Three essays on how firms' strategies affect the performance of subsidiary businesses

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UNIVERSITÉ CÔTE D'AZUR

ÉCOLE DOCTORALE
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Trois essais sur l'influence des stratégies des entreprises sur la performance de leurs filiales

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Devant le jury, composé de :

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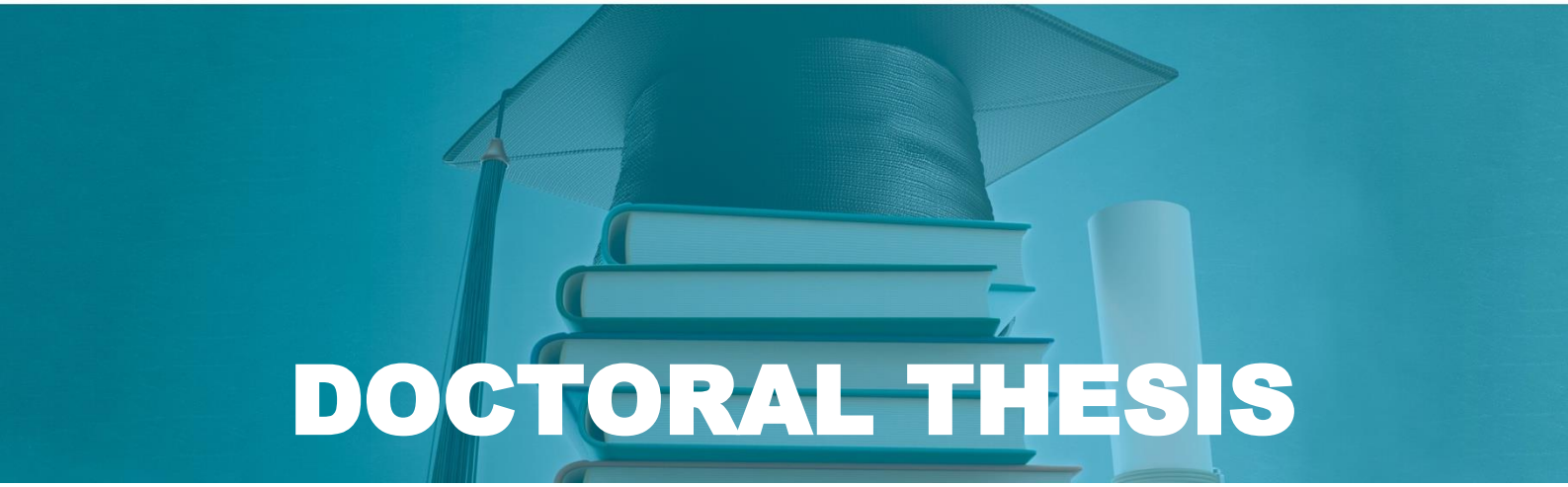

DOCTORAL THESIS

Three Essays on How Firms' Strategies Affect the Performance of Subsidiary Businesses

Ghahhar Zavosh

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Defense presented for the purpose of obtaining a PhD in Economics
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Titre

Trois essais sur l'influence des stratégies des entreprises sur la performance de leurs filiales

Title

Three Essays on How Firms' Strategies Affect the Performance of Subsidiary Businesses

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Titre

Trois essais sur l'influence des stratégies d'entreprises sur
la performance des filiales

Résumé

Cette thèse étudie comment et dans quelle mesure les décisions stratégiques des firmes multi-divisionnelles affectent la performance de leurs filiales. Elle contribue aux débats récurrents liés l'importance de la stratégie d'entreprise, du ressort des sièges sociaux, dont le but est d'optimiser la performance de l'ensemble des filiales, comparée aux stratégies des filiales (*business strategy*) dédiées à optimiser leur performance. L'enjeu de ce débat est de mieux comprendre les leviers d'action des sièges sociaux et d'éclairer les choix d'allocation des ressources en prenant en considérations les interdépendances ou synergies potentielles entre les filiales, ce que la littérature a peu étudié jusqu'alors.

Dans le premier chapitre, nous nous intéressons à la question de l'importance relative des décisions stratégiques des sièges sociaux sur la performance de leurs établissements. Cette question fait l'objet d'un débat toujours ouvert depuis l'article de Schmalensee (1985) montrant que les effets industrie était les plus significatifs dans la détermination de la performance des filiales. Un nombre de travaux important ont depuis affiné les outils méthodologiques permettant de comparer les effets fixes des sièges sociaux, aux effets industries et filiales. Après avoir comparé les différents résultats mis en avant dans la littérature, nous montrons l'incapacité des méthodes traditionnelles à rendre compte efficacement des effets entreprises. Nous soutenons en effet que les études précédentes sous-estiment systématiquement les effets des sièges sociaux car elles ne tiennent pas compte des effets différenciés des décisions des sièges sociaux sur leurs filiales. En effet, très peu de choix stratégiques concernent toutes les filiales de manière homogène. Par exemple, une décision de fusion-acquisition affectera (positivement ou négativement) la profitabilité d'une filiale selon qu'elle soit ou non concernée par les activités de la nouvelle filiale. Une fusion

engendre presque systématiquement une réorganisation et donc un redéploiement de ressources. En fonction des caractéristiques de la filiale et des synergies potentielles avec l'entreprise acquise, elle se trouvera dans une position plus ou moins avantageuse vis-à-vis des autres filiales de l'entreprise et pourra recevoir ou se voir confisquer une quantité plus ou moins significative de ressources. Par conséquent, le fait d'étudier, comme le font l'essentiel des études s'intéressant à la stratégie des sièges sociaux, toutes les filiales comme s'il s'agissait d'un seul groupe sous-estime systématiquement les effets entrepris. Nous proposons plutôt de tenir compte de la variance induite par les décisions des sièges sociaux sur la performance des filiales et montrons qu'il existe un effet différencié par filiale. Nous appelons cette variance induite un « effet variable » pour le distinguer de l'effet traditionnel qui, par définition, est « invariant » en ce qu'il rend compte d'un effet homogène sur la performance des filiales. Cette approche originale révèle que cet effet variable est aussi important que l'effet des sièges sociaux traditionnel. Elle nous permet surtout de montrer que la valeur totale des *effets sièges sociaux* est e même ampleur que les *effets filiales* et donc beaucoup plus élevés que les travaux précédents.

Dans le deuxième chapitre nous nous sommes intéressés au débat relatif à l'efficacité des marchés internes de capitaux. Les choix d'allocation du capital sont reconnus comme une des sources essentielles d'hétérogénéité quant à la performance des filiales. Le débat se justifie par les résultats des études empiriques récents mettant en évidence des choix d'allocation très différents des allocations optimales telles qu'elles sont prescrites par la théorie standard. De fait, ces résultats concluent à niveaux de croissance relativement faibles. Les écarts observés sont justifiés par des déviances comportementales, qu'elles soient dues à des problèmes d'agence (liés à des asymétries d'information importante entre le dirigeant de la filiale et les membres du siège social) ou des biais cognitifs. Dans ce chapitres, nous proposons de modifier le cadre analytique prenant à la fois en compte le degré d'incertitude

auquel la firme est confrontée lorsqu'elle décide d'allouer son capital et du niveau d'interdépendance de ses filiales. Ce cadre conceptuel nous permet de distinguer les choix inefficaces, au sens de la théorie standard, de choix « déviants » mais que nous montrons justifiés une fois considérés les niveaux d'incertitude et d'interdépendance des filiales. Ainsi, la logique de *winner picking* - investir systématiquement dans les filiales positionnées sur les marchés les plus porteurs- peut s'avérer sous- optimale compte-tenu des caractéristiques spécifiques de chaque filiale et des interdépendances potentielles entre les filiales. Des choix différents peuvent ne pas relever de biais comportementaux mais d'intentions stratégiques prenant en considération des spécificités liées à chaque filiale telles que leur taille relative, le risque lié au retour sur investissement ou aux synergies potentilles entre filiales. Notre approche empirique susceptible d'estimer le rôle de l'incertitude dans la prise de décision consiste à prendre en considération la diversité des expertises du PDG de l'entreprise. Notre hypothèse consiste à prédire un effet modérateur positif sur la relation entre incertitude et la performance de la firme. Un PDG aux expertises diversifiées doit être plus à même d'anticiper les effets liés à l'incertitude et prendre de meilleures décisions. Cette relation étant confirmée, nous montrons donc un résultat intéressant d'un point de vue managérial. Les PDG ayant démontré une capacité à assurer leur fonction dans différents environnements industriels sont plus à même de gérer les incertitudes liées aux environnements instables et imprévisibles et à prendre les décisions d'allocation des ressources adaptées.

Le troisième chapitre approfondit cette problématique en s'intéressant aux mécanismes justifiant la nécessité de prendre en considération les caractéristiques des filiales lors de décisions d'allocation du capital de l'entreprise. Ce chapitre porte sur les effets inégaux des décisions en matière de redéploiement de ressources au sein de la firme. Dans le but de mettre en évidence la portée générale de notre analyse, notre première contribution consiste à incorporer les ressources financières comme des ressources sujettes à des arbitrages

lors des décisions de redéploiement. Le capital financier est, par définition, parfaitement fongible et infiniment divisible, donc supposé inconditionnellement redéployable si nécessaire. Notre propos consiste à montrer que des irréversibilités de l'investissement réalisé impose une prise en compte de contraintes propre au capital physique quelle que soit la nature des ressources allouées. Traditionnellement, seules des ressources imparfaitement divisibles et ou imparfaitement fongibles sont supposées faire l'objet d'arbitrage lors de décisions d'investissements ou de réallocation de ressources. Par définition, elles engendrent une irréversibilité et sont susceptibles d'engendrer des coûts d'opportunité. La théorie standard a exclu les ressources financières de cette problématique puisque, par définition, elles peuvent être librement réallouées vers tout type d'investissement sans contrainte. Nous propos consistent toutefois à considérer que lors qu'elles sont allouées à une filiale, ces ressources financières sont en réalité investies dans du capital physique, tel que des usines ou des ressources technologiques. Dès lors, le choix d'investissement présent doit être réalisé en tenant compte des coûts de redéploiement éventuels dans le futur. En d'autres termes, à cet investissement est attaché l'achat d'une option de redéploiement de ces ressources dans le futur. Par conséquent, la direction des flux de capitaux actuels entre les filiales ne sera pas simplement réalisée en fonction des opportunités actuelles de croissance relative du marché, mais aussi en fonction des coûts d'ajustements dus aux redéploiements éventuels entre les filiales dans les périodes ultérieures. Lors de l'affectation du capital, le siège social doit donc tenir compte de la flexibilité de redéploiement potentiel des ressources. Ce résultat nous permet de conclure qu'il est légitime d'étendre la théorie du redéploiement des ressources aux pratiques d'allocation du capital financier. Cette extension, outre l'intérêt qu'elle représente en matière de choix d'investissement, permet d'étendre le champ d'études empiriques de la théorie du redéploiement aux domaines liées aux ressources non-financières. En effet, les études empiriques dans ces domaines sont rares en raison du défi que représente l'observation

et la mesure du redéploiement des ressources non financières. Ainsi, l'intégration du capital financier dans les champs d'investigation peut augurer d'études plus fines et plus nombreuses nous permettant de mieux comprendre les choix stratégiques réalisés par les grandes entreprises multi-divisionnelles.

Mots-clés: Stratégie de corporation; sièges sociaux; théorie du redéploiement des ressources; marché intérieur du capital

Title

Three Essays on How Firms' Strategies Affect the Performance of Subsidiary Businesses

Abstract

This dissertation deals with how multi-business firms' strategies affect the performance of subsidiary businesses and contributes to long standing debates in corporate strategy. Overall, each of my 3 dissertation essays are designed to, correspondingly, analyze the debated *magnitude*, *efficiency*, and *mechanism* of the effect of a multi-business firms' strategies on the performance of its subsidiaries.

In the first chapter of my dissertation, I address a root question in corporate level strategy; I question traditional methods to estimate corporate effects (the effect of corporate headquarters on subsidiary businesses' performance) and analyze whether and to what extent corporate headquarters "really" affect the performance of their subsidiary businesses. I argue that previous corporate effect studies fail to account for the uneven impact of corporate decisions on subsidiaries. A headquarters makes conscious and deliberate decisions that induce *performance heterogeneity* among its subsidiaries. Depending on the relative characteristics of a business unit compared to its sister businesses, it may receive different shares of corporate resources. Consequently, considering all subsidiaries as a bundle will systematically underestimate the corporate effects. Rather, I argue that it is important to account for the firm's induced variance on the subsidiaries' performance. We connote this induced variance as "business-variant corporate effects", and show that they are just as important in magnitude as the value of the standard corporate effects, namely "business-invariant corporate effects", found in previous studies.

In the second essay, I focus on corporate capital allocation as a critical dimension of corporate strategies that might contribute to, within-firm, subsidiaries' performance heterogeneity. We particularly delve deeper into the internal capital market *efficiency* debate by

extending current theories that aim to justify why headquarters provide more resources, than internal capital market theory would suggest, to subsidiaries with seemingly lower growth opportunities. Considering both the level of *uncertainty* a firm faces when making capital allocation decisions, and the level of *interdependence* among its subsidiaries, we disentangle between inefficient and not-necessarily-inefficient deviations from standard models' prescription. We explain that deviations from the logic of winner-picking in capital allocation decisions (i.e., investing relatively more in subsidiaries with higher growth opportunities) may simply reflect different strategic intents rather than allocation inefficiencies. Furthermore, we consider *the breadth of CEOs' prior experience* in subsidiaries' domain, as a source of firms' capital allocation competency. We then highlight the role of this breadth of CEOs' experience in attenuating inefficient deviations and enhancing corporate value through better capital allocation practices.

The third essay focuses on corporate resource redeployments as a source of uneven effects of headquarters' decisions on subsidiary businesses. My first contribution is to incorporate financial resources, as a perfectly fungible and divisible resource, within the scope of the resource redeployment theory. Indivisibility and imperfect fungibility of resources play a critical role in the theory and this is why the standard theory has excluded the financial resources from its boundaries. I, however, argue that when allocating financial resources, such as capital, to one of its subsidiaries to acquire non-financial assets such as plants or technology, a corporate headquarters also purchases the *option* to redeploy those same resources in subsequent periods. Therefore, the direction of current capital flow among subsidiary businesses will not merely be a function of their current relative market growth opportunities. Rather, this flow of capital also is a function of the adjustment costs of potential resource redeployments among the subsidiaries in subsequent periods. In other words, headquarters do consider the potential "future" redeployment flexibility of resources

when allocating capital. Consequently, we expect to see trace evidence of non-financial resource redeployment theory in corporate capital allocation practices. Empirical studies in this area have been scarce so far, due to the challenge of observing and measuring the redeployment of *non-financial* resources. Thus, my extension of the resource redeployment theory to include intrafirm capital allocations paves the way for further empirical investigations of the theory. In turn, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel predictions for the theory.

Keywords: Corporate strategy; corporate effect; corporate resource allocation; resource redeployment theory; internal capital market

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The story of my Ph.D. started from one of the last evenings of a cold winter, a few days before the Iranian New Year in 2012. After work, I went to visit Dr. Arasti, my Strategy professor in my MBA, to congratulate him for the New Year as a habit I had done at the end of every year since finishing my MBA. Like every year I explained how the managerial knowledge I gained during my two years and half MBA had helped me progress in my career and also get promoted and be successful in new positions. That year was different, however. I wanted also to share my thoughts, my enthusiasm, and even my fear about my decision that would change my entire life. I wanted to enter academia. He told me about the hardship. He explained that I should search for my first academic career, if I enter this path, when I would be less than a decade to retirement otherwise. However, he encouraged me. He said this is a way that I should go. I acknowledge him for helping me to be brave and make this decision.

I am indebted to my supervisors Dr. Ludovic Dibiaggio and Dr. Patrick Musso for all of their trust, all of their support, and their insightful feedback on my work. Ludovic has been patient with me during the challenging years of my PhD and taught me through my very first steps into research. It was his very course on industrial organization that sparked my interest in corporate research; and it was my discussions with him on the underestimated corporate effect that gave birth to my first paper, and the dissertation as a whole. I am simply thankful to him in so many ways, for so many things.

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this extremely tough project of three students at home with our love and endurance. Part of the job is done, my loves. Let’s focus on the rest!

INTRODUCTION

My dissertation is inspired by a twenty-year-long debate on the main source of business-level performance heterogeneity (McGahan and Porter, 1997; Misangyi *et al.*, 2006; Rumelt, 1991). Whether some scholars argued that business units hold the greatest effect on performance heterogeneity, or others advocated for the strong role of industry and firm positioning, the peripheral result of the debate was that corporate effect relative to industry and business effects is not a very important source of business-level performance heterogeneity. This poses a conundrum as to why it is still important to learn about topics of diversification, merger & acquisition, corporate resource allocation, etc. when corporate strategy itself is argued to have no important effect on performance. As such, my thesis intends to uncover the sources of corporate effect (the effect of corporate headquarters on subsidiary businesses' performance) and also suggest a better estimation for it. As this introduction details, my research project – originally meant to contribute to long standing debate on the magnitude of corporate effect on subsidiaries' performance – was further deepened to studying and contributing to complementary corporate-level debates on the efficiency, and mechanisms underlying the corporate effect.

The first essay of my thesis analyzes the potential underestimation of corporate effect (or corporate strategy in general) by the extant work. As is reported in the first chapter of this dissertation, we find that previous corporate effect studies fail to account for the uneven impact of corporate decisions on subsidiaries. This failure to do so systematically leads to underestimating corporate effect. Aiming to optimize the overall performance, a headquarters makes conscious and deliberate decisions that might induce performance heterogeneity among its subsidiaries. For example, depending on the relative characteristics of a business unit compared to its sister businesses, it may receive different shares of corporate resources, and so corporate headquarters' performance contributions. Consequently, attempting to study

corporate effect on the subsidiaries as a bundle will systematically underestimate such effect. Rather, for such analysis, it is important to account for the intentionally induced variance of the subsidiaries' performance. We connote this induced variance as "business-variant corporate effects", and show that the magnitude of "business-variant corporate effects" is just as important as the previously studied corporate effects, which we connote as "business-invariant corporate effects".

Interestingly, the two core research streams capable of explaining a headquarters' uneven contributions to its subsidiaries' performance, have been developed independently and separately. On the one hand, the theory of resource redeployment (Anand, 2004; Anand, Kim and Lu, 2016; Helfat and Eisenhardt, 2004; Lieberman, Lee, and Folta, 2017; Sakhaertov and Folta, 2014, 2015) contends that a multi-business firm redeploys its non-financial resources in order to achieve intra or inter-temporal economies of scope.[1] Optimality of resource allocation, according to this theory, is essentially affected by path-dependency and firm-specific measures (Sakhartov, 2017). In other words, the theory advocates that the current decisions of a firm may influence the optimality of the future decisions. On the other hand, the theory of internal capital markets (Stein, 1997; Williamson, 1975) suggests that multi-business firms may create value through allocating financial resources - particularly capital - internally more efficiently than external capital markets could. This efficiency relies on headquarters' managers having better access to the information of the businesses than external intermediaries do. Therefore, internal capital markets are justified (only) to compensate for external markets' inefficiencies. Subsequent empirical work, in internal capital market line of inquiry, extends this thought and assumes that, similarly to an external capital market, an internal capital market is efficient only if it tilts the capital towards the businesses active in more attractive markets, i.e. picks the

[1] Whereas the former economies arise from the simultaneous and synergistic use of resources by different subsidiary businesses, the flexibility and the ease, i.e. low adjustment cost, of withdrawing the resource from the current endeavor and allocating it to another endeavor results in the latter economies.

winners (e.g., Berger and Ofek, 1995; Billett and Mauer, 2003; Ozbas and Scharfstein, 2010; Rajan et al., 2000). The optimal capital flow between any two subsidiary businesses of a multi-business firm is argued to be a function of their relative market opportunities. As a consequence, the optimal capital flow between any two subsidiaries is independent of the rest of the firm. Unfortunately, these two lines of research both have suffered the above mentioned problem, i.e., being developed independently from the other. First, the empirical studies of internal capital market suffer validity issues. While reporting significant capital allocation inefficiency (i.e., deviation from winner-picking approach), existing work proves unable to link this inefficiency to actual corporate value destruction (e.g., Billett and Mauer, 2003). In fact, in many instances, corporate headquarters exhibiting the reported inefficiency, demonstrate higher market value growth than headquarters aligning with the winner-picking approach. Second, due to the inherent complication of tracking redeployment of non-financial resources, the resource redeployment theory has been mainly developed through formal models and simulations (Lieberman *et al*., 2017; Sakhartov, 2017; Sakhaertov and Folta, 2014, 2015) and has found little empirical confirmation. In the second and third essays of my thesis, I address these two concerns. More precisely, in the second essay, we revisit why firms might invest extra capital in subsidiaries with seemingly lower growth opportunities. Considering the extents of *uncertainty* firms confront while making capital allocation decisions, and of *interdependence* among their subsidiaries, we disentangle between inefficient and not-necessarily-inefficient deviations. We explain that deviations from the winning-picking strategy may simply reflect different strategic intents. Moreover, we highlight the role of *the breadth of CEOs' prior experience* in subsidiaries' domain, as a source of firms' capital allocation competency, in attenuating inefficient deviations and enhancing corporate value through better capital allocation practices. The third study of my thesis, on the other hand, aims to deepen the understanding of intrafirm allocation and redeployment of both financial

and non-financial resources. It extends the boundaries of the theory of resource redeployment (RR theory) to encompass financial as well as non-financial resources. More precisely, using a simulation model followed by empirical tests of the model's propositions, we develop and test a theory that clarifies how capital allocation decisions provide trace evidence of *non-financial* resource redeployments. By this, we set the stage for empirical investigations and validation of RR theory which has been mainly developed through formal models and simulations. In turn, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel predictions for the theory. This study illuminates how prior studies, claiming that firms extensively misallocate capital, may have reached their conclusion because they did not consider the value derivable from investing in resource redeployability. Finally, addressing the internal capital market efficiency debate, both the second and third studies of my thesis tackle the validity issues in the link between efficiency (inefficiency) of capital allocations and firms' value creation (destruction). The studies contribute to the theory of capital investment by helping to resolve these validity issues.

Chapter 1: "Business-Variant vs. Business-invariant Corporate Effects: A three-stage Multilevel Analysis" (Co-authored with Ludovic Dibiaggio[2]).

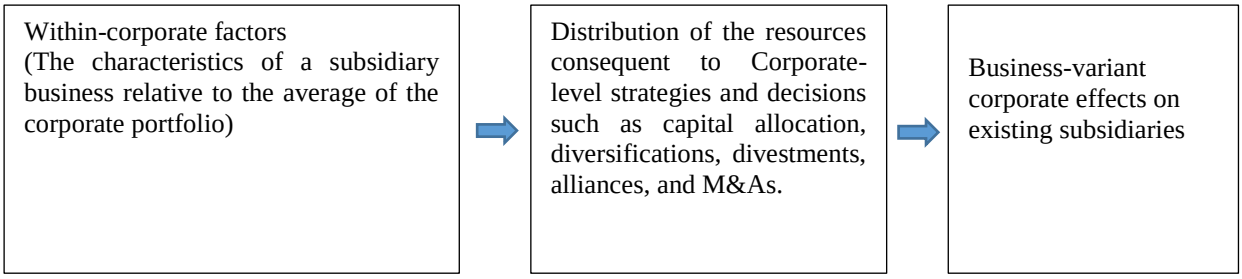
The design of the first paper is geared towards tackling whether corporate effect on business performance, in extant work, has been systematically underestimated. We argue that the uneven contribution a headquarters makes to the wealth of its different subsidiaries makes standard variance analyses systematically underestimate the corporate effect. It is only possible to precisely discover the real importance of the corporate effect if we partition the effects of each headquarters' uneven contributions among its subsidiary businesses. To this end, we draw from the literature of diversification, corporate resource redeployment and capital allocation, to

[2] University of Cote d'Azur

discern the antecedents of a headquarters' uneven contributions to its subsidiaries' performance.

Figure 0.1, demonstrates the argument which underlies the first paper. We argue that subsidiaries' relative characteristics and position within the portfolio, the left box in *Figure 0.1*, influence firms' corporate-level decisions. These corporate-level initiatives may result in a re-distribution of resources among subsidiaries, the middle box, resulting in ultimate uneven corporate effect on the performance of the subsidiaries, the right box. While the uneven contribution of headquarters to the performance of subsidiaries is more evident for some corporate-level strategies such as capital allocation, headquarters' uneven contribution might happen through any kind of corporate initiative. For example, headquarters' decision to acquire a firm with specific technological expertise might provide one of the existing subsidiaries with valuable resources (the knowledge existing in the newly acquired unit) while another subsidiary might not benefit from the acquisition (if the newly acquired knowledge is irrelevant to this second subsidiary). The first essay focuses on the first and the third box to emphasize the impact of business-variant corporate effects on performance of businesses.

Figure 0.1: The relationship between the factors which affect corporate-level strategies and business-variant corporate effects



In this essay, we first explain how corporate strategy may unevenly affect subsidiary businesses' performance. We then explain why standard variance decomposition methods (either ANOVA, Components of Variance, or standard hierarchical linear modeling) cannot

capture business-variant corporate effects. Next, we propose an empirical model (a three-stage hierarchical model) to estimate the impact of different potential sources of uneven contribution from corporate headquarters on subsidiary businesses' performance. Replicating previous works, we use the Compustat database. The majority of prior studies aggregated the data related to business-segments' size and profit at industry level. However, aiming to detect the details of the contribution of corporate headquarters to the performance of subsidiaries, we decided not to aggregate the business-segments at industry level and, following Hough (2006), we preserved the operating segment categorization reported by multi-business firms. The fact that the corporations follow the new Statement of Financial Accounting Standard (SFAS 131) helps us in this regard. Based on SFAS 131, effective since December 1997, firms categorize their business units into different business segments based on their management approaches and the way the managers organize different segments of their organizations (Hough, 2006). Therefore, each corporation in our sample may possess more than one business-segment in a single industry. We set apart our proposed "business-variant corporate effects" from the standard corporate effects that we connote as "business-invariant corporate effects". We show that these new "business-variant corporate effects" are as important as the standard corporate effects, and both together are at least as important as the business effects. We also show that firms induce performance variance among their subsidiaries differently, and that they preserve this difference across time.

Chapter 2: "Insights Into Internal Capital Market Debate: Why Headquarters Deviate from a Winner-Picking Approach" (Co-authored with Samira Fallah[3], and Olivier Bertrand[4]).

The theory of internal capital market suggests that corporate capital allocations are efficient if firms invest relatively more in subsidiaries with higher growth opportunities (that

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is, if they pick the winners). However, extant empirical work has demonstrated that headquarters do not necessarily tilt capital investments towards their subsidiaries which have relatively higher growth opportunities (i.e. deviate from winner picking approach). Curiously, so far, existing research has been unable to link this deviation to actual corporate value destruction (e.g., Billett and Mauer, 2003). In the second essay, we address this validity issue by theoretically claiming, and providing empirical evidence, that this deviation is not necessarily equivalent to corporate capital allocation inefficiency. We provide a typology for the roots of multi-business firms' deviations from the winner-picking approach (Stein, 1997). We disentangle between deviations that are attributable to the failure of managers to identify and shift more capital to units with higher market opportunities; and those deviations that might be corresponding to situations in which managers need to follow strategies other than that of simply investing more in units with higher prospects. To this aim, we focus on different complexities in decision environment that may, theoretically, strengthen the mechanisms underlying these two types of deviation from winner-picking capital allocation. We considered two types of complexities. First we examine the deviation effects of *uncertainty* about the potential investments' returns. This complexity may make it harder for a CEO/headquarters to find and implement the optimal allocations (cognitive/behavioral reasons) and, in parallel, make it easier for self-interested actors to mislead the decision making (agency reasons). Therefore, we expect that the deviation from winner-picking which is rooted in this decision-making complexity results in the failure of managers to efficiently allocate capital. Second, we look into the deviation effect of firms' *interdependence among business units*. We expect that a headquarters would leverage its subsidiaries interdependence to accrue synergistic rents. Therefore, while segments' interdependence might result in deviations from winner-picking logic of capital allocation, it might not be rooted in inefficiencies. Rather, the simple winner-picking approach could reveal suboptimal to the headquarters. To examine our typology, we

hypothesize on the contrasting effect of firms' capital allocation competency (Arrfelt *et al*, 2015) and managerial dynamic capability (Adner and Helfat, 2003) on the two previously mentioned types of deviations from winner-picking. We use *the breadth of CEO's prior experience* in firms' subsidiaries' domains as a source of firms' managerial capability. In turn, we expect that this capability would make firms more competent in realizing both real growth opportunities in subsidiaries and also synergy potentials among subsidiaries. We find empirical evidence that the breadth of CEO's prior experience attenuates the effect of the *uncertainty-based* complexity on deviation from winner-picking approach; also, as expected, we see that this breadth of CEO's experience does not attenuate the relationship between the segments' interdependence and deviations. This second chapter also mainly uses the Compustat data. The data on all variables were collected from Compustat except the required data on CEOs' experience that were collected manually from proxy statements, firms' annual reports and websites, BusinessWeek website, and LinkedIn profiles.

Chapter 3: "Extending the Theory of Resource Redeployment to Financial Resources: Evidence from Corporate Internal Capital Markets" (Co-authored with Timothy B. Folta[5]).

The third chapter, of my thesis aims to respond to the second paper's call for new theoretical frameworks that could explain the flow of corporate capital allocations considering the interdependencies between subsidiaries; and similar to the second chapter, focusses on the left and middle boxes in Figure 0.1. In this chapter, we extend the boundaries of the resource redeployment (RR) theory to encompass financial, as well as non-financial resources. We argue that when investing capital to acquire/develop non-financial resources such as plants or technology in a particular subsidiary, the corporate headquarters also acquires an *option* to redeploy those same resources to other business units in subsequent periods. Therefore a

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segment's overall redeployability of resources plays a substitute role for its overall market growth opportunity in corporate capital investment due diligence. We focus on two elements of subsidiaries' resources' redeployability: *resource relatedness* to other sister businesses, and *resource divisibility*. We study whether leveraging these two elements of resource redeployability (in firms' capital investment decisions) contributes to firm value. More importantly, we explore whether either of these elements becomes the main source of value creation under different contingencies such as firms' *market volatility* and *cash-limitedness*. To this end, first, we develop a simulation model based on the premises of RR theory and provide propositions about firms' optimal capital allocation. Consequently, we succeed in providing preliminary empirical support for the potency of RR theory in explaining corporate capital allocation and for our novel propositions.

We find that leveraging resource redeployability in capital allocation decisions is of paramount importance particularly for firms which are active in highly volatile markets. Further, we find that cash-rich and cash-limited firms differ in their main source of redeployment flexibility. While both reployability elements are important for both types of firms, cash-rich firms achieve inter-temporal economies (Helfat and Eisenhardt, 2004) by investing, mainly, in resource relatedness; however, cash-limited firms mainly leverage latent resource's divisibility, in their capital investment decisions, in order to reach resource redeployment flexibility and gain inter-temporal economies. This is due to the fact that cash-limited firms have fewer means to acquire new resources when needs arise in face of external opportunities. Therefore overcommitting to indivisible resources results in cash-limited firms' rigidity and is extremely hazardous to them.

This study contributes to two different literatures. First, it extends the boundaries of RR theory to embrace capital allocation. We argue and show that observing internal capital allocation allows to empirically test RR theory, which has been developed mainly through

simulation models. In turn, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel predictions for the theory. Second, the paper contributes to internal capital market literature. Relying on the premises of RR theory, we complement the theories of capital investment optimality that have been merely accounting subsidiaries' exogenous market opportunities. This resonates with the second chapter of my thesis; it illuminates how prior work claiming firms misallocate capital may have reached their conclusion because they did not consider firm-specific aspects in the quest for capital allocation optimality. Furthermore, the internal capital markets theory advances that intrafirm capital allocation may create value because there is less information asymmetry between the subsidiaries and headquarters (vs between firms and external markets). Our analysis, however, confirms that internal capital markets may create value also because internal capital markets consider the firm-specific optimality of capital investment.

Chapter 1

(Essay 1)

Business-variant vs. Business-invariant Corporate Effects:

A Three-stage Multilevel Analysis

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Business-variant vs. Business-invariant Corporate Effects:

A Three-stage Multilevel Analysis

ABSTRACT

In this paper, we revisit the analysis of the effect of corporate decisions on the performance of business units. We argue that prior studies, relying on standard variance decomposition estimations, failed to account for the performance variance of businesses born from the *uneven* influence of a headquarters' corporate decisions across its subsidiaries. Using a three-stage multilevel approach, we find that taking into account what we called "*business-variant corporate effects"* increases the estimated influence of corporations on business performance variance, with a magnitude as important as that of the standard corporate effects, i.e., *business-invariant corporate effects*. We find the total corporate effects to be just as important as the business effects, which have been found as the dominant effects in the previous work. We also find that the patterns of "business-variant corporate effects" are firm-specific, suggesting persistent differences in firms' resource management processes.

Keywords:
Corporate-level strategy; business-variant corporate effects, corporate resource allocation; hierarchical linear modelling; total corporate effects on business performance

INTRODUCTION

The objective of corporate strategy is to make the corporate whole add up to more than the sum of its business units if they were independent or owned by another corporation (Chandler, 1991; Goold, Campbell, and Alexander, 1994; Grant, 2016; Porter, 1987). If mainstream strategy and major textbooks (e.g., Ansoff, 1965) emphasize the role of corporate strategy as a major determinant of firm success, recent studies discussing the relative importance of industry vs. business effects on persistent performance differences among businesses (McGahan and Porter, 1997; Misangyi *et al.*, 2006; Rumelt, 1991) question the relative influence of corporate decisions on the profitability of their subsidiary businesses. On the fringes of this debate, the minor impact of corporate effects found in models has generated a new discussion stream among scholars (Adner and Helfat, 2003; Bowman and Helfat, 2001; Brush and Bromiley, 1997; McGahan and Porter, 2002, 2005; Guo, 2017; Vanneste, 2017). Although they all recognize the significant impact of corporate strategy as a source of performance differences, the discussion centers on the magnitude of corporate effects compared to other effects and, in particular, compared to business effects. In their literature review, Bowman and Helfat (2001) report very different estimates of corporate effects, ranging from negligible (e.g., Rumelt 1991; Schmalensee 1985) to relatively high (e.g., Roquebert, Phillips, and Westfall, 1996). Authors who contend that corporate effects are underestimated present arguments mainly related to methodological problems. The most common explanations lie in sample selection issues (e.g., Bowman and Helfat 2001; McGahan and Porter 2002, 2005), problems of collinearity and relationships between effects (Guo 2017; Hough 2006; McGahan and Porter 2002, 2005), and "exclusion of time-varying corporate effects (Adner and Henfat 2003). In his recent meta-analysis, Vanneste (2017) concludes that while the measures of estimations, e.g., variance, standard deviation, etc. also meaningfully influence the effect size estimations, corporate effects turn out to persistently demonstrate half the explanatory power of business effects.

However, the objective of this paper is to show that corporate effects are of a higher magnitude than those found in prior studies. The reason for systematic underestimation, we argue, relies on the particular inability of standard variance decomposition methods to fully capture corporate effects using categorical variables. While categorical variables can be appropriate for estimating industry and business effects, they may be more problematic for the evaluation of corporate effects. A headquarters can have uneven influence on its subsidiaries, as decisions can benefit some subsidiaries more than (and sometimes at the expense of) others. For instance, a headquarters' decision to acquire a firm with specific technological expertise might provide one of the existing subsidiaries with valuable resources (the knowledge existing in the newly acquired unit) while another subsidiary might not benefit from the acquisition (if the newly acquired knowledge is irrelevant to this second subsidiary). Therefore, a firm's corporate strategies might induce resource redistributions among subsidiaries and thereby generate or increase performance differences across them. We argue that standard variance decomposition estimations do not account for the uneven contribution of corporate headquarters to their subsidiaries' performance; this may lead to a systematic underestimation of corporate effects, and thereby undermine the importance of corporate strategy.

To examine whether and to what extent the headquarters' induced intra-corporation variance in business performance accounts for the overall corporate effects we suggest disentangling the standard *business-invariant corporate effects* (the even impact of headquarters' decisions on all subsidiaries' performance) from *business-variant corporate effects* (the uneven impact on subsidiaries' performance) to estimate overall corporate effects. Drawing on the literature addressing the allocation and the redeployment of non-scale-free resources within corporations, we discuss how and according to which criteria corporate strategy may unevenly affect subsidiary businesses' performance. We consider three factors that may directly or indirectly determine whether a subsidiary business will receive an above

(or below) average level of resources: the level of relatedness between the subsidiary business and the main activity of the corporation (Helfat and Eisenhardt, 2004; Lieberman, Lee, and Folta, 2017; Sakhartov and Folta, 2014), the relative attractiveness of its market (Porter, 1987; Sakhartov and Folta, 2015; Wu, 2013), and its relative size in the corporate portfolio (Bardolet, Brown, and Lovallo, 2017; Rajan, Servaes, and Zingales, 2000; Scharfstein and Stein, 2000; Shin and Stulz, 1998). We review standard variance decomposition methods and explain why the use of categorical variables prevents them from capturing *business-variant corporate effects*. We use hierarchical linear modeling (HLM) which was recently used in this line of inquiry (e.g., Misangyi *et al*. 2006; Hough 2006) to overcome the problems of collinearity in models estimating industry, business and standard corporate effects. However, to be able to estimate *business-variant corporate effects* resulting from corporate resource allocation decisions, we develop an extended HLM.

Our study contributes to the long lasting debate on the main sources of business performance heterogeneity. We find that our proposed "*business-variant corporate effects"* are at least as important as the standard corporate effects, i.e., *business-invariant corporate effects*, in explaining the variance of businesses' performance. We also find that the magnitude of the total corporate effects to be as important as that of the business effects, which have been found as the dominant effects in previous work (e.g., Hough, 2006; McGahan and Porter, 1997; Misangyi *et al.*, 2006). Finally, through some further exploratory investigations, we find that patterns of "business-variant corporate effects" are specific to each corporation suggesting persistent differences in firms' resource management processes.

BUSINESS-INVARIANT AND BUSINESS-VARIANT CORPORATE EFFECTS

Headquarters may affect businesses' performance in a number of ways. Some structural characteristics, company-wide processes or decisions are supposed to benefit a firm's all businesses similarly, while other strategic decisions such as diversification, mergers and

acquisitions or resource allocation are expected to benefit some divisions more than others and may increase performance variance between businesses in the firm. However, all the firm's corporate office decisions are susceptible to having both a homogeneous influence and a heterogeneous influence on all subsidiary business at the same time. The homogeneous impact results in what we call *business-invariant corporate effects* captured by corporate fixed (or random) effects in standard variance decomposition models; whereas the heterogeneous impacts generate *business-variant corporate effects*, that is, an increase in the variance across subsidiary businesses' performance within the firm's portfolio.

Grouping together different businesses in a single corporation, per se, provides structural characteristics benefitting all divisions. Corporate size, for instance, is supposed to increase negotiating power and to give businesses better access to external resources and capital markets in particular (Williamson 1975). It also enables cash flow to be pooled at a corporate level to support subsidiaries' investment projects (Penrose 1959; Stein 1997; Williamson 1975) and internal capital markets to be organized to compensate for external market inefficiencies (Hoskisson 1987; Khanna and Rivkin 2001; Myers and Majluf 1984; Stein 1997; Williamson 1975). As they benefit from better information to evaluate expected resource productivity in each specific application context, the internal mechanisms of corporations are supposed to outperform external markets in allocating resources (Williamson 1975). However, corporate resource allocation is a critical decision process that may generate significant performance differences across corporations (Arrfelt *et al*., 2015). The literature has emphasized distinctive resource management capabilities – i.e., evaluating, selecting, combining and deploying resources in the most efficient way (Barney, 1986; Lippman and Rumelt, 2003; Makadok, 2001; Sirmon, Hitt, and Ireland, 2007) – as an essential source of value creation in multi-business firms (Adner and Helfat, 2003; Arrfelt *et al*., 2015; Barney; 1986; Collis, Young, and Goold, 2007; Donaldson, 1984; Stein, 1997). Headquarters generally evaluate resources with no price

reference, and under uncertainty. Subsequently, they can only infer the value for these resources and efficiency of their resource allocations long after the deployments. This delayed value appropriation leads to an evaluation disparity of the resources and deployment choices (Leiblein, Chen and Posen, 2017; Lippman and Rumelt, 2003). In turn, this results in disparate headquarters' contribution to business units' performance and may create differences among the performance of subsidiaries depending on the firm they belong to (Adner and Helfat, 2003; Barney, 1991).

The influence that a single headquarters exerts over its businesses is however imbalanced when the corporate office must determine the allocation of non-scale-free resources that could potentially be exploited by different activities, but not simultaneously. Firms tend to allocate resources to those markets exhibiting potential higher returns to growth relative to other projects in the company (Maksimovic and Philips, 2002; Porter, 1987; Stein, 1997; Williamson, 1975). Resources such as financial resources, technical or management expertise, or machine tools that can be used in different related businesses offer redeployment options and can adapt to what Penrose (1959) referred to as *changing productive opportunities*: at any point in time, the opportunity cost of the current use of non-scale-free resources can be evaluated to determine their best use (Levinthal and Wu, 2010; Wu, 2013), and they can potentially be reallocated until marginal returns are equal (Maximovic and Phillips, 2002). As the attractiveness of one business diminishes compared to others, the opportunity cost increases as does the likelihood of resource redeployment. Consequently, intrafirm allocations and redeployments of non-scale-free resources may increase performance heterogeneity between businesses enjoying additional resources and others that are excluded from or negatively affected by the allocation process.

A headquarters' potential uneven contribution to its subsidiaries is not limited to the allocation and redeployment of non-scale-free resources. The resource-based view of the firm suggests that multi-business firms should favor investments in related businesses to enjoy

synergies between markets with similar resource requirements (Markides and Williamson, 1994; Montgomery and Wernerfelt, 1988; Palepu, 1985; Palich, Cardinal, and Miller, 2000; Penrose, 1959; Rumelt, 1974; Teece, 1982). However, even apparently scale-free resources may not impact all businesses equally. Resources such as brand names or technological knowledge may exhibit some properties of rival goods and generate negative externalities for some businesses. For instance, using umbrella branding to benefit reputational economies of scope may be detrimental if there are high quality differences between products (Cabral, 2009; Wernerfelt, 1988). Similarly, a headquarters' decision to acquire a firm with specific technological expertise might provide one of the existing subsidiaries with valuable resources (the knowledge existing in the newly acquired unit) while another subsidiary might not benefit from the acquisition (if the newly acquired knowledge is irrelevant to this second subsidiary).

VARIANCE DECOMPOSITION BACKGROUND AND CORPORATE EFFECTS

Early variance decomposition studies discussing the relative importance of industry, corporate and business effects on the performance of businesses have primarily used components-of-variance (COV) and nested ANOVA (OLS hierarchical regression) techniques.[6] However, these techniques prove unable to clearly disentangle corporate effects from business and industry effects. COV models, as used in the seminal work by Schmalensee (1985), assume that the effects of different factors are random in nature and therefore uncorrelated. McGahan and Porter (1997) show an important and significant negative relationship between industry and corporate effects, which limits our ability to distinguish the independent effects of each factor. Furthermore, the results obtained with COV models prove highly dependent on the composition of the dataset: different tests with the same population can end up with totally different

[6] The studies by Brush, Bromiley, and Hendrickx (1999) and Ruefli and Wiggins (2003) use different methods. The former uses a two-stage least squares model (2SLS), while the latter uses a non-parametric, ordinal variable approach. Because neither of these approaches was re-used in later studies, we do not discuss their relevance.

estimations for the importance of each factor (Brush and Bromiley, 1997)[7]. Unlike COV, hierarchical OLS regressions (or nested ANOVA) do not assume random effects and instead calculate the fixed effects of all categorical variables. However, the main source of problems in the ANOVA is the sequential introduction of dummy variables in the model, imposing an order in the estimation of the effects. Then, the significance of the covariance of factors results in an overvaluation of the effects of those factors introduced into the model earlier at the expense of others.[8] In addition, because businesses are nested within corporations, the inherent collinearity between corporation and business categorical variables distorts the estimations. Rumelt (1991) recognized this problem and suggested that a substantial part of the effect ascribed to the corporate level may instead be associated with the business-level effect. Thus, Rumelt (1991) was reluctant to attribute a strong effect (more than 10 percent) to corporate parents[9].

Furthermore, categorical variables impose variance decomposition methods to exclusively estimate effects based on estimations of the intra-class variance in businesses' performance. This logic of estimations may lead to a particularly salient problem when estimating corporate effects. Variance decomposition estimations rely on the difference between within-group and between-group variances: high (low) between-group and low (high) within-group variances result in a high value for the considered factor's effects[10]. This may not be problematic for factors such as business, industry or year effects, but it is more questionable for the examination of corporate effects. Suppose that the corporate headquarters intentionally

[7] For more information about COV and other parametric variance decomposition approaches, see methodological studies such as Searle *et al*. (2006, p. 391).
[8] The studies that use ANOVA usually report a window of estimations of industry and corporate parent effects resulting from different orders of integration of dummies into the model (e.g., McGahan and Porter, 1997).
[9] This problem cannot be solved by changing the order in which business and corporate dummy variables are introduced because importing dummy variables related to the smaller-grid lower-level variable (business dummies) before higher-level dummies (corporate dummies) would lead to ascribing all of the variance associated with corporates factors to business effects. Studies prior to Rumelt (1991) did not consider this problem, as they used market share as a proxy for business effects and did not introduce business segment dummies into their models (Kessides, 1990; Montgomery and Wernerfelt, 1988; Schmalensee, 1985).
[10] For instance, let us assume that we have a dataset with two years of observations comprising a high within-group (within-year) performance variance in each year and a low performance variance between the two years (low between-group variance). Then, the estimations would end up with low year effects.

makes a decision, such as rotating a successful top manager from a less strategic business to a more strategic one which is already performing relatively better. This decision may benefit the latter at the expense of the former, thus increasing within-corporate business performance variance. Standard variance decomposition techniques could not take this effect into consideration, thus underestimating corporate effects.[11]

In recent studies, HLM has been used to address the collinearity problem between corporate and industry effects and between corporate and business effects (Hough, 2006; Misangyi *et al.*, 2006). HLM recognizes the interdependency of observations and, as its main technical difference from standard fixed/random effect models, it integrates residuals in each level to be estimated separately (Hofmann, 1997, 1998). To estimate all effects simultaneously, this method uses maximum likelihood estimations through an iterative procedure. In addition, using HLM techniques eliminates the need to regress business performance against dummy variables, thus providing a higher statistical power than nested ANOVA models (see Goldstein, 2011, p. 922).

However, the standard HLM proves unable to account for *business-variant corporate effects*, as it cannot evaluate more than one cross-nested effect simultaneously. Prior studies could address settings where lower-level categories are cross-nested in two higher-level categories, which typically occur when businesses are nested both within corporations and within industries simultaneously (Hough, 2006; Misangyi *et al.*, 2006). Simple cross-nesting can be sorted out in standard HLM by artificially creating a hierarchy between the two higher-level categories (Bryk and Raudenbush, 1992). However, examining business-variant corporate

[11] In other words, we argue that the mentioned variance decomposition techniques' logic captures a portion of corporate effect which addresses the extent to which the subsidiaries of a corporation perform similarly different from others corporations; we connote this part of corporate effect as business-invariant corporate effect. Moreover, we claim for the existence of within corporate variance performance resulted from resource redistributions among the subsidiaries consequent to corporate headquarters' strategic initiatives; which we called business-variant corporate effects. Finally, we suggest that since the existence of business-variant corporate effects distorts the estimations and systematically leads to underestimations of business-invariant corporate effect, one should estimate the both to provide a full account of corporate effects on business performance.

effects necessitates multiple simultaneous cross-nested categorical variables. First, similar to previous studies, we must model business segments as a categorical variable cross-nested in corporate parents and industries. In addition, to capture the uneven impact of corporate decisions on business performance, we need to consider that yearly business performance is cross-nested within both the corporate parent and year categories. We can capture the variance related to the *business-variant corporate effects* only if we introduce the variables that potentially affect the corporate resource allocation decisions into the model at a corporate parent-year level. Finally, business performance is affected by both stable and transient industry effects, which generate another cross-classification problem (Adner and Helfat, 2003; McGahan and Porter, 1997). These transient industry effects are critical because, given the time length of the observations, not considering the variance between industries' performance over time may undermine the overall industry effects. To account for transient industry effects, one would need to introduce a categorical variable (industry-year) that is simultaneously cross-nested within year and industry categories. Prior studies by Hough (2006) and Misangyi *et al.*, (2006) were more focused on accounting for effects' collinearity and did not address multiple cross-nesting settings.

In other words, all three cross-classifications, i.e., industry-year, industry-corporation, and corporation-year, are highly important in our model. This is why we decided to propose a model that is a mixture of the nested ANOVA and HLM models to estimate different effects, in particular, the newly introduced *business-variant corporate effects.*

ADDRESSING BUSINESS-VARIANT CORPORATE EFFECTS

In order to account for *business-variant corporate effects*, we need to use both random intercepts and random slopes (Short, Ketchen, Bennet & Toit, 2006; Castellaneta and Gottschalg, 2014). Mainstream research examining the relative importance of different effects on business performance only used random intercept HLM to capture the variance to be

explained by each categorical factor (e.g., Hough, 2016; Misyangi et al., 2006)[12]. Including a random intercept for each categorical factor, including year, industry, industry-year, corporate parent and business segment, helps us partition that part of the business performance variance explained by each factor. However, capturing the portion of within portfolio performance variance induced by corporate headquarters relies on the introduction of a random slope for each variable of interest, which potentially affects the intrafirm resource allocation, at the corporate-year level. This is due to the fact that the uneven contribution of corporations to subsidiaries' performance arises from the redistribution of resources across subsidiaries in each single year independently. Therefore, only observations of each similar corporate-year should be clustered with each other to estimate the random slopes. Finally, as we explained above, standard hierarchical linear models are unable to consider more than one cross-nested categorical variable. Therefore, we propose a three-stage hierarchical linear model, where every subsequent stage takes the residuals of the previous stage.

We propose considering the relative *market attractiveness* of businesses, their *level of relatedness* to their parent firm main activities, and their *relative size* compared to the size of the parent firm, as the potential variables that affect intrafirm resource allocations, to estimate *business-variant corporate effects*. Markets' attractiveness and the level of opportunities are known as one of the main inducements of resource redeployments (Penrose, 1959; Porter, 1987; Sakhartov and Folta, 2015; Wu, 2013). On the other hand, by allocating resources to subsidiaries having more related resources, a headquarters increases the opportunity of

[12] It is worth mentioning that only the studies by Short *et al.* (2006) and Castellaneta and Gottschalg (2016) have addressed the present debate while introducing a random slope for the year variable (only) at the firm level. The former study argues that if corporations experience performance increases or decreases differently over time, i.e., the year random slope significantly explains the performance variances, this effect should also be added to the corporate effects. Put more precisely, firms differ not only if on average they have different returns, but also if their returns show different patterns of improvement or decline. To avoid cross-classification problems, they limited their sample to single business firms. Therefore, corporate and business effects are not disentangled. In addition, they find that only very low amounts of performance variance could be attributed to a uniform increase/decrease in the firms' performance. The latter study hypothesizes about the effect of different factors on the growth and shrinkage in the variance of the performance of private equity firms. Private equity firms in that paper resemble the corporations in the mainstream research to which we aim to contribute.

synergistic use of firms' resources and realizes what Helfat and Eisenhardt (2004) have termed "intra-temporal" economies of scope. Allocating resources to these subsidiaries also facilitates the future redeployments by facilitating the potential withdrawals and decreasing the adjustment costs of a resource redeployment if the allocation proves inefficient in the future (Lieberman *et al.*, 2017; Sakhartov, 2017). This provides the firm with "inter-temporal" economies of scope (Helfat and Eisenhardt, 2004; Sakhartov and Folta, 2014, 2015). Finally, the literature on internal capital markets has evidenced that smaller businesses are likely to receive relatively more resources than their larger sister businesses (Bardolet, Lovallo, and Rumelt, 2012; Rajan *et al.*, 2000; Scharfstein and Stein, 2000; Shin and Stulz, 1998). First, all else being equal, smaller investments have lower opportunity costs. For instance, Shin and Stulz's (1998) study of the internal capital markets of diversified corporations show that smaller divisions' investments are much less sensitive to their own cash flow compared to those of larger divisions when opportunities are high. Furthermore, recent studies evidence that when smaller divisions have limited access to external markets, they are allocated relatively more capital than theory would suggest, even when expected returns are relatively low. This finding has been considered to be a consequence of internal political bias (Rajan et al. 2000; Scharfstein and Stein 2000) or managers' cognitive bias (Bardolet *et al.*, 2011, 2012); however, Billett and Mauer (2003) find that these supposedly inefficient capital allocation decisions have a positive relationship with overall corporate value.[13] Thus, we expect that the relative attractiveness, the level of relatedness to the overall corporate portfolio and the relative size of business units significantly affect their capacity to attract corporate resources and, subsequently, their corporate parents' contribution to their profitability.

[13] In a more recent study, Bardolet *et al.* (2017) find that subsidiaries size play a more complex role in intrafirm capital allocations. They suggest that the firms are likely to subsidize the smallest subsidiaries of their portfolios. However, for the rest of the subsidiaries, relative size is positively related to their allocated capital. The authors explain the positive effect of the relative size, on allocated capital, by higher political power of larger subsidiaries.

SAMPLE SELECTION

Replicating previous works, we use Compustat to obtain industry, corporation, and business levels data. Our sample set includes the 9-year period from 2001 to 2009, which represents an economic cycle in North America: growth in the early 2000s followed by recession in the later 2000s. Industries are identified based on the 4-digit SIC code. The majority of prior studies aggregated the data related to business segments' size and profit at the industry level. However, because we wanted to detect details for the contribution of corporate headquarters to subsidiary performance, we decided not to aggregate the business segments at the industry level and, following Hough (2006), we preserved the operating segment categorization reported by corporations. This was facilitated by the Statement of Financial Accounting Standard (SFAS 131), effective since December 1997, which makes corporations categorize their business units into different business segments based on their management approaches and on how the managers organize different segments of their organizations (Hough 2006). Therefore, each corporation in our sample may possess more than one business segment in a single industry.

We mainly followed McGahan and Porter (1997) in the data screening process. We excluded business segments with assets under $10 million, businesses active in depository segments (SIC codes starting with 60), and businesses with missing data[14]. Following Bowman and Helfat's (2001) suggestion, we also excluded single-business corporations. Bowman and Helfat (2001) suggest that including single-business corporations in the sample confounds the business and corporate parent effects. Moreover, the impact of those criteria affecting corporate resource allocation decisions and thereby resulting in *business-variant corporate effects* can be studied only in corporations with more than one subsidiary business. We decided to limit our sample to multi-business firms that were active in at least two different industries. This helped

[14] For this condition, conservatively, we excluded the observations related to the entire corporation. As we intend to study within-corporation dynamics, excluding only the business might lead to biased data, particularly if some of the major subsidiaries of corporations are excluded in this way.

us to account for the different levels of attractiveness of the industries in which they had active subsidiaries and for potential differences in being related/unrelated to the main activity of the corporation as potential sources of *business-variant corporate effects*. In addition, we excluded data related to industry-years with only one observation in the sample, which might confound industry-year and business effects.

The final sample contains 6,821 observations for 2,129 business segments possessed by 539 corporations across 291 industry classifications.

METHODS

Estimation model

We propose a three-stage hierarchical linear model, in which every subsequent stage takes the residuals of the previous stage as the explained variable. We set the order as follows: In the first stage, we partition the macro effects including year, industry and industry-year effects through a random intercept HLM setting:

$$Y_{tijk} = M_{ti} + R_{tijk} \quad (1a)$$

where Y_{tijk} represents performance, measured by return on assets (ROA), of the k^{th} business segment of corporation j in industry i in year t. R_{tijk} is the residual of the first stage of our model. We assume that R_{tijk} has a mean of zero and is distributed normally with a variance of τ_R . M_{ti}, which is the composition of macro effects, is modeled by a four-level hierarchical linear model whose reduced form is as follows[15]:

$$M_{ti} = \mu_{0000} + \gamma_{t000} + \gamma_{0i00} + \gamma_{ti00} \quad (1b)$$

where μ_{0000} represents the overall average of the business segments' return for our sample, i.e., the grand mean, γ_{t000} represents the year random intercept, γ_{0i00} is the industry random

[15] For the sake of brevity, we show only the reduced form of the first stage of the model. The second and third stages of the model, which are the most important stages, are presented in detailed form.

intercept, and γ_{ti00} is the industry-year cross-classified random intercept. The year, industry, and industry-year random intercepts are assumed to have a mean equal to zero and to be distributed normally with variances equal to τ_t, τ_i, and τ_{it}, respectively. Dividing each of these variances by the outcome, i.e., business segment ROA variance, τ_Y, provides us with the estimation of their effects.

In the second stage, we use a three-level random intercept hierarchical linear model to partition the corporate and business segment effects simultaneously out of the residuals of the first stage model:

$$R_{tijk} = \pi_{0ijk} + S_{tijk} \quad (1c)$$

$$\pi_{0ijk} = \lambda_{00j0} + r_{ijk} \quad (1d)$$

$$\lambda_{00j0} = u_j \quad (1e)$$

where at the first level, R_{tijk} is the residuals of the previous stage, i.e., the residuals of the business segment ROA after partitioning year, industry, and industry-year effects; π_{0ijk} is the mean of the residuals, i.e., R_{tijk}, (across time) for business segment *ijk*; and S_{tijk} captures the time-level random error of R_{tijk}. We also assume that S_{tijk} has a mean of zero and is distributed normally with a variance of τ_S. At the second level of the second stage, the business segment mean of the residuals from the first stage, i.e., π_{0ijk}, is modeled through equation 1d, simultaneously, as an outcome of the random business segment intercept around the corporation mean, i.e., λ_{00j0}, . At the third level of the second stage, equation 1e, u_j is the between-corporation residuals; r_{ijk} and u_j are also assumed to have a mean equal to zero and to be distributed normally with a variance of τ_r and τ_u, respectively. S_{tijk} represents the part of the variance of the outcome measure, business segment ROA, that is not explained by macro effects, i.e., year, industry, industry-year effects, through equations 1a and 1b, or by the corporate and business segment effects, through equations 1c through 1e.

Finally, through the third stage, we try to explain the residuals of the second stage by a random slope, i.e., coefficient, HLM model. We import the random slope of the strategic factors that may affect the resource redistribution decisions of headquarters to the model. It is worth remembering that in addition to the potential direct effect, our variables of interest may interact to induce *business-variant corporate effects*. For example, although the relatedness of a subsidiary business decreases the cost of redeploying corporate resources to and from a subsidiary business, it is not sufficient reason for a subsidiary business to receive a higher share of corporate resources. More precisely, in addition to lower redeployment costs, other inducements, e.g., higher market attractiveness, are needed for a subsidiary to receive an above-average level of corporate resources (Lieberman *et al.*, 2017; Sakhartov and Folta, 2015). Therefore, the interaction of relatedness and the relative attractiveness of the businesses' markets may also explain a portion of *business-variant corporate effects*. Moreover, considering Shin and Stulz's (1998) results, we expect that the interaction of the relative size of the subsidiaries and the relative attractiveness of their markets may explain the portion of the *business-variant effects* that cannot be captured by either of these variables alone. The random slopes are defined at corporate-year level:

$$S_{tijk} = \gamma_{t0j0} + \boldsymbol{\beta_{tj}} \boldsymbol{X_{tijk}} + \varepsilon_{tijk} \quad (1f)$$

where $\boldsymbol{X_{tijk}}$ includes our proposed strategic factors (i.e., relatedness, relative market attractiveness and relative size) and their two-by-two interaction terms. $\boldsymbol{\beta_{tj}}$ is the matrix of estimated coefficients for our six proposed regressors, three factors and three interaction terms; where the coefficients are estimated for each subsample of the corporation-year. γ_{t0j0} represents the random intercept for the cross-classified categorical variable, corporation-year. Although we did not have a direct need to introduce the random intercept of this new cross-classified categorical variable, our model should include it because it is impossible to introduce the random slope of a regressor on the level of a categorical variable into a model without also

introducing that categorical variable's random intercept. ε_{tijk} is the error term of the third stage of our model. We assume that ε_{tijk} has a mean of zero and is distributed normally with a variance of τ_{ε}. The higher the variance of the estimated slopes are compared to their estimated errors, the greater the difference is between variances τ_s and τ_{ε}, and the greater the estimation is of the *business-variant corporate effects.*

Variables

Dependent variable

Profitability: To facilitate comparison with prior studies, we use the accounting value of ROA as the dependent variable. A small number of studies operationalized performance using value-based measures such as market-to-book value and economic profit. These supported the robustness of the results for the dependent variable (e.g., Hawawini et al. 2003).

Independent variables

Relatedness: To report whether a business segment is related to the main activities of its parent company, we use a dummy variable with a value equal to one when the segment is in parent's main industry group, that is if it shares the first three digits of the SIC code of its parent company, and zero otherwise. Because the relatedness measure has an inherently relative nature, i.e., some of the subsidiaries are recognized as related and others as nonrelated to the corporation's main activities, we do not need to group mean center the measure, and we use the absolute zero/one values for relatedness in our model.

Reversed relative size: The reversed relative size, or *smallness,* of a business segment is measured as the natural logarithm of the relative size of the entire corporation that the focal business belongs to relative to that business's size. The reversed relative size of a business segment to the entire corporation has a paradoxical effect on the extra contribution that a

subsidiary business can receive from its corporate headquarters. On the one hand, smaller subsidiaries may obtain their corporate parents' support more easily, particularly if they have greater future prospects than their sister businesses (Shin and Stulz, 1998). On the other hand, smallness may mean that business segment has less power to influence corporate decisions in its favor (Bardolet et al. 2017). It is measured as follows:

$$smallness_{tijk} = \ln(\frac{\sum_{tj} size_{tijk}}{size_{tijk}})$$

Therefore, *smallness* can only have a positive value.

Business segment relative attractiveness: Business segment relative attractiveness, or *attract,* measures the relative attractiveness of a business's industry compared to the other industries in which the parent corporation is active. The allocation of non-scale-free resources appears to be a function of the relative attractiveness of the subsidiary rather than its absolute attractiveness (Levinthal and Wu 2010; Wu 2013). To construct the measure for this variable, we first use the empirical Bayes predictions for industry and industry-year random intercepts from the first stage of our model, i.e., γ_{0i00} and γ_{ti00}. The summation of these two provides us with a proxy for the profitability of industry *i* in a given year *t* relative to the grand average of all industries in the entire sample, where γ_{0i00} addresses the profitability of industry *i* over the entire time frame of the study, and γ_{ti00} captures the variations of industry i's profitability *at year t* beyond the average of industry *i*:

$$attract_{tijk} = \gamma_{0i00} + \gamma_{ti00}$$

We group mean center the value of *attract* for each group of observations for a similar corporation-year. In general, there is no statistically always true mean centering strategy, and researchers should determine their strategy considering the theory their studies are dealing with (Hofmann and Gavin, 1998; Kreft, De Leeuw, and Aiken, 1995). Because *attract* does not

inherently address a characteristic of a subsidiary business relative to its sister businesses, we decided to group mean center the values[16].

RESULTS

The descriptive statistics and pairwise correlations for the variables to be used in the third stage of our model are presented in Table 1.1.

Table 1.1: Descriptive analysis and pairwise correlations

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.Profit	0.073	0.456	-9.776	8.477	1.00						
2.Relatedness (R)	0.469	0.499	0.000	1.000	-0.00	1.00					
3.Reverse Relative Size (S)	1.534	1.098	0.002	7.103	-0.01	-0.28	1.00				
4.Relative Attractiveness (A)	0.000	0.087	-1.424	1.211	0.22	0.02	-0.02	1.00			
5.S*A	-0.002	0.223	-5.530	3.427	0.31	0.01	-0.02	0.85	1.00		
6.S*R	0.566	0.910	0.000	6.062	-0.04	0.66	0.28	-0.00	-0.01	1.00	
7.A*R	0.001	0.053	-1.424	1.211	0.10	0.01	-0.02	0.61	0.36	-0.01	1.00

As explained earlier, our model is composed of three stages. Each stage partitions the variance related to some of the categorical variables and transfers the residuals, i.e., the unexplained variance, to the next stage. The results of the test of our proposed three-stage hierarchical linear model are provided in Table 1.2. The first stage presents the macro effects including year, industry, and industry-year effects through a four-level hierarchical linear model. Year, industry, and industry-year respectively explain 0.15, 3.70, and 5.63 percent of the total variance of the dependent variable, i.e., business segment performance. Similar to Adner and Helfat (2003), we find that the industry-year effect explains more variance in business segment performance than does the stable industry effect. This supports our claim that it is worth preserving this cross-classification effect in the model. We transfer the

[16]As we discussed earlier, to capture the extra positive/negative effect of strategic decisions by corporate headquarters on the performance of subsidiaries, i.e., the *business-variant corporate effects*, we need to import the variables that have a relative nature into the model. We did not center mean the other regressors, relatedness and reversed relative size, as they inherently have a relative nature.

residuals of this stage to the second stage, where they will potentially be explained by other effects.

Table 1.2: 3-stage HLM estimation of variance

	Variance estimate	Standard error	[95% Conf. Interval]		χ^2	P-value
Stage 1. year, industry, industry-year effects					411.87	0.0000
Outcome measure: ROA						
Variance of outcome measure: 0.2076825						
Level 4 variable variance (year)	0.0003073	0.000306	.0000436	0.002168		
Level 3 variable variance (industry)	0.0076859	0.001476	.0052755	0.011198		
Level 2 variable variance (industry-year)	0.0111357	0.001363	.0087611	0.014154		
Level 1 Residuals	0.1819776	0.003266	.1756886	0.188492		
year (Percentage of total variance): 0.15%						
industry (Percentage of total variance): 3.70%						
industry-year (Percentage of total variance): 5.36%						
Stage 2. corporate and business effects					2126.64	0.0000
Outcome measure: Stage-1 residuals						
Variance of outcome measure: 0.1719019						
Level 3 variable variance (corporation)	0.0508935	0.00492	.0421086	0.061511		
Level 2 variable variance (business segment)	0.103904	0.005055	.0944537	0.1143		
Level 1 Residuals	0.0707793	0.001524	.067855	0.07383		
corporation (Percentage of total variance): 16.01%						
business segment (Percentage of total variance): 32.68%						
Stage 3. business-variant corporate effects					4128.49	0.0000
Outcome measure: Stage-2 residuals						
Variance of outcome measure: 0. 052892						
Variance related to random slope (attract)	0.3368191	0.081075	.2101388	0.539867		
Variance related to random slope (smallness)	0.0020592	0.000128	.0018238	0.002325		
Variance related to random slope (attract*smallness)	0.5804858	0.049719	.4907781	0.686591		
Level 2 variable variance (corporation-year)	5.48E-20	4.65E-20	1.04E-20	2.89E-19		
Level 1 Residuals	0.0203553	0.000437	.0195161	0.02123		
business-variant corporate effects (Percentage of total variance): 14.20%						

As explained before, we use empirical Bayes predictions for industry and industry-year random intercepts from the test in this stage, i.e., γ_{0i00} and γ_{ti00}, to construct the measure of

industries' attractiveness. The summation of these two provides us with a proxy of the profitability, i.e., attractiveness, of industry *i* in a given year *t* relative to the grand average of all industries in the entire sample.

The second part of Table 1.2 presents the results of the second stage of the model and displays the estimations of business segment and standard corporate effects. The simultaneous estimation of corporate and business segment effects through the three-level hierarchical linear model, in this stage, prohibits the possibility of miscalculating and wrongly imputing one of these effects to the other. Our results show that corporation categories and business segment categories represent 16.01 and 32.68 percent of the variance in business segment performance, respectively. This estimation of business segment effects is approximately two times greater than corporate effects, and in line with estimations in previous studies (Vanneste, 2017). Standard corporate effects make explicit the extent to which the subsidiary businesses of a corporation, on average, perform differently from the business segments owned by other corporations. As such they can be considered as *business-invariant corporate effect.*

The last part of Table 1.2 reports the results of the last stage of our model to estimate *business-variant corporate effects,* i.e. the importance of the above-/below-average contribution of a corporation to the performance of each of its subsidiaries depending on its relative characteristics. First, we entered relatedness, relative size, relative attractiveness, and their two by two interactions into the model. However, because relatedness and its interactions with relative attractiveness and relative size did not add significant explanatory power to the model, we eliminated them through the main stream of the paper, to increase the parsimony of the model [17]. The third part of Table 1.2 shows that the *business-variant corporate effects*, including the effect of factors such as relative attractiveness, relative size

[17] The comprehensive model, i.e., the model which also includes relatedness and the interactions of relatedness and the other two independent variables, is provided in the appendix 1, Table A1.1.

and the interaction of these two variables, accounts for 14.2 percent of the variance of business segment performance.

Variance estimated for the random intercepts, through the first and second stages, directly addresses the extent to which the difference in the categories of a categorical variable accounts for the variance of the response variable. However, estimating the share of the variance accounted for by the random slopes, i.e., through the third stage, is a little different. For this, we should first calculate the explained variance using the introduced random slopes; this is the difference between the variance of the outcome measure and the residuals in this stage, 0.049841 and 0.020355, respectively. Thus, the explained variance is equal to 0.029486. Comparing the explained variance in this stage and the total variance of business segment performance, 0.2076825, provides us with the estimation of the *business-variant corporate effects*, which is approximately 14.2 percent.

Disregarding the newly introduced *business-variant corporate effects*, our results are in the range of those found by previous studies. As shown in Table 1.3, the effects estimated by the first two stages of our model are close to those found in previous studies. Small differences between the estimated effects in previous studies generally arise from sample differences (time frame, studied sectors, data cleaning procedures) and from the methods used (Bowman and Helfat, 2001; McGahan and Porter, 2002). However, our results also reveal the importance of the newly introduced *business-variant corporate effects*. Two patterns emerge from the results that are worth mentioning. First, the results of the third stage of our model show that the effect of the corporate headquarters (as the allocator of corporate resources) on the performance of subsidiaries is almost as important as its effect on the average return of subsidiaries as estimated in the second stage. In other words, our results find that not only do corporate parents contribute to the performance of their subsidiaries when, on average, their subsidiaries make different profits than other corporations' subsidiaries, but they also

specifically contribute to the performance of their subsidiaries by inducing performance variance among them (as a zero sum game) based on relative characteristics that are both internal and external to the corporation. We entitled the former and latter effects *business-invariant corporate effects* and *business-variant corporate effects*, respectively, and estimated their effects on the businesses' performance to be of approximately the same order of magnitude.

Table 1.3: Comparison of the explained variance of each factor of current study and the previous studies

Method	3-Stage HLM	Nested ANOVA	COV		HLM	
Study[a]	Current study	McGahan and Porter (2002)[b]	Roquebert *et al.*, (1996)	McGahan an Porter (1997)	Hough (2006)	Misangyi *et al.* (2006)
Data	Compustat	Compustat	Compustat	Compustat	Compustat	Compustat
Time frame	2001-09	1981–94	1985–91	1981–94	1995-99	1984-99
Sector	All[c]	All	Manuf.	All	All	All
Year %	0.2	0.8	0.4	2.4	0.6	0.8
Industry %	3.7	9.6	10.2	18.7	5.3	7.6
Ind-Year %	5.4	N/A[d]	N/A	N/A	N/A	N/A
Corporate[e]%	16.0	12.0	17.9	4.3	20.2	7.2
Ind-Corp Cov.%	N/A	N/A	0.0	-5.5	N/A	N/A
Ind-Year Cov.%	N/A	N/A	2.3	N/A	N/A	N/A
Business[f] %	32.7	37.7	37.1	31.7	40.1	36.6
Business-variant corporate effects%	14.2	N/A	N/A	N/A	N/A	N/A
Total explained%	71.2	60.1	67.9	51.6	66.2	52.2

a. We focus here only on studies which used business unit ROA as the dependent variable
b. Effects were added in the sequence of year, industry, corporate parent, and business unit.
c. All except depository sector due to significant difference in ROA (See McGahan and porter, 1997)
d. Not applicable
e. We named it business-invariant corporate effect.
f. Here refers to businesses segment, as all of the studies reported in the table used Compustat.

In addition to the estimations of the standard corporate effects, the *business-invariant corporate effects* reached more than one half of that estimated for business segment effects in the extant studies. This is also the case for the results of the second stage of our model (where the results show that the corporation category and the business segment category represent

16.01 and 32.68 percent of the variance of business segment performance, respectively). However, by adding the estimations of both models of corporate effects (16.01 percent for the *business-invariant corporate effects* and 14.2 percent for the *business-variant corporate effects*), we estimate the total corporate effect on business performance as 30.2 percent, which is highly comparable to the business segment effect.

To control for the possibility that the increase in the explanatory power of our model is due to random improvement or computational effects, we ran a robustness test. We randomly changed the values for the relative size and relative attractiveness among the observations and reran the third stage of the model for 100 iterations. The results showed that the averages of the third-stage residuals variance found in the 100 regression iterations were not significantly different from the variance of the outcome measure in this stage. This resulted in an estimation of *business-variant corporate effects* equal to zero for the samples with randomly changed independent variables, thus confirming that our results are not a statistical artifact.

DISCUSSION

Despite initial debates, the literature interested in determining the relative importance of industry, corporate and business effects have converged to agree that business performance varies depending on which corporation it belongs to. However, in this paper, we have argued that prior studies have systematically underestimated the magnitude of corporate effects because they could not account for the uneven impact of corporate office on the performance of its subsidiary businesses. Our results confirm the existence of a share of a firm's headquarters' contribution to the performance of its subsidiaries which is specific to each subsidiary in the firm's portfolio, i.e., the *business-variant corporate effects*. We captured these effects by the subsidiaries' level of relatedness, relative market attractiveness and relative size, suggesting a significant impact of the corporate resource allocation decisions on *business-variant corporate effects*. B*usiness-variant corporate effects* significantly, both

statistically and economically, contribute to increase the magnitude of overall corporate effects and the explanatory power of the estimation models.

However, whether these business-variant effects are really corporate-related effects remains to be discussed. Given that the effect may be different for each subsidiary of a corporation, one could argue that it is business (and not corporation) specific and therefore should be considered as a business effect. However, constructs such as business' size or market attractiveness are not measured in isolation but they are relative measures defined in relation to the corporate portfolio, thus making the so-called *business-variant corporate effect* a zero-sum effect across each corporate portfolio in each year. Then, the estimation of the effect is not sensitive to only business-related characteristics.

Our results provide us with the opportunity for more exploratory discussions. Although we witness cross corporate-year differences, we can wonder whether a single corporation conserve its decision making style over different years? In other words, are the random slopes of relative size, relative attractiveness, and their interaction firm-specific? To answer this question, we use empirical Bayes predictions for the random slopes of relative size, relative attractiveness and their interaction in each corporation-year. On average, we have predictions of the random slopes for each corporation over more than four years[18]. We ran one-way ANOVA tests for the predicted slopes for each of the independent variables against the corporation categories. The results presented in Table 1.4 provide strong evidence that the random slopes of relative attractiveness and the interaction of relative size and relative attractiveness are corporate-specific. In other words, different corporations exhibit persistent differences in subsidizing (or transferring resources to) subsidiaries with higher relative attractiveness and a higher level for the interaction of relative attractiveness and

[18] Our sample is composed of 2,283 corporation-year data for 539 corporations.

reversed relative size. The results do not support relative size as a persistent criterion on which a corporate headquarters bases its redistribution decisions.

Table 1.4: One-way ANOVA test of random slopes against corporation categories

number of observation:	2282
between corporation df:	538
within corporation df:	1744

Factor random slope	F-Value	P-value
Relative attractiveness (attract)	1.47	0.0000
Relative size (smallness)	0.29	1.0000
attract*smallness	1.5	0.0000

Moreover, we can investigate whether the average of each factor's random coefficients are associated with corporate performance, thus suggesting that the uneven effect to businesses is corporate specific and contribute to generate enduring differences across corporations. To do this, we use empirical Bayes predictions of the corporation random intercepts, i.e., business-invariant corporate effects, as a proxy for corporate performance. This is a good proxy, as it addresses the extent to which the subsidiaries of a corporation performed on average better/worse than the overall average, while the macro effects including year, industry and industry-year are controlled for. We regress our measure of corporate performance against the average of the predicted slopes of the strategic factors through the different years. Table 1.5 presents the results. The first three models separately test the relation of corporate performance with corporate style in terms of uneven support of subsidiaries based on each of the introduced strategic factors. Finally, Model 4 tests this relation for all of the three independent variables simultaneously. The tests provide us with some interesting results that are worth further discussions. First, our results strongly support that the best (worst) performing corporations, on average, subsidize the segments that are active in relatively less (more) profitable industries at the cost of those segments active in

relatively more (less) profitable industries. This might be rooted in a reverse causality: The higher level of firms' slack, gained from a better overall corporate-level performance, might lead to firms' more inefficient allocation of resources (Jensen, 1986). Moreover, the behavioral account of intrafirm allocation anomalies suggests that firms might subsidize businesses which perform worse than their aspirational levels in hope to correct the performance of these businesses. Thus, these firms opt out of allocating more resources to those businesses which have better growth opportunities (Arrfelt, Wiseman, and Hult, 2013). Our result shows that this association is more likely to be seen in firms which have overall higher returns.

Table 1.5: Is the firms' pattern of business-variant corporate effects associated with corporate performance?

	(1)	(2)	(3)	(4)
VARIABLES	Business-invariant corporate random intercept			
relative attractiveness average slope	-0.468***			-0.152***
	(0.0803)			(0.0483)
relative size average slope		10.23***		10.35***
		(0.746)		(0.500)
attract*smallness average slope			0.512***	0.513***
			(0.0275)	(0.0204)
Constant	-0.000997	0.00463	-0.00706	-0.00271
	(0.00712)	(0.00632)	(0.00573)	(0.00421)
Observations	539	539	539	539
R-squared	0.059	0.259	0.393	0.675

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In addition, our results show that providing relatively smaller subsidiaries, particularly those that are both smaller and active in more attractive industries, with extra support is related to corporations' performance. These results suggest that merely attributing the cross-subsidization of relatively smaller subsidiaries to decision makers' cognitive limitations (Bardolet et al. 2011, 2012) may provide an incomplete story. This resonates with Bardolet et

al. (2017) suggestion that subsidiaries' size plays a more complex role in intrafirm allocations.

Our results show that although relatedness, by itself, does not explain the variance of corporations' contribution among their subsidiaries, the interactions of relatedness–relative attractiveness and also relatedness–relative size provide some explanations of the within portfolio redistribution of wealth[19]. Our findings comply with new suggestions in the field of strategy about the relatedness of subsidiary businesses. Sakhartov and Folta (2015) suggest that although a higher level of relatedness of a subsidiary business decreases the cost of redeploying corporate resources to and from that business, it does not necessarily mean more resources allocated. More precisely, in addition to lower redeployment costs, redeployments must be associated with other inducements, e.g., higher market attractiveness, for a subsidiary to receive an above-average level of corporate resources. Lower redeployment costs lead headquarters to both allocate resources to the related businesses in priority, and more easily withdraw resources when performing below expectations (Lieberman *et al.*, 2017; Sakhartov, 2017). It is worth mentioning that relatedness also underlies intra-temporal economies of scope or synergy effects (Helfat and Eisenhardt, 2004; Sakhartov and Folta, 2014) traditionally captured by corporate fixed (or random) effects, and accounted for in the second stage of our model (in table 1.2).

We captured the *business-variant corporate effects*, partly, through capturing some indirect effects of industry as an important criterion shaping corporate-level decisions (Vanneste, 2017). Recent studies, Misangyi *et al.*, (2006) and Hough (2006) in particular, find that industry effects account for a very low share of business performance variance (e.g., 7.6%, and 5.3% in the studies by Misangyi *et al.*, 2006 and Hough, 2006, respectively). This is lower than initial variance decomposition studies' estimations and goes against what the

[19] The inclusive model is presented in table A1.1 in the appendix 1.

positioning school would suggest. Misangyi *et al*. (2006) provide a nice explanation. The authors show that a portion of the overall differences among the corporations arise from the composition difference in their portfolios and could be taken as indirect industry effect which shows itself in the standard corporate effect. The important indirect industry effects we captured in our *business-variant corporate effects* provide further evidence that the industry effects should not be as unimportant as recent studies have estimated. We suggest that neglecting industry transient effects due to the limitations of standard HLM also contributed to the underestimation of industry effects. Indeed, we found a transient industry effect of 5.36 percent, which is higher than stable industry effects of 3.70 percent. Finally, we address the call by McGahan and Porter (2002), "new approaches are necessary to generate significant insight about the relationship between [the effects],"pp. 834. We argue that the indirect industry effects are not limited to choosing in which industries a business should be active. They are also an important source of the ongoing business-variant corporate effects because the industry contributes to define the relative attractiveness of a business and its level of relatedness with the rest of corporate portfolio.

Finally, in this paper, our aim was to discuss the existence and importance of *business-variant corporate effects*. Then, it is worth disentangling this discussion and another line of inquiry studying potential contingencies affecting the magnitude of corporate effects. For example, corporate effects may be more or less important depending on the level of development of the country (Makino, Isobe, and Chan 2004), the stage of the industry life cycle (Karniouchina *et al*., 2013), the sector of activity (e.g. manufacturing vs non-manufacturing industries, McGahan and Porter, 1997). Similarly, Castellaneta and Gottschalg (2014) studying the determinants of the performance variance of buyout investments suggest that the corporation effects (in this case, the private equities effect) on buyout's performance increase over time and are more important in developed countries and during economic

downturns. These studies concentrate on the estimation of the even effects to all subsidiaries to examine to which extent, and under which conditions business-invariant corporate effects matter. On the contrary, we showed that corporate effects matter more than prior studies have found, due to the existence of *business-variant corporate effects*, which are neglected in those studies. The magnitude of *business-variant corporate effects* also reveals the importance of the question of "which subsidiaries receive more?" that might have important implications for the performance appraisal of firms' subsidiaries. Our results illustrated that an important share of a firm's businesses' performance differences, that might simply be attributed to the difference in their within business managerial factors, can be explained by the head office's distribution of corporate resources.

Our study is also subject to several limitations and caveats. First, similar to other recent studies in examining the importance of industry, corporate and business effects, we used Compustat data and SIC codes as the identifiers of the industries; these are very broad and do not provide a precise classification of business segments (McGahan and Porter, 1997). Second, to include all of the cross-classification possibilities in the model, such as industry-year and corporation-year, we were obliged to introduce a 3-stage HLM. This prevented us from estimating the industry effect simultaneously with the corporate and business effects. A third issue is, it may be claimed, that because both business-variant corporate effects and business-segment effects are two business-specific effects in a portfolio, the estimation of the business segment effects through the second stage of the model and the estimation of the business-variant corporate effects in the third stage lead to a systematic overestimation of the former and an underestimation of the latter. We agree with this argument and, therefore, we claim that our results are rather conservative. Our estimations provide a minimum for the *business-variant corporate effects* and a maximum for the business-segment effects. Because observations are cross-nested in the corporate-year and business segment categories, they

should be estimated simultaneously. However, they both are categorical variables belonging to many categories. Then, the two effects cannot be estimated simultaneously. To be convinced that our results are conservative, we concentrated on smaller sub-samples to repeat our estimations for the business segment effect and business-variant corporate effect in the same stage. We persistently ended up achieving significantly lower estimations for the business segment effects and higher estimations for the business-variant corporate effects. Therefore, we make a strong claim that the total effect of corporations on the businesses' performance is at least as important as the business effects. Then, although our model lacked the comprehensiveness of capturing different sources of the *business variant corporate effects*, we provided strong evidence for claiming that the total corporate effects on the heterogeneity of subsidiary business performance, is *at least* of the same order of magnitude as the business segment effects[20].

CONCLUSION

In this study, we proposed that considering *business-variant corporate effects* on subsidiary businesses' performance would significantly increase the estimation of corporate effects and the explanatory power of the entire model. In line with Adner and Helfat (2003), Bowman and Helfat (2001), and McGahan and Porter (2002), our results confirm that standard variance decomposition methods underestimate the impact of corporate-level decisions on the performance of subsidiary businesses. We find that including variables that may affect corporate-level resource allocation decisions dramatically improves the explanatory power of the models in explaining business-level performance. We showed that beyond the performance difference of businesses depending on their corporate affiliation,

[20]For example, in order to capture differences in headquarters' attention depending on geographical markets of their businesses (Bouquet and Birkinshaw, 2008), we should include the geography of the subsidiaries into the model. Naturally, this would increase the comprehensiveness of the business-variant corporate effects estimation. However, following previous studies using Compustat business segment data, we could not account for the geographical business-variant corporate effects.

there also are within corporation performance differences depending on each business unit's capacity to attract more attention from their headquarters, and then to receive more resources for instance. We concluded that taking into account both business-variant and business-invariant corporate effects, the total corporate effects are at least as high in their order of importance as business segment effects. Finally, we showed that corporations differ in their patterns of resource allocation among their subsidiaries and that they conserve these patterns over the time.

Chapter 2

(Essay 2)

Insights into Internal Capital Market Debate:

Why Headquarters Deviate from a Winner-Picking Approach

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ABSTRACT

Internal capital market literature assumes that corporate capital allocations are efficient if firms invest relatively more in subsidiaries with higher growth opportunities (that is, pick the winners). However, empirical findings provide mixed evidence on the winner-picking strategy. In this paper, we revisit why firms might invest extra capital in subsidiaries with seemingly lower growth opportunities. Building on the extents of *uncertainty* firms confront while making capital allocation decisions, and *interdependence* among their subsidiaries, we disentangle between inefficient and not-necessarily-inefficient deviations. We explain that deviations from the winning-picking strategy may simply reflect different strategic intents. Moreover, we highlight the role of CEOs' breadth of prior experience in subsidiaries in attenuating inefficient deviations and enhancing corporate value through better capital allocation practices.

Keywords: Corporate resource allocation; internal capital market efficiency; CEO experience; random-coefficient hierarchical linear models

INTRODUCTION

One of the critical decisions in every multi-divisional firm is to allocate capital among subsidiary business units. The main stream research on internal capital markets assumes that an efficient capital allocation is the one in which corporate headquarters engage in a winner-picking strategy (Stein, 1997) that is shifting larger portions of capital to units with more market growth opportunities. However, empirical evidence shows that, although headquarters have better access to their business units' information than do the external intermediaries and are able to better evaluate business units' prospects, firms are likely to cross-subsidize units with lower expected future returns at the expense of units with higher prospects (Arrfelt, Wiseman, and Hult, 2013; Bardolet, Fox, and Lovallo, 2011; Billett and Mauer, 2003; Shin and Stulz, 1998). In addition, although a successful capital allocation is assumed to follow the proposition of winner-picking strategy, there exists some evidence showing that overinvestment in units with lower expected future returns and underinvestment in units with higher prospects may not necessarily destroy the overall firm value (Billett and Mauer, 2003; Arrfelt *et al.*, 2015).

To shed more light on the determinants of deviation from winner picking and the observed mixed results on value-decreasing nature of this deviation, in this paper we argue that not all deviations from winner picking approach signify an inefficient and unsuccessful decision. We try to disentangle between deviations that are attributable to the failure of firms to identify and shift more capital to units with higher market opportunities and those attributable to pursuit of strategies other than investing more in units with higher future returns. To this aim, acknowledging that capital allocation is a complex decision (Bower, 1970; Sengul, Almeida Costa and Gimeno, 2019), we examine deviation effects of different dimensions of *complexity in decision environment* that each may, theoretically, trigger one of these two types of deviation more than the other one. A more complex environment may make it harder for CEOs to find and implement the optimal allocations due to cognitive constraints; in line with the agency

theory, it also make it easier for both self-interested CEO and divisional managers to mislead the decision makings to their own benefit; and also makes it likely that firms pursue their unique strategies, by their capital allocations, than simply follow a winner-picking approach. In particular, we focus on *return uncertainty of investment potentials*, as a decision making complexity that motivates the former type of deviations, and *segments' interdependence*, as a complexity that prompts the latter type of deviation through motivating firms' investments in synergistic linkages among subsidiaries.

We also study the role of managerial dynamic capabilities (Adner and Helfat, 2003) in firms' capital allocation decisions and these decisions' value implications. We focus on the effect of the *breadth of CEO's prior experience in firm's different business units* on the two types of deviations. We argue that the breadth of CEO's prior experience in firm's different business units may have contrasting effects on deviations from winner-picking logic of capital allocation. It *attenuates* the deviation effect of the complexity that results in the failure of company in efficiently allocating capital. In the opposite, we expect the breadth of CEO's prior experience in firm's different business units to *strengthen* the relationship between the complexity and deviation when the complexity is expected to trigger an efficient deviation; here, drives firms' intentions to invest in subsidiaries' synergetic linkages.

Finally, and in order to provide further support for the co-existence of efficient and inefficient deviations from winner-picking, we examine the value implications of conformity with winner-picking. We discern that conformity with winner-picking is associated with firms' value creation not as a general rule, but if it is mindfully adopted, i.e., when adopted by firms with high level of dynamic managerial capability – here, firms whose CEO has a relatively high breadth of prior experience in firm's different business units.

The contributions of this paper are twofold. First, it contributes to the debate on the internal capital market efficiency by showing that the extant literature overemphasizes the

capital allocation inefficiency by failing to consider various strategies that might be pursued by headquarters when allocating capital to their business units. We follow the insights from the Journal of Management's special issue (Maritan and Lee, 2017), in general, and Busenbark *et al.* (2017), in particular, on the importance of recognizing the underlying purposes and strategies for capital allocation, when evaluating efficiency in this decision. To our knowledge, the present study is the first that empirically shows that not all deviations from winner picking is attributable to the failure in making an efficient decision. Second, it also highlights the CEO's breadth of prior experience as a source of firms' dynamic managerial capability (Adner and Helfat, 2003) and capital allocation competency (Arrfelt *et al*, 2015). It reveals the contrasting effect of CEO's breadth of prior experience on the inefficient and not necessarily inefficient deviations and shows its role as a boundary condition, under which, a firm can enhance corporate value by conformity with winner-picking logic of capital allocation.

The rest of the paper is organized as follows. First, after a brief review of the debate on internal capital market efficiency, we present our arguments about the existence of two types of deviation from winner picking. In order to disentangle between these two types of deviations, we use different dimensions of firms' decision-making environment complexity and hypothesize on their association with firms' deviation from winner-picking logic of capital allocation and also on the moderating effect of breadth of CEO's prior experience on the proposed associations. Next, we briefly describe our sample, empirical analyses and results. Then, through our further exploratory analyses we examine the value implications of firms' conformity with winner-picking capital allocations and also whether our captured firms' inefficient deviations from winner-picking contracts with CEO's stock-ownership. Finally, we discuss important patterns emerging from the results, our contributions and limitations as well as further research directions.

THEORETICAL DEVELOPMENT AND HYPOTHESES

Capital allocation in complex decision environments

The theory of internal capital markets (Williamson, 1975) contends that multi-business firms outperform external markets in evaluating business units' prospects and allocating capital to realize their opportunities due to their better access to business units' information. The mainstream research on internal capital markets proposes a winner-picking logic (Stein, 1997) for optimality of internal capital markets. This literature assumes that internal capital allocations are optimal if top managers in headquarters shift the capital investments towards the units with higher market growth prospects. The empirical studies, however, provide ample evidence that multi-business firms deviate from the winner-picking logic and cross-subsidize units with lower prospects at the expense of units with higher expected future returns (Berger and Ofek, 1995; Billett and Mauer, 2003; Ozbas and Scharfstein, 2010). To explain the observed deviations, scholars have pointed at agency problem resulting from rent seeking behaviors of corporate CEOs and divisional managers (e.g. Antle and Eppen, 1985, Ozbas and Scharfstein, 2010; Rajan, *et al.*, 2000) as well as behavioral biases and cognitive limitations of decision makers (e.g., Bardolet *et al*., 2011; Arrfelt, *et al*., 2013).

The agency account of internal capital market inefficiency perceives subsidiaries as rent-seekers wishing to acquire a bigger share of available resources. Subsidiaries may conceal their information, exaggerate their prospects, and even use their power to influence corporate level decisions to receive more resources. Rajan *et al.*, (2000) suggest that CEOs intentionally tilt more capital budgets towards subsidiaries with less resources and market opportunities to decrease the diversity of expected returns between the subsidiaries and make them behave more cooperatively, i.e., make firm-wide optimal decisions where they have private information, and decision right is delegated to them. Scharfstein and Stein (2000) maintain that, on top of subsidiaries as rent-seeking entities, CEOs are also rent seekers who allocate capital based on

their own incentives which may be misaligned with the interest of owners. The behavioral account of internal capital market inefficiency, on the other hand, asserts that decision makers' behavioral biases and cognitive limitations make capital allocation deviate from a rational process. Arrfelt *et al.* (2013) argue that corporations allocate their capital through a backward-looking, aspiration (referent) driven, decision making process. According to them, the subsidiary businesses which perform relatively weaker than either their peers in the industry, or their sister businesses, or themselves in previous years are likely to receive relatively higher capital investments. They contend that actual internal capital allocation is a retrospective inefficient, performance-correcting, process rather than a prospective profit-maximizing one. As another explanation of internal capital market inefficiencies which is rooted in decision-makers' behavioral biases, Bardolet *et al.* (2012) provide evidence from both a secondary data analysis and an experiment showing that headquarters' top managers tend to an "even distribution" of capital among subsidiaries. They show that decision-makers are likely to distribute the capital in a way that the segments which should, optimally, receive significantly less capital investments than average receive only slightly less than the ones who should receive, optimally, much higher capital investments than average. Their study has been considered as one of the major works explaining why relatively smaller subsidiaries receive relatively higher capital investments.

Although the extant research considers the deviation from winner-picking approach equivalent to an inefficient capital allocation, it is not always found to be detrimental to firm value. For example, Billett and Mauer (2003) find that inefficient subsidies (i.e., capital over-investment) provided to small business units not only do not destroy corporate value, but are even positively associated with multi-business firms' excess value. Disregarding the overall firm-level effect, Arrfelt *et al.* (2015) find mixed results: over-investment in business units with less attractive prospects negatively contributes to their business-level return, while there is no

negative business-level performance effect of underinvestment in units with more attractive prospects[21]. Additionally, in a recent study Gupta, Briscoe, and Hambrick (2017) showed that the egalitarian values of liberal corporate CEOs results in even-handedly allocating capital to their business units. When the organizational members also have liberal orientations (similar to the CEO) such pattern in capital allocation is value-enhancing for the firm.

In an effort to resolve the controversial results emerging out of this line of inquiry Busenbark *et al.* (2017) suggests that the deviation from the winner-picking logic of capital allocation can also be interpreted as firms pursuing a different corporate strategy. In other words, not every multi-business firm may necessarily follow this capital allocation logic, that is, decide to allocate the capital resources on the basis of the growth prospect of their subsidiaries. For example, multi-business firms might also decide to distribute capital based on the potential to achieve synergy gains among subsidiaries. Extending this reasoning, this paper aims at better identify deviations that are attributable to the failure of managers to identify and shift more capital to units with higher market opportunities and those deviations that might be due to situations in which managers might follow strategies other than that of simply investing more in units with higher future returns.

According to Simon (1990), actors' rational behaviors, here capital investment decisions, are shaped simultaneously by two set of factors which are related to the extent of *cognitive abilities of decision-makers* and the degree of *complexity of the decision-making environment.* We first posit that decision-makers are boundedly rational (Cyert and March, 1963). As a result, they might follow some rules of thumb and biased decision making approaches when allocating capital (Bardolet *et al*., 2011; Arrfelt, *et al*., 2013); they also might not have the required knowledge about different aspects of their businesses and are likely to make decisions based on distorted information provided by divisional managers

[21] In fact, if this deviation is inefficient, under-investment in the businesses with better investment prospects should make them underperform, at least compared to their peers who received enough capital investment.

(Harris and Raviv, 1996). However, we do not limit the first set of factors to decision-makers' cognitive limitations, and in line with the agency theory, we also acknowledge that decision-makers might allocate capital self-interestedly (Scharfstein and Stein, 2000).

Second, firms' resource allocation, in general, and capital allocation, in particular, is indeed a complex process (Bower, 1970; Sengul *et al.*, 2019). Committing to holding an integrated view of capital allocation process, we select and use different dimensions of the *complexity of decision environment* that may trigger the mechanisms underlying our proposed two types of deviation from winner-picking. First, we look at uncertainty as a complexity dimension that theoretically leads to inefficient deviation by making managers less capable of identifying the subsidiaries with higher market prospects and tilting capital flow towards them. We follow Leiblein, Chen, and Posen (2017) conceptualization of uncertainty. They graft the insights from strategic factor market and real option theory and suggest that there are two uncertainties about the value of a resource: a *prospective* and a *contemporaneous* uncertainty. While the former pertains to how the value of resources would evolve over time, the latter is rooted in inefficiency of factor market and differential believes that firms have about the current value of a resource. Leiblein *et al.* maintain that firms' feedback learning and information processing ability make them exercise better "contingent claims on an asset in a factor market" (2017: p.2590). We suggest that selecting between capital investment opportunities to acquire potential resources in different business units could be observed through a similar lens. There is contemporaneous uncertainty about the relative value of the potential resources to be acquired by capital investment; there is also prospective uncertainty about the evolution of their value over time. We use firms' *overall market volatility* and *number of business segments* as proxies for prospective and contemporaneous uncertainty respectively, to capture inefficient deviations from winner-picking logic of capital allocation. When markets are volatile, headquarters may not be able to properly predict the future returns

of their business units and therefore are not able to shift capital to the units with higher prospects which is the very proposition of winner-picking strategy. Similarly, the larger the number of segments a multi-business firm is active in, the more calculations and information processing activities are required from top managers which may exceed their cognitive capacities. Consequently, headquarters would be more likely to utilize heuristics to find the solution which lead to more biases in decision making (Bettis, 2017), which results in deviation from rationally picking the winners. Also, the costs of auditing and collecting information on a large number of business segments might be too high, making a thorough evaluation unlikely and headquarters more vulnerable toward information asymmetry and rent seeking behaviors of divisional managers (Harris and Raviv, 1996). Therefore, uncertainty about investments' returns might amplify the divisional managers' self-interested behavior and lead to inefficient deviations from winner-picking. Additionally, uncertainty about investment alternatives' return also makes it easier for a self-interested CEO to make decisions to her personal benefit. When there are different voices and opinions about making new investments in which subsidiaries would provide the firm with higher returns, the CEO finds it easier to make decisions self-interestedly. In sum, when markets are volatile and when the number of business segments is large, firms are more likely to deviate from rationally picking the winners. Considering the above discussion, we hypothesize:

Hypothesis 1a: A firms' overall market volatility is negatively related to its conformity with winner-picking approach to capital allocation.

Hypothesis 1b: The number of a firm's business segments is negatively related to its conformity with winner-picking approach to capital allocation.

In addition to those elements of decision environment complexity which make managers *less capable* to follow winner-picking strategy (as discussed above), there are some complexities that make managers *less likely* to follow this approach, not necessarily

inefficiently. As previously mentioned, multi-business firms allocate capital to their business units, considering different criteria and corporate strategies (Busenbark *et al.*, 2017). One simplifying assumption of winner-picking strategy is that a headquarters considers each business unit at a time, evaluates its prospects, and allocates capital to it based on its expected future returns compared to its sister businesses. However, corporate headquarters also take into account the relationships between business units when allocating capital to them (Bardolet *et al*., 2017). The winner-picking logic of capital allocation neglects the subsidiaries' interdependence which is one important aspect of multidivisional firms. Interdependence is the extent to which different business units might support or complement each other's activities through sharing or redeploying financial, tangible, and intangible resources (Bower, 1970). We argue that interdependence among subsidiaries, as a capital allocation decision complexity dimension, makes managers less likely to follow the winner-picking approach. Multidivisional firms are able to achieve superior performance by creating synergies among their different business units and allocating capital accordingly to create firm value (Williamson, 1975). Therefore, when allocating capital to their businesses, a headquarters may be less concerned about the growth prospects of each single unit independently, and instead, it might try to make investments in a way that enhances the overall firm performance. The more interdependent the business units in a multi-business firm are, the more potential exists for creating synergies (Rumelt, 1974). Therefore, we advance that when the degree of interdependence among business units within a multi-business firm is high, and so more opportunities for synergy exists, it is less likely that the headquarters follows the pure winner-picking approach and invests more in units that individually have more growth prospects. We expect such firm to give a more complex answer to capital investment challenge. We then hypothesize:

Hypothesis 2: The degree of interdependence among a firm's business segments is negatively related to its conformity with winner-picking approach to capital allocation.

The role of capital allocation capabilities in complex decision environments

In the previous section we explored the role of decision-making complexity and related it to different types of deviations from winner-picking approach to capital allocation. On the one hand, we hypothesized on the deviation arising from a firm's uncertainty about the best use of capital. Such deviations are source of inefficiency in internal capital market. On the other hand, we introduced and hypothesized on the deviation effect of interdependence among business segments of a firm. Deviations then do not necessarily destroy firm value; rather, they may reflect value-enhancing synergetic linkages among subsidiaries.

The co-existence of efficient and inefficient deviations from winner-picking logic of capital allocation warrants contrasting moderating effects of capital allocation competencies (Arrfelt *et al*, 2015) on firms' deviations from winner-picking logic of capital allocation. Arrfelt *et al.* (2015) introduce firms' capital allocation competency as the underinvestment of firms in subsidiaries with lower market prospects. We push more on the concept and, acknowledging the complexity of firms' capital allocation decisions, we define firms' capital allocation capabilities as those characteristics of firms' structures, systems and decision-makers which make firms more *competent* to make proper capital investment decisions. We expect that firm's capital allocation capability, as an exemplary dynamic managerial capability (Adner and Helfat, 2003), impedes inefficient and suboptimal deviations from winner-picking approach, i.e., the deviations accruing from the investments' return uncertainty; and, therefore, demonstrate a weakening moderating effect on this sort of deviation. However, we expect a strengthening moderating effect of firm's capital allocation capabilities on the second type of deviations. If firm's deviations pertain to decision-makers' searching for better allocation strategies when winner-picking might prove suboptimal, we

expect this behavior strengthens with firms' decision resources. In the next section, we develop our hypotheses on the moderating effect of breadth of CEO's prior experience in various firm's business segments, as a source of firm's capital allocation capability, on the deviations proposed in previous hypotheses.

Breadth of CEO's prior experience in firm's business segments

We take the breadth of CEO's prior experience, in the domain of firm's subsidiaries, as an important source of firm's dynamic managerial capability (Adner and Helfat, 2003) with regard to corporate capital allocation decisions. Adner and Helfat (2003) attribute a good deal of corporate effect on subsidiaries' profitability to firms' dynamic managerial capability, by "which managers build, integrate, and reconfigure organizational resources and competences …[through firms'] high level decisions" (P. 1020). They enumerate managerial human capital, social capital, and cognition as three factors of managerial dynamic capability that, in addition to their direct effect, interact, and resonate each other's effect on the quality of firms' decisions. For example, a managers' industry-specific human capital, obtained from prior industry experience, contributes to her internal and external social ties that in return provides her with better access to new information, and ultimately higher quality of decisions. Career experience is an important aspect of managers' human capital which imprints in them a repertoire of job relevant knowledge and skills and impact the way they process information (Carpenter, Sanders, and Gregersen, 2001).

We focus on corporate CEOs since they are the most influential and powerful executives in any firm and usually have the discretion to determine the firms' overall strategy and policy (Quigley and Hambrick, 2015) in capital allocation. CEO prior experience, in particular, has been known as a critical determinant of firms' strategies and performance (Carpenter *et al.*, 2001; Gunz and Jalland, 1996). When a CEO has prior experiences in different business units or their various domain of activity, she is better able to evaluate their

prospects in complex situations and therefore allocate capital to the best use of it. First, prior experience in firm's business units provides the CEO with superiority in knowledge and information about those businesses' markets. Therefore, she is less vulnerable toward the information asymmetry that exists between the headquarters and divisional managers since she is not solely dependent on the information provided by divisional managers to make investment decisions (Ang, De Jong, and Van der Poel, 2013). Additionally, the more experience a CEO has in different business units, the more comfortable she is in searching for information and process the relevant information to make decisions. Therefore, even when investment alternatives' returns are highly uncertain for the majority of managers in a domain, a CEO with prior experience in those markets is more likely to be able to reduce the uncertainty compared to other CEOs who lack the experience. Considering the above discussion, we hypothesize that:

Hypothesis 3a: The negative relationship between a firm's market volatility and its conformity with winner-picking approach to capital allocation weakens with the breadth of CEO's prior experience in a firm's business units.

Hypothesis 3b: The negative relationship between a firm's number of business segments and its conformity with winner-picking approach to capital allocation weakens with the breadth of CEO's prior experience in a firm's business units.

On the other hand, we expect that the breadth of CEO's prior experience in the domains of firm's subsidiaries helps her better recognize potentials for synergistic rents among different subsidiaries to be pursued by firm's capital investments. Therefore, deviations pertaining to subsidiaries interdependence should be accentuated by the *breadth of CEO's prior experience* in subsidiaries:

Hypothesis 3c: The negative relationship between interdependence among a firm's business segments and its conformity with winner-picking approach to capital allocation strengthens with the breadth of CEO's prior experience in a firm's business units.

SAMPLE AND VARIABLES

Sample selection

Similar to previous studies, we used Compustat data. Our sample includes a 16-year period from 1998 to 2013 in which industries are identified based on the SIC system at the 4-digit level. We set 1998 as our starting year considering the fact that companies follow the new Statement of Financial Accounting Standard (SFAS 131) since December 1997. Based on SFAS 131, multi-business firms categorize their business units into different *operational* business segments based on their management approaches in addition to difference in industries (Hough, 2006). Therefore, each firm in our sample may possess more than one business-segment in a single industry[22].

We mainly followed Billett and Mauer (2003) in our data screening and selection process. We excluded business segments with assets less than $10 million. We also excluded businesses active in industries with either 6000s SIC codes (depository segments) or 9000s (non-classifiable establishments, and government, excluding finance) because they are not comparable with other businesses (Misangyi *et al.,* 2006). We excluded the observations in which both previous and next year related data were missing. Also, similar to previous studies, we excluded single-business firms because the analysis of internal capital markets, at the business segment level, is only applicable to multi-business firms. Further, we decided to limit our sample to firms active at least in two different industries in each year we had data for. This

[22] This smaller grid for business segments than in previous standards, in which a business segment was unique for each pair of firm-industry, warrants for more within-segment similarity of businesses, in general, and investment opportunities, in particular.

helped us capture the potential effects of industry opportunity difference of the sister subsidiaries. The final sample contains 4283 segment-level observations for 1078 business segments possessed by 362 firms across 205 industry (4-digit) classifications. This provides us with 1638 firm-level observations. They account for our main level of analysis in this study.

The data on all variables were collected from Compustat except the required data on CEOs that were collected manually from proxy statements, firms' annual reports and websites, BusinessWeek website, and LinkedIn profiles.

Dependent variable: Our firm-year level dependent variable, *Conformity with winner-picking*, is an estimated dependent variable (Añón Higón, Gómez, and Vargas, 2017; Lewis and Linzer, 2005; Malen and Vaaler, 2017) which we estimate in one stage ahead and at the segment-year level. Details of the procedure is reported in Appendix 2. Briefly, using the capital subsidy each business segment receives as the dependent variable, and controlling for other variables, we derive random coefficients for business segments' relative overall market opportunities at firm-year level. The greater the positive random coefficient for a firm-year, the greater the conformity of capital allocations of that firm-year with the winner-picking approach, and vice-versa.

Independent variables:

Segments' interdependence: We calculate firms' segments' interdependence by using segments' resource relatedness to the rest of firm portfolio. Similar to some previous work (e.g., Keil, Maula, Schildt, and Zahra, 2008; Villalonga and McGahan, 2005), we operationalize resource relatedness based on the proximity of industry SIC codes. The Relatedness variable can take values of 1, 0.75, 0.5, 0.25, or 0. Then, we take the average of relatedness values through a firm's portfolio as a proxy for the overall firm's segments' interdependence in a given year.

Overall market volatility: We use market volatility as a proxy for prospective uncertainty and unpredictability of future returns on potential investments. To this aim, we follow Sakhartov and Folta (2015) and operationalize a segment's market volatility by the standard deviation of return on assets (ROA) of the businesses active in that segment's industry. We use a step-wised process to calculate market volatility at the narrowest possible SIC level (that includes at least five data points). Finally, we take the average of *market volatility* values through a firm's portfolio to derive firms' *overall market volatility* for the focal firm-year.

Number of business segments: This is a count measure of the operating segment categorization (Hough, 2006) each firm owns. The operating segment categorization allows a firm to identify and differentiate between its business segments, even within a same 4-digit SIC code industry, based on their operational differences. Therefore, the number of a firm's business segments is more insightful about capital allocation decision complexity than the number of the industries that firm is active in.

Breadth of CEO's prior experience: First, we define a CEO's prior experience in a business segment as a dummy variable at segment-year level receiving 1 if the CEO had experience in segment's domain before assignment to CEO position and 0 otherwise. Then, we calculate *breadth of CEO's prior experience* in firm's business segments, which is a firm-year level variable, by taking the average of the CEO's prior experience in business segments across the firm's portfolio. This variable *breadth of CEO's prior experience* captures the CEO's overall competence in recognizing, comparing, and selecting the best investment opportunities, existing in subsidiaries, and pursuing synergies among firm's different business units. To test the Hypotheses 3a through 3c, we respectively interact the variable *Breadth of CEO's prior experience* with variables *firms' overall market volatility, number of business segments,* and *segments' interdependence.*

Control Variables:

Variable CEO's tenure: We measure CEO's tenure as the number of years that a CEO held her position in the focal firm. The common aspects of every CEO's job is that they usually start their position with low levels of power and knowledge about their job and as time passes, they become more powerful and build more knowledge about different aspects of the firm (Hambrick and Fukutomi, 1991). Therefore, throughout the cycle of their tenure, not only CEOs become less susceptible toward political complications within the firm that might impact their capital investment decisions (Xuan, 2009), but also they become more familiar with business units and more comfortable in collecting and processing required information even in complex decision environments.

Variable Segments' opportunity diversity: Rajan *et al.* (2000) suggest that CEOs intentionally tilt more capital budgets towards the subsidiaries with less resources and market opportunities to decrease the diversity of expected returns between the subsidiaries and make them behave more cooperatively. To account for this possible mechanism, we calculate the variable *segments' opportunity diversity,* similar to Rajan *et al.*, as the standard deviation of asset-weighted market opportunity of segments through a firm portfolio.

CEO Stock ownership: One suggested explanation for the deviation of firms from efficient allocation of capital is the self-interested behaviors of corporate CEOs. It is expected that owning firm's stock decreases the probability of CEOs pursuing self-serving behavior, and instead they would be more likely to act in the interest of the whole firm (Jensen and Meckling, 1976). We measure CEO stock ownership as the natural logarithm of the value of firm stock owned by the CEO measured in 1000 dollars.

We also control for variables such as firm's *size*, measured in logarithm of total asset, and *cash munificence*, i.e., asset-normalized firm's generated cash.

EMPIRICAL ANALYSIS

In our empirical analysis, we start with testing our different hypotheses. In a post-hoc analysis, we explore the value implications of firms' conformity with winner-picking approach to capital investment. This provides us further empirical support for our proposed typology on the deviations from winner-picking logic of capital allocation.

Main Results:

We use a fixed effect panel regression model including year, industry, and firm fixed effects. Table 2.1 presents descriptive statistics and the pairwise correlations of variables used in our analysis. There is only one particular point emerging from Table 2.1 that is worth mentioning. CEO's tenure has relatively important correlations with the two other CEO related variables: a positive correlation of 34% with CEO's stock ownership and a negative correlation of 21% with breadth of CEO's prior experience. The CEO's stock ownership and the breadth of CEO's prior experience do not have significant correlations with each other; nor has CEO's tenure a significant correlation with the dependent variable, i.e., the conformity with winner-picking capital investment approach. To ascertain that CEO's tenure would not artificially affect the estimations of coefficients related to the other two variables, we will exclude CEO's tenure from the model in our robustness tests and re-run the regression tests.

Table 2.2 provides the results of our hypothesis testing. Model 1 includes control variables. Only the variable *segments' opportunity diversity* receives a significant, indeed negative, coefficient. This supports Rajan *et al.*'s (2000) argument that headquarters might intentionally deviate from winner-picking approach, partly, to make segments' managing directors collaborate. The results of model 1 lacks enough statistical significance to confirm that cash-rich firms are less likely to conform to winner-picking approach and that CEOs' stock ownership is positively associated with firms' conformity with winner-picking approach.

Table 2.1: Descriptive statistics and pairwise correlations (firm-level); n= 1638

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Conformity with winner-picking	0	25.7	--247	304	1									
2. Overall market volatility	0.162	0.061	0.028	0.382	-0.04	1								
3. Number of business segments	2.615	0.92	2	8	0.03	-0.03	1							
4. Segments' interdependence	0.563	0.241	0	0.95	-0.03	0.11	0.08	1						
5. Breath of CEO's prior experience	0.259	0.333	0	1	0.06	-0.03	0.05	0.09	1					
6. CEO's stock ownership	5.589	1.849	0	11.23	-0.04	0.01	0	-0.18	-0.05	1				
7. CEO's tenure	1.793	0.99	0	4.025	0.02	0.02	0	0.01	-0.21	0.34	1			
8. Size	7.251	1.646	3.419	11.62	0.03	-0.14	0.27	-0.09	0.11	0.11	-0.13	1		
9. Cash munificence	0.063	0.074	0	0.555	-0.02	0.2	0.02	0.06	-0.08	-0.11	0.01	-0.08	1	
10. Segments' opportunity diversity	0.489	0.401	0	5.846	-0.06	0.18	-0.26	0.04	-0.02	-0.07	-0.03	-0.04	0.04	1

Table 2.2: Testing the hypotheses

	Conformity with winner-picking						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Size	-2.177	-1.198	-0.897	-0.886	-0.538	2.000	3.255
	(3.958)	(3.965)	(3.974)	(3.988)	(3.995)	(2.527)	(2.562)
Cash munificence	-5.726	-7.538	-9.068	-7.466	-9.058	-16.92	-15.34
	(20.91)	(20.79)	(20.83)	(20.81)	(20.84)	(15.81)	(15.79)
Segments' opportunity diversity	-6.866**	-5.315*	-4.960	-5.800*	-5.439*	-7.329***	-6.615***
	(3.085)	(3.114)	(3.120)	(3.130)	(3.135)	(2.522)	(2.552)
CEO's tenure	0.328	-0.0704	-0.168	0.195	0.0891	1.743*	1.653
	(1.394)	(1.425)	(1.425)	(1.437)	(1.437)	(1.002)	(1.017)
CEO's stock ownership	1.011	0.906	0.949	-2.793	-2.427		
	(0.928)	(0.937)	(0.940)	(3.572)	(3.589)		
Breath of CEO's prior experience		-4.059	-25.72	-4.807	-27.39		-11.07
		(5.324)	(21.32)	(5.349)	(21.38)		(16.57)
Overall market volatility		-67.03**	-101.9***	-119.4*	-155.3**		-55.24**
		(27.01)	(31.84)	(71.97)	(73.83)		(24.02)
Number of business segments		-1.707	-2.339	-0.370	-0.566		-1.767
		(1.702)	(1.903)	(3.748)	(3.782)		(1.531)
Segments' interdependence		-50.40***	-49.64***	-76.33***	-74.56***		-34.04***
		(12.91)	(13.35)	(24.02)	(24.54)		(10.28)
Overall market volatility * Breath of CEO's prior experience			134.8**		136.8**		110.0**
			(68.18)		(68.24)		(49.76)
Number of business segments * Breath of CEO's prior experience			2.105		2.069		0.575
			(4.906)		(4.931)		(3.889)
Segments' interdependence * Breath of CEO's prior experience			-13.92		-12.86		-10.77
			(20.36)		(20.47)		(15.99)
Overall market volatility * CEO's stock ownership				9.155	9.237		
				(11.26)	(11.27)		
Number of business segments * CEO's stock ownership				-0.293	-0.369		
				(0.601)	(0.604)		
Segments' interdependence * CEO's stock ownership				4.883	4.669		
				(3.702)	(3.711)		
Constant	19.40	65.55*	70.74**	84.97**	88.25**	-5.788	21.44
	(33.68)	(34.67)	(35.06)	(40.45)	(40.69)	(24.853)	(25.89)
Firm, industry and year fixed effects	YES	YES	YES	YES	YES	YES	YES
Observations	864	864	864	864	864	1,469	1,469
adjusted R-squared	0.196	0.22	0.222	0.219	0.221	0.157	0.169
R-squared	0.382	0.403	0.407	0.406	0.410	0.354	0.366

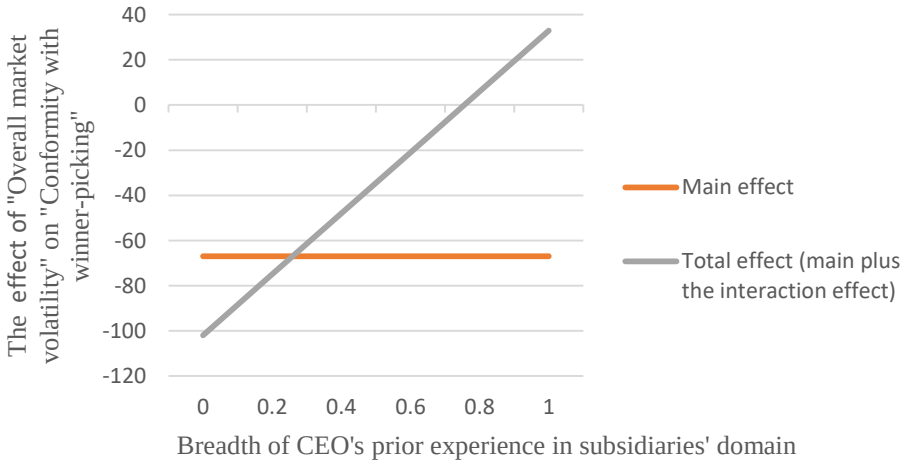
Standard errors in parentheses

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

We add independent variables to build Model 2. Variable *Number of business segments*, related to H1b, does not receive a significant coefficient. However, both other hypothesized effects of firms' *Overall market volatility*, H1a, and *Segments' interdependence*, H2, receive strongly significant negative coefficients (p-values equal to 0.013 and 0.000, respectively), conforming to hypotheses. It is worth mentioning that although only two out of the three hypothesized deviation effects receive statistical support, all of the three direct effects demonstrate relatively high importance, i.e., economic significance. One standard deviation increase in firms' *Overall market volatility*, *Number of business segments*, and *Segments' interdependence* result in a decrease of 16%, 6%, and 47% of dependent variable standard deviation respectively.

We test hypotheses 3a, 3b and 3c in Model 3. We find that the *Breadth of CEO's prior experience* significantly moderates, and attenuates the negative relation between the firm's overall market volatility and conformity with winner-picking approach to capital allocation, supporting the Hypothesis 3a (Figure 2.1).

Figure 2.1: The attenuating moderating effect of the breadth of CEO's prior experience on the negative relation between the firm's overall market volatility and the conformity with winner-picking approach to capital allocation



The other moderating effects of the *Breadth of CEO prior experience* on the variables *Number of business segments* (H3b) and *Segments' interdependence* (H3c) do not receive statistical significance.

***Robustness check tests**:*

We run some complementary tests to ascertain the robustness of our results.

First, to verify the dependence of deviation effects of firms' *Overall market volatility* on and also the independence of deviation effects of firms' *Segments' interdependence* from *Breadth of CEO's prior experience*, we split the sample in two subsamples: firm-years with higher and lower than average *Breadth of CEO's prior experience*. We run the test of direct effects for each subsample separately. While the deviation effect of *Segments' interdependence* significantly exists in both and is statistically indifferent between the two subsamples, the deviation effect of firms' *Overall market volatility* only exists in the subsample of firm-years with lower than average decision making resources. Further, as we explained earlier the variable *CEO's tenure* might potentially distort the estimations of the coefficients, due to its relatively important correlation with both CEO's breadth of prior experience and stock ownership. To ascertain that our results are not distorted and artificially strengthened, we re-run all tests while excluding CEO's tenure from the model. The fit of our models increases slightly in general, however, we do not witness any significant change in our estimated coefficients.

Further, as an exploratory test we are interested to see whether *CEO's stock ownership* also has an attenuating effect on inefficient deviations in our data; similar to *CEO's breadth of CEO prior experience*. In Model 4 we test for the moderating effect of CEO's stock ownership separately and in Model 5 together with breadth of CEO prior experience. Model 4 and Model 5 suggest that CEO self-interestedness do not have a significant moderating effect on deviations from winner picking.

Finally, data limitations on *CEO's stock ownership* has contracted our data by around 40%. Witnessing that CEO's stock ownership does not provide any significant either direct or moderating effect on firms' deviation from winner-picking capital investment approach, we decided to eliminate this variable from our model and re-run our regressions. Models 6 and 7 demonstrate the replications of Models 1 and 5 (or 3), respectively, from which CEO's stock ownership variable is eliminated. While the tests' sample size, at the firm-year level, increases from 869 to 1469 observations, the results are qualitatively similar.

Post-hoc analysis: Value implications of firm's conformity with winner-picking

To complement our analysis, we explore the value-implications of firms' conformity with winner-picking logic of capital investment. To this end, we regress the next year value of firms' market value, Tobin's $Q_{(t+1)}$, in our sample on the degree of conformity to winner-picking capital investment in previous year. We control for firms' current year market value[23], Tobin's $Q_{(t)}$, and other firm and CEO level variables we used in the main analysis of the paper. We also introduce firm and year fixed effect to all of our models. Results are presented in Table 2.3.

Model 1 only includes the control variables. Firms' current year market valuation and firm size receive significant positive and negative coefficients, respectively. The rest of variables receive insignificant coefficients, although, with a sign complying with the theory. We introduce firms' conformity to winner-picking in the second model that receives a positive, although insignificant coefficient; providing empirical evidence that winner-picking does not *always* enhance corporate value. Finally, in the third model we also capture the moderating effect of the *Breadth of CEO's prior experience*, on the relationship between the

[23] Since it is probable that the value of current year market value of the firm is highly dependent on its previous year value (much more than that to be captured the fixed effect which only captures the average value along the analysis timeframe), we added this.

firms' conformity with winner-picking and value creation. It receives a positive significant coefficient. This shows that conformity with winner-picking would be particularly associated with firms' value creation if CEO has had enough mastery over the domains of the subsidiaries and has adopted winner-picking mindfully.

Table 2.3: Value implications of firm's conformity to winner-picking

	Tobin's $Q_{(t+1)}$		
	Model 1	Model 2	Model 3
Tobin's $Q_{(t)}$	0.415***	0.415***	0.417***
	(0.0333)	(0.0334)	(0.0333)
Size	-0.146***	-0.147***	-0.148***
	(0.0533)	(0.0534)	(0.0533)
Cash munificence	0.286	0.291	0.335
	(0.325)	(0.326)	(0.326)
Segments' opportunity diversity	-0.0537	-0.0535	-0.0591
	(0.0534)	(0.0534)	(0.0535)
CEO's prior experience	0.0873	0.0858	0.0847
	(0.0793)	(0.0795)	(0.0794)
CEO's tenure	0.0162	0.0155	0.0143
	(0.0200)	(0.0201)	(0.0201)
Overall market volatility	-0.121	-0.116	-0.137
	(0.417)	(0.417)	(0.417)
Number of business segments	-0.00341	-0.00308	-0.00329
	(0.0260)	(0.0260)	(0.0260)
Segments' interdependence	0.265	0.270	0.259
	(0.204)	(0.204)	(0.204)
Conformity with winner-picking		0.000197	-0.000763
		(0.000609)	(0.000830)
conformity with winner-picking * Breath of CEO's prior experience			0.00360*
			(0.00212)
Constant	1.274**	1.273**	1.272**
	(0.568)	(0.568)	(0.567)
Firm and year fixed effects	YES	YES	YES
Observations	1,108	1,108	1,108
Adjusted R-squared	0.6727	0.6723	0.6731
R-squared	0.7741	0.7742	0.775

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

DISCUSSION

Williamson (1975), comparing Multi-division (M-Form) and Unitary (U-form) types of firms, suggests that multi-divisional form of firm acts as "miniature" capital markets, i.e., internal capital markets, which makes it possible for a firm to assign cash to the uses with higher

yields. According to him, M-Form can compensate for external capital markets' failure. He ascribes this "fundamental attribute" of M-form to potential feasibility and efficiency of the internal capital markets due to higher availability of information for internal auditors compared to the external ones (Williamson, 1975, p:148). The subsequent empirical work extends the logic underlying this analogy of internal capital market and assumes that an internal capital market, similar to an external one, is efficient only if it picks the winners, i.e., tilts the capital towards the businesses with higher growth opportunity, usually, the ones which are active in more attractive markets. Consequently, this enormous body of empirical work takes the observed pervasive deviations of multi-business firms from winner-picking approach as an evidence for inefficient internal capital market and tries to explain it by either agency theory or behavioral/cognitive perspectives.

In the present study, however, we addressed the recent theoretical argument (Busenbark *et al.*, 2017; Sengul *et al.*, 2019) about the importance of recognizing the purposes and strategies underlying firms' capital allocation when analyzing internal capital markets' efficiency. We argued and provided some empirical evidence that not all deviations from winner-picking approach is attributable to failure in making an efficient decision, and similarly, not all conformities with winner-picking could be expected to be value-enhancing. To this end, we leveraged the extent of decision-making complexity companies have to cope with to disentangle between the inefficient and not necessarily inefficient deviations from winner-picking logic of capital allocation. First, we used *uncertainty* about the best use of capital as an example of complexities that would lead to managers' failure in recognizing opportunities and allocating more capital to units with more opportunities, i.e., inefficient deviations from winner-picking. Second, we used segments' interdependence as an example of complexities that would make firms follow strategies other than *growth* and managers decide not to follow this "simply investing more in units with higher future returns" and

deviate from it. In particular, interdependence might provide firms with more opportunities to accrue synergistic rents from their capital investment decisions. Our analysis provided empirical supports for deviation effects of both *prospective uncertainty*, captured by *firms' overall market volatility*, and *firms'* s*egments' interdependence*.

Then we analyzed the effect of firms' capital allocation capabilities on deviations. Arguing for that each of the *firms' overall market volatility*, and *firms'* s*egments' interdependence* complexities trigger a different nature of deviation from winner-picking, i.e. an inefficient and an efficient deviation respectively, we expected firms' decision-making capabilities to have opposite moderating effect on these complexities' associated deviations. Our results supported that the *breadth of CEO's prior experience* in firm's different business domains attenuates the inefficient deviations, i.e., deviations associated with firms' overall market volatility in our paper. Under market volatility, it is extremely challenging for a multi-business firm to compare the return prospects of investment alternatives among its subsidiaries. Our results showed that a CEO's breadth of prior experience in firm's subsidiaries' domains, as a source of firms' capital allocation capability, makes her overcome this hardship and deviate less from winner-picking. As we expected, this is not the case regarding the deviations associated with subsidiaries' interdependence which, we suppose, are due to a CEO's intention to not analyze subsidiaries' opportunities separately and try to achieve synergistic rents through capital investments.[24] Finally, we also find that the conformity with winner-picking logic of internal capital market is positively associated with corporate value creation only in firms benefiting from dynamic managerial capabilities i.e.,

[24] The fact that we failed to find statistical significance for the opposite, strengthening, effect of firms' capital allocation capability on the deviation effect of segments' interdependence might be also suggestive in some extent. This might indicate that segments' interdependence might simultaneously trigger both forms of deviations, i.e. an efficient deviation through providing the firm with synergy-seeking investment opportunities and inefficient one related to complexity and hardship of monitoring the relations and coordinating highly-interdependent subsidiaries (Zhou, 2011). Then, the capital allocation capability helps the decision-makers accentuate more the efficient deviations while relax the inefficient one, resulting in an insignificant total moderating effect.

the breadth of CEO's prior experience in this paper. This provide further empirical support that allocating capital conforming to winner-picking could be value-enhancing only if it is deployed mindfully. Our finding resonates with RBV scholarship that dynamic managerial capability (Adner and Helfat, 2003) may explain the corporate-effect on performance heterogeneity of businesses, which arises from the difference in quality of high-level decisions in firms' headquarters.

In a different note and in comparison between prospective uncertainty and contemporaneous uncertainty, our results supported the inefficient deviation effect of prospective uncertainty, captured by firms' overall market volatility, which would be corrected by firms' decision-making resources. However, this was not the case for contemporaneous uncertainty, which we captured by firms' number of business segments. Our failure to find statistical support for the latter uncertainty might be due to imperfectness of the variable we used.

Finally, our results show that what we categorized as *inefficient* deviations from winner-picking ensue more from decision-makers' cognitive limitations to find the best investment opportunities under uncertainty than from CEO's use of uncertainties self-interestedly. Indeed, we do not aim to conclude that our results corroborate for higher explanatory power of behavioral/cognitive factors compared to agency reasons for capital missallocations. This is first because the corrective effect of the breadth of CEOs' prior experience might also be rooted in its functionality in countervailing divisional managers' rent-seeking behavior. Second, it is also possible that the uncertainty, as the complexity we used to trigger inefficient deviations, might per se trigger cognitive reasons more than agency ones.

Our analysis is subject to some caveats. First, as we mentioned, firms' number of business segments is not a perfect variable to capture the decision complexity dimension

rooted in contemporaneous uncertainty about the valuation of rival capital investment opportunities; and might have prevented us from finding statistical support for this uncertainty's effect. Moreover, and from a methodological standpoint, the adjustment of capital intensity by the norms of a business segment's industry, i.e., to derive *Industry-Adjusted, AI, capital intensity* in the Appendix 2, might affect our results. In general, industry-adjustment of capital intensity has its own pros and cons. As a positive point, it partitions the residuals that are industry-year-specific while are not related to market opportunity. For example, an industry might become extremely capital intensive, due to emergence of a new technology for instance, and not adjusting for this temporal effect would distort the estimations. On the other hand, this industry-year-level adjustment washes out a great deal of residuals pertaining to the industries' overall growth opportunity, especially if responded by the majority of businesses in a same industry. We decided to follow the methods excessively used in previous research to make it easier to compare our results with those of previous work.

It should be noted that, the present study intended to provide further support for the recent argument that not all deviations from winner picking are symptoms of inefficiency in capital allocation. To do this, we studied different dimensions of firms' decision-making complexity that would trigger either of the two inefficient and not necessarily inefficient deviations, and examined the effect of firms' capital allocation capabilities on those deviations. Our aim was not providing structural analysis about which segments are likely to receive over- or under-investment in the presence of each dimension of complexity we analyzed. This interesting question calls for further studies in the future. Further, our work focused on segments' interdependence as a complexity dimension that provides firms with an opportunity to pursue synergies in their capital investments, as a strategy that might make firms deviate from winner-picking. The study of deviation effects of other corporate-level

strategies and competitive objectives such as risk mitigation (Busenbark *et al.*, 2017) and avoiding competition escalation from the rivals (Sengul and Gimeno, 2013) also opens some avenues for further empirical work in this area. Similarly, it would also be some opportunities in examining the corrective effects of firms' decision-making resources other than the breadth of CEO's prior experience in subsidiaries businesses.

CONCLUSION

By the present work, we took the first step to swing the pendulum of the analogy of internal capital market a little back, and claim that, in contrast to external capital markets, the deviation of internal capital markets from winner-picking approach to capital investment is not equivalent to its inefficiency.

Chapter 3

(Essay 3)

Extending the Theory of Resource Redeployment to Financial Resources:

Evidence from Corporate Internal Capital Markets

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Extending the Theory of Resource Redeployment to Financial Resources: Evidence from Corporate Internal Capital Markets

ABSTRACT

This study aims to reconcile the theories of internal capital market and resource redeployment (RR theory). Using a simulation model followed by empirical investigations of the model's propositions, we develop and test a theory that clarifies how capital allocation decisions provide trace evidence of *non-financial* resource redeployments. By this, we set the stage for empirical investigations and validation of RR theory which has been mainly developed through formal models and simulations. In turn, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel predictions for the theory. Our research also illuminates how prior studies, claiming that firms extensively misallocate capital, may have reached their conclusion because they did not consider the value derivable from investing in resource redeployability.

Keywords:

Resource redeployment theory; inter-temporal economies of scope; resource divisibility; internal capital market efficiency debate; computational simulation

INTRODUCTION

Resource redeployment across businesses is one of the fundamental roles of corporate headquarters. Significant theoretical advances in recent years have illuminated the conditions under which there exists considerable potential for corporate value creation through withdrawing resources from one subsidiary business and redeploying them to other businesses (e.g., Helfat and Eisenhardt, 2004; Levinthal and Wu, 2010; Sakhartov and Folta, 2014, 2015; Lieberman, Lee, and Folta, 2017). However, empirical investigation into this emerging theory of resource redeployment (RR theory from now on) is scarce. It has been argued that the main reason behind this oversight is the challenge that exists in observing the internal redeployment of *non-financial* resources (Sakhartov and Folta, 2015). RR theory's lack of empirical work is in stark contrast to the immense theoretical and empirical body of research on internal capital markets (e.g., Arrfelt, Wiseman, and Hult, 2013; Rajan, Servaes, and Zingales, 2000; Stein 1997) which tracks capital flows between a firm's businesses. In this paper, we contend that capital flows might also be used to diagnose evidence around the redeployment of non-financial resources, because capital is eventually converted to resources of the non-financial kind. In reconciling the theory of internal capital markets with the theory of resource redeployment we also challenge the established conclusion stipulating that firms frequently misallocate capital.

Internal capital markets literature stipulates that firms' capital allocation is suboptimal; firms ought to invest in subsidiaries with higher growth opportunities, however they are observed not to do so. In turn, we argue that firms consider more than just its subsidiary's growth opportunities in allocation capital. A corporate headquarters investing capital in one of its subsidiaries to acquire non-financial resources (e.g. plants or technology), *also* purchases the *option* to redeploy those same non-financial resources in subsequent periods. Therefore, the direction of current capital flow among subsidiary businesses will not be a mere function

of their current relative market growth opportunities. Rather, this flow of capital is also a function of the flexibility, i.e., feasibility and adjustment costs, of potential resource redeployments among subsidiaries in subsequent periods. In other words, headquarters also consider the potential subsequent resource redeployments when allocating capital to develop resources.

We draw on RR theory which contends that different characteristics of a firm's resource influence the resource's optimal redeployment. In particular, the feasibility and adjustment cost of redeployments are driven by two characteristics of a potential latent resource: *fungibility* (Levinthal and Wu, 2010; Penrose, 1959) and *divisibility* (Helfat and Eisenhardt, 2004; Penrose, 1959).[25] On the one hand, a subsidiary's resource fungibility refers to its value if employed elsewhere; it contributes to the lower adjustment cost of withdrawing the resources from that business and redeploying them to another firm's business in the future (e.g. when a more opportune use of those resources is available). Similar to other works in the field, we proxy for a subsidiary's resource fungibility as the subsidiary's *resource relatedness* with other firm's businesses. On the other hand, a subsidiary's resource divisibility results in higher ability to smoothly scale it up or down (depending on whether the market demand grows or declines respectively). We study whether investing capital in these two elements of resource redeployability (i.e., resource relatedness and divisibility) contributes to firms' creation of inter-temporal economies (i.e., aptitude to flexibly adjust their subsidiaries' resource bases to external opportunities). More importantly, we explore whether either of these elements becomes the main source of value creation under different contingencies such as firms' *market volatility* and *cash-limitedness*.

The complex non-linear system of effects and interactions between the factors, and the path-dependence of firms' capital allocation and resource redeployment decisions, make our

[25] Latent resources refer to the resources that a subsidiary would develop by means of the allocated capital.

analysis not amenable to analytical solutions. Therefore, we develop a computational simulation model that complements the classic, winner-picking (Stein, 1997) logic of intrafirm capital allocation (i.e., investing in subsidiaries with higher growth opportunity). In addition to the value firms may gain from allocating capital to subsidiaries with higher growth opportunities, our model also accounts for the potential value firms might create through investing in resource redeployment flexibility. Through computational experimentation of our model, we study the effect of firm's *market volatility* and *cash-limitedness,* as two important contingencies, on the extent the firm would optimally leverage the elements of subsidiaries' resource *redeployability* when deciding about capital allocation. The results of the simulation suggest that for extremely low levels of market volatility, a firm is better-off if it distributes capital among its subsidiaries only according to subsidiaries' relative growth opportunity. However, for a range of moderate to relatively high levels of market volatility, the firm can create value by leveraging both elements of resource redeployability as market volatility increases. It also turns out that the firm's cash-limitedness imposes converse effects on the importance of the two elements of resource redeployability in firms' capital investment decisions. While cash-limitedness pushes firms to invest more in subsidiaries' resource divisibility, it alleviates inter-temporal economies rooted in resource relatedness. We provide empirical support for our propositions and theory using data from Compustat.

This study contributes to two different literatures. First, it contributes to RR theory by extending its boundaries to embrace capital allocation. We argue and show that observing internal capital allocation enables an empirical test of RR theory. Moreover, by offering new predictions, we also contribute to further development of this theory. Second, the paper contributes to internal capital market literature (Stein, 1997; Williamson, 1975). Relying on the premises of RR theory, our work complements the theory of capital investment optimality that have been merely accounting for subsidiaries' relative market growth opportunities. This

illuminates how prior work claiming that firms broadly misallocate capital may have reached this conclusion because they did not consider the potential value derivable from investing in resource redeployability. Our study confirms that internal capital markets may be more efficient than external capital markets; they can create value not only because of information premium of headquarters over external markets on subsidiary businesses, but also because internal capital markets consider the firm-specificity of capital investment.

THEORETICAL BACKGROUND

The theory of resource redeployment argues that a multi-business firm may create value by redeploying its resources when it realizes intra- and/or inter-temporal economies of scope (Helfat and Eisenhardt, 2004; Sakhartov and Folta, 2014). On the one hand, the intra-temporal economies arise from resource sharing, or in other words, which is the simultaneous and synergistic use of resources by different subsidiaries of a firm. Resource sharing leads to cost-reduction for the units of a multi-business firm relative to their single-business firm rivals. This value-creation mechanism applies to resources that do not have capacity limitation, i.e., scale-free resources, or those whose capacity is not fully utilized by either use. On the other hand, the inter-temporal economies are rooted in the flexibility and ease, i.e., low sunk cost and adjustment cost, of withdrawing the resource from current endeavor and allocating it to another. This value-creation mechanism is particularly salient when the firm's markets are volatile and returns are uncertain (Sakhartov, 2017; Sakhartov and Folta, 2014).

A value-maximizing firm faces a wide range of redeployment potentials for its resources that selecting the optimal redeployment strategy is challenging. In addition to targeting intra-temporal and/or inter-temporal economies, the firm should decide whether to redeploy its resources internally or externally. It may redeploy its resources internally through strategies such as diversification, reorganization (i.e., creation, deletion or recombination) of business units (Karim, 2009), redeployment of human capital (Wang, He, and Mahoney,

2009) and executives (Karim and Williams, 2012); or externally through strategies such as divestitures and alliances.

RR theory introduces two pillars for optimal redeployments. First, resource characteristics essentially determine the optimal redeployment strategy over a resource (Anand *et al.,* 2016). Scale-free nature (Levinthal and Wu, 2010), fungibility (Anand and Singh, 1997), and divisibility (Helfat and Eisenhardt, 2004; Penrose, 1959) are among the most important characteristics of resources in this regard. Scale-freeness makes it possible to redeploy a resource to other endeavors, parallel to the current use, without any opportunity cost. Fungibility refers to the value of a resource if employed elsewhere; the higher the resource's fungibility, the better the chances for its potential redeployments. Finally, a resource may have an indivisible scale that makes its optimal scale up (and scale down) non-continuous. For instance, in contrast to capital which is perfectly divisible, a special purpose milling machine with a 1000 piece per hour milling capacity is indivisible; and a firm which produces 1500 pieces per hour needs two of these machines, rather than one and half. Redeployment of the underutilized capacity of an indivisible non-scale-free resource may also result in intra-temporal economies (Helfat and Eisenhardt, 2004).

Second, decisions seeking scope economies are path-dependent and firm-specific. The optimality of current decisions is dependent on previous decisions and varies across firms (Folta, Helfat and Karim, 2016; Sakhartov, 2017). One important facet of path dependency in corporate decisions is the resource relatedness (Rumelt, 1974) between a firm's current businesses and a new business into which the firm diversifies. According to the theory, particularly, resource relatedness among a firm's subsidiary businesses, is positively associated with the value to be created from both intra- and inter-temporal economies of scope mechanisms (Sakhartov, 2017; Sakhartov and Folta, 2014). Resource relatedness leads to intra-temporal economies of scope by increasing the chance and decreasing the cost of

sharing scale-free resources (Maritan and Brush, 2003) and also by facilitating more efficient utilization of under-utilized non-scale-free resources (Karim and Mitchell, 2000). Resource relatedness also creates value through inter-temporal economies (Sakhartov and Folta, 2014; 2015) by cutting future redeployment costs and facilitating potential reversal, i.e., non-redeployment (Sakhartov, 2017). This redeployment flexibility makes the firm decide to redeploy resources among the businesses and achieve higher margins even if the expected margin in the new use of the resource is only slightly higher than the margins of its current use (Lieberman *et al.*, 2017; Sakhartov, 2017).

We argue that RR theory does apply to multi-business firms' *capital allocation* decisions. Standard RR theory has been developed limited to non-financial resources. It takes capital as a *pure fungible* resource whose allocation is not subject to any sunk or adjustment cost. Capital is also a *perfectly divisible* resource that can be allocated at the exact amount needed without any underutilization. Therefore, the mainstream has excluded capital allocation from the boundary of RR theory (Folta, Helfat, and Karim, 2016). We argue, however, that by investing capital in one of its subsidiaries to acquire a non-financial resource, a corporate headquarters also purchases the *option* to redeploy that resource to other subsidiaries in the future when needed. Therefore, managers with high capital allocation competences (Arrfelt *et al.*, 2015) would not limit their decision criteria solely to the currently anticipated returns and prospects of the potential resources to be developed/acquired by the competing capital investment opportunities. Rather, the headquarters' managers also take the potential ex-post resource redeployments into account in their capital allocation decisions.

We mainly focus on two different sources of redeployment flexibility: the latent resources' *relatedness* and *divisibility*. We explore the value effect of investment in resource relatedness and divisibility; both provide a firm with flexibility and the opportunity to continuously adjust its resource deployments to external opportunities in next periods. The

more a subsidiary's developed resource is related to the other sister businesses, the more flexibility the headquarters would have to withdraw that resource and redeploy it to the best use (when the composition of market opportunities changes between the subsidiary businesses; and the current investment proves suboptimal). In addition, the more divisible a subsidiary's resource is, the more feasible it would be for the headquarters to ration the resource in that subsidiary (i.e. following a decline of market demand) and redeploy the unutilized units of that resource in other subsidiaries with growing demands.

We raise the question whether and when investing capital in these two elements of resource redeployability (i.e., resource relatedness and divisibility) contributes to firms' creation of inter-temporal economies of scope. More precisely, we explore the effect of important contingencies, such as firms' *market volatility* and *cash-limitedness*, on the extent a firm would optimally leverage these two elements of resource redeployability in its capital investment decisions.

On the one hand, RR theory suggests that inter-temporal economies of scope are particularly momentous in uncertain markets where the entry and exit may happen more frequently (Sakhartov and Folta, 2014). Therefore, we expect that a performance maximizer firm happen to assign higher weights to both of our studied latent resources' elements of redepolyability (compared to external growth opportunities) in its capital investment decisions when the firm is active in relatively more volatile markets.

On the other hand, we expect that the firm's cash-limitedness plays a more complex role.

Firm's cash-limitedness, as a general rule, might weaken the value implications of investing in redeployability; a shallow pocket, in general, underinvests in its potential growth opportunities, and would have a relatively higher level of demand it cannot respond to. Thus, a cash limited firm would be less likely to have its resources underutilized. Knowing that

underutilization of resources is one of the reasons behind their withdrawal and redeployments, we might expect that firm's cash-limitedness makes the firm less willing to invest in latent resources' relatedness or divisibility. However, as a specific effect, cash-limitedness might have a positive effect on the value to-be-created from investing in resource divisibility. This new effect arises from particular hazard of shallow-pockets' overcommit to indivisible resources. Investing in indivisible resources, in general, is harmful since it makes firms less flexible in adjusting their resource deployments to external opportunities. However, this effect is less hazardous for cash-rich firms which are capable of continuously investing in new resources and can plan their new resource developments in a way to correspond to new market landscapes and opportunities. Conversely, redeployments are critically more important for cash limited firms since these firms have fewer means to acquire new resources when needs arise in face of external opportunities. In other words, cash-limited firms depend more heavily on the latent resources' divisibility in order to more gradually withdraw those resources from the current use and allocate them to a better one. We will study which mechanism underlies the stronger effect of firms' cash-limitedness on the extent latent resource' divisibility should be leveraged in firms' capital allocation decisions. We will also explore whether our studied contingencies, *market volatility* and *cash-limitedness*, interact with each other to affect the value implications of investing in redeployability elements.

SIMULATION MODEL

In this section, we study how firms' consideration of latent resources' redeployability, in addition to their subsidiaries' market growth opportunity, might help firms create further value by their intrafirm capital allocations. It is worth mentioning that the complex non-linear system of effects and interactions between the factors and also the path-dependence of capital allocation and resource redeployment decisions makes the capital investment optimization problem not amenable to analytical solutions. Therefore, we decided to develop a

computational model and study the intrafirm capital allocation through simulation of the system of the effects.

We computationally experiment how the optimal weights assigned to latent resources' relatedness and divisibility, in a firm's capital investment due diligence, would adapt with the variation of firm's *market volatility* and *cash-limitedness*. To do so, we analyze the evolution of our model's outcome, i.e., firm's average value growth, consequent to the gradual alteration of the parameters of the model.

General specifications of the model:

We simulate a firm's capital allocation to its subsidiaries and potential resource redeployments among them for 10 periods of time. The periods are comparable to years in related empirical work. Initially, a firm is randomly given a number of business segments, drawn from a negative binomial probability distribution with a minimum of 4 subsidiaries. Each firm's subsidiary businesses is randomly assigned to one of 360 industries. We model the industries as a set of points uniformly located around a circle, where the angular distance of each two industries defines their resource relatedness:

$$\text{relatedness}_{ik} = \quad e^{-\alpha\theta_{ik}} \tag{1}$$

where, θ_{ik} is the angular distance in degrees between the two industries *i* and *k* serve, and α is a parameter to set the relatedness in a suitable range. We set α as 0.01, in our model, which offers a granular range for relatedness.

Firm's business segments are fixed in quantity and never change their industry during the periods of our simulation. We also use constant probability distributions to assign each industry an "indivisible investment threshold" which is the cost of one uniform production line and is an integer number between 1 through 5. Similarly, each subsidiary of the firm is then assigned a number of production lines between 5 through 10 in the first

period[26]. The reverse of this "indivisible investment threshold" of each industry defines the resource divisibility of a subsidiary assigned to that industry that varies between 0.2 and 1. Every period includes random modifications in industries' (by implication, business segments') growth opportunity, actual demand and profitability. As it is elaborated in the Appendix 3, the mean and standard deviation of the normal distributions from which these variables are generated are calibrated with our empirical data; and, the industry's random growth opportunity, in each period, affects the mean of normal distributions from which the industry's demand and profitability random values are generated[27]. In each period, the firm *optimally* invests the summation of the generated cash by its subsidiaries, back into the subsidiaries in the form of new production lines. These investment decisions are made based on the marginal value of the investment of one unit of cash in subsidiaries which have un-responded demand. To derive the marginal value of capital investment in each subsidiary, the firm calculates *capital investment score*, *CIS*, for that subsidiary and corrects the *CIS* with a correction factor if the new production line would not be completely utilized:[28]

$$Capital\ investment\ \text{score}_{it} = \frac{Q_{it}}{\widehat{Q_t}} + \gamma_1 \frac{R_i}{\hat{R}} + \gamma_2 \frac{D_i}{\hat{D}} \qquad (2)$$

where, Q_{it} is the growth opportunity of the industry in which the business *i* is active, and is captured by that industry's overall *Tobin's q*; R_i is the average relatedness of business *i* with its sister businesses, i.e., other businesses existing in firm's portfolio; γ_1 and γ_2 are coefficients that capture the difference in weighting the elements of redeployability in decision making criteria (i.e., relatedness and divisibility, respectively) and receive values from 0 through 1 for γ_1, and 0 through 0.2 for γ_2 (both in steps of 0.05). The overall *Tobin's q*

[26] Changing α in equation 1 or the range of the integers for the initial number of production lines or indivisible investment thresholds does not qualitatively change our results.
[27] Therefore, industries with relatively higher growth opportunity, in general, receive higher actual demand growth and profit margin.
[28] The correction factor would be equal to the un-responded demand divided by the indivisible investment threshold.

of an industry stands for the overall growth opportunity in that industry, and usually has been operationalized with the average or median of single business firms' *Tobin's q* in that industry in empirical work. Q_{it}, R_i, and D_i and are normalized with (i.e. divided by) their average values, the $\widehat{Q}$, $\widehat{R}$, and $\widehat{D}$, respectively. Setting $\gamma_1 = \gamma_2 = 0$ demonstrates the scenario in which a firm follows the standard internal capital market theory's, i.e., winner-picking, logic of capital allocation.

In addition, each period also includes the redeployment of potential unutilized production lines of each subsidiary in sister businesses which still have un-responded demand, even after the capital investment phase, and also provide the highest redeployment value added to the firm for each unit of redeployed production line. Unutilized production lines emerge in subsidiaries following their potential demand fall. The value added of each potential redeployment is a function of the value that the receiving subsidiary offers and of the redeployment cost (which is a negative function of the resource relatedness between the transferring and receiving subsidiaries). Redeployment cost pertaining to the redeployment of a production line, which is originally developed in subsidiary *i*, in subsidiary *k* is calculated as follows:

$$Redeployment\ \text{cost}_{ik} = (1 - \text{relatedness}_{ik}) \ . \ 1/ D_i \qquad (3)$$

where, the reverse of subsidiary i's divisibility, D_i, stands for its indivisible investment threshold (i.e., the cost of one production line). Equation 3 suggests that a production line which is originally developed for a specific subsidiary would be able to demonstrate only a fraction of its nominal functionality if being used for another purpose (the fraction is equal to the resource relatedness between the original and new subsidiaries). Finally, we calculate the model's outcome, i.e., *Average value growth*, as follows:

$$Average\ value\ growth = (firm's\ value_{t=10} / \ external\ value_{t=0})^{1/10} - 1 \qquad (4)$$

where,

$$Firm's\ value_t = \sum_{i=1}^{N}(A_i.\ Q_{it}\ .Responded\ demand_{it}\ /\ Production\ capacity_{it}) \quad (5)$$

N is the number of firm's subsidiary businesses. Equation 5 denotes that subsidiaries contribute to the value of their parent firm only by the utilized share of their production capacity. Therefore, the value-maximizing firm tries to, optimally, both allocate capital to develop new production lines, and also redeploy them in future if needed. Further details about the model's specification and also its calibration with our empirical data is provided in Appendix 3.

The effect of resource divisibility on investment affordability

In the first stage of our experiment, we set γ_1 and γ_2 at zero, to derive the standard winner-picking pattern of capital allocation. We run 1000 repetition of the model (each for 10 periods); in result, we obtain a sample of 45,023 capital investment in the subsidiary-year level. During the simulation, we control for firms' size, number of subsidiaries, cash munificence (i.e., firms' aggregated generated cash divided by its size), the growth opportunity for the subsidiaries and their sister businesses, and subsidiaries' average resource relatedness with their sister businesses. We find that subsidiaries' divisibility is positively related to their size-adjusted capital investment, i.e., capital intensity. While the average capital intensity in this sample is 8.6 percent, as Figure 3.1a demonstrates, the coefficient of the studied relationship is equal to 9.8 percent. It means that, on average, the capital intensity in the most divisible subsidiaries (subsidiaries with divisibility equal to 1, i.e., the ones with an indivisible investment threshold equal to 1) is 7.8 percent higher than in the most indivisible subsidiaries (subsidiaries with divisibility equal to 0.2, i.e., the ones with an indivisible investment threshold equal to 5). This finding of subsidiaries' resource-divisibility-related investment subsidization is particularly important when we remember that, in this stage, firm is not intentionally investing more in subsidiaries with higher divisible

resources (i.e., we have set γ_2 at zero). Rather, this investment subsidization is rooted in better affordability of investments in resources with lower indivisible investment thresholds. The negative moderating effect of firm's cash munificence on the effect of subsidiaries' divisibility on allocated capital, demonstrated in Figure 3.1a, confirms this finding.

Figure 3.1: Higher capital investment in subsidiaries with lower indivisible investment thresholds (The role of investment affordability)

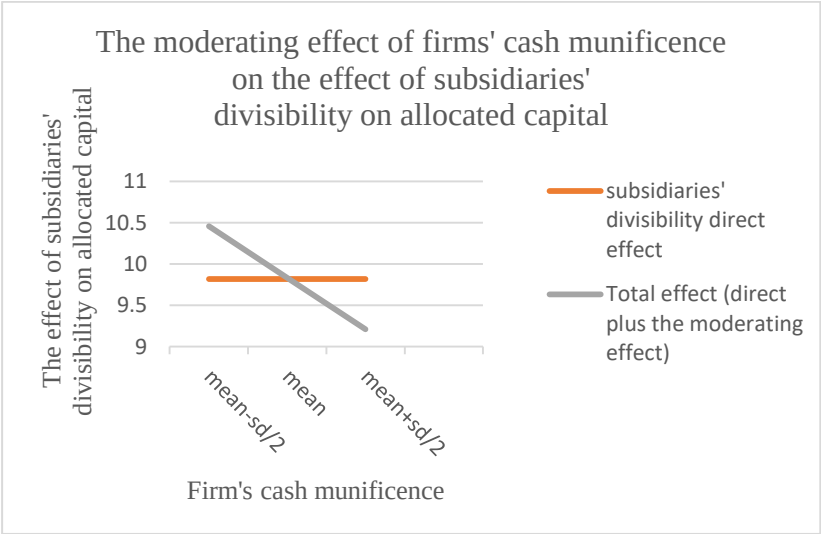

Figure 3.1a: The negative moderating effect of cash munificence on relatively higher investments in subsidiaries with more divisible resources

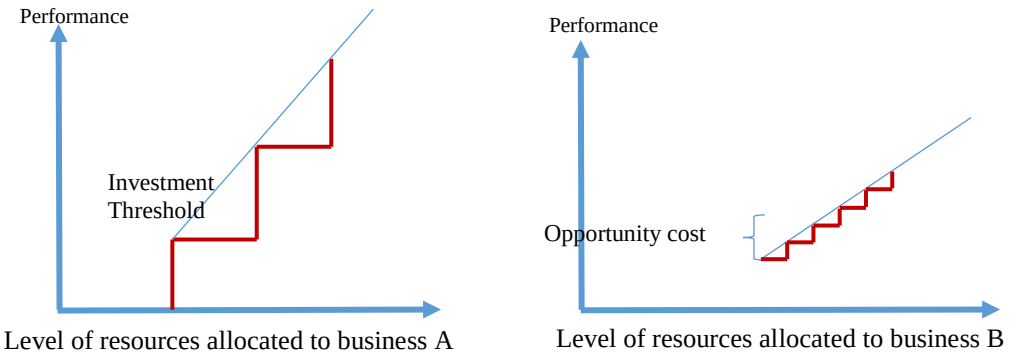

Figure 3.1b: Demonstration of *internal opportunity cost* which is rooted in subsidiaries' investment thresholds

Proposition 1: *Intrafirm capital allocations are subject to a constraint of less affordability of fulfilling greater opportunities existing in subsidiaries with higher indivisible investment thresholds. Therefore, firms might allocate capital to businesses that do not represent the portfolio's best opportunity if those businesses have low indivisible investment thresholds relative to other businesses in the portfolio. Cash-limited firms are expected to display this pattern more prevalently in their allocations.*

Proposition 1 highlights the effect of investment *affordability*, arising from the *threshold effects* (Baldwin and Clark, 1992), on firms' capital allocation decision. Threshold effects reflect the concept that return to investments are not a linear function of investments. More precisely, a subsidiary's return improves after each indivisible investment threshold is reached, i.e. as an investment quantum (for example the cost of a new production line in our model). Further, the capital investments needed for developing resources with higher indivisible investment thresholds are less likely to be affordable. Therefore, a subsidiary's resources' indivisible investment thresholds may increase the parent firm's *internal opportunity cost* of capital investment in that subsidiary. Assume that a firm has 1,000 Dollars of capital and intends to choose between investment opportunities in two of its subsidiaries. The expected rate of return on capital investment in subsidiary A, (*Figure 3.1b left)*, and subsidiary B, (*Figure 3.1b right*), is 20% and 15% respectively. Now, assume that the indivisible investment thresholds which trigger those rates of return are $2,000 and $500 in subsidiaries A and B, respectively. Because the headquarters does not afford subsidiary A's indivisible investment threshold, it has to invest all of its available capital in the second subsidiary as *a second-best decision*. Otherwise, it faces an *internal opportunity cost* (shown in the right-hand graph) that takes account of the fact that investing $1000 in subsidiary A

does not provide the firm with any return. Logically, this affordability-based pattern of investments would be more pronounced by cash-limited firms.

Resource redeployability and capital allocation- the effect of firm's market volatility: The resource redeployment theory lens for capital investment, represented in our paper, suggests that investing capital to develop more redeployable resources in businesses provides multi-business firms with an *option* (Folta and O'Brien, 2004; O'Brien and Folta, 2009) to deploy their resources to the best use in later periods. This option arises from both higher feasibility of more gradual withdrawal and continuous adjustment of divisible resources, and also the lower redeployment cost of resources between subsidiaries which have more related resource bases. Further, the value of this option, i.e., inter-temporal economies of scope, increases with the firm's market volatility which increases the likelihood of resource withdrawals and redeployments. We computationally experiment whether and under which conditions firms' simultaneous consideration of latent resources' redeployability, in addition to their subsidiaries' market growth opportunity, might result in value creation through intrafirm capital allocations.

In the first step, we compute the model's outcome variable (i.e., firm's average value growth) using different weight values of resource relatedness (i.e., the γ_1 coefficient from the *capital investment score* equation) and explore how the optimal γ_1 depends on the firm's market volatility. We dial market volatility, captured by the standard deviation of the normal distributions of both industries' *Tobin's q* and actual demand growth, from minus 50 percent to plus 150 percent of the related values drawn from our sample. While we adjust the weight firms give to latent resources' relatedness, γ_1, from 0 to 1 in steps of 0.05, we fix γ_2 (the score firms give to latent resource's divisibility) at 0 in this stage of our simulation. Figure 3.2a compares the change of the outcome variable as a function of γ_1 under different schemes of market volatility.

Figure 3.2: Simulation results. Firms' average value growth (over 10-period) as a function of γ_1 (the coefficient of resource relatedness in Capital Investment Score) and γ_2 (the coefficient of resource divisibility in Capital Investment Score). The mean of profitability (i.e., generated cash) normal distribution = The mean of actual demand growth normal distribution = 12%

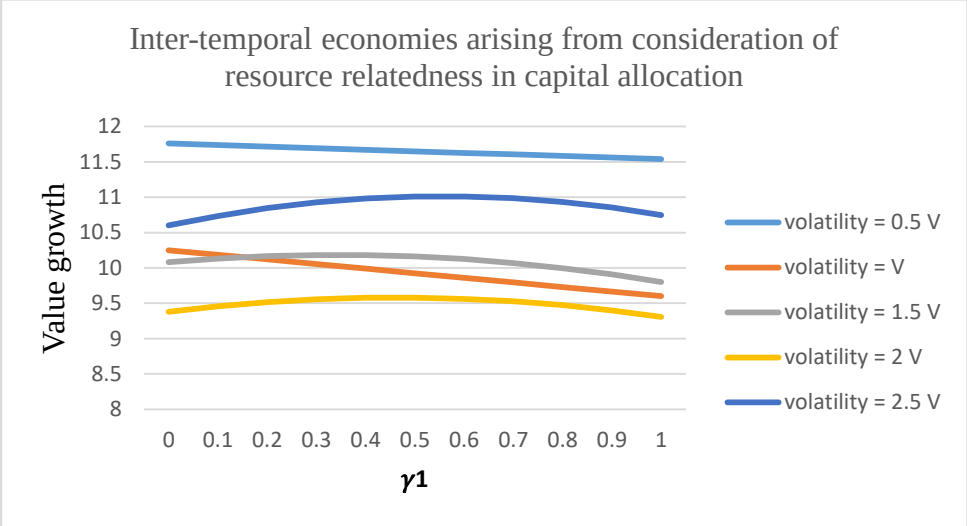

Figure 3.2a: The relation between the coefficient of resource relatedness in Capital Investment Score, γ_1, and firms' average value growth when firms do not consider resource divisibility, γ_2=0, under different volatility schemes.

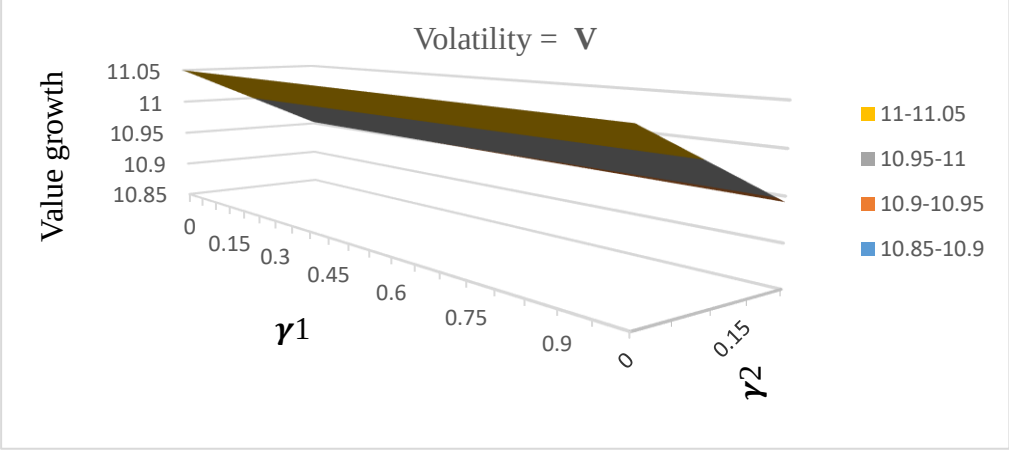

Figure 3.2b: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth under moderate market volatility (volatility is equal to its average value drawn from our sample, i.e. volatility = V)

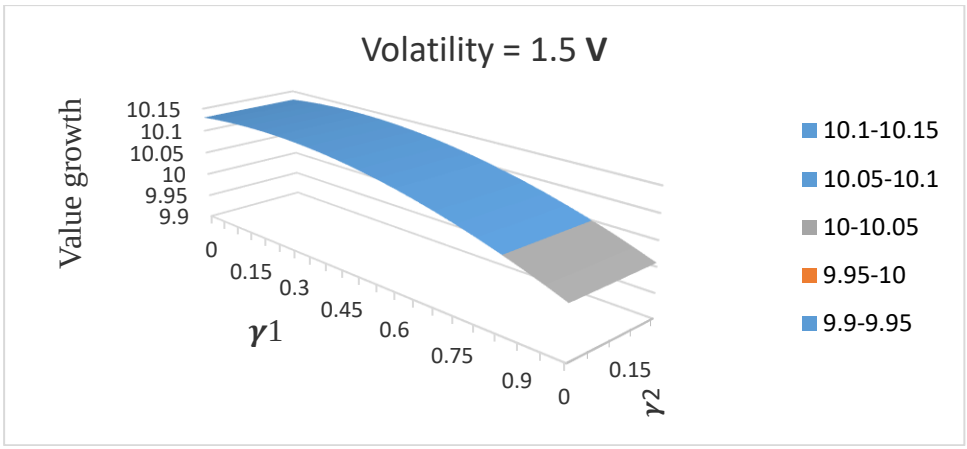

Figure 3.2c: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth when volatility is 50% higher than the average value drawn from our sample (i.e., volatility = 1.5V)

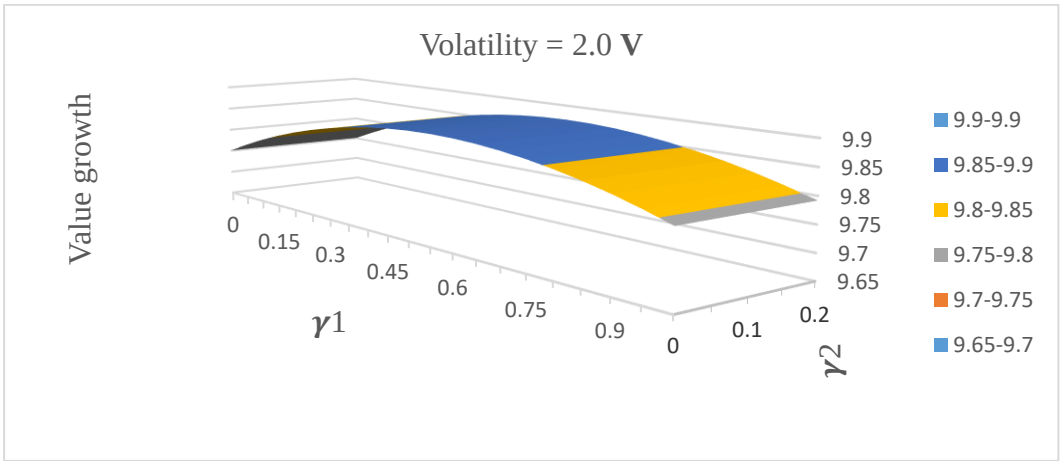

Figure 3.2d: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth when volatility is 100% higher than the average value drawn from our sample (i.e., volatility = 2V)

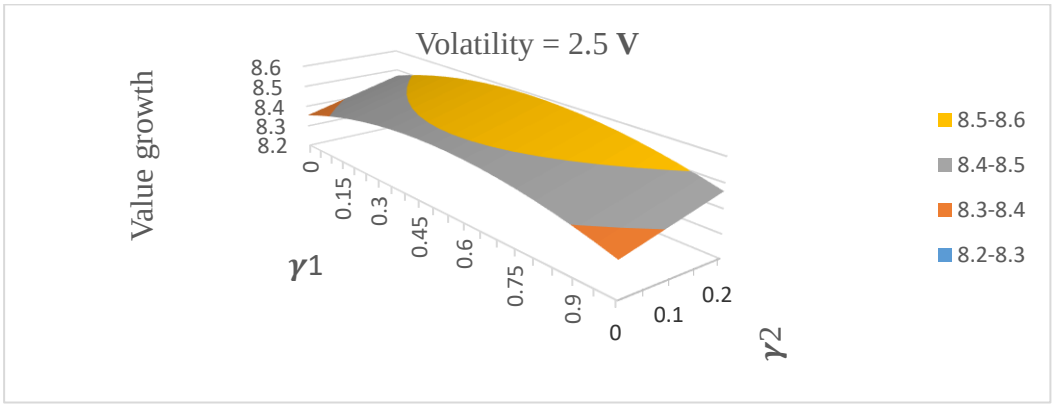

Figure 3.2e: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth when volatility is 150% higher than the average value drawn from our sample (i.e., volatility = 2.5V)

Each graph in figure 3.2a is a line or a second order curve that best fits[29] the outcome variable medians of 1000 repetition of the model under each setting of the parameters. Two important patterns emerge from the figure. First, the increase of market volatility leads to, overall, lower creation of firm value which is rooted in the frequent change of the composition of market growth opportunities and need for redeployments that accrue considerable redeployment costs. Second, the graphs support the existence of an inverted U-shape relation between γ_1 and firms' created value when market volatility is sufficiently high. This effect fades for very high levels of market volatility (when volatility is far greater than the range demonstrated in Figure 3.2a) and changes to a consistently negative relation between γ_1 and firms' value creation for low levels of market volatility. Extremely high market volatility makes the firm's value growth random with respect to the weights given to resource relatedness. On the other hand, when market volatility is very low, the firm's future outlook, especially the relative market opportunity of its business segments, will be very similar to its current situation. Therefore, it would make sense that capital allocation will be optimal if firms only consider subsidiaries' relative market growth opportunities, i.e., when γ_1 is equal to zero. Conversely to these two extremes, a range of moderate to relatively high market volatility demands the simultaneous consideration of both segments' overall market growth opportunity and latent resources' relatedness. Whereas the former optimizes the decisions for the scenario in which the future is the continuation of the current situation, the latter provides the firm with flexibility for less costly management of future withdrawals and redeployments.

Next, we complement the simulation model by also including the latent resource's divisibility and computing the capital investment score using its complete form as illustrated in Equation 2. That is, in addition to γ_1, similar to the previous experiment, here we also

[29] Either one which provides a higher adjusted R-squared

adjust the weight firms give to latent resources' divisibility, γ_2, from 0 to 0.2 in steps of 0.05. We study the model under a wide range of market volatility schemes; we dial the market volatility value starting from the overall volatility computed in our sample (Volatility = **V**) to 150 percent higher (Volatility = 2.5**V**). For each setting of parameters (e.g. γ_1, γ_2, and volatility), we run the model for 1000 repetitions to obtain a set of 1000 value growth computations. We then use the median of the 1000 obtained growth values to plot firm's value growth as a function of γ_1 and γ_2 (under a given volatility value). Each surface in figure 3.2b through 3.2e is the best fitted surface for different volatility schemes[30]. Comparing the results of both stages of our experiments, we conclude:

Proposition 2: *For very low levels of market volatility a firm is better-off if it purely follows the suggestions of internal capital market theory, i.e., allocates capital to the subsidiaries with the highest growth opportunity. However, for a range of moderate to relatively high levels of market volatility, a firm can create value by simultaneously leveraging the market growth opportunity and both elements of resource redeployability (resource relatedness and divisibility) of its subsidiary businesses. Further, within this range of market volatility, the weights assigned to subsidiaries' elements of resource redeployability increases with market volatility.*

Resource redeployability and capital allocation- the effect of firm's cash-limitedness:

In the final stage of our experimentation, we explore how firm's *cash-limitedness* affects its optimal investment in elements of resource redeployability when making capital allocation decisions. We expect that, as a general effect, the firm's cash-limitedness shrinks the potential inter-temporal economies derived from investing in elements of redeployability; a shallow-

[30] We regress the outcome variable, in the sample of the outcome variable medians (under each vale of volatility), on all possible combinations of γ_1, γ_2, γ_1-squared, and γ_2-squared. We use the regressors and their significant coefficients in the combination that provides the highest adjusted R-squared to construct the surface which provides the best fit.

pocket, in general, would have a relatively higher level of demand that it cannot respond to. Therefore, a cash-limited firm would be less likely to have its resources unutilized when the demand declines. However, as a specific effect, investing in resource divisibility might be specifically beneficial for cash-limited firms, so that cash-limitedness might have a positive effect on the inter-temporal economies rooted in investing in resource divisibility[31]. This new effect arises from the particular hazard for shallow-pockets to overcommit to indivisible resources.

Investing in indivisible resources, in general, is harmful since it makes firms less flexible in adjusting their resource deployments to external opportunities. However, this effect is less hazardous for cash-rich firms which continuously invest in new resources and can plan their new resource developments in a way to correspond to new market landscapes and opportunities. Conversely, redeployments are critically more important for cash limited firms since these firms have fewer means to acquire new resources when needs arise in face of external opportunities. In this stage, we experiment whether and how cash-limitedness affects the potential value of investing in latent resources' divisibility differently from how it affects the value of investing in the resource's relatedness. Moreover, by this stage of our experiment, we would be able to derive further insights on whether the firm's market volatility and cash limitedness interact with each other to affect the value implications of investing in redeployability elements.

We repeat the previous experiments related to extreme market volatility values (i.e., volatility equal to **V** and 2.5 **V)** while limiting firms' cash resources. To impose the cash-limitedness, we divide the mean of the profitability normal distribution by two; whereas, we get the random numbers for industries' demand from a similar normal distribution as in the previous section. This puts the firms, in general, in situations that they lack enough cash

[31] This effect is different from the extra investment in divisible resources which is rooted in higher affordability of investment in divisible resources (i.e., proposed in Proposition 1).

resources to respond to their growth opportunities. Figures 3.3a and 3.3b demonstrate the results.

Figure 3.3: Simulation results for cash-limited firms. Firms' average value growth (over 10-period) as a function of γ_1 (the coefficient of resource relatedness in Capital Investment Score) and γ_2 (the coefficient of resource divisibility in Capital Investment Score). The mean of profitability (i.e., generated cash) normal distribution = 6%. The mean of actual demand growth normal distribution = 12%

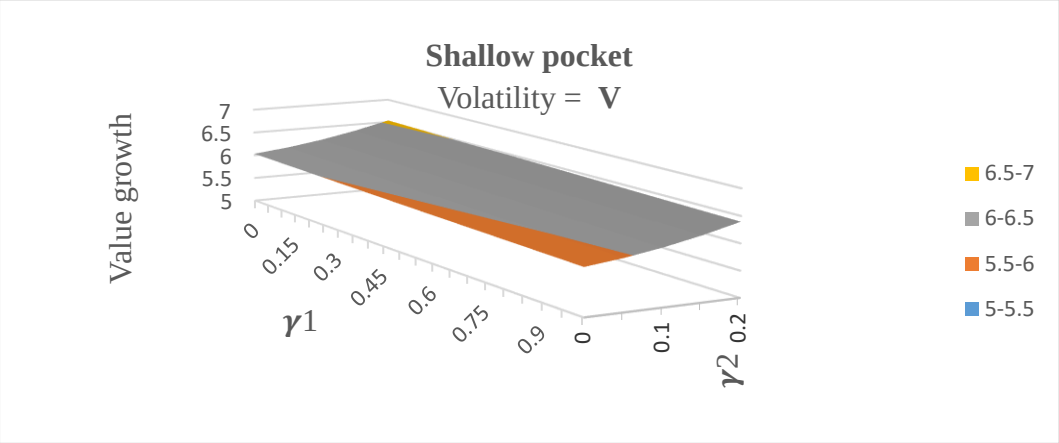

Figure 3.3a: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth under moderate market volatility (volatility is equal to its average value drawn from our sample, i.e. volatility = V) for a cash-limited firm (Generated cash is 50% less than the average in the sample, i.e., cash = 0.5C)

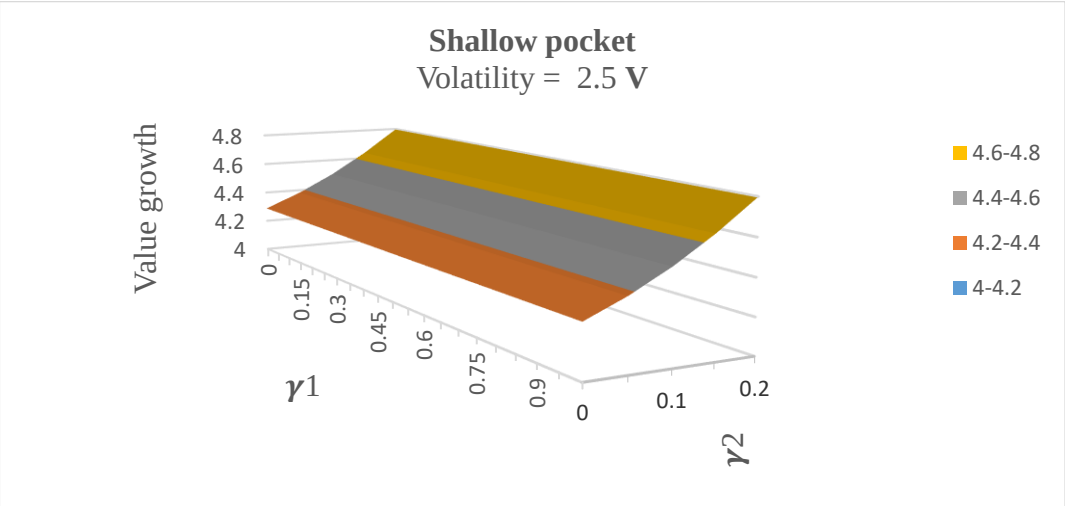

Figure 3.3b: Simultaneous experiment of the effect of both elements of redeployability on firms' value growth when volatility is 150% higher than the average value drawn from our sample (i.e., volatility = 2.5V) for a cash-limited firm (Generated cash is 50% less than the average in the sample, i.e., cash = 0.5C)

Table 3.1 compares these new pieces of experiment *vis-a-vis* the ones when firms were under the same volatility scheme but were not cash limited. An important pattern emerges from this stage of our analysis. As expected, higher market volatility uniformly strengthens the value implications of investing in both elements of latent resources' redeployability. However, cash-limitedness makes a clear-cut win between the latent resources' relatedness and the resource's divisibility as the main source of redeployment flexibility.

Table 3.1: The effects of firms' cash-richness and market volatility on optimal weighting of latent resources' relatedness and divisibility (setting γ_1 and γ_2) in Capital Investment Score.

		cash-richness	
		Average	shallow pockets
volatility	2.5 **V**	γ_1: inverted U γ_2: weak linear positive effect	γ_1: insignificant γ_2: strong concave positive effect
	V	γ_1: insignificant γ_2: linear negative effect	γ_1: uniform negative effect γ_2: weak concave positive effect

It turns out that for a relatively cash-rich firm, inter-temporal economies arise mainly from firm's investment in resource relatedness (captured by γ_1); and cash-limitedness weakens the foreseeable benefits of investing in resource relatedness as expected. More interestingly, the results reveal that the introduced specific effect of cash-limitedness, i.e. the one specific to latent resources' divisibility, more strongly affects the value implications of investing in divisibility than the general effect: Shallow pockets might create value by strategically investing relatively more in divisible resources. In other words, cash-limited

firms depend more heavily on the latent resources' divisibility (captured by γ_2) to leverage inter-temporal economies. We propose:

Proposition 3: *Cash-rich and cash-limited firms differ in their main source of resource redeployment flexibility: While both reployability elements are important for both types of firms, cash-rich firms achieve inter-temporal economies by, mainly, investing in resource relatedness; however, cash-limited firms leverage mainly the latent resource's divisibility, in their capital investment decisions, in order to reach resource redeployment flexibility and gain inter-temporal economies.*

In the next sections we provide some empirical evidence from intrafirm capital allocation for our propositions.

SAMPLE AND VARIABLES

Sample selection

Similar to previous studies, we use Compustat database. Our sample set includes a 16-year period from 1998 to 2013 in which Industries are identified based on the SIC system at the 4-digit level. We only use data since 1998 because from December 1997companies have followed the new Statement of Financial Accounting Standard (SFAS 131). Based on SFAS 131, corporations categorize their business units into different business segments based on their management approaches and the way the managers organize different segments of their organizations (Hough, 2006). We followed earlier studies addressing the internal capital market efficiency debate in the data screening process (e.g., Bardolet *et al.*, 2011; Arrfelt *et al.*, 2013). We excluded business segments with assets under $10 million; those with missing capital expenditure or capital expenditure greater than their size, i.e., capital intensity greater than one; those for which data is lacking for both preceding and subsequent periods; businesses active in industries with either 6000s (depository segments) or 9000s (non-

classifiable establishments) SIC codes because they are not comparable with other businesses (Misangyi *et al.,* 2006); single-business firms and firms with missing or non-positive assets or market value; and lastly firms with missing capital expenditure. The final sample contains 4283 observations for 1078 business segments possessed by 362 firms, across 205 industry classifications.

Dependent variable

Subsidy intensity: We follow Rajan *et al*. (2000) to derive our dependent variable. First, we calculate the capital investment intensity (Bardolet *et al.,* 2011) by dividing the capital invested in the focal subsidiary business[32] by its identified asset at the beginning of the fiscal year.

$$Capital\ intensity_{\ it} = \frac{Capital\ investment_{\ it}}{A_{\ it}} \quad (6)$$

Then, we adjust capital intensity in two stages. First, we adjust a segments' capital intensity by the median of capital intensity of single business firms in the narrowest industry category for which we have at least five observations (Equation 7). Second, we adjust the result of the first stage by the asset-weighted average of all business segments in the portfolio (Equation 8). The industry-adjusted capital intensity, i.e., *IA capital intensity*, shows the positive/negative deviation of capital investment intensity in a firm's subsidiary, *i*, relative to the norms of its industry.

$$IA\ capital\ intensity_{\ it} = Capital\ intensity_{it} - \frac{Capital\ investment^{SS}{}_{it}}{A^{SS}{}_{it}} \quad (7)$$

where, $\frac{Capital\ investment^{SS}{}_{it}}{A^{SS}{}_{it}}$ stands for the median of capital intensity of the single business firms in the focal subsidiary's industry.

[32] Here, we use the terms "subsidiary businesses" and "business segments" interchangeably; that refer to firms' business segments we derived from Compustat.

The asset-weighted average of the result of the first stage in a multi-business firm portfolio (the last term in Equation 8) reveals the extent that the firm, overall, invests more/less than comparable single business firms do. Finally, the subsidy intensity reveals the capital investment preferences in firm *j*'s portfolio, i.e., the capital flow among sister businesses.

$$Subsidy\ intensity_{\ it} = IA\ capital\ intensity_{it} - \sum_{k=1}^{N_{jt}} w_{kt}(IA\ capital\ intensity_{kt}) \quad (8)$$

where, w_{kt} refers to the segment *k*'s share of the total asset of firm *j* at time *t*.

Independent variables

Relative size: We take a business segment's relative size compared to its parent firm as a proxy for its resource indivisible investment thresholds. This is to say, in general, a headquarters is more likely to be capable to afford capital investments to develop the resources needed by its relatively smaller segments. We measure a segment's *relative size* as the natural logarithm of the result of entire parent firm's size divided by the focal business segment's size; in order to both have a more normally distributed variable and also work with positive values. Therefore, *relative size* receives a higher value for the smaller segments of a firm.

Relative relatedness: We follow extant work that has operationalized SIC proximity in different ways to capture relatedness (e.g., Keil, Maula, Schildt and Zahra, 2008; Villalonga and McGahan, 2005). *Relatedness* receives values equal to 1, 0.75, 0.5, 0.25 or 0 if of all four, only the first three, first two, only the first one or none of SIC code digits of the subsidiary business and the parent firm are identical. Then, the portfolio group mean-centered measure of *relatedness* provides us with *relative relatedness*.

Volatile-portfolio: is a firm-year-level dummy variable that takes 1 if the focal firm's overall market volatility of the businesses in its portfolio is more than half of the firm-years in the sample and 0 otherwise. Following Sakhartov and Folta (2015), we take the standard

deviation of the ROA of the businesses in the industry as the proxy for the industry volatility. Then the average volatility of a firm's industries provides the overall portfolio volatility of that firm-year.

Shallow-pocket: is a firm-year dummy variable that takes 1 if the focal firm has practiced less overall industry-adjusted capital intensity than half of the firm-years in the sample, and 0 otherwise.[33]

Control Variables

We control for *relative market opportunity* by using the median of *Tobin's q* of single business firms in each industry as the proxy for the market opportunity of the businesses active in that industry; and adjusting it with an asset-weighted average of its value through the parent firm's portfolio.

$$relative\ market\ opportunity_{\ it} = Tobine's\ q^{\ SS}{}_{it} - \sum_{k=1}^{N_{jt}} w_{kt}(Tobine's\ q^{\ SS}{}_{kt}) \quad (9)$$

We also control for variables such as asset-normalized subsidiary's generated cash (*Cash intensity*) and sisters' generated cash (*Sisters' cash intensity*), number of parent's subsidiary businesses (*Number of segments)*.

EMPIRICAL ANALYSIS

In our empirical analysis, we investigate if multi-business firms' capital investment data provide a preliminary support for our developed theory. Then, through a post-hoc analysis, we explore the association between firms' capital investment practices and value creation/destruction.; by which, we, particularly, aim to discriminate between mechanisms underlying capital subsidization of smaller segments.

[33] The robustness check of repeating our analysis while operationalizing this variable based on generated cash divided by the total asset of the firms, provides us with qualitatively similar results. We preferred capital investment-based to cash-based operationalization of this variable, because the relation between generated cash and investment may not be uniform and comparable through different industries.

Main results

We use a fixed effect regression model including year, industry and firm fixed effects with lagged independent and control variables. This one-year lag helps to reduce potential endogeneity problems. Table 3.2 presents the pairwise correlations for the variables used in our empirical analysis. The relatively high correlation between a firm's number of business segments and the relative size of segments is natural. The higher the number of segments, the smaller they are on average relative to their corporate parent's overall size. The only important high correlation emerging in Table 3.2 is the positive correlation between the asset-divided cash generated by the subsidiary businesses and their other sister businesses which is 0.23.

Table 3.2: Descriptive statistics and pairwise correlations (Business-level); n= 4283

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1- Subsidy intensity	0.00	0.06	-0.52	0.71	1						
2- Relative size	1.66	1.05	0.00	6.13	0.09	1					
3-Relative relatedness	0.00	0.34	-0.86	0.75	-0.06	-0.42	1				
4-Relative market opportunity	0.01	0.45	-7.62	4.32	0.06	0.04	-0.06	1			
5- Cash intensity	0.16	0.18	-0.93	1.00	-0.02	0.09	0.04	-0.05	1		
6- Sisters' cash intensity	0.16	0.15	-0.84	0.95	0	0.04	-0.04	0	0.23	1	
7- Number of segments	2.94	1.13	2.00	8.00	0.04	0.23	0	-0.01	0.02	0.03	1

Table 3.3 provides the results of our regression models. Model 1 only includes the control variables. Similar to the majority of the empirical studies addressing internal capital market efficiency debate (e.g., Arrfelt, *et al.*, 2013; Bardolet *et al.*, 2011; Billett and Mauer, 2003; Rajan, *et al.*, 2000; Shin and Stulz, 1998), our results show that *relative market opportunity* does not significantly explain capital flow among the subsidiary businesses of a multi-business firm.

Table 3.3: Fixed effect regression models (Empirical investigations of our propositions)

VARIABLES	DV: Capital subsidy intensity (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Cash intensity	0.0165**	0.0143*	0.0145*	0.0141*	0.0142*	0.0143*
	(0.00764)	(0.00763)	(0.00764)	(0.00763)	(0.00764)	-0.00764
Sisters' cash intensity	-0.00605	-0.00576	-0.00601	-0.00392	-0.00418	-0.00437
	(0.0103)	(0.0103)	(0.0103)	(0.0103)	(0.0103)	(0.0103)
Number of segments	0.00195	0.00122	0.00137	0.000819	0.000963	0.000990
	(0.00187)	(0.00187)	(0.00188)	(0.00188)	(0.00188)	(0.00189)
Relative market opportunity	0.00177	0.00142	0.00119	0.00111	0.000898	0.000925
	(0.00309)	(0.00308)	(0.00308)	(0.00308)	(0.00308)	(0.00308)
Relative size		0.00594***	0.00462**	0.00325*	0.00215	0.00233
		(0.00148)	(0.00193)	(0.00186)	(0.00221)	(0.00224)
Relative relatedness		0.00479	-0.00315	0.00416	-0.00354	-0.00360
		(0.00480)	(0.00625)	(0.00480)	(0.00624)	(0.00625)
Volatile-portfolios			-0.00110		-0.00115	-0.00116
			(0.00300)		(0.00300)	(0.00300)
Relative relatedness * volatile-portfolios			0.0148**		0.0144*	
			(0.00747)		(0.00747)	
relative size * volatile-portfolios			0.00265		0.00226	0.00229
			(0.00265)		(0.00265)	(0.00266)
shallow-pockets				-0.00440	-0.00433	-0.00378
				(0.00463)	(0.00464)	(0.00478)
relative size * shallow-pockets				0.00521**	0.00513**	0.00480**
				(0.00216)	(0.00216)	(0.00227)
Relative relatedness * volatile-portfolios * shallow-pockets						0.0122
						(0.00870)
Relative relatedness * volatile-portfolios * deep-pockets						0.0168*
						(0.00901)
Constant	0.0409	0.0329	0.0279	0.0328	0.0280	0.0275
	(0.0866)	(0.0864)	(0.0865)	(0.0864)	(0.0865)	(0.0865)
Firm fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
Year Fixed effects	YES	YES	YES	YES	YES	YES
Observations	3,106	3,101	3,101	3,101	3,101	3,101
R-squared	0.304	0.311	0.312	0.313	0.314	0.314

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 2 includes the independent variables. *Relative relatedness* receives a positive non-significant coefficient; this shows that there is not sufficient statistical evidence that multi-business firms are likely to, consistently, tilt the capital flow towards the more related

subsidiary businesses. However, the results of the Models 3 and 5, which test this effect for the firm-years with higher than average market volatility, provide preliminary statistical evidence for Proposition 2; the moderation effect, *Relative relatedness * volatile-portfolios,* receives significant, positive coefficients in both models. However the moderation effect of *Relative size * volatile-portfolios* receives insignificant positive coefficient, supporting that firms' market volatility has a greater effect on the leverage of resource relatedness, as a source of resource redeployment flexibility, than resource divisibility. Further, while the direct effect of the *relative size* receives significant positive coefficients in Models 2 through 4, its coefficients lose statistical significance when we test a more inclusive model. However, the moderating effect of *shallow-pockets* on *relative size* receives strong statistical support in Models 4 through 6, providing preliminary support for propositions 1 (i.e., extra investment in divisible resources due to better affordability) and 3 (the contingent effect of firms' cash-limitedness on leveraging the resource divisibility as a stronger source of resource redeployability).

We, particularly, develop Model 6 to test whether cash-rich and cash-limited firms differ in leveraging resource relatedness as the main source of resource redeployability; as stated in Propositions 3. To do this, we separate the moderation effects of *Relative relatedness * volatile-portfolios* for shallow-pockets and deep-pockets. We observe that this moderation effect is particularly significant for the firms with relatively higher cash resources. Our regression models provide the preliminary empirical evidence for our developed RR theory of intrafirm capital investment. To check for the robustness of our results, we operationalized the cash-richness of the firms based on their generated cash divided by their total asset. The repetition of our regression tests provided us with qualitatively similar results.

Post-hoc analysis: Further analysis of subsidization of smaller segments

In this section of our empirical analysis, we take a closer look at firms', relatively, higher capital investment in smaller segments. We differentiate between the previous work's explanation that attributes this subsidization to managerial cognitive limitations (e.g., Bardolet et al., 2011), and our proposed mechanisms which are rooted in potential higher divisibility of investing in smaller subsidiaries. Bardolet et al. (2011) imputes the subsidization of relatively smaller segments to the cognitive limitations of corporate managers and takes it as evidence for naïve diversification. Therefore, according to their view, this subsidization is expected to result in value destruction at the firm level. However, we suggested that extra investment in smaller subsidiaries might be also rooted in smaller subsidiaries' higher affordability of investment opportunities due to their potential *lower indivisible investment thresholds* and the potential *redeployment flexibility* that higher divisibility might offer. The results of our experiments showed that firms' cash-limitedness positively moderates these mechanisms. Therefore, we expect that the subsidizations of smaller subsidiaries by shallow pockets, in particular, to be associated with shallow-pockets' value creation. We examine the value implications of cross-subsidization of smaller segments to discriminate between the *overall* value-destroying capital subsidization of smaller segments and the specific shallow-pockets' value-enhancing capital subsidization of smaller segments.

To this end, we regress the next year *Tobin's q* of the firms, as a measure of firm created value, on the extent of accordance of firms' capital allocation practices to either of the terms at the right hand-side of Equation 2. We follow Rajan *et al.,* (2000) to construct the measure of firms' capital allocation accordance to market growth, i.e., *Market-based value-added,* and develop the other two dependent variables in a similar vein[34]. We control for the

[34] The measure takes the multiplication of the amount of capital subsidized (transferred) to (from) a subsidiary business, i.e., positive (negative) capital subsidy intensity, and its relative (positive or negative) market opportunity as the value-added by capital allocation related to that segment. According to the logic underlying this measure, corresponding to each subsidiary business, an absolute amount equal to the multiplication of

firms' current year *Tobin's q*, average relatedness of their subsidiary businesses, the logarithm of size (total asset), the logarithm of generated cash and the number of business units. Our test includes a fixed effect panel regression model including year and firm fixed effects.

Some insightful patterns emerge from our results. First, we find that, in general, neither significant value creation nor value destruction results from shifting capital towards either the more related subsidiary businesses or the ones which are active in markets with higher growth opportunity. However, we find that firms that are mainly active in relatively high volatile markets may create value by tilting the capital flow towards their relatively more related businesses. Second, while *overall* committing to invest in relatively smaller subsidiaries receives an almost significant negative coefficient (P-Value equal to 10.9%), *specific* behavior of either shallow-pockets or firms with relatively volatile markets to invest in relatively smaller subsidiaries receives positive, albeit, insignificant effect.

DISCUSSION

In this study, we reconcile the theories of internal capital market and resource redeployment. We extend the boundaries of RR theory, which merely explains the redeployment of non-financial resources, to embrace the corporate capital allocation process. By doing so, we set the stage for empirical investigations of RR theory and also contribute to a better understanding of the corporate capital allocation process. In turn, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel predictions for the theory.

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capital subsidy intensity and relative market opportunity would be created (destroyed) if the signs of these two match (mismatch). The aggregation of this measure at a firm's portfolio-level provides that firm's expected value creation/destruction by capital allocation. We develop *relatedness-based value-added* and *size-based value-added* in the same manner.

However, we do not take the absolute values of these value-added measures as equivalent to created/destroyed value. Instead, we introduce these variables to our regression models and let the regression tests identify their value creation/destruction implications. Therefore, the fact that our different value-added measures, i.e., market-based, relatedness-based and size-based, do not have similar dimensions is not problematic for our tests.

From a theoretical perspective, while we acknowledge that capital is perfectly fungible and divisible, we show that the fungibility and divisibility of latent resources (which are competing choices for headquarters' capital investment decisions) significantly affect capital allocation decisions. The fungibility and divisibility of a latent resource provide the headquarters with resource redeployability. Redeployability is the flexibility and ease to gradually withdraw the resource from the use it is developed for and redeploy it in another use in future. We find that leveraging this characteristic, in capital allocation decisions, results in inter-temporal economies particularly for firms which are active in highly volatile markets. Further, we find that cash-rich and cash-limited firms differ in their main source of redeployment flexibility. While both reployability elements are important for both types of firms, cash-rich firms achieve inter-temporal economies by investing, mainly, in resource fungibility; however, cash-limited firms mainly leverage latent resource's divisibility, in their capital investment decisions, in order to reach resource redeployment flexibility and gain inter-temporal economies. This is due to the fact that cash-limited firms have fewer means to acquire new resources when needs arise in face of external opportunities. Therefore overcommitting to indivisible resources results in cash-limited firms' rigidity and is extremely hazardous. Also, the divisibility of a resource might affect firms' capital allocation decisions through another mechanism, i.e., the *affordability-based subsidization.* A headquarters might not afford to develop a resource with high indivisible investment threshold; alternately, it only invests its available capital in a less opportune resource that has instead a lower indivisible investment threshold. Similar as in the first mechanism (i.e., leveraging resource divisibility in capital allocation decisions to gain resource redeployability), the affordability-based subsidization of more divisible resources would be also more pronounced for cash-limited firms.

Our results confirm the propositions of Busenbark *et al.* (2017) that the controversial results of the studies addressing internal capital market debate are partially due to the complexity of capital allocation decisions unaccounted for by the extant research. By applying the RR theory-based lens to the corporate capital allocation process, we take the first steps to unravel this complexity. As such, our work contributes to internal capital market literature in two main ways as we reveal the effects of two critical contingencies on both capital allocation practices and their value implications.

First, although a general tendency to tilt the capital flow towards more related subsidiary businesses would not guarantee any contribution to corporate value, firms whose portfolios include businesses serving relatively more volatile industries may create value by subsidizing more related subsidiary businesses. Interestingly, our results in Table 3.3 show that multi-business firms' managers have already put this piece of knowledge into practice.

Second, our results confirm the existence of two distinct and different mechanisms that explain the tendency of headquarters to tilt capital flow towards relatively smaller subsidiaries. The first mechanism is the overall firm's tendency to subsidize smaller business units. This overall tendency is the consequence of a headquarters' behavior in the even allocation of capital among its subsidiaries. This overall tendency is rooted in headquarters' cognitive limitations (Bardolet *et al.* 2011) and destroys value at the firm level. The second mechanism is practiced especially by cash-limited firms, (shallow pockets). Here, the subsidization of relatively smaller business units is rooted in the potential limitations of shallow-pockets to *afford* fulfilling the growth opportunities of their relatively larger subsidiaries, even if these subsidiaries have more attractive growth opportunities, or in shallow-pockets' quest for *resource redeployability*. Our results confirm that this second mechanism would have positive effect on firm value, if any. Our results related to the affordability mechanism comply with those found by Shin and Stulz (1998). They find

empirical support that capital investment in the subsidiaries with the highest market opportunities is independent of the subsidiaries' generated cash flow when they are also the smallest business segments of the portfolio. Conversely, capital investment in the subsidiaries with the highest market opportunities is dependent on their generated cash if they are the largest segments of their corporate parents' portfolio.

Despite its contributions, our study is subject to several limitations. First, similar to other recent studies addressing the internal capital market efficiency debate, we used Compustat data and SIC codes as the identifiers of the industries; these are very broad (McGahan and Porter, 1997) and do not provide a precise measure of market opportunities a business segment perceives. Second, our relatedness measure is not sufficiently precise. However, since our sample includes a wide range of industries, it is hard to replace our measure with more precise ones such as those developed on technological relatedness (Silverman, 1999).

CONCLUSION

Headquarters' managers do not limit their capital allocation decision criteria merely to the, anticipated, very first returns on their investments. Rather, they also take potential ex-post resource redeployments into account in such decisions. Extending the resource redeployment theory and applying it to corporate capital allocation, we show that what previous research has documented as pervasive inefficient capital cross-subsidization of multi-business firms, partly results from the fact that those studies have not considered firms' quest for resource redeployment flexibility in their capital allocation decisions. We also showed that both subsidiaries' resources' *divisibility* and *relatedness* may contribute to firms' redeployment flexibility and ultimate inter-temporal economies. However, the impact of these two elements of resource redeployability is different for a firm depending on the specific conditions it faces.

CONCLUSION

This dissertation was intended to answer the question of "how firms' strategies affect the performance of subsidiary businesses". I split this broader question into more focused questions starting with "how importantly firms' strategies affect the performance of subsidiary businesses" and "what are the mechanisms underlying this firms' contribution to subsidiaries' performance." Answering these questions motivated other ones such as "which subsidiaries receive more of headquarters' contribution", and "whether firms are as inefficient in their capital allocation practices as the extant internal capital market literature suggests". I designed each chapter of my dissertation to provide an answer to one or two of these more concentrated questions. In the present conclusion section, first I review the answers my thesis provides to these research questions as different facets of its main and broader one. Then, I enumerate the main contributions this dissertation makes, and explain some of limitations and caveats in my studies. Finally, I introduce some research avenues my dissertation motivates for future work.

Answers to the research questions

The first chapter of my dissertation was designed to answer the question of how importantly firms' strategies affect the performance of subsidiary businesses. In this chapter, we argued that, due to methodological limitations, prior studies failed to account for the business-variant corporate effects – the uneven impacts of a corporate office on the performance of its subsidiary businesses. This methodological failure resulted in a systematic underestimation of corporate effects. Our results in this chapter confirmed the significance and importance of the *business-variant corporate effects* contributing to the magnitude increase in overall corporate effects. We showed that the total corporate effect is at least as important as the business

effect. This finding corroborates the importance of the effects of firms' strategies on the performance of subsidiary businesses.

The second chapter provided an answer to the question related to the efficiency of firms' capital allocation. This intrafirm capital allocation represents an exemplary mechanism underlying a firm's uneven contribution to the performance of its subsidiaries. The extant work, almost unanimously, took the firms' deviations from the winner-picking logic of capital allocation (that is investing relatively more in subsidiaries with higher growth opportunities) as evidence of inefficiency. Deviations from winner-picking have been attributed to agency problems resulting from rent seeking behaviors of corporate CEOs and divisional, behavioral biases and cognitive limitations of decision makers, as well as intrafirm politics. We provided a different answer by empirically showing that these deviations might simply reflect firms' different corporate characteristics generating different strategic intents. We showed that these deviations might be, in part, attributable to firms' quest of leveraging synergistic rents which is not rooted in inefficiencies.

The third chapter of my dissertation strives to provide answers to questions about how firms make capital allocation decisions and which subsidiaries are potent to receive higher shares of firms' capital investments. This chapter draws from the theory developed in regard to firms' resource redeployments and shows that while the extant work excludes firms' allocation of financial resources from the boundaries of this theory, due to the perfect fungibility and divisibility of financial resources such as capital, this theory demonstrates great potential to explain firms' capital allocations. Our simulation analysis and the subsequent empirical work showed that a headquarters takes its subsidiaries' overall redeployability of resources as a substitute for their overall market growth opportunity in its capital investment due diligence. Our analysis in this chapter suggested that for very low levels of market volatility a firm is better-off if it purely follows the suggestions of internal capital market theory: investing more

of firms' capital in subsidiaries with higher growth opportunity, i.e., the winner picking approach. However, for a range of moderate to relatively high levels of market volatility, a firm can create value by simultaneously considering the overall market growth opportunity and overall redeployability of its business segments (which provides the firm with flexibility in potential future redeployments). Further, within this range of market volatility, the weights assigned to segments' redeployability increases with market volatility. We also showed that cash-rich and cash-limited firms differ in their main source of redeployment flexibility. While both reployability elements, i.e., *resource relatedness* and *divisibility*, are important for both types of firms, cash-rich firms achieve inter-temporal economies by investing, mainly, in resource relatedness; however, cash-limited firms would be, relatively, more willing to invest in subsidiaries with lower indivisible investment thresholds.

Main contributions

Contributions to the debate on the sources of performance heterogeneity

My dissertation, particularly by the first chapter, sheds more light on the counterintuitive results of previous studies about the extent of the effect of firms' headquarters on the performance of businesses. Different theoretical strands such as dominant general management logic (Prahalad, Bettis, 1986), parenting theory (Goold, Campbell, and Alexander, 1994), portfolio management (Haspeslagh, 1982) have emphasized the role of corporate headquarters in creating value. However, *the empirical variance decomposition studies* (e.g., Guo, 2017; Hough, 2006; McGahan and Porter, 1997; Rumelt, 1991) have estimated relatively low corporate effects on the performance of businesses. My dissertation explains that the statistical approach has been used to estimate the relative importance of industry, firm, and business effects on persistent performance differences among businesses is potent to systematically underestimate the corporate effects. This underestimation is rooted in failing to account for the "business-variant corporate effects" that are the uneven impact of a

corporate office on the performance of its subsidiary businesses. By developing a three-stage hierarchical linear model, we could manage to capture the non-previously-explored business-variant corporate effects. Our results showed that our proposed business-variant corporate effects are as important as the previously studied standard corporate effects, which we connote as "business-invariant corporate effects". We showed that the total corporate effects are at least as important as the business effects that has been estimated to be far higher than the other effects by the extant work.

Contributions to the intrafirm capital allocation studies

Firms' capital allocation is one of the most important decisions a headquarters makes. Since empirical studies in financial economics literature provided evidence that diversified firms are traded at a discount compared to comparable portfolio of single business firms in the market (e.g., Lang and Stulz, 1994), a stream of empirical studies was initiated to address the sources of the observed *diversification discount;* out of which, a line of inquiry argued for corporate capital allocation process inefficiency as a potential source of diversification discount (Berger and Ofek, 1995; Rajan et al., 2000; Shin and Stulz, 1998). Even though the early evidence on the existence of diversification discount has been challenged and imputed to some methodological problems (Campa and Kedia, 2002; Gomes and Livdan, 2004; Levinthal and Wu, 2010; Villalonga, 2004)[35], the empirical debate on the corporations' internal capital market efficiency, per se, has continued and also expanded to strategy management literature (e.g., Arrfelt, *et al.*, 2013; Bardolet, *et al.*, 2011). The mainstream research on internal capital markets proposes a winner-picking logic (Stein, 1997) to obtain the optimality of internal capital

[35] Campa and Kedia (2002), Gomes and Livdan (2004) and Villalonga (2004) attribute the evidence on the existence of diversification discount to the endogenous self-selection of the firms into the act of diversification. According to them, the firms which undergo diversification would be likely to perform worse than the others even if they would not diversify. On the other hand, Levinthal and Wu (2010), taking an opportunity cost lens, suggest that firms try to dedicate their resources to the best use of them; so, in response to the changes in the markets they are active in, "demand maturity" for example, the firms may reallocate their "resources away from established markets and, at the sacrifice of profit margins but not total profits" (p., 785).

markets. This literature assumes that internal capital allocations are optimal if top managers in headquarters shift the capital investments towards the units with higher market growth prospects. The empirical studies, however, provide ample evidence that multi-business firms deviate from the winner-picking logic and cross-subsidize units with lower prospects at the expense of units with higher expected future returns (Berger and Ofek, 1995; Billett and Mauer, 2003; Ozbas and Scharfstein, 2010). Deviations from winner-picking have been attributed to agency problems resulting from rent seeking behaviors of corporate CEOs and divisional managers (e.g. Antle and Eppen, 1985, Ozbas and Scharfstein, 2010; Rajan, *et al.*, 2000), behavioral biases and cognitive limitations of decision makers (e.g., Bardolet *et al*., 2011; Arrfelt, *et al*., 2013), as well as intrafirm politics (e.g., Cremers, Huang, and Sautner 2013; Duchin and Sosyura, 2013; Graham, Harvey, and Puri, 2015; Glaser, Lopez-de-Silanes, and Sautner 2013). Deviation from winner-picking approach, however, was not always found to be detrimental to firm value (Arrfelt *et al.*, 2015; Billett and Mauer, 2003; Gupta *et al.*, 2017).

The second and third chapters of my dissertation contributed to fill this gap. These chapters illuminated how prior work claiming that firms misallocate capital might have reached their conclusion because they did not consider firm-specific aspects in capital allocation optimality. The deviations from the winning-picking strategy might simply reflect firms' strategic intents other than growth which is the strategic intent which fits the winner-picking logic of capital allocation. On the one hand, the second chapter contributed by providing empirical evidence for the existence of and disentangling between inefficient and not-necessarily-inefficient deviations. It also highlighted the role of firms' managerial capability (Adner and Helfat, 2003), captured by the CEOs' breadth of prior experience in subsidiaries, in attenuating inefficient deviations and enhancing corporate value through better capital allocation practices. The third chapter, on the other hand, revealed how subsidiaries' resources' relatedness (which provides the firm with flexibility in potential future redeployments), and

divisibility (that makes the gradual investments and resource withdrawals more feasible) play a substitute role of subsidiaries' growth opportunities in headquarters' capital investment decisions. Further, results in this chapter showed that two important factors affect the weight of subsidiaries' resources' relatedness and divisibility, in comparison to their growth opportunity, in headquarters' due diligence. On the one hand, the overall *volatility* of markets in which a firm is active increases the weight of subsidiaries' both elements of redeployability; and on the other hand, the *cash-limit* of the firms increases the weight of subsidiaries' divisibility. Finally, my studies confirmed that internal capital markets might be more efficient than external capital markets and create value not only because of information premium of headquarters over external markets on subsidiary businesses[36], but also because internal capital markets consider the firm-specificity of capital investment.

Contributions to the theory of resource redeployment theory

Seeking to maximize profit, firms intend to optimally allocate non-scale free resources and capabilities across their business units. Since allocating a non-scale free resource to one subsidiary might be at the expense of other subsidiaries, allocation of non-scale free resources is subject to opportunity cost (Levinthal and Wu, 2010; Milgrom and Roberts, 1992). A recent stream of research, interested in diversification practices, has brought the consideration of resources' opportunity cost into account to resolve the inconsistencies found in the results of the studies estimating the relation between diversification and firms' performance (Levinthal and Wu, 2010; Wu, 2013). Consequently, the research in the realm of the theory of resource redeployment (RR theory hereafter) has provided a substantial theoretical contribution to explain how "the opportunity cost of the continued use of resources in an underperforming business" (Sakhartov, 2017; p.4) and the cost of redeployment of the resources in a new

[36] Which is the underlying logic of value-creation by the multi-business firms in the theory of internal capital markets (Stein, 1997; Williamson, 1975)

business opportunity, together, shape the firms' diversification decisions (Lieberman, Lee and Folta, 2017; Sakhartov and Folta, 2014, 2015). We know much less about how the opportunity cost of investing resources in *existing* subsidiary businesses affects the flow of resource redeployment among a firm's existing subsidiaries; that is to explain the likelihood of a subsidiary business to be allocated more or less resources from its headquarters. In addition, empirical investigation into this emerging RR theory is scarce. It has been argued that the main reason behind this oversight is the challenge of observing redeployment of *non-financial* resources (Sakhartov and Folta, 2015).

The third chapter of my thesis contributes to resolve this shortcoming by pushing the boundaries of the theory beyond *redeployment of non-financial resources* to also incorporate the *allocation of financial resources,* particularly capital. The extant work in RR theory excludes firms' capital allocation from the boundaries of this theory due to the perfect fungibility and divisibility of capital. If a resource is perfectly fungible and divisible, a firm has a perfect flexibility to rationalize it according to the optimal capacity in the current use and redeploy the unutilized capacity to a new use either internally or externally. We argue however that the potential resource to be developed by the invested capital would not be necessarily perfectly fungible or divisible. Further, when investing capital in one of its subsidiaries to acquire non-financial resources such as plants or technology, a corporate headquarters also purchases the *option* to redeploy those same resources in subsequent periods. Therefore, the direction of current capital flow among subsidiary businesses will not merely be a function of their current relative market growth opportunities, but also other factors explained by RR theory. This chapter contributes to RR theory by extending its boundaries to embrace capital allocation. We show that observing internal capital allocation enables an empirical test and investigation of RR theory. More importantly, studying intrafirm capital allocations through the lens of RR theory helps us further develop and offer novel

predictions for this theory. We find that cash-rich and cash-limited firms differ in their main source of redeployment flexibility. While both reployability elements are important for both types of firms, cash-rich firms achieve inter-temporal economies by investing, mainly, in resource relatedness; however, cash-limited firms mainly leverage latent resource's divisibility, in their capital investment decisions, in order to reach resource redeployment flexibility and gain inter-temporal economies. This is due to the fact that cash-limited firms have fewer means to acquire new resources when needs arise in face of external opportunities. Therefore overcommitting to indivisible resources results in cash-limited firms' rigidity and is extremely hazardous to them.

Methodological contributions

The studies included in the present dissertation use a broad range of methodologies including Hierarchical Linear Models, Panel Data Analysis, and Simulations to contribute to management theory as well as to offer important managerial implications with respect to corporate-level decisions. Among these methods, the 3-stage, random coefficient, hierarchical model developed in the first chapter offered a creative solution for the methodological limitations underlying the systematic underestimation of corporate effects in the previous work that is worth further consideration.

The use of hierarchical linear models (HLM) since 2006 (Hough, 2006; Misangyi *et al*., 2006) helped scholars to resolve the collinearity problem between corporate and industry effects and between corporate and business effects. This was due to HLM's capacity (unlike standard fixed/random effect models) to integrate residuals in each level to be estimated separately (Hofmann, 1997, 1998). In addition, using HLM techniques eliminated the need to regress business performance against dummy variables, thus providing a higher statistical power than nested ANOVA models (see Goldstein, 2011, p. 922). However, the standard HLM proves unable to account for our introduced *business-variant corporate effects*, as it cannot evaluate

more than one cross-nested effect simultaneously. Prior studies, using HLM, were limited to modeling only the most important cross-classification where lower-level categories of businesses are cross-nested in two higher-level categories, i.e., corporations and industries, simultaneously (Hough, 2006; Misangyi *et al*., 2006). However, examining business-variant corporate effects necessitated multiple simultaneous cross-nested categorical variables. First, similar to previous studies, we had to model business segments as a categorical variable cross-nested in corporate parents and industries. In addition, to capture the uneven impact of corporate decisions on business performance, we needed to consider that yearly business performance is cross-nested within both the corporate parent and year categories. We could capture the variance related to the *business-variant corporate effects* only when we introduced the variables that potentially affect the corporate resource allocation decisions into the model at a corporate parent-year level. Finally, business performance was affected by both stable and transient industry effects, which would generate another cross-classification problem (Adner and Helfat, 2003; McGahan and Porter, 1997). Given the time length of the observations, not considering the variance between industries' performance over time might undermine the overall industry effects. To account for transient industry effects, one would need to introduce a categorical variable (industry-year) that is simultaneously cross-nested within year and industry categories.

In other words, all three cross-classifications, i.e., industry-year, industry-corporation, and corporation-year, are highly important in our model. This is why we decided to propose a model that was a mixture of the nested ANOVA and HLM models to estimate different effects, in particular, the newly introduced *business-variant corporate effects.* We devised a three-stage hierarchical linear model, where every subsequent stage takes the residuals of the previous stage: In the first stage, we partitioned the macro effects including year, industry and industry-year effects through a random intercept HLM setting. In the second stage, we developed a three-level random intercept hierarchical linear model to partition the standard corporate, i.e.,

business-invariant corporate, and business segment effects simultaneously out of the residuals of the first stage model. And finally, through the third stage, we explained the residuals of the second stage by a random slope, i.e., coefficient, HLM model. In this stage, we estimated the random slope of the strategic factors that may affect the resource redistribution decisions of headquarters to the model. These factors helped us partition the *business-variant corporate effects.*

Limitations

The studies included in this dissertation are subject to several limitations. First, similar to other recent studies addressing either the relative importance of different effects on business performance or the internal capital market efficiency debate, I used Compustat data and SIC codes as the identifiers of the industries. These codes are very broad (McGahan and Porter, 1997) and do not provide a precise measure of market opportunities a business segment perceives. Second, I followed extant work that has operationalized SIC proximity in different ways to capture relatedness (e.g., Keil, Maula, Schildt and Zahra, 2008; Villalonga and McGahan, 2005). This provided me with a less precise relatedness measure than those developed on technological relatedness (Silverman, 1999), for example. However, since my sample includes a wide range of industries, it is hard to replace my measure of relatedness with more precise ones.

Moreover, as mentioned in the previous section, to include all of the cross-classification possibilities in our model in the first chapter, my coauthor and I were obliged to introduce a 3-stage HLM. This prevented us from estimating the industry effect simultaneously with the corporate and business effects. However, we believe, the fact that we have partitioned the effects from the most macro ones towards the lower-level effects has protected our methods from potential estimation biases rooted in sequential estimations. Finally, and from a methodological standpoint, the adjustment of capital intensity by the

norms of a business segment's industry, in both second and third chapters, might affect the results. In general, industry-adjustment of capital intensity has its own pros and cons. As a positive point, it partitions the residuals that are industry-year-specific while are not related to market opportunity. For example, an industry might become extremely capital intensive, due to emergence of a new technology for instance, therefore, not adjusting for this temporal effect would distort the estimations. On the other hand, this industry-year-level adjustment washes out a great deal of residuals pertaining to the industries' overall growth opportunity, especially if responded by the majority of businesses in a same industry. My coauthors and I decided to follow the methods excessively used in previous research to make it easier to compare our results with those of previous work.

Motivating new research

I aimed to answer core questions in Strategy through my thesis work. More precisely, my thesis incorporated rigorous mathematical and empirical analysis to offer solutions to long standing debates in corporate strategy. It aimed to unbundle the black box of corporate effect (the effect of corporate headquarters on subsidiary businesses' performance). Overall, through my dissertation, I contributed to the debated *magnitude*, *efficiency*, and *mechanism* of the effect of a multi-business firms' headquarters on the performance of its subsidiaries. My dissertation, however, opens new directions for future research in different ways. First, by extending the boundaries of the theory of resource redeployment (RR theory) to include intrafirm capital allocations, my study sets the stage for further empirical investigations of RR theory. It also facilitates looking at the role of firms' and managers' specific characteristics that may influence the resource allocation and redeployment within the boundaries of multi-business firms. Further, my work focused on segments' interdependence, as a decision complexity dimension that provides firms with an opportunity to pursue synergies in their capital investments. Pursuing synergies, in turn, might make firms deviate from winner-

picking logic of capital allocation. My dissertation motivates the study of deviation effects of other corporate-level strategies and competitive objectives such as risk mitigation (Busenbark *et al.*, 2017) and avoiding competition escalation from the rivals (Sengul and Gimeno, 2013) for further empirical work in this area. Similarly, my work signals for opportunities in examining the corrective effects of firms' decision-making resources and capabilities on firms' inefficient capital allocations. While my research has mostly highlighted the breadth of CEO's prior experience in subsidiaries businesses as one source of firms' decision-making capability, there remains many other such sources to explore. For example, I expect that firms with more developed decision support systems (Sharda, Barr, and MCDonnell, 1988) would be also less likely to deviate inefficiently from winner-picking capital allocation.

Last but not least, as I mentioned in the introduction and also is reflected in Figure 0.1, a firm's uneven contribution to the performance of its businesses is not, merely, rooted in corporate-level decisions such as capital allocation in which the headquarters directly selects between its subsidiaries, as the locus of capital investments. Rather, any corporate-level initiatives may result in a re-distribution of resources among subsidiaries at the benefit of some subsidiaries and at the expense of others. For example, acquisition of a knowledge firm by the headquarters might provide one of the existing subsidiaries with valuable resources (the knowledge existing in the newly acquired unit) while another subsidiary might not benefit from the acquisition (if the newly acquired knowledge is irrelevant to this second subsidiary). Thus, the study of business-variant corporate effects of specific corporate-level initiatives would be a potentially promising extension of my work. For example, studying which subsidiaries are likely to benefit headquarters' acquisition decisions more than their sister businesses might provide us with new knowledge and help us fill the existing gaps in the area of this corporate-level strategy.

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APPENDIX

Appendix 1. Table A.1: 3-stage HLM estimation of variance including random slopes for relatedness and its interactions

	Variance estimate	Standard error	[95% Conf. Interval]		χ^2	P-value
Stage 1. year, industry, industry-year effects					11.87	0.0000
Outcome measure: ROA						
Variance of outcome measure: 0.2076825						
Level 4 variable variance (year)	0.0003073	0.000306	.0000436	0.002168		
Level 3 variable variance (industry)	0.0076859	0.001476	.0052755	0.011198		
Level 2 variable variance (industry-year)	0.0111357	0.001363	.0087611	0.014154		
Level 1 Residuals	0.1819776	0.003266	.1756886	0.188492		
year (Percentage of total variance): 0.15%						
industry (Percentage of total variance): 3.70%						
industry-year (Percentage of total variance): 5.36%						
Stage 2. corporate and business effects					126.64	0.0000
Outcome measure: Stage-1 residuals						
Variance of outcome measure: 0.1719019						
Level 3 variable variance (corporation)	0.0508935	0.00492	.0421086	0.061511		
Level 2 variable variance (business segment)	0.103904	0.005055	.0944537	0.1143		
Level 1 Residuals	0.0707793	0.001524	.067855	0.07383		
corporation (Percentage of total variance): 16.01%						
business segment (Percentage of total variance): 32.68%						
Stage 3. business-variant corporate effects					177.37	0.0000
Outcome measure: Stage-2 residuals						
Variance of outcome measure: 0. 052892						
Variance related to random slope (attract)	0.2412113	0.0787476	.1272061	0.457391		
Variance related to random slope (smallness)	0.0018875	0.000143	0.0016279	0.002189		
Variance related to random slope (relatedness)	7.43E-26	1.77E-22	0	.		
Variance related to random slope (attract*smallness)	0.5877234	0.050353	.496874	0.695184		
Variance related to random slope (attract*relatedness)	0.460295	0.129818	.2648314	0.800024		
Variance related to random slope (relatedness *smallness)	0.0006705	0.000254	.0003194	0.001408		
Level 2 variable variance (corporation-year)	6.95E-25	7.19E-25	9.16E-26	5.28E-24		
Level 1 Residuals	0.0197304	0.000432	.0189017	0.020595		
business-variant corporate effects (Percentage of total variance): 14.498%						

Appendix 2. Deriving firms' conformity with (deviations from) winner-picking approach

Here we derive the extent of firms' conformity with (or deviations from) winner-picking approach to capital investment, i.e., the dependent variable of our hypothesis testing models as an estimated dependent variable, EDV, to be used in our main analysis. To this end, we estimate the *Relative market opportunity* variable random coefficients at the firm-year level in a mixed effect hierarchical linear model. Considering the hierarchical structure of our data in this stage, we use the empirical Bayes predictions (Skrondal, Rabe-Hesketh, 2009) of the relative market opportunity variable random coefficients. We rescale the estimated random coefficients by multiplying them in 10,000 to derive the value of the variable accounting for firms' *Conformity with winner-picking*.[37]

Dependent variable: the variable *Subsidy intensity* captures the capital flow for each segment in a firm's portfolio in each year. Positive amounts of subsidy intensity for a business segment reveals the extent to which the focal segment has been subsidized by the capital that would be invested in other sister businesses if the internal capital market was not existing. We follow Rajan *et al*. (2000) to calculate subsidy intensity. We derive subsidy intensity by adjusting capital intensity, i.e., asset-based normalized form of capital expenditure, in a two stage process. We first derive industry-adjusted capital intensity for each segment, and then adjust the industry-adjusted value by the average at the segment's corporate parent's portfolio in a following way:

$$Subsidy\ intensity_{\ it} = IA\ capital\ intensity_{it} - \sum_{k=1}^{N_{jt}} w_{kt}(IA\ capital\ intensity_{kt}) \quad \text{(A2.1)}$$

[37] Since the estimated random coefficients are from the order of magnitude between 0.00001 and 0.001, using the raw values of them (without any rescaling) as DV in the main analysis, makes all of the estimated coefficients and standard deviations in an order of magnitude of 0.00001; which makes the table of regression results unreadable. Indeed, our rescaling does not affect the t-statistics estimations (significance/insignificance).

where, w_{kt} refers to the segment *k*'s share of the total asset of firm *j* at time *t* and $IA\ capital\ intensity_{it}$ refers to industry-adjusted capital intensity which is calculated as follows:

$$IA\ capital\ intensity\ _{it} = Capital\ intensity_{it} - \frac{Capital\ investment^{SS}{}_{it}}{A^{SS}{}_{it}} \quad \text{(A2.2)}$$

where, $\frac{Capital\ investment^{SS}{}_{it}}{A^{SS}{}_{it}}$ stands for the median capital intensity of the single business firms in the focal subsidiary's industry at the narrowest industry category that we have data at least for 5 single-business firms.

***Independent variable**:*

The variable *Relative market opportunity:* following previous research (e.g., Arrfelt *et al.*, 2013; Rajan *et al.*, 2000) we use *Tobin's q* of the single business firms in each industry as a reference for the market opportunity of firms' business segments which are active in that industry. More precisely, we take the median of *Tobin's q* of the single business firms at the narrowest industry category that we have at least five observations as proxy for business segments' overal market opportunity and adjust it with an asset-weighted average of its value through the parent firm's portfolio:

$$Relative\ market\ opportunity\ _{it} = Tobin's\ q\ ^{SS}{}_{it} - \sum_{k=1}^{N_{jt}} w_{kt}(Tobin's\ q\ ^{SS}{}_{kt}) \quad \text{(A2.3)}$$

where, *i* is a business segment of firm *j*, and $Tobin's\ q\ ^{SS}{}_{it}$ stands for the median of *Tobin's q* of the single business firms at business segment *i*'s industry and w_{kt} refers to the segment *k*'s share of the total asset and N_{jt} refers to the number of the business segments of firm *j* at time *t*.

***Control Variables**:*

We control for the variable *Relative size* (measured as the natural logarithm of the total asset of the entire firm that the focal business segment belongs to divided by the identified asset of

that business segment), the variable *Cash intensity* (computed as asset-normalized segment's generated cash, i.e., segment's generated cash divided by its identified asset), S*isters' cash intensity* (which is sisters' asset-normalized generated cash) and CEO's *prior experience in business segment* which is a dummy variable receiving 1 if the CEO had experience in the segment's domain before assignment to CEO position and 0 otherwise. [38]

***Statistical model and Results**:*

We use a mixed-effect panel data hierarchical linear model (Bryk and Raudenbush, 1992; Hofmann, 1997; Misangyi *et al*. 2006). The fixed part of the model includes the independent and control variables as well as firm, industry, and year fixed effects. The variable part of the model includes firm-year random intercepts and random coefficients of the variables C*ash intensity* and *Relative market opportunity* at the firm-year level. Our preliminary analysis revealed that there is a significant variation between firms in how the difference in their segments' cash generation affects the capital flow within their portfolios. This is why we decided to control for the *cash intensity* random coefficient at the firm-year level in addition to estimate *relative market opportunity*, whose random coefficients are needed for constructing firms' conformity to winner-picking variable. The statistical model can be summarized as follows:

$$Subsidy\ intensity_{\ it} = \alpha_0 + \lambda_i + \gamma_t + \ \beta X_{it} + \varphi_j + \ \nu_{jt} + \beta_{1jt}\ \ cash\ intensity_{\ it} + \\ + (\beta_0 + \beta_{2jt}\ )\ \ relative\ market\ opportunity_{\ it} + \varepsilon_{it} \qquad \text{(A2.4)}$$

where *i* is a business segment belonging to firm *j*, α_0 is model's constant, λ_i are the industry fixed effects, γ_t are year fixed effects, X_{it} is the vector of control variables, φ_j are the firm

[38] It is worth mentioning that since we are eager to capture the firms' difference in their conformity with (or deviation from) winner-picking, we do not control for any firm-level variable in this stage. Later, in our main analysis we try to explain firms' difference in capital allocation patterns.

random intercepts, α_{jt} are firm-year random intercepts, β_0 is the estimated coefficient for the independent variable as a pooled variable, β_{2jt} are the estimated $relative\ market\ opportunity$ random coefficients to be used to construct the dependent variable in our main analysis of the paper, and finally, ε_{it} are the error terms.

Table A.2 presents descriptive statistics and pairwise correlations of the variables used in this model. There is a relatively important positive 23% correlation between business segments and their sister segments cash intensity. This correlation between the returns of different subsidiaries of a single firm may be rooted in the firm's effect on performance (McGahan and Porter, 1997; Misangyi *et al*. 2006), or be related to similarity between overall profitability of the industries each firm is active in.

Table A.2: Descriptive statistics and pairwise correlations (Business-level); n= 4283

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)
1- Subsidy intensity	0.004	0.063	-0.519	0.709	1					
2- Relative market opportunity	0.012	0.447	-7.617	4.321	0.06	1				
3- Breath of CEO's prior experience	0.266	0.442	0	1	-0.04	-0.03	1			
4- Relative size	1.662	1.049	0	6.133	0.09	0.04	-0.14	1		
5- Cash intensity	0.157	0.179	-0.932	0.997	-0.02	-0.05	0.03	0.09	1	
6- Sisters' cash intensity	0.156	0.145	-0.838	0.946	0	0	0	0.04	0.23	1

Table A.3 provides the results of our mixed effect models. Model 1 includes control variables which is the whole model introduced in Equation A2.4 except for the terms related to the variable *Relative market opportunity*. Only two variables in the fixed part of the model receive significant coefficients: CEOs' prior experience receives a significant negative coefficient conforming to Xuan's (2009) suggestion that CEO's are likely to tilt the capital investments towards the subsidiaries they do not have prior experience in, as a "bridge-building tool" to elicit those divisions' directors' cooperation. Further, segments' relative size receives a significant positive coefficient meaning that relatively smaller businesses are

subsidized which is in accordance to the results of previous studies (e.g., Bardolet *et al.*, 2011; Billett and Mauer, 2003).

Table A.3: Random coefficient hierarchical linear model for estimating firms' conformity to winner-picking; n= 4283

	subsidy intensity					
	Model 1		Model 2		Model 3	
Relative market opportunity			.00673	(.00236)	.00815	(.00282)
CEO prior experience	-.00628	(.00239)	-.00618	(.00238)	-.00618	(.00237)
Relative size	.00434	(.00102)	.00427	(.00102)	.0041788	(.00102)
Cash intensity	-.00894	(.00648)	-.00862	(.00647)	-.00794	(.00646)
Sisters' cash intensity	.00328	(.00733)	.00436	(.00733)	.00458	(.00730)
Year fixed effects	YES		YES		YES	
Industry fixed effects	YES		YES		YES	
Variance components						
Level 1, *eit*	.0029488	(.0000783)	.002944	(.0000781)	.0029156	(.0000798)
Level 2, *corporate-year intercept*	2.65e-18	(2.85e-18)	5.72e-18	(7.20e-18)	1.58e-18	(2.04e-18)
Cash intensity slope	.0047905	(.0007842)	.0047849	(.0008087)	.0045799	(.0007547)
Relative market opportunity slope					.0002365	(.0002277)
Level 3, *corporate intercept*	7.47e-06	.000027	5.69e-06	(2.68e-05)	2.88e-06	(.0000252)
Observations	3906		3,906		3,906	
Log likelihood	5683.6638		5687.7116		5688.5979	

Model 2 includes the variable *Relative market opportunity* fixed effect in addition to the variables included in Model 1. *Relative market opportunity* receives a significant positive estimated coefficient. This result shows that, in general, multi-business firms in our sample have a tendency to comply with the winner-picking approach to capital allocation. Finally, we complete our model in Model 3 by introducing *relative market opportunity* random coefficients at firm-year level. The results show that dependent variable's variance explained by *relative market opportunity* random variables is not statistically significant. A likelihood ratio test which is not reported in the table A2 indicates that the overall model fit improvement related to introduction of *relative market opportunity* random variables is significant only at an 18% p-value. However, the variance explained by *relative market opportunity* random coefficients are economically important. The improvement in model fit related to the introduction of the *relative market opportunity* random coefficients, in Model 3

compared to Model 2, is more than 20% of the improvement in fit due to adding *relative market opportunity* variable to the fixed part of the model in Model 2, compared to model 1. Therefore, we decide to use the estimated random variables as a proxy for the extent of firms' conformity to winner-picking approach to capital investment.

APPENDIX3. More details about the simulation model

In this Appendix, I provide more details about the specification of the simulation model, in chapter three, and its calibration with the empirical data.

Model initialization

At the beginning of simulation (t=0), each industry receives a random *Tobin's q* from a normal distribution with its average and standard deviation at 1.69 and 0.45 respectively, which are the calibrated values with four central years (2004 through 2007) of the sample used for our empirical analyses. Similarly, each industry receives a random actual demand growth and ROA from two normal distribution. We define the average in ROA normal distribution and actual demand by taking into account the industries' *Tobin's q*. To account for industry effect on industries' ROA and actual demand, we define the mean in ROA and demand normal distributions as follow:

$$ROA\ distribution\ mean_{it} = \overline{\mathrm{ROA}_{it}} + \beta_1\ (Tobin's\ q_{it} - \overline{Tobin's\ q_{it}}) \quad \text{(A3.1)}$$

$$Demand\ distribution\ mean_{it} = \overline{\mathrm{Demand}_{it}} + \beta_2\ (Tobin's\ q_{it} - \overline{Tobin's\ q_{it}}) \quad \text{(A3.2)}$$

where, β_1 and β_2 capture the effect of industry *i*'s *Tobin's q* on its profitability and demand growth, respectively. $Tobin's\ q_{it}$ is adjusted by its average value in our sample (which is 1.69) . To estimate the β_1, we regress the business segments' ROA on their industries' overall *Tobin's q* while controlling for business segment fixed effects. From the similar period of 2004 through 2007 of our sample we find values of 0.0133 and 0.124 for β_1 and average ROA, i.e., $\overline{\mathrm{ROA}_{it}}$, respectively. This is to say, an industry with an overall *Tobin's q* equal to 1.69 receives its random ROA at the first period from a normal distribution averaging 12.4 percent. However, a segment that serves an industry with higher (lower) *Tobin's q*, receives its ROA from a normal distribution whose average is modified (e.g., the distribution average would be 13.7 percent if a segment's industry *Tobin's q* is 2.69). Through a relatively similar procedure, we find β_2 and average demand equal to 0.07 and 0.0127 respectively. We decided

to fix both of the mean values of ROA's and demand's normal distribution means at 12 percent for the experiments reflected in Figures 1 and 2. Later, to impose a cash-limitedness to firms, for the experiment related to Figure 3, we divide the mean of the profitability normal distribution by two. We set the standard deviation in normal distribution of ROA at one-third for simplicity (not generating negative cash). This does not affect models' predictions qualitatively. It only makes the model less complicated. On the other hand we set the standard deviation of actual market growth at 12 percent to represent a moderate volatility. We would adjust the standard deviations of both actual demand growth and *Tobin's q* according to the extent of volatility we would like to impose to the model.

Details of calculations in each period:

Each period comprises the following steps:

1- Industries receive their *Tobin's q* value from a normal probability distribution around the previous period Tobin's q with a standard deviation equal to *Tobin's q* volatility. *Tobin's q* volatility is the square root of the portion of variance of current year industries' *Tobin's q* which is not explained by industries' preceding year *Tobin's q* value. We find *Tobin's q* volatility equal to 0.36 from the four central years of our sample.

2- Industries (and similarly the business segments) receive their ROA from a normal probability distribution around the last period ROA which is modified by the current year growth of industry *Tobin's q* (similar to equation 5 in chapter 3) and standard deviation equal to ROA volatility.

3- Optimal capital investment and resource redeployment decisions are made based on the marginal value of the investment of one unit of cash (in case of capital allocation) and one unit of unutilized production line (in case of resource redeployment) in subsidiaries which have unresponded demand.