent studies. Technical and integrative capabilities serve as building blocks for the relationship between diversification and firm performance to take place. Board capital is hypothesized to positively impact diversification. Motivational factors can additionally prompt firms to overcome environmental uncertainties and diversify, strengthening

the positive effect of board capital. Ultimately, the goal is to capture the various contingencies and provide a nuanced view on the diversification-performance linkage by incorporating square terms suggesting non-linear relationships, which is in line with the recent trends in literature.

Methodology

Sample

In this study, a panel of the top IT firms derived from the list of the world's biggest public companies for 2017 (Forbes, 2017) is used. The total sample size is 119 firms whose main operations are in the sectors Computer hardware and software, Computer storage devices, Programming and Semiconductors. Furthermore, the sample includes also the top IT companies that are actively diversifying in other markets (IDC, 2015). The analysis will be conducted on a firm level data for the time period of 2008-2017. The complete sample population is exhibited in table 1a in the appendix section 1. The table below shows a short overview of the sampled companies grouped in regions.

Region	Countries	Number of Companies
North America	United States, Canada	57
Asia	Japan, China, South Korea, Taiwan, India	40
Europe	Germany, Ireland, Great Britain, Finland, France, Sweden, the Netherlands, Spain, Switzerland	22

Table 1. Sample overview

The group of companies is versatile enough to include representatives of different countries and lines of business. They do vary, however, with regard to their degree of diversification and profitability. For instance, companies such as Apple are predominantly one-product whereas companies such as IBM or Cisco have multiple segments. Therefore, it can be concluded that there are representatives of successfully diversified profitable organizations and companies with more focus. Additionally, there are also firms that have heavily invested to keep pace with the new digitalization trends, and others who have focused primarily on their traditional businesses. For instance, according to *Forbes* rankings from 2017 companies such as Microsoft, IBM, Oracle and SAP were among the top Cloud service providers worldwide (Evans, 2017) whereas other organizations in the sample are late-comers on that market. Nevertheless, the population is comparable on other dimensions such as

being representatives of the IT industry, relatively large in size and public which ensures more data availability. Since the sample is comparatively smaller than in past studies and it represents one industry, it accounts for the acknowledged weaknesses of previous large multi-industry samples that overlook essential industry and firm particularities (e.g. Ahuja & Novelli, 2016; Mackey et al., 2017).

Data and Measures

The main data source for this study is Orbis. Orbis provides company specific data on both publicly listed and private companies worldwide. The information is derived from their annual reports and it also contains ownership structure and other detailed industry reports.

The main variables and their operationalization are presented in the following table.

Variable	Measure	Data source
Firm performance	ROA	Orbis
Diversification	Entropy measure of diversification – calculated as the weighted average of the shares of all market segments in the total sales of the firm (Palepu, 1985)	Orbis
Technical capabilities	Logged number of patents in relation to technical fields (Jaffe, Trajtenberg, & Henderson, 1993; Moeen, 2017)	Orbis
Integrative capabilities	Logged number of business segments the firm is active in (Chen et al., 2012; Helfat & Campo-Rembado, 2016; Kapoor, 2013; Moeen, 2017)	Orbis
Board capital	The number of companies in which a board member holds a position. It is a proxy for board interlocks (Ellstrand et al., 2002; Pfeffer, 1972; Pfeffer & Salancik, 1978)	Orbis
Motivation	Revenue taken as a moving average throughout the period. It serves as an indication of the firm's performance aspiration level (Eggers & Kaul, 2018; Eggers & Park, 2018)	Orbis

Table 2. Variables Definition

The main independent variable is the degree of diversification, and in line with previous literature it will be measured with the entropy measure suggested by Jacquemin and Berry (1979) and Palepu (1985). It is calculated as the weighted average of the shares of all market segments the firm is active in. The weight for each segment is the logarithm of the inverse of its share. Therefore, the entropy measure takes into account the number of segments the company operates in and their relative

importance to revenue. The measure addresses the limitations of the previously established methods relying solely on the Standard Industrial Classification (SIC) without representing the segments' degree of relatedness (Montgomery, 1982). The entropy measure allows for distinguishing between related (four digit SIC code) and unrelated (two digit SIC code) diversification by constructing an index that combines the advantages of both categorical classification ratios (Rumelt, 1974) and product-count type measures of the total diversity of a firm's operations (Amit & Livnatt, 1988; Palepu, 1985). The measure resonates well with the findings of more contemporary studies suggesting that any type of diversification, whether related or unrelated, creates value for the firm (e.g. Mackey et al., 2017). It has also been applied in recent empirical analyses (e.g. Delios, Xu, & Beamish, 2008; O'Brien et al., 2014; Su & Tsang, 2015). The computation is as follows:

$$DT = \sum_{i=1}^N P_i \ln\left(\frac{1}{P_i}\right)$$

where P_i is the share of the i th segment in the total sales of the firm.

The other important independent variable is board capital as represented by the board interlocks. As it was postulated in the original resource dependence theory, board composition and size reflect the degree of dependence with the external environment (Pfeffer, 1972) since this is one of the means to retain control and power within the organization. Board interlocks has been extensively researched in the context of resource dependence literature (e.g. Hillman & Dalziel, 2003; Johnson, Daily, & Ellstrand, 1996; Zahra & Pearce, 1989). Board interlocks show how influential the social network of CEOs is, which can have an effect on the firm's strategic interactions with other actors (e.g. Gulati & Westphal, 1999). The board capital that the board of directors brings in the form of connections and expertise can be used as a tool to manage and control interdependencies, and thus make strategic investments to enter new markets.

Along with the direct relationships several variables have been identified as moderators and mediators. These variables serve as conditions enabling the firm to successfully diversify. The technical capabilities are operationalized with the logged number of patents in technical fields. They represent the knowledge that the company possesses which can be reconfigured and applied to the new market (Moeen, 2017). The larger the technological breadth is, the more likely that the company has the relevant expertise. In addition to that the integration process should run smoothly which requires integrative capabilities. Alongside past empirical studies it can be concluded that firms who are already active in various business segments, have successfully undergone integration in the past which is evidence for integrative capabilities. The logged number of business segments then serves as a

proxy for integrative capabilities (Chen et al., 2012; Helfat & Campo-Rembado, 2016; Kapoor, 2013; Moeen, 2017). Finally, large incumbent firms need the motivation to diversify. Very often they grow too dependent on their current customer demand and environment (Gilbert, 2005) which might make them less willing to disrupt their usual way of doing business. If current performance is satisfactory then they might be more cautious to take the risk of diversifying. If, however, performance is below a certain aspiration level, then the motivation to adopt a new business practice is more pronounced (Eggers & Kaul, 2018; Eggers & Park, 2018; Miller & Yang, 2016). Motivation is measured as a moving average of the revenue throughout the period (2008-2017). Companies whose revenues are quite stable and satisfactory can be expected to be less motivated to diversify.

The dependent variable is firm performance. There has been an on-going debate in management literature regarding the best measure for that indicator. A reason for that is the multidimensionality of the variable since it encompasses both aspects of organizational performance and effectiveness. In that sense it can reflect both the traditional measures associated with economic performance such as profits, sales, shareholder return, etc. but also with more efficient internal processes (Richard, Devinney, Yip, & Johnson, 2009). Despite the vast array of possible approaches to measuring firm performance, those based on accounting indicators have been the most validated in previous research (e.g. Danielson & Press, 2003; Jacobson, 1987; Richard et al., 2009). Part of the complexity to truly capture the diversification-performance relationship is the fact that both constructs comprise of multiple dimensions that have been overlooked in early studies (Ahuja & Novelli, 2016). This thesis will make use of the measure that has been most widely empirically verified, namely the return on assets (ROA) which illustrates efficiency with regard to the total use of assets (e.g. Ansoff, 1965; Bourgeois, 1980; Chakrabarti, Singh, & Mahmood, 2007; Dess & Robinson, 1984; Gale, 1972; Miller & Yang, 2016; Su & Tsang, 2015).

Control Variables

To account for the fact that other factors might also influence firm performance and diversification, several variables that have been found to be of importance will be controlled for. These have been established as key indicators in previous empirical studies of diversification (e.g. Chakrabarti et al., 2007; Chatterjee & Wernerfelt, 1991; Mackey et al., 2017; Markides, 1995; Miller & Yang, 2016; O'Brien et al., 2014; Su & Tsang, 2015), resource dependence (e.g. Casciaro & Piskorski, 2005) or firm performance in general (e.g. Decarolis & Deeds, 1999; Huselid, Jackson, &

Schuler, 1997). In general they illustrate the company's access to resource as well as certain constraints that might both affect the relationship.

- Firm size as measured by the company's total assets. Larger firms can be said to have more assets at their disposition, and be also more resilient to risk (e.g. Chakrabarti et al., 2007; Chang & Hong, 2002; Mawdsley & Somaya, 2018) which enables them to pursue diversification. Organizational size has also been associated with efficiency and legitimacy which is a prerequisite for improved performance (Greve, 2008; Miller & Yang, 2016; Moeen, 2017; Su & Tsang, 2015). Furthermore, larger firms are found to be more likely to successfully commercialize new products and technologies and overcome barriers of external knowledge acquisition (Eggers & Park, 2018). This can affect how successful they are in their new diversified markets. Other measures of size such as total sales and number of employees are found to yield similar results (e.g. Carpenter, 2002).
- R&D intensity is measured by R&D expenses as a percentage of operating revenue to account for the fact that more profitable firms can have an access to a greater knowledge base. Diversified firms have been found to have greater breadth of technology than focused ones (Miller, 2004; Miller 2006). This implies that they have an excess of technological and knowledge resources which are deployed into a more productive use (Baysinger & Hoskisson, 1989). Higher R&D intensity is also associated with more innovation and creation of commercially viable products and services (e.g. Artz, Norman, Hatfield, & Cardinal, 2010; Su & Tsang, 2015) which improves performance.
- Employee productivity represents the quality of human capital. The company may possess a large amount of resources but in order for them to generate returns employees should make effective use of them. Higher labour productivity is an indication for efficiency and effective strategic human resource management which increases overall market performance (Richard & Johnson, 2001). Additionally, employees are carriers of accumulated tacit knowledge that needs to be strategically leveraged in the new market setting, thus they might influence the outcome of diversification (Chang, 1996; Miller & Yang, 2016). The variable is measured by profit per employee.
- Debt/Equity ratio is an indication for the company's capital structure. A higher debt burden would imply that top management should be more efficient in allocating resources and choosing investments wisely (Jensen, 1986; Markides, 1995; Miller & Yang, 2016; O'Brien et al., 2014).

Table 3 represents summary statistics for the list of variables.

	Mean	Standard deviation	Minimum	Maximum	Skewness	Kurtosis
Diversification	0.46	0.58	0.00	2.31	1.19	3.30
Technical capabilities	6.15	3.81	0.00	12.97	-0.25	2.01
Motivation	7.67	1.67	-0.48	11.13	-0.88	4.94
Board Capital	3.99	0.94	1.79	7.29	0.08	3.54
Integrative capabilities	1.00	0.44	0.69	2.20	1.27	3.44
Employee Productivity	3.65	1.27	0.00	6.74	-0.23	2.89
Size	9.31	1.38	3.96	12.84	-0.20	3.65
R&D Intensity	10.77	8.66	1.00	55.41	1.00	4.29
Debt/Equity	0.89	0.62	0.08	6.90	2.51	17.35
<i>N</i>	1190					

Table 3. Summary statistics after data transformation

The entropy measure for diversification ranges from 0 (indicating a single business-company) to 2.31. Skewness and kurtosis are also reported in the table, and indicate the deviation of the data from the normal distribution. For some variables such as Diversification, Technical and Integrative capabilities the values fall within the acceptable range for a normal distribution, i.e. (-1.96, 1.96) for skewness and 3 for kurtosis. Other predictors such as Board capital, Debt/Equity and Motivation fall out of this range. This implies that the data departs from the normal distribution. When checking the normality of the residuals, however, there were no deviations from normality which is more crucial for the analysis. Natural logarithms have been taken anyway to have more coherent measurement levels for all variables. Table 2a in the appendix section 2 illustrates the summary statistics before transforming the variables. The transformations did indeed alleviate the problem of skewness and kurtosis significantly. The majority of their values are within the normal distribution range with the exception of Debt/Equity, which even after the natural logarithms exhibit kurtosis, however to a much less degree than previously.

Tables 4 shows the correlation matrix for the first model.

	Diversification	Board Capital	Motivation	Size	Debt/Equity	R&D Intensity	Employee Productivity
Diversification	1.00						
Board Capital	0.35 (0.00)	1.00					
Motivation	0.41 (0.00)	0.37 (0.00)	1.00				
Size	0.57 (0.00)	0.41 (0.00)	0.72 (0.00)	1.00			
Debt/Equity	0.20 (0.00)	0.11 (0.00)	0.26 (0.00)	0.14 (0.00)	1.00		
R&D Intensity	-0.31 (0.00)	-0.21 (0.00)	-0.35 (0.00)	-0.18 (0.00)	-0.25 (0.00)	1.00	
Employee Productivity	-0.18 (0.00)	-0.10 (0.00)	-0.17 (0.00)	0.09 (0.01)	-0.33 (0.00)	0.38 (0.00)	1.00

Note: P-values in parentheses *Table 4. Correlation matrix for model 1*

The correlation coefficients between the dependent variable Diversification and the two main predictors Motivation and Board capital are moderately positive. The control variable Size is rather strongly correlated with Motivation (0.72) and Board capital (0.41). Other empirical studies have also detected that when firm size is being controlled for, rather high correlations are observed with other predictors (e.g. Eggers & Kaul, 2018). This is only logical since larger firms are expected to generate more revenue, invest intensively in technology and operate in more complicated environments. None of the other bivariate correlations are excessive. However, the positive and somewhat high correlations between the above mentioned explanatory variables might be an indication for multicollinearity. Therefore, the variance inflation factor (VIF) is used as an estimator of multicollinearity between the predictors. The results are presented in the table 3a in the appendix section 2. The highest VIF value is 2.01 for the variable Motivation, which is high, but still lower than the critical value of 10. High VIF values imply that the standard errors of this control variable has been inflated 1.418 as shown by the square root of vif, which would make it harder to find a significant effect.

Model 2 investigates how diversification is translated into improved performance through technical and integrative capabilities. Table 5 exhibits the correlation matrix for model 2.

	ROA	Diversification	Technical capabilities	Integrative capabilities	Employee Productivity	Size	Debt/Equity	R&D Intensity
ROA	1.00							
Diversification	-0.09 (0.01)	1.00						
Technical capabilities	-0.11 (0.00)	0.36 (0.00)	1.00					
Integrative capabilities	-0.00 (0.99)	0.24 (0.00)	0.17 (0.00)	1.00				
Employee Productivity	0.65 (0.00)	-0.18 (0.00)	-0.02 (0.58)	0.02 (0.54)	1.00			
Size	-0.05 (0.12)	0.57 (0.00)	0.38 (0.00)	0.26 (0.00)	0.09 (0.01)	1.00		
Debt/Equity	-0.36 (0.00)	0.20 (0.00)	-0.05 (0.09)	0.25 (0.00)	-0.33 (0.00)	0.14 (0.00)	1.00	
R&D Intensity	0.15 (0.00)	-0.31 (0.00)	0.06 (0.06)	-0.11 (0.00)	0.38 (0.00)	-0.18 (0.00)	-0.25 (0.00)	1.00

Note: P-values in parentheses

Table 5. Correlation matrix for model 2

The correlation coefficients between the dependent variable firm performance and the main independent variables Diversification and Technical and Integrative capabilities are very low which indicates that would be rather difficult to find a significant effect. Size is again moderately correlated with the three main predictors. The vif values (table 4a in the appendix, section 2), however, are not excessive. The highest value is for the variable Size, which as already discussed is quite common in empirical analysis. Therefore, there are no concerns for multicollinearity.

Empirical Approach

The analysis will be conducted on the statistical software STATA version 13. The thesis aims to analyze two models using a panel set of 119 IT firms for a 10-year period. The first model will examine the relationship between Board capital and Diversification applying standard panel regression including interactions and squared terms.

The second stage will test the model on firm performance and diversification which hypothesizes mediation effects. They will be tested by first applying the 3-step approach as suggested by Baron and Kenny (1986) in order to detect if there is some mediation. If evidence of mediation is

found, a more updated technique will be used to test the significance of those mediation effects in STATA through causal mediation analysis (Imai, Keele, & Tingley, 2010). The advantages of this analysis technique are that it is based on the Barron and Kenny approach making it easy to interpret while it also provides statistical inference and sensitivity analysis (Hicks & Tingley, 2011).

Finally, in order to validate the main results several robustness checks will be run by applying split samples where the same analysis will be run on smaller subsamples of the population. For instance, it would be insightful to see whether there is a difference between the companies that are true diversifiers (having an entropy measure higher than or equal to 1) and those that are more specialized (entropy measure lower than 1). With the robustness checks the goal is to obtain a reliable interpretation of the causal relationships and derive recommendations for practitioners (Lu & White, 2014).

Results

The analysis begins with testing the first model on diversification. The results are shown below in table 6.

	(1)	(2)	(3)	(4)	(5)
	Model 1.1	Model 1.2	Model 1.3	Model 1.4	Model 1.5
Board Cap	0.1822*** (0.0645)	0.1779*** (0.0648)	0.1701*** (0.0641)	0.1943*** (0.0554)	0.2213*** (0.0568)
Motivation		-0.0222 (0.0480)	-0.1305 (0.1330)	-0.2574** (0.1278)	-0.2304† (0.1426)
Motivation ²			0.0082 (0.0115)	0.0175† (0.0115)	0.0172† (0.0119)
BoardCap*Motivation				-0.0575* (0.0334)	0.1925* (0.1058)
BoardCap*Motivation ²					-0.0175** (0.0080)
Size	0.0635*** (0.0223)	0.0973** (0.0449)	0.0853* (0.0472)	0.0758* (0.0457)	0.0764* (0.0436)
Debt/Equity	0.0100 (0.0234)	0.0370** (0.0173)	0.0351* (0.0186)	0.0307* (0.0178)	0.0268† (0.0178)
R&D Intensity	-0.0046 (0.0036)	-0.0064** (0.0028)	-0.0060** (0.0029)	-0.0054* (0.0028)	-0.0046* (0.0027)
North American	-0.0914 (0.1596)	-0.0506 (0.1523)	-0.0628 (0.1469)	-0.0259 (0.1472)	0.0287 (0.1523)
Asian	-0.0410 (0.1741)	-0.0149 (0.1708)	-0.0264 (0.1665)	0.0050 (0.1614)	0.0532 (0.1665)
Constant	-0.6596* (0.3893)	-0.8149** (0.3837)	-0.3418 (0.5893)	0.0548 (0.6664)	-0.2831 (0.6927)
Observations	846	663	663	663	663
R-squared	0.2800	0.3273	0.3455	0.3510	0.3595
Number of id	93	92	92	92	92

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1, † p<0.15
Table 6. Results for Diversification

The model has been estimated using panel regression with fixed and random effects respectively. The Hausman test was then applied to see if there are systematic differences between the coefficients. The test was significant ($p = 0.0000$), indicating that fixed effects model should be preferred since there might be some other unobserved factors not included in the model that affect the relationship. Recent research, however, has reached the conclusion that the Hausman test should not be used as an indication of the type of model since theoretical applications should also be considered (Bell & Jones, 2015; Bell, Fairbrother, & Jones, 2016). Random effects are more in line with the theoretical setting of the thesis given that the time period is short and there is little variation in some predictors whose impact will be lost if fixed effects model is used. To account for the bias and the systematic difference

in coefficients, a regional dummy was added to the random effects model indicating whether the enterprise is North American, Asian or European (the reference category). The sampled companies are converging in other unobserved characteristic, namely they are active in the same industry and are relatively large in size. In that way the random effects model is equivalent to a fixed effects model since some constant firm-specific characteristics are incorporated in the analysis. The model was also tested for heteroscedasticity by applying the likelihood ratio test which gave a significant result ($p = 0.0000$) even after the log transformations. Therefore, robust standard errors have been used throughout all the steps of the analysis. The Wooldridge test for autocorrelation did not indicate any concerns about serial correlation.

The explanatory power of the model is quite good ranging from 28 to almost 36% as it can be seen from the R-squared. Some observations have been lost due to the data transformations and missing values, but the sample size is big enough to allow statistical inference. The main predictors have been added to the model step by step in order to illustrate the impact of each variable. The control Employee Productivity has been excluded since it had quite some missing values from which the analysis could suffer. All interaction and squared terms have been mean centered to control for any potential multicollinearity.

The main independent variable remains significant and positive throughout all the steps of the analysis which is a robust evidence supporting the first hypothesis. Board capital does indeed contribute to diversification. As already established in past literature board capital facilitates internationalization as a strategy (e.g. Sanders & Carpenter, 1998) whereas this thesis finds evidence that board capital facilitates diversification as well. With regard to the role of motivation as a driver for diversification (hypothesis 1a and b), the analysis shows some mixed evidence. The coefficients of the squared and non-squared terms are with the expected signs, however, they are not robustly significant throughout the analysis. It is a partial proof that if indeed revenue declines or suddenly improves, the strength of the board capital as a diversification factor decreases. The interaction term is interpreted as follows: when Board Capital increases with 1%, and the level of Motivation is taken to be 7.67%, which is the average value for the sample, then Diversification would increase by 23.606%. Additionally, comparing the values in the last few columns, it can be seen that the interaction terms have strengthened the effect of Board capital, which supports hypothesis 1a. Another interesting insight from the analysis of the first model is that the dummy for Asian and North American enterprises are not significant which implies that other things held constant IT companies from different countries and regions do not exhibit distinct diversification trends.

Table 7 shows the results from the panel regression for the relationship between diversification and performance.

	(1)	(2)
	Model 2.1	Model 2.2
Diversification	-0.1434* (0.0871)	-0.2303* (0.1260)
Diversification ²		0.1183 (0.0988)
R&D Intensity	-0.0443*** (0.0100)	-0.0440*** (0.0100)
Size	0.0064 (0.0744)	0.0050 (0.0743)
Debt/Equity	-0.5115*** (0.1534)	-0.5114*** (0.1536)
North American	0.2584 (0.2055)	0.2458 (0.2036)
Asian	-0.5996*** (0.2303)	-0.6199*** (0.2312)
Constant	2.9256*** (0.7024)	2.9555*** (0.7054)
Observations	767	767
R-squared	0.1530	0.1487
Number of id	92	92

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1, † p<0.15
Table 7. Results for Performance

The same procedure as the one for the first model was followed. The results indicate that there is indeed some evidence for a non-linear relationship between diversification and firm performance as it can be seen from the coefficients of the first two variables. This is in line with hypothesis 2a and the more recent trends in diversification literature (Ahuja & Novelli, 2016; Hashai, 2015; Palich, Cardinal, & Miller, 2000). The evidence, however, is not sufficiently robust to grant full support for the hypothesis. The regional dummies are also significant in the two columns. In general, Asian companies tend to be less profitable than European or North American firms. An explanation for this could be that Asian firms are often affiliated with larger conglomerates, which has been found empirically to be associated with lower financial performance (e.g. Carney, Gedajlovic, Heugens, van Essen, & van Oosterhout, 2011). The control variable Debt/Equity as an indication of the firm indebtedness is significant and with the expected sign, as for R&D intensity scholars have not reached an agreement. There is evidence in literature that excessive investments in R&D could hurt firm performance (e.g. Koellinger, 2008; Matsusaka, 2001).

The second model, however, aims to detect the presence of mediation effects. In order to obtain statistical validation the 3-step Baron and Kenny approach (1986) is applied. The analysis is comprised of separate regressions where in the first step the dependent variable is the mediator (Technical/Integrative capabilities), in the second the same model is run on performance, and then lastly the mediator is added to see whether it reduces the significance or impact of the other

independent variables. The 3-step regression results are presented in the appendix table 5a section 3. Including technical capabilities in the final column did indeed change the sign and impact of diversification on firm performance which shows a possible mediation effect (table 5a $\beta = -0.0577$ in the second and $\beta = -0.0295$ in the third column). The significance of such an effect is tested with causal mediation analysis in STATA. The confidence intervals are reported in table 8 below.

Effect	Mean	[95% Conf.	Interval]
ACME	-.0290049	-.0602412	-.0057292
Direct Effect	-.0259371	-.153024	.100765
Total Effect	-.0549419	-.1819872	.0719717
% of Tot Eff mediated	.3274364	-5.534899	6.016338

Table 8. Mediation effect significance for Technical capabilities

The first path is the one between Technical capabilities (mediator) and Diversification (treatment), which is significant and positive ($\beta = 0.7850; p = 0.000$). The second path is the one between the mediator and Performance (outcome), which is negative and significant ($\beta = -0.0514; p = 0.000$), whereas the third path between the treatment and the outcome is insignificant ($\beta = -0.0295; p = 0.653$). The mediation effect can be deemed significant despite one of the paths being insignificant since the additional analysis has shown that the mediation effect (ACME) is within the range of significance. The significance of the effect can be seen by whether the mean falls within the range of the 95% confidence interval in the third column. The average effect of the mediator (Technological capabilities) on the outcome variable (Performance) is -0.0290, whereas the average effect of the treatment (Diversification) on the outcome (Performance) is -0.0259. The percentage of the total effect mediated is approximately 33%.

With causal mediation analysis it is always recommended to conduct sensitivity analysis in order to check the robustness of the results under the sequential ignorability assumption (Hicks & Tingley, 2011). In other words this sensitivity check controls whether the assumptions the researcher has made are debatable, and whether a slight violation of those assumptions would lead to different conclusions, for instance due to omitted variables, etc. The results are presented in the graph below, and the total output in the appendix section 3 table 7a.

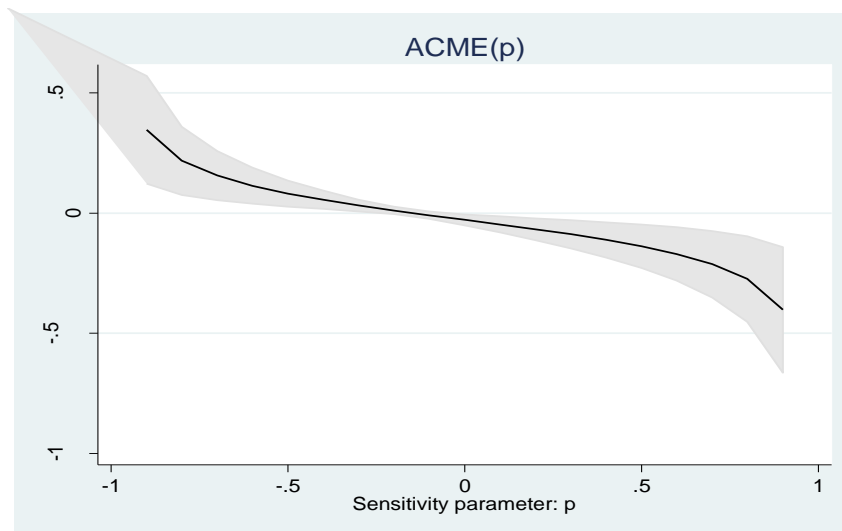


Fig.2. Sensitivity analysis for Technical capabilities

The analysis indicates that for the average causal mediation effect to be zero the correlation between the error terms (ρ) should be approximately -0.15. It should be noted, however, that there exists no scale indicating what is deemed to be small, medium or large correlations between residuals (Cox, Kisbu-Sakarya, Miočević, & MacKinnon, 2013). The product of the R^2 's measures of sensitivity for the mediator and outcome models for the residual and total variance are also exhibited in the table. For the ACME to be zero, the product of those variances should be 0.0215. For example, an omitted variable should explain 20% of the remaining variance in the mediator and 10.75% of the remaining variance in the outcome ($0.2 * 0.1075 = 0.0215$). Since it is a product other combinations are also possible. With respect to the total variation, the product of the R^2 's is 0.0087. The further the curve is from the y-axis when it crosses the x-axis, the less likely is for the omitted confounder to be a problem in the model (Cox et al., 2013). Therefore, it can be concluded that in this case there are no concerns regarding the sensitivity of the model.

The same procedure is then repeated for analyzing the second mediation effect through Integrative capabilities. The three separate regressions adhering to the Baron and Kenny approach are examined first (table 6a in the appendix) followed by bootstrapping in order to capture their significance (table 9 below).

Effect	Mean	[95% Conf.	Interval]
ACME	.002932	-.0037788	.0126493
Direct Effect	-.0575556	-.1701217	.0546696
Total Effect	-.0546235	-.1671593	.0568244
% of Tot Eff mediated	-.0375309	-.5011833	.4864039

Table 9. Mediation effect significance for Integrative capabilities

The first path between Integrative capabilities (mediator) and Diversification (treatment) is significant

and positive ($\beta = 0.0825; p = 0.005$). The second path between the mediator and Performance is negative and insignificant ($\beta = 0.0724; p = 0.400$). The third path between the Diversification and Performance is also insignificant ($\beta = -0.0607; p = 0.350$). The additional bootstrapping analysis can be more revealing about the significance of each causal effect. The average causal effect is positive and significant. The direct effect, i.e. the one that does not include the mediator is also significant but negative. The mediation effect, however, is quite small to overcome the negative direct effect, which explains why the total effect is negative. The sensitivity graphic is depicted below, and the output can be found in the appendix section 3 table 8a. It indicates that for the average mediation effect to be zero the correlation in the error terms should be 0.0315. The curve is intersecting the x-axis closer to 1 indicating that there is no confounder bias.

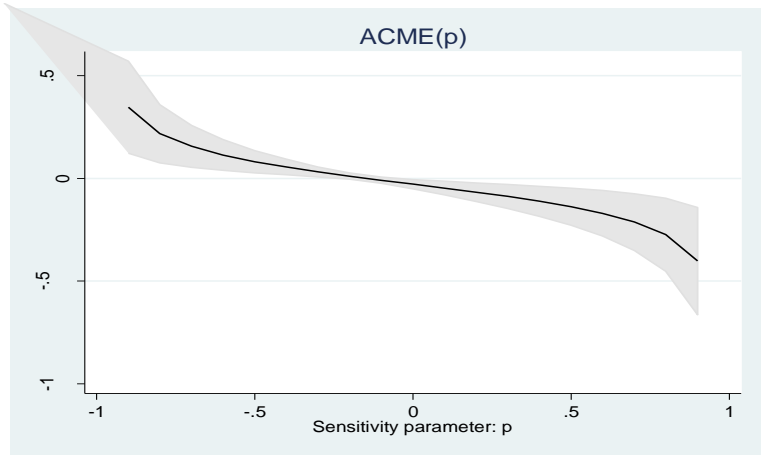


Fig.3. Sensitivity analysis for Integrative capabilities

Robustness Tests

In order to better illustrate the differences between the impact of diversification factors and the impact of diversification itself on firm performance, the same analysis will be run on smaller subsamples distinguishing between more diversified and more focused firms. The benchmark for this is the value of the entropy measure – higher than or equal to 1 for the first group and lower than 1 for the second. Table 10 shows the differences between the two for the first model.

	(1) <i>Diversified</i>	(2) <i>Focused</i>
Board Cap	0.0497 (0.0423)	0.0303 (0.0345)
Motivation	0.3637 (0.2648)	-0.0455 (0.1712)
Motivation ²	-0.0295 (0.0217)	0.0030 (0.0109)
BoardCap*Motivation	0.0028 (0.0846)	0.1078 (0.0882)
BoardCap*Motivation ²	-0.0019 (0.0068)	-0.0085* (0.0045)
Size	0.2448** (0.1247)	0.0492 (0.0335)
Debt/Equity	0.0050 (0.0158)	0.0305 (0.0198)
R&D Intensity	-0.0059 (0.0072)	-0.0025 (0.0018)
North American	0.0441 (0.1284)	-0.0362 (0.0882)
Asian	0.1815 (0.1465)	-0.0587 (0.0913)
Constant	-2.2516 (1.8341)	-0.0478 (0.5585)
Observations	163	500
R-squared	0.1944	0.1891
Number of id	34	77

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 10. Results for the first model for subsamples

The analysis does not reveal big differences between the two groups. The drivers for diversification in terms of motivation as expressed in the revenue have lost their significance for the group of diversified firms. The effect is diminished since firms who have already entered several markets might base their strategic decisions on other considerations such as degree of relatedness, cost reduction, etc. Firm size is the only factor influencing the relationship. Companies that have already diversified have grown inorganically, and thus have more resources to enter new markets than relatively more focused firms. The results for the group of the more focused firms indicate that motivation can be a factor to some extent that influences diversification strategy. Even though not all coefficients are significant, they are in the hypothesized direction emphasizing non-linear relationships. Therefore, it can be said that diversified firms due to being larger in size and having access to more resources are more prone to keep diversifying than focused firms irrespective of the location. Companies with a relatively lower degree of diversification might indeed be more inclined to diversify based on their current performance and aspiration level, as shown by the significance of the second interaction term.

The second model testing the Diversification-Performance relationship and the mediation effects has also been validated.

	(1) <i>Diversified</i>	(2) <i>Focused</i>
Diversification	1.1571 (0.8734)	-0.4521** (0.2219)
Diversification ²	-0.4267 (0.3884)	-0.3446 (0.5893)
R&D Intensity	0.0002 (0.0199)	-0.0459*** (0.0116)
Size	-0.2699** (0.1369)	0.0767 (0.0836)
Debt/Equity	-0.3129* (0.1662)	-0.7258*** (0.1502)
North American	0.2949 (0.2864)	0.2357 (0.2203)
Asian	-0.7646* (0.3935)	-0.4094* (0.2320)
Constant	3.9770** (1.8246)	2.5507*** (0.7712)
Observations	189	578
R-squared	0.3160	0.1439
Number of id	33	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11. Results for the second model for subsamples

The robustness checks show quite some differences between the groups. It can be said that diversification could lead to better firm performance only in the cases where the companies are already diversified to a certain degree, whereas this relationship is negative and significant for more focused firms. The analysis does not show robust evidence for non-linearity for the two subsamples. In fact for the first group, there is some indication that after a certain optimal level the effect of more diversification is detrimental for performance, i.e. implying an inverted U-shape relationship whereas for the second group the coefficients remain negative. Firms that have already diversified have established some synergies which have been translated into superior performance, thus it is easier for them to build up on it. The control variables for indebtedness and R&D have more negative impact on the group of focused firms. This might be due to the fact that diversification is a source of financial synergies, and leveraging knowledge as previous literature suggests (e.g. Chang, 1996; Gopalan & Xie, 2011; Miller & Yang, 2016; O'Brien et al., 2014). Size, on the other hand, is only detrimental to profitability for the subgroup of diversified firms. They are more likely to be bigger in size which implies coordination and administrative costs affecting performance.

The complete output of the mediation analysis can be seen in the appendix tables 9a to 12a and figures 1a and 2a section 4.1. The significance and impact of the mediation effects through Technical capabilities for the subgroups are exhibited in the table below.

Diversified firms

Effect	Mean	[95% Conf.	Interval]
ACME	.1515741	.0155393	.3301846
Direct Effect	-.0702598	-.5031351	.3613043
Total Effect	.0813143	-.3545686	.4959927
% of Tot Eff mediated	.4876609	-12.74367	8.576064

Focused firms

Effect	Mean	[95% Conf.	Interval]
ACME	-.0745833	-.1461442	-.0093468
Direct Effect	-.0320292	-.2804842	.2156732
Total Effect	-.1066125	-.3254618	.1182781
% of Tot Eff mediated	.468328	-5.525834	8.875572

Table 12. Mediation effects for Technical capabilities for the two subgroups

The mediation effects fall within the range of confidence interval for both subgroups. For diversified firms it can be concluded that technical capabilities fully mediate the effect – the coefficients in table 9a show that diversification as the treatment is insignificant in the third column in the presence of the mediator ($\beta = -0.0823; p = 0.760$). For the subgroup of focused firms the output also suggests that there is full mediation since diversification is again not significant in the presence of the mediator ($\beta = -0.0389; p = 0.754$). The mediated effect is slightly stronger for diversifiers (49% compared to 47% for the focused subgroup). The robustness check confirms the conclusions from the main analysis. The sensitivity statistics and graphs exhibited in the appendix also validate the main analysis. The rho would have to equal -.1427 for the subgroup of diversified, and -0.0941 for focused firms in order for the true mediated effect to be zero.

The same procedure is then followed for Integrative capabilities for the two subgroups. Tables 13a to 16a and figures 3a and 4a in the appendix section 4.2 show the separate regressions and the sensitivity analysis.

Diversified firms

Effect	Mean	[95% Conf.	Interval]
ACME	.0306443	-.0411319	.1293715
Direct Effect	.0539141	-.3563505	.4629361
Total Effect	.0845583	-.3122165	.4795066
% of Tot Eff mediated	.1044562	-3.533266	1.809834

Focused firms

Effect	Mean	[95% Conf.	Interval]
ACME	-.0025528	-.0197969	.0074144
Direct Effect	-.1035981	-.3318374	.12395
Total Effect	-.1061508	-.3301258	.1241223
% of Tot Eff mediated	.0163807	-.2679228	.2284706

Table 13. Mediation effects for integrative capabilities for the two subgroups

The 3-step Baron and Kenny regression output from the appendix tables indicates that there is no ground for mediation for any of the subgroups. The coefficients of Diversification are insignificant, but their impact does indeed decrease in the presence of the mediator (for diversifiers it changes from $\beta = 0.0739, p = 0.711$ to $\beta = 0.0425, p = 0.867$; and for focused firms from $\beta = -0.1121, p = 0.353$ to $\beta = -0.1099, p = 0.361$). The bootstrapping shows that the mediation effects are significant for the split samples, but rather small which could be a reason why they cannot be detected in the Baron and Kenny approach. The sensitivity analysis indicates that rho should be equal to 0.0829 for diversified and -0.0255 for focused firms. The models do not suffer from confounder bias.

Discussion

Contribution and Managerial Recommendations

The recent technological landscape has caused quite some alterations of the way traditional businesses work. Due to digitalization companies from various industries have been heavily investing in IT technologies in an attempt to boost their performance and grow. Previous literature has empirically examined the impact of IT technologies on firm performance (e.g. Bharadwaj, Bharadwaj, & Konsynski, 1999; Hu & Plant, 2001; Huang, Ou, Chen, & Lin, 2006), however, there is lack of papers that focus on the IT industry itself as a unit of investigation, and the opportunities these IT companies have due to digitalization. As other traditional industries are struggling to make the transformation to the digital age IT firms are enabling this transition for them by stepping in as business consultants, financial advisers, infrastructure builders, etc. Therefore, they have started to diversify the portfolio of their activities into new areas.

The relationship between firm diversification strategy and firm performance has been widely researched in the past, and academics have discovered that it is not so straightforward. Contingencies such as firm or industry characteristics have been acknowledged, but the majority of the empirical work has been done on large multi-industry samples overlooking those characteristics. Therefore, this thesis contributes to the topic by empirically testing the relationship between firm performance and

diversification in a more updated context, namely by analyzing only IT firms that are at the forefront of digitalization. The aim is to capture how much they can exploit new business opportunities as a source of growth. Additionally, the paper incorporates the importance of internal capabilities (both integrative and technological) as building blocks for the mechanism to work. The complexity of the external environment has also been accounted for examining the role of board capital and how it can bring network and external expertise broadening the diversification perspectives of companies. The analysis has been extensive, and has detected several important insights. There is evidence that indeed board capital positively affects the diversification strategy. There is mixed evidence that the motivational driver for diversification as expressed in the firm's aspiration revenue level has a U-shaped relationship. This effect is found to be more pronounced for firms with a relatively low degree of diversification and should be accounted for when they contemplate strategic entry in new markets. Thus, managers should base their diversification strategies on the network capital and market insight of their external board members to an extent that they can also exploit their existing resource base while still being financially vital.

The second chain of the mechanism explores the relationship between diversification and performance. The analysis partly supports the hypothesis that the relationship is non-linear as more recent studies suggest (e.g. Ahuja & Novelli, 2016; Hashai, 2015). Thus, it can be argued that initially diversification costs may outweigh the benefits in terms of synergies and spreading risks, but later performance is positively affected, or simply the effect turns less negative. Interestingly, the nature of nonlinearity is different depending on the degree of diversification as the robustness test showed, i.e. it is inverted U-shaped for diversified firms, whereas it remains negative for the focused ones. This might be an indication that along with the benefits diversification entails costs in terms of adapting the current resource base onto the new market setting. It can be said that companies need some degree of diversification to be able to capture any potential benefits and improve performance but to a certain limit as it is visible for the subgroup of the already diversified companies. The analysis confirms that the relationship is not so straightforward, and the trade-off between costs and benefits is crucial. The additional mediation analysis indicated that Technical capabilities fully mediate the relationship between diversification and firm performance, whereas integrative capabilities are a weaker mediator. The robustness tests illustrate that the mediation effect of integrative capabilities is considerably more pronounced for diversified companies than for the focused ones. Therefore, it can be concluded that technical capabilities are essential building blocks on which companies that undergo diversification can ensure improved performance. Given that the sample population consisted of IT companies at the forefront of digitalization, it is not surprising that technical capabilities are more relevant. Digitalization has resulted in industry convergence, which might also explain why integrative

capabilities are not so decisive for the said group of companies. However, given the fact that broadening the technological breadth requires investments, practitioners should still make sure that their technology is an optimal fit with the intended market setting and would have its application generating returns. Integrative capabilities on the other hand can smooth the diversification process through coordinating resources and enforcing synergies when companies already have more lines of business. Managers can stimulate the process by providing communication and coordination channels to the middle management level since research has established that they enact organizational linkages (Taylor & Helfat, 2009).

By including the regional dummies the analysis also captured differences among IT companies based on their country characteristics. The results suggest that in general Asian enterprises are more likely to perform worse compared to their North American and European counterparts. This might be due to the specific organizational structures that Asian conglomerates adopt in order to offset domestic market inefficiencies. For instance, business group affiliation is associated with poorer profitability (e.g. Carney et al., 2011), and market immaturity prevents companies from securing resources to enter new businesses (e.g. Lins & Servaes, 2002). Therefore, managers of Asian IT companies might need to develop alternative routes to expand its business activities. Given that their environment is more complex and uncertain, the board network could play even more prominent role in that case. The robustness check, however, unraveled that irrespective of the company's nationality if it is already operating in several business segments it is more likely to diversify further than if it is more specialized. Performance is also superior for diversifiers than for focused firms no matter whether European, North American or Asian. This is good news for practitioners since it indicates that regional disparities cannot be an insuperable obstacle to enter new markets.

With regard to the control variables both the main analysis and the robustness tests validated what has been discovered in previous literature. Size is in general beneficial for diversification since bigger firms are more likely to possess extensive resource base to invest in the new market, and perform better. Indebtedness as measured by the debt-equity ratio might prompt companies to search for new sources of revenue, and thus diversify since it is detrimental for overall performance. R&D intensity affects negatively performance and prevents firms from diversifying since it requires substantial investments. The robustness check, however, indicates that focused firms are more likely to suffer from the negative effects of indebtedness and R&D intensity than diversified ones. This is relevant for practitioners since it confirms that diversification is a source of financial synergies (e.g. Gopalan & Xie, 2011; O'Brien et al., 2014), and it can arguably make the R&D process more efficient as human capital and knowledge, if complementary, can be shared (e.g. Chang, 1996; Miller & Yang,

2016). Managers should also note that if the company grows through diversification the coordination costs might actually hurt profitability as indicated by the negative significant coefficient for Size of the diversified subsample. Therefore, it can be concluded that as companies grow in size they gain access to more resources, knowledge and markets which enable them to diversify further but it also makes them more complicated to manage. The overall impact depends on the interplay between these two trade-offs. As there is an optimal level of diversification, it can be deduced that there are reasonable limits to how much a company can grow, and practitioners should beware of the negative consequences of growing their organization too large to handle.

Future Research Directions

Previous research on the linkage between diversification strategy and firm performance has not taken in much consideration industry characteristics. This thesis aimed to address this research gap by performing an extensive empirical analysis on a relatively smaller sample of representatives of the IT industry. Further in-depth empirical studies on larger samples and longer time periods are necessary in order to exhaustively capture the complexities of the relationship (i.e. non-linearity, mediation, boundary conditions), and pinpoint the channels through which diversification translates into improved performance accounting for industry characteristics. For example, in the research context of this thesis it was established that technical capabilities are vital mediators for the relationship between diversification and performance. Other sets of internal capabilities might be more relevant for other industry contexts, which is worth researching into. The fact that some coefficients were in the hypothesized direction but were not robustly significant throughout the analysis can also be used as implications for future research. This, however, requires more detailed firm- and industry-specific data along with more sophisticated empirical techniques which is beyond the scope of the thesis. Case studies might also be insightful since they allow the precise identification of how the diversification strategy is applied in practice, and how companies trade off between the costs and benefits the strategy entails. The additional robustness tests have detected differences between firms that already have some degree of diversification and those that are relatively more specialized which could be researched in more depth. Future research might also delve into other boundary conditions besides motivation that might affect the diversification patterns of companies. Instances of such might be the relatedness to existing businesses and distinguishing between sources of synergies. The entropy measure of diversification used in this study accounts for the degree of relatedness between the business segments

to an extent. Yet future research might explicitly distinguish between the types of diversification, and identify their effect on performance in different industry contexts.

Conclusion

The on-going digitalization has indeed open many doors for companies in the IT industry. Phenomena in recent years such as IoT, Big Data, Cloud technology have dramatically changed the world of business, and IT firms can take advantage of the current hype. This thesis aimed to empirically investigate the implications digitalization entails for said group of companies and their diversification strategy and market performance. The main argument of the paper was that even when companies possess the necessary motivation, market knowledge, board social capital and connections to enter new business lines, there should be an optimum fit with its internal resource base and capabilities in order to guarantee improved profitability after diversification. Furthermore, it was hypothesized that the internal set of capabilities mediate the diversification process ensuring a smooth reconfiguration of resources, processes, actors, etc. The conducted empirical analysis provided some support for these mechanisms indicating the complexity of the relationships. Board capital is the most essential determinant positively influencing firm diversification whereas the motivation in terms of the aspiration level of the revenue is moderating that relationship. Diversification on the other hand is non-linearly affecting firm performance with the effect being initially negative since at lower degrees of diversification the investment costs may overshadow the synergies, while as firms diversify more intensively internal capabilities come into play that facilitate linkages, resource sharing and synergies positively affecting firm performance. The additional robustness checks have unraveled that depending on the degree of diversification, the nature of the non-linear relationships changes. It is negative for the group of focused firms further emphasizing that companies need certain experience with entering new markets and establishing synergies in order to diversify successfully and be profitable.

Limitations

As with any empirical analysis this one also comes with its limitations. Firstly, missing data lead to the loss of quite some observations despite the fact that the variable with the most missing values, namely Employee productivity, was not included in the analysis in order to reduce this impact. Additionally, the time period of the study was quite short which implied that there is little variation in

some of the firm characteristics that are relatively stable for shorter periods of time. For example, these include the board structure and the internal capabilities. There is also the possibility of measurement errors despite the data source being Orbis. Therefore, future research should take this into account by resolving these data limitations.

Secondly, the sample comprised of companies who are actively diversifying and companies who are relatively more focused on one business line. Since the aim of the thesis is to investigate the pre-conditions for diversification and respectively its impact on firm performance, the sample composition could have biased the results. As the robustness check indicated the nature of the relationship does indeed change for the two groups of companies. Hence, there is room for future research including only “true” diversifiers.

Lastly, the empirical approach also faced some limitations. The Hausman test, standardly used in order to determine whether fixed or random effects should be used in a panel regression, consistently showed that fixed effects model should be run, i.e. indicating that there is difference between the coefficients of the random and fixed effects model. Fixed effects model is generally deemed to be more efficient and it is often preferred since it accounts for unobserved characteristics (Wooldridge, 2015). There is, however, an on-going debate in academia regarding the choice between fixed and random effects which has not been settled yet. In general researchers agree that statistical considerations should not come at the cost of theoretical ones, and that the Hausman test is simply an indication (e.g. Bell & Jones, 2015). The little variance in some key measures of this study is the reason why random effects model is more appropriate for the analysis. The bias in the coefficients was addressed by including regional dummies but, of course, it is possible that there might be other unobserved characteristics that have been omitted. The mediation effect was tested by applying causal mediation analysis in STATA (Imai, Keele, & Tingley, 2010) and the 3-step Baron and Kenny regression (1986). There are more sophisticated techniques, for instance SEM for panel data, yet they require larger datasets which is beyond the scope of the thesis.

Appendix

1. Sample

Position	Company name	Country
#9	Apple	United States
#15	Samsung	South Korea
#19	Microsoft	United States
#24	Alphabet	United States
#43	IBM	United States
#54	Intel	United States
#58	Cisco Systems	United States
#70	Oracle	United States
#77	Deutsche Telekom	Germany
#119	Facebook	United States
#148	Tencent Holdings	China
#390	Baidu	China
#553	RELX Group	United Kingdom
#820	Netease	China
#822	ATOS	France
#898	Yahoo!	United States
#1222	Naver	South Korea
#1367	Iliad	France
#1439	Equinix	United States
#1641	Tsinghua Tongfang	China
#1759	Nomura Research Institute	Japan
#1790	SYNNEX	United States
#1979	F5 Networks	United States
#1998	Akamai Technologies	United States
#171	Hewlett Packard Enterprise	United States
#610	Legend Holding	China
#870	Quanta Computer	Taiwan
#1394	Focus Media Information Technology	China
#1531	Compal Electronics	Taiwan
#1667	Wistron	Taiwan
#1872	Innolux	Taiwan
#1970	China Great Wall Computer	China
#757	Western Digital	United States
#1036	Seagate Technology	Ireland
#1615	NetApp	United States
#701	Adobe Systems	United States
#929	Salesforce.com	United States
#958	HCL Technologies	India
#972	Fiserv	United States

#1042	Intuit	United States
#1045	Amadeus IT Group	Spain
#1155	CDW	United States
#1227	CA	United States
#1251	Check Point Software	Israel
#1321	Dassault Systemes	France
#1405	Open Text	Canada
#1461	Citrix Systems	United States
#1694	Snap	United States
#1809	Autodesk	United States
#1811	VeriSign	United States
#1881	Workday	United States
#1907	Amdocs	United States
#1935	Red Hat	United States
#1967	ServiceNow	United States
#127	Taiwan Semiconductor	Taiwan
#170	Qualcomm	United States
#349	SK Hynix	South Korea
#387	Texas Instruments	United States
#482	Micron Technology	United States
#499	Applied Materials	United States
#531	ASML Holding	Netherlands
#592	Broadcom	Singapore
#726	NVIDIA	United States
#844	NXP Semiconductors	Netherlands
#871	Lam Research	United States
#906	Infineon Technologies	Germany
#991	Mediatek	Taiwan
#1017	Tokyo Electron	Japan
#1049	Advanced Semiconductor	Taiwan
#1067	Analog Devices	United States
#1150	Renesas Electronics	Japan
#1171	Skyworks Solutions	United States
#1246	KLA-Tencor	United States
#1371	Xilinx	United States
#1499	STMicroelectronics	Switzerland
#1504	Maxim Integrated Products	United States
#1904	Microchip Technology	United States
#1955	Advanced Micro Devices	United States
#1973	Nanya Technology	Taiwan
#230	General Dynamics	United States
#271	HP	United States
	EMC	United States
#690	Lenovo	China

#1202	Xerox	United States
	Huawei Investment & Holding Co., Ltd.	China
#997	CGI	Canada
#608	Dell	United States
#608	Nokia Corporation	Finland
#272	Accenture	Ireland
	Bull	France
#1834	Inventec	Taiwan
#203	BT Group	Great Britain
	NTT Data	Japan
#201	Hitachi	Japan
	Alcatel-Lucent	France
#857	Symantec	United States
#877	NEC	Japan
#178	SAP	Germany
	NCR	United States
#460	Fujitsu Limited	Japan
#297	Northrop Grumman	United States
#765	Wipro	India
#649	Fidelity National Information Services	United States
	Acer	Taiwan
#376	Tata Consulting Services	India
#598	Infosys	India
	Cognizant	France
#817	Toshiba	Japan
#449	Sony	Japan
	Xiaomi Inc.	China
#1052	ZTE Corp.	China
#266	Canon	Japan
#811	LG Electronics Inc.	South Korea
#152	Lockheed Martin	United States
#522	Kyocera Corp.	Japan
#639	Capgemini	France
#710	Ericsson	Sweden
#1074	ASUSTeK Computer, Inc.	Taiwan
#1423	Seiko Epson Corp.	Japan

Table 1a. Sample of IT firms. Source: Forbes (2017) & IDC's Global Technology and Industry Research Organization (2015)

2. Descriptive Statistics

	Mean	Standard deviation	Minimum	Maximum	Skewness	Kurtosis
Diversification	0.46	0.58	0.00	2.31	1.19	3.30
Technical capabilities	6.15	3.81	0.00	12.97	-0.25	2.01
Motivation	19428.27	31138.48	1.00	233716.00	3.25	16.53
Board Capital	87.47	147.70	6.00	1462.00	7.59	69.84
ROA	7.17	10.20	-62.79	71.34	-1.22	12.41
Integrative capabilities	1.00	0.44	0.69	2.20	1.27	3.44
Employee Productivity	68.79	112.81	-96.00	842.00	3.32	17.39
Size	26708.05	42783.02	52.37	375320.00	3.19	15.94
R&D Intensity	10.77	8.66	1.00	55.41	1.00	4.29
Debt/Equity	2.44	43.68	-815.01	991.21	5.20	407.40
<i>N</i>	1190					

Table 2a. Summary statistics before data transformation

VARIABLE	VIF
Motivation	2.01
Size	1.97
R&D intensity	1.50
Employee productivity	1.39
Debt/Equity	1.34
Board Capital	1.23
Mean VIF	1.57

Table 3a. VIF values for model 1

VARIABLE	VIF
Size	2.16
Diversification	1.99
R&D intensity	1.66
Employee productivity	1.52
Debt/Equity	1.35
Technical capabilities	1.34
Integrative capabilities	1.30
Mean VIF	1.62

Table 4a. VIF values for model 2

3. Analysis and Results

	(1)	(2)	(3)
	Technical cap	ROA	ROA
Diversification	0.7850*** (0.2178)	-0.0577 (0.0651)	-0.0295 (0.0642)
Technical cap			-0.0514*** (0.0107)
Size	0.9870*** (0.0971)	-0.0129 (0.0310)	0.0389 (0.0314)
Debt/Equity	0.0649 (0.1348)	-0.6077*** (0.1106)	-0.6003*** (0.1104)
R&D Intensity	0.1185*** (0.0139)	-0.0173*** (0.0062)	-0.0103 (0.0064)
North American	3.2363*** (0.3044)	0.0568 (0.0866)	0.2324*** (0.0887)
Asian	5.5054*** (0.2882)	-0.5484*** (0.0989)	-0.2607** (0.1083)
Constant	-7.3666*** (0.8606)	2.9583*** (0.3076)	2.5580*** (0.3047)
Observations	869	767	767
R-squared	0.4640	0.1948	0.2121

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5a. 3-step mediation for Technical capabilities

	(1)	(2)	(3)
	Integrative cap	ROA	ROA
Diversification	0.0825*** (0.0295)	-0.0577 (0.0651)	-0.0607 (0.0648)
Integrative cap			0.0724 (0.0859)
Size	0.0615*** (0.0127)	-0.0129 (0.0310)	-0.0192 (0.0333)
Debt/Equity	0.1362*** (0.0234)	-0.6077*** (0.1106)	-0.6139*** (0.1108)
R&D Intensity	-0.0153*** (0.0023)	-0.0173*** (0.0062)	-0.0156** (0.0062)
North American	0.5160*** (0.0366)	0.0568 (0.0866)	0.0170 (0.0858)
Asian	0.0490 (0.0335)	-0.5484*** (0.0989)	-0.5497*** (0.0981)
Constant	0.1549 (0.1214)	2.9583*** (0.3076)	2.9555*** (0.3074)
Observations	869	767	767
R-squared	0.3466	0.1948	0.1956

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6a. 3-step mediation for Integrative capabilities

Sensitivity results	
Rho at which ACME = 0	-0.1466
R ² _M *R ² _Y * at which ACME = 0:	0.0215
R ² _M ~R ² _Y ~ at which ACME = 0:	0.0087

Table 7a. Sensitivity results for Technical capabilities

Sensitivity results	
Rho at which ACME = 0	0.0315
R ² _M *R ² _Y * at which ACME = 0:	0.001
R ² _M ~R ² _Y ~ at which ACME = 0:	0.0005

Table 8a. Sensitivity results for Integrative capabilities

4. Robustness Tests

4.1 Technical capabilities mediation

	(1)	(2)	(3)
	Technical cap	ROA	ROA
Diversification	-2.0919*** (0.5364)	0.0739 (0.2535)	-0.0823 (0.2693)
Technical cap			-0.0664*** (0.0253)
Size	1.3244*** (0.1719)	-0.2599*** (0.0883)	-0.1652* (0.0922)
Debt/Equity	0.5076** (0.2239)	-0.4625*** (0.1539)	-0.4360*** (0.1529)
R&D Intensity	0.1585*** (0.0396)	-0.0008 (0.0138)	0.0064 (0.0147)
North American	3.1543*** (0.5133)	0.3446* (0.1810)	0.5786*** (0.1781)
Asian	7.7225*** (0.4347)	-0.9470*** (0.2201)	-0.4123 (0.3101)
Constant	-8.5548*** (1.7732)	5.1758*** (0.8193)	4.5633*** (0.8100)
Observations	209	189	189
R-squared	0.6642	0.3159	0.3319

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9a. 3-step mediation for Technical capabilities for the subgroup of diversified firms

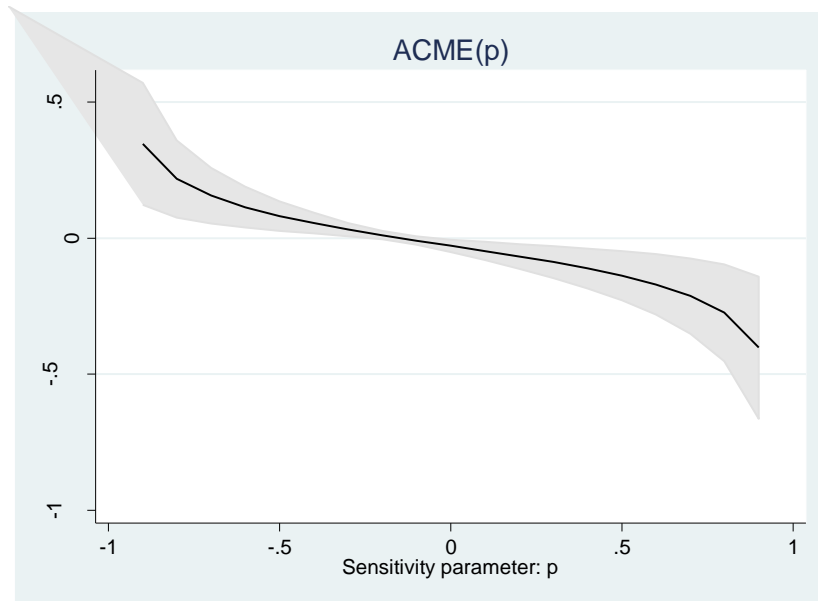


Fig. 1a. Sensitivity analysis for Technical capabilities for diversified firms

Sensitivity results

Rho at which ACME = 0		-.1427
$R^2_M * R^2_{Y^*}$ at which ACME = 0:		.0204
$R^2_M \sim R^2_{Y\sim}$ at which ACME = 0:		.0045

Table 10a. Sensitivity analysis for Technical capabilities for diversified firms

	(1)	(2)	(3)
	Technical cap	ROA	ROA
Diversification	2.7664*** (0.3514)	-0.1121 (0.1206)	-0.0389 (0.1243)
Technical cap			-0.0318*** (0.0121)
Size	0.8963*** (0.1132)	0.0183 (0.0334)	0.0481 (0.0340)
Debt/Equity	-0.1254 (0.1736)	-0.7844*** (0.0919)	-0.7846*** (0.0924)
R&D Intensity	0.0932*** (0.0143)	-0.0119* (0.0061)	-0.0082 (0.0064)
North American	3.4222*** (0.3455)	-0.0755 (0.0960)	0.0365 (0.0958)
Asian	4.9600*** (0.3326)	-0.3839*** (0.0974)	-0.2265** (0.1045)
Constant	-6.4395*** (1.0056)	2.7589*** (0.3253)	2.5363*** (0.3249)
Observations	660	578	578
R-squared	0.4353	0.2066	0.2139

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11a. 3-step mediation for Technical capabilities for the subgroup of focused firms

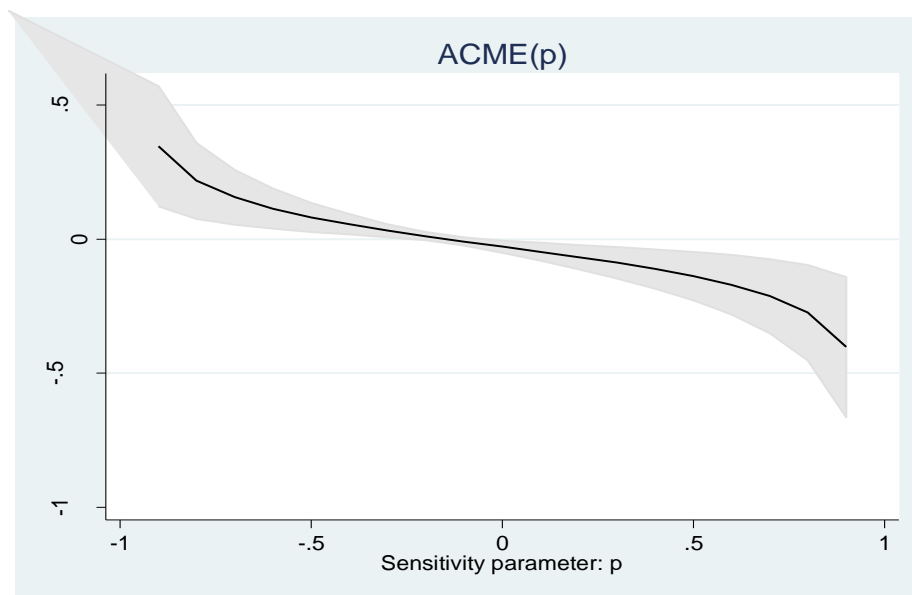


Fig.2a. Sensitivity analysis for Technical capabilities for focused firms

Sensitivity results

Rho at which ACME = 0		-.0941
R ² _M *R ² _{Y*} at which ACME = 0:		.0089
R ² _{M~} ~R ² _{Y~} at which ACME = 0:		.0037

Table 12a. Sensitivity analysis for Technical capabilities for focused firms

4.2 Integrative capabilities mediation

	(1)	(2)	(3)
	Integrative cap	ROA	ROA
Diversification	0.1735 (0.1081)	0.0739 (0.2535)	0.0425 (0.2534)
Integrative cap			0.2105 (0.1656)
Size	0.0588** (0.0292)	-0.2599*** (0.0883)	-0.2737*** (0.0866)
Debt Equity	0.1201** (0.0469)	-0.4625*** (0.1539)	-0.4817*** (0.1582)
R&D Intensity	-0.0448*** (0.0073)	-0.0008 (0.0138)	0.0111 (0.0153)
North American	0.5582*** (0.0992)	0.3446* (0.1810)	0.2109 (0.1680)
Asian	-0.0816 (0.0980)	-0.9470*** (0.2201)	-0.9294*** (0.2195)
Constant	0.2852 (0.2949)	5.1758*** (0.8193)	5.1132*** (0.8044)
Observations	209	189	189
R-squared	0.4575	0.3159	0.3213

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 13a. 3-step mediation for Integrative capabilities for the subgroup of diversified firms

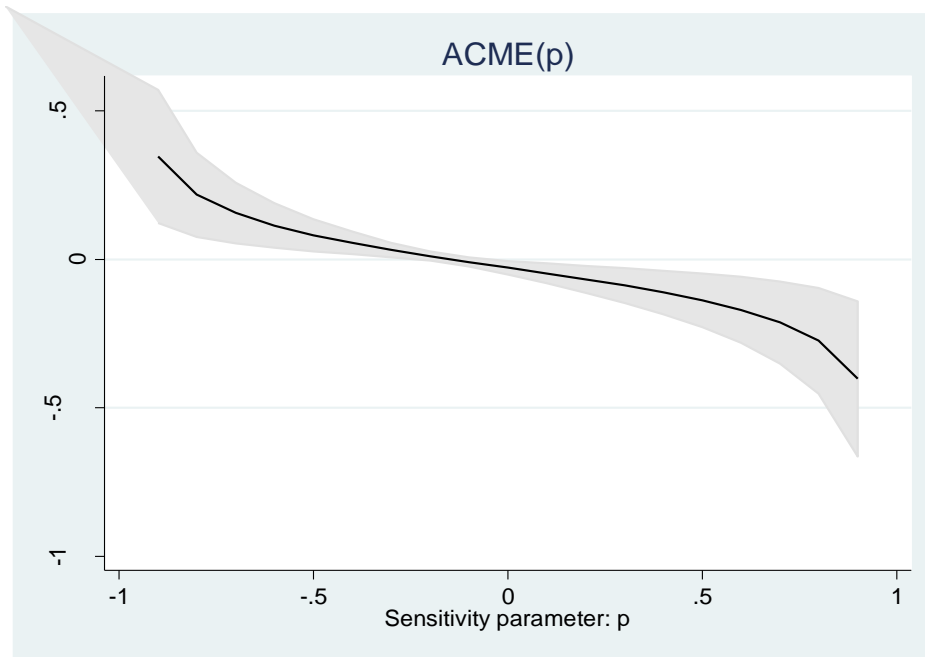


Fig. 3a. Sensitivity analysis for Integrative capabilities for diversified firms

Sensitivity results

Rho at which ACME = 0		.0829
$R^2_M * R^2_{Y^*}$ at which ACME = 0:		.0069
$R^2_M \sim R^2_{Y\sim}$ at which ACME = 0:		.0023

Table 14a. Sensitivity analysis for Integrative capabilities for diversified firms

	(1)	(2)	(3)
	Integrative cap	ROA	ROA
Diversification	0.0533 (0.0508)	-0.1121 (0.1206)	-0.1099 (0.1203)
Integrative cap			-0.0586 (0.0999)
Size	0.0752*** (0.0147)	0.0183 (0.0334)	0.0246 (0.0367)
Debt/Equity	0.1202*** (0.0267)	-0.7844*** (0.0919)	-0.7813*** (0.0919)
R&D Intensity	-0.0100*** (0.0024)	-0.0119* (0.0061)	-0.0129** (0.0062)
North American	0.4781*** (0.0404)	-0.0755 (0.0960)	-0.0458 (0.0977)
Asian	0.0911*** (0.0278)	-0.3839*** (0.0974)	-0.3802*** (0.0974)
Constant	-0.0090 (0.1409)	2.7589*** (0.3253)	2.7491*** (0.3273)
Observations	660	578	578
R-squared	0.2602	0.2066	0.2072

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 15a. 3-step mediation for Integrative capabilities for the subgroup of focused firms

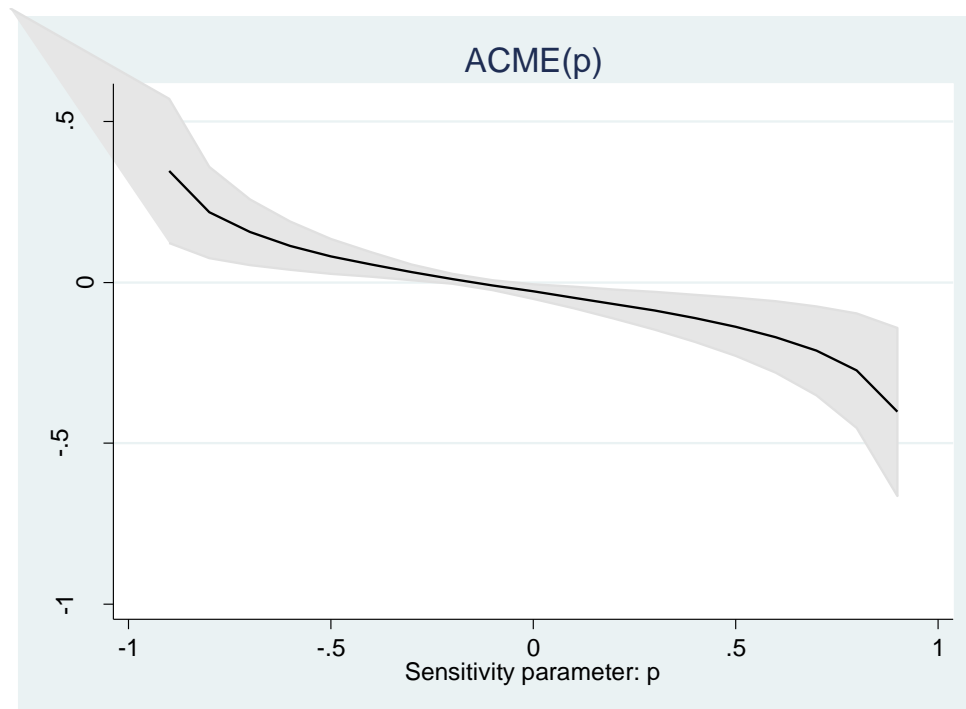


Fig. 4a. Sensitivity analysis for Integrative capabilities for focused firms

Sensitivity results	
Rho at which ACME = 0	-.0255
R ² _M *R ² _{Y*} at which ACME = 0:	.0007
R ² _M ~R ² _{Y~} at which ACME = 0:	.0004

Table 16a. Sensitivity analysis for Integrative capabilities for focused firms

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