Bond University

DOCTORAL THESIS

Financing, Firm Size and Productive Efficiency: the Effect of Family Ownership

Barbera, Francesco

Award date:
2014

Financing, Firm Size and Productive Efficiency: The Effect of Family Ownership

Francesco Barbera

Submitted in partial fulfilment of the requirements of the degree of Doctor of Philosophy (with coursework component)

School of Business

Bond University, Australia

August 2013

Statement of Original Authorship

This thesis is submitted to Bond University in fulfilment of the requirements of the degree of Doctor of Philosophy. This thesis represents my own original work towards this research degree and contains no material which has been previously submitted for a degree or diploma at this University or any other institution, except where due acknowledgement is made.

Signature: ______________________

Francesco Barbera

Date: August 24th 2013

Acknowledgments

I would like to thank the many people who have helped me through the completion of this thesis. First and foremost I offer my sincerest gratitude to my supervisory committee, starting with Dr Rodney Falvey who - through his patience, wisdom and honesty - has become a true mentor to me; Dr Ken Moores, who has profoundly influenced my professional development, including inspiring and fostering my academic interest in family business; and Dr Gulasekaran, who I owe a great deal, especially the bulk of my econometric aptitude. I could not have asked for a more brilliantly diverse and insightful committee, and consider myself very fortunate to have had their guidance. Other faculty at Bond University were also crucial to the development of this thesis, especially Shravan Luckraz, Justin Craig and Natalina Zlatevska. If not for their persistent support and valuable assistance the research presented in this thesis would not be possible.

I was also fortunate to have worked with a stimulating group of fellow doctoral students, who each contributed to this thesis in their own way. Throughout our candidatures, Andrew, Claudia, Lars, Manny, Safdar, Tim, Warwick, and I regularly supported, encouraged, collaborated, debated and at times even competed with one another. My interaction with them was instrumental in making my time at Bond an unforgettable experience, and I will always value their friendship.

I would also like to acknowledge the loving support of my wife, Marisa, who has enthusiastically stood by me no matter what. The completion of this thesis marks a new chapter in our journey and I look forward to what the future holds. I am also thankful for the support and guidance of my parents. They have taught me the value of hard work and always encouraged me to do my best in all matters of life. Finally, to my beautiful daughter Mia, who was born in the midst of my candidature and - above all others - has motivated me to complete this endeavour. This thesis is dedicated to her.

Abstract

The role that non-economic objectives play in determining the behaviour of the firm is said to be a key distinguishing feature of family owned firms. This, in conjunction with their economic significance, has prompted previous examinations into the effect of family ownership on firm performance. Although numerous, these investigations have predominately focused on public firms and are acknowledged to suffer from measurement and methodological issues. This thesis therefore aims to identify, and subsequently test, how financing preferences driven by non-economic, emotionally-based objectives can have consequences for the size and performance of small and medium-sized family enterprises. Small and medium-sized enterprises (SMEs) in general are known to have difficulty accessing finance, but the extent to which family owners' preferences might further limit the firm's use of finance, and in turn its size, remains largely unexplored to date.

Based on the popular non-parametric technique known as Data Envelopment Analysis, we calculate the theoretically founded performance measure of productive efficiency. This is made possible by a large panel data set derived from Australian SMEs. Using a sample of 3450 firms across 3 years, we further conduct econometric comparisons between family and non-family firms in order to quantify the effect of family ownership on financing preferences, firm size and efficiency. Unlike other studies which have treated firm size as an exogenous control variable, we consider how firm size is an outcome of what the current literature calls socio-emotional wealth preservation.

Relative to their non-family counterparts, we find that family SMEs rely more heavily on internally sourced finance, are significantly smaller and as a result face measurable efficiency consequences. These findings enable a better understanding of the dilemmas faced by family business owners when making the apparent trade-off between non-economic and economic objectives. In the context of the challenges specific to SME financing, this thesis yields new insights into how, why and to what extent family ownership affects firm performance.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

CRS	Constant returns to scale
DEA	Data Envelopment Analysis
DRS	Decreasing returns to scale
FE	Fixed effects
FF	Family firm
FOE	Family ownership effect
FTE	Full-time equivalent
ID	Internal debt
IE	Internal equity
IF	Internal finance
IRS	Increasing returns to scale
K	Capital
L	Labour
NF	Non-family firm
OECD	Organisation for Economic Co-operation and Development
PE	Productive efficiency
POH	Pecking order hypothesis
RE	Random effects
SE	Scale efficiency
SEW	Socio-emotional wealth
SME	Small and medium-sized enterprise
TA	Total assets
TD	Total debt
TE	Technical efficiency
WOE	Working owner's equity

Chapter 1. Introduction

1.1 Family firms are economically significant and different

Family ownership, no matter the criteria used for its definition[1], is arguably the most prevalent form of ownership in the world. According to reported stylised facts in the family business literature, family businesses are widespread and represent a substantial portion of economic activity in both developed and developing economies alike (La Porta et al. 1999). On their own, such claims would not be especially interesting were it not for the abundance of anecdotal and empirical evidence that family firms are significantly different from other organizations. Many of these apparent differences are founded on the notion that, as opposed to their non-family counterparts, family owners give priority to objectives other than profit, leading to specific behavioural and performance outcomes.

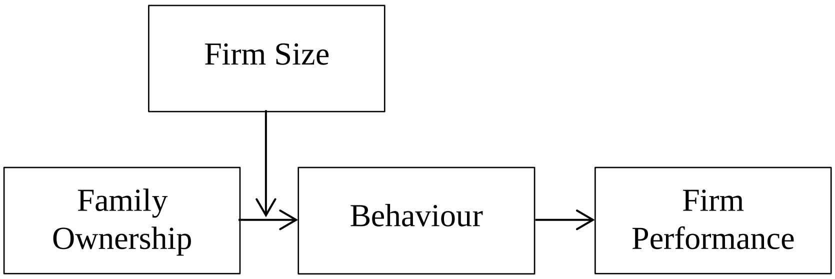
In their influential review of this literature, Gomez-Mejia et al. (2011) argue that these non-economic objectives, which they label as *socio-emotional wealth* (SEW), in fact play a pivotal role in the managerial choices made by family firms. Through these choices the authors infer that the SEW considerations related to family ownership will change behaviour and ultimately impact firm performance. Figure 1 illustrates the connections presented in their central argument[2], which is consistent with a behavioural theory of the firm, that is, ownership will influence behaviour, which in turn will determine firm performance.

[1] The actual prevalence of family ownership around the world depends heavily on how one defines a 'family firm'. We discuss this issue in greater detail in Chapter 2.

[2] For brevity, Figure 1 assumes that family ownership and SEW preservation are one in the same. With that said, Gomez-Mejia et al. (2011) argue that numerous contingency variables will moderate the relationship between family ownership and SEW preservation.

Specifically, they examine how family firms differ from nonfamily firms along five broad categories of behaviour, namely organizational choices concerning 1) management processes, 2) firm strategies, 3) corporate governance, 4) stakeholder relations and 5) business venturing. The authors also identify how firm size, among other important control variables, will moderate the importance of the family's SEW as the primary frame of reference in the management of the firm[3].

Figure 1: Links between ownership and performance[a]



[a] Figure 1 is loosely based on the diagram labelled *"Figure 1 Family Firm Research from a Socioemotional Wealth Preservation Perspective"* on pg. 657 in their article entitled "*The Bind that Ties: Socioemotional Wealth Preservation in Family Firms*" (Gomez-Mejia et al. 2011).

Noticeably missing among the behaviours listed, are inferences into how the pursuit of SEW objectives might in turn influence the various financing decisions of family owners. This is especially interesting in the context of broader challenges that all SMEs face in accessing finance.

Further, despite the well-established links between owners' financing preferences and firm size in the economic and finance literature (Carpenter and Petersen 2002), as well as the numerous descriptive links between family ownership and a smaller firm size, surprisingly very little research has investigated how firm size may be a direct outcome, rather than an antecedent or moderator, of family owners' ability and willingness to

[3] Due to lower levels of psychological ownership and a greater reliance on bureaucratic controls, Gomez-Mejia et al. (2011) explain that *"as the family firm grows in size, the use of socioemotional wealth preservation as a primary reference point for guiding managerial choices tends to decrease"* pg. 687.

maintain SEW. One of the reasons for this is that most comparisons between family and non-family firms focus on performance, rather than size, differentials. However, as we will demonstrate in this thesis, there is a more immediate relationship between firm size and performance.

With this research gap in mind, this thesis utilises the concept of SEW to explain why family SMEs make the financing choices they do and in turn how those financing choices may lead simultaneously to both firm size and performance outcomes. We specifically explore and test whether a preference towards internal finance impacts the quantum of finance raised, leading to a potential size constraint related to family ownership, which in turn may have both measurable scale and technical efficiency consequences.

By quantifying these effects, we can take one step closer to what Gomez-Mejia et al. (2011) refer to as the 'Holy Grail' in family business research; that is accurately measuring the impact of family owners' SEW maximising behaviour on firm performance. As the metaphor suggests, this task has proven to be challenging to date.

1.2 The challenge of measuring the impact of family ownership

Over the past two decades, those studies which have investigated, and attempted to quantify, the various ways that family ownership might affect firm performance have yielded ambiguous predictions and mixed results (Carney et al. 2010). In fact, to this day there is no consensus among family business researchers on whether family ownership has a net positive, negative, or *any* effect on performance.

Granted, different definitions of a family firm, different time periods, different measures of performance, different methodologies and data sets partly explain the variation. However, notwithstanding said technical issues, the many nuances of family firm behaviour, combined with the very idiosyncratic desires of family owners, means that reaching a clear consensus on how family owners impact firm performance is extremely difficult. What is generally agreed upon is that, when family owners have been found to significantly impact firm performance, they do so in both positive *and* negative ways (Habbershon et al. 2003).

What is less established however, are methods of analysis which can disentangle the simultaneous positive and negative performance outcomes associated with family firm behaviours. Echoing this point, Gomez-Mejia et al. (2011) claim that many aspects related to the desire to preserve SEW carry both 'good' and 'bad' connotations in terms of consequences for firm performance. They go on to state that *"In the end, both positives and negatives probably coexist in family firms, and it would be difficult to determine which predominates when it comes to performance results"* pg. 691. As a result, it is possible that simultaneously occurring positive and negative effects may nullify each other, leading the researcher to find no significant net relationship between family ownership and firm performance.

Additionally, Gomez-Mejia et al. (2011) highlight other noteworthy problems associated with quantifying the effect of SEW related behaviour on performance outcomes of the firm. For example, despite the best efforts of empirical researchers to rule out endogeneity bias, isolating an unbiased family ownership effect has proven to be difficult since performance is ultimately a variable influenced by many factors. This thesis addresses these methodological challenges by using a large panel data set consisting of Australian SMEs, robust econometric techniques to compare between family and non-family firms, and a performance measure which has not yet been utilised in a family ownership context – known as 'productive efficiency' (PE).

As we will demonstrate in this thesis, PE is based on well-established economic theory and contains aspects of efficiency related to both the firm's scale of production, or 'scale efficiency', as well as efficiency related to the method with which resources are organized in the production process, or 'technical efficiency'. As such, PE is considered a practical and fundamental measure of a firm's performance[4].

1.3 Research questions

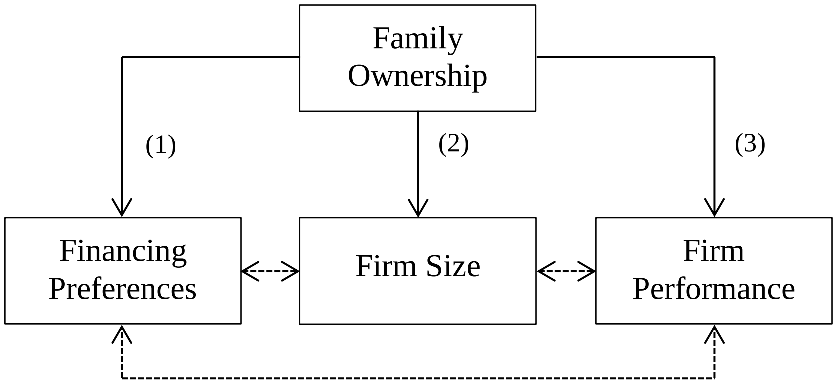
Based on this discussion, this thesis aims to answer the following overarching research question: 1) *What is the effect of family ownership on firm performance?* We examine this broad question by investigating the differences between family and non-family PE. Based on this measure, this thesis further intends to answer the related question: 2) *How does family ownership affect productive efficiency?* Specifically, we aim to quantify the family ownership effects on both scale and technical efficiency. This thesis also explores a particular answer to the question: 3) *Why is productive efficiency affected by family ownership?* We do this by forwarding and testing the notion that the financing preferences of family owners will constrain the size of the firm and thus affect the scale and means by which family firms produce.

1.4 Organisation of this thesis

To answer our stated research questions, this thesis begins with an investigation of the relevant economic, finance and family business literatures in Chapter 2. We use these to establish an argument that family SMEs will have different preferences with respect to financing and that such preferences might constrain the size of the firm and ultimately impact its performance. This argument, illustrated in Figure 2, extends the central line of reasoning in Gomez-Mejia et al. (2011) by specifically including financing preferences as a behavioural outcome of family ownership.

[4] Productive efficiency can be considered a fundamental measure of a firm's performance in the sense that it is driven by increases in output while holding inputs constant, or decreasing inputs while holding output constant, which in turn positively impacts financial performance variables like sales revenue, operating expenses and net profit.

Figure 2: Links between ownership, financing, firm size and performance



We further argue that firm size and performance are related to these financing preferences, and therefore simultaneously impacted by family ownership. Illustrated by the dotted lines, we expect fundamental interrelations between these variables. SMEs in general are known to have difficulty accessing finance, but how family owners' preferences might affect the firm's total access to finance remains largely unexplored to date. The argument illustrated in Figure 2 therefore proposes important connections through which the SEW considerations of family owners may affect their financing preferences as well as the firm's size and performance. Based on these connections, we formulate testable hypotheses which propose 'family ownership effects' (FOEs)[5] on 1) various debt and equity financing preferences, 2) measures of firm size, and 3) productive efficiency.

Specifically, we argue that owners of family SMEs may have financing preferences that could limit the magnitude of physical capital available to the firm. In terms of performance, a physical capital, or size, constraint specific to family firms may in turn manifest itself as an inefficient or suboptimal production scale and technology. This thesis therefore contributes to the work of Gomez-Mejia et al. (2011) by identifying how financing preferences are also potentially influenced by the SEW considerations of

[5] FOEs are defined as the measured difference between family and non-family owned firms, which are found in multiple ways throughout this thesis. A positive (or negative) FOE thus indicates that the variable in question is greater (or lower) for family firms relative to non-family firms.

family owners, and then examining how these preferences might translate into size and performance outcomes for family firms.

Of the more influential family firm studies relating to performance, most have focused solely on large publicly traded firms, however, based on the notion that SEW maximizing behaviour may be most prevalent in small unlisted firms, the results of these studies may not be generalizable to the broad population of family firms, most of which will never be publicly traded. The data we employ in this thesis enable us to identify family owned SMEs and therefore provide a rare opportunity to use a large, national, legally enforced, and longitudinal survey to test our hypotheses. Such scope and rigour will add to the external validity and robustness of our empirical findings and allow us to overcome the well-known generalization problems associated with family business samples of limited geographic or industry scope (Handler 1989).

In Chapter 3 we describe this data source, the 'Business Longitudinal Survey' (BLS), and define how these data are used to construct variables pertaining to family ownership, firm size and financing preferences. Differentiating by ownership type, we further conduct a preliminary descriptive analysis and present key statistics on the FOEs pertaining to the composition of finance and firm size. Among other significant differences, we show that family firms on average hold more internally sourced debt and equity finance and are smaller in size relative to non-family firms. We also show that a greater reliance on internally sourced finance is correlated with various measures of a smaller firm, which supports the thesis arguments proposed in Chapter 2.

To quantify a FOE on firm performance, we draw upon the well-established economic theory of productive efficiency (Farrell 1957), which has seen some application in the SME literature, but has been largely overlooked in the family business literature. Based on this theoretical foundation, which is described in detail in Chapter 4, PE is a performance measure which can simultaneously extract information about the coexisting performance effects of family ownership. The measure specifically enables us to distinguish the efficiency impact of a firm's size separately from the efficiency impact of its internal resource allocation. By decomposing PE in this way, we are further able to empirically isolate the simultaneous FOEs on both components. This decomposition is accomplished by using a Data Envelopment Analysis methodology (DEA), a popular non-parametric methodology in economics (Charnes et al. 1979).

DEA consequently tackles the problems associated with quantifying interrelated outcome measures and is noted by many in the management and entrepreneurship disciplines as a superior, but underutilised, approach to traditional parametric alternatives which measure performance (Richard et al. 2009). The method also reduces measurement error and improves the construct validity of the performance measure used in this thesis, which also addresses the "urgent need" to improve the rigor of measures used in empirical family business research (Pearson and Lumpkin 2011). Yet despite the inherent advantages of the DEA approach, as well as the rapid and continuous growth in its use across multiple disciplines over the past 30 plus years, this thesis is the first study to utilise a DEA method as a basis to compare various efficiency differentials across family and non-family owned SMEs. As a result, we also consider the application of DEA to be a major contribution of this thesis.

We use DEA to calculate scale and technical efficiency scores for each firm in the BLS sample. Consistent with the previous chapter, differentiating by ownership type, we also conduct a preliminary descriptive analysis and present key statistics on the FOEs pertaining to various measures of efficiency. Among other significant differences, we show that family firms on average exhibit greater inefficiencies related to a suboptimal scale of production, which implies that the average size of family firms is constrained.

Since the BLS data are longitudinal, we are able to utilize both the cross-sectional and time-series dimensions to test our hypotheses related to the magnitude, direction and significance level of the FOEs on financing preferences, firm size and efficiency. These data therefore improve our econometric estimates by enabling us to effectively control for time and firm heterogeneity. Encouraged by the preliminary results from Chapters 3 and 4, we specify the econometric tests used to test our thesis argument in Chapter 5.

Based on these specifications, we then perform robust empirical comparisons across family and non-family firms. In particular, we conduct panel regressions which control for individual firm heterogeneity and quantify the FOE using several techniques, such as the fixed effects, random effects, and hybrid models. By this approach, and controlling for important covariates, we establish that family ownership is significantly related to a preference for internally sourced debt and equity finance, a smaller firm, and inefficiencies associated with a suboptimal scale of production. We also establish that financing preferences, firm size and efficiency are inherently interrelated; thus our investigation into the FOEs takes into account the underlying simultaneity pertaining to these relationships.

Given their generalizability, our results ultimately yield important insights into the trade-off that family owners face between SEW maximising behaviour and best practice from an economic standpoint. The results presented in this thesis therefore have important implications for family business researchers, policy makers, the providers of external finance and family business owners themselves. In Chapter 6 we discuss these implications along with the overall meaning of our findings, highlight the limitations of the thesis, suggest avenues for future research, and conclude the thesis.

Chapter 2. Literature Review and Hypotheses Development

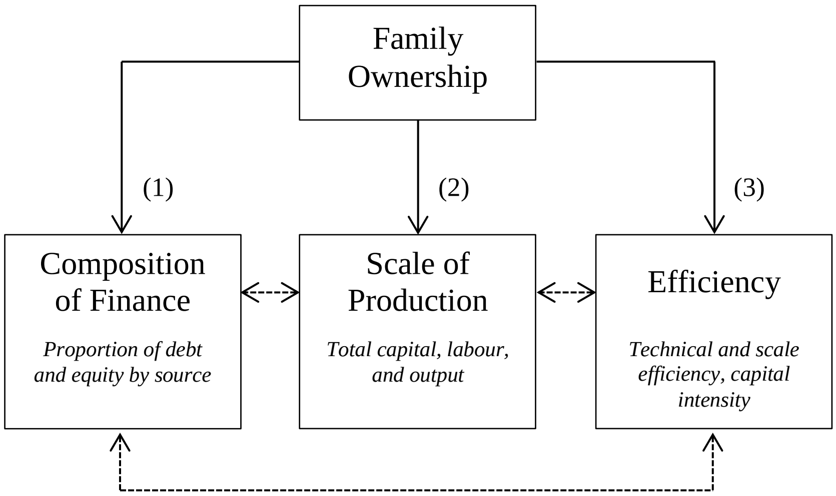
2.1 Chapter introduction

In this chapter we review the literature which pertains to how family ownership may ultimately affect the performance of small and medium sized family enterprises. It is well known that small firms in general have difficulties accessing finance, but the literature which examines how family ownership may mitigate or enhance these difficulties remains largely dispersed and anecdotal in nature. Furthermore, the studies that do draw upon theory do so in an ad hoc manner and do not consider a holistic view of the family firm's financing decisions. With this gap in mind, by drawing upon the overarching paradigm of SEW and the various behaviours by family owners which result from the preservation of such wealth, this chapter develops an argument on how these relatively unique tendencies may manifest themselves in the financing preferences of family owners and ultimately the size and performance outcomes of family firms.

Specifically, this chapter argues that there are well-established simultaneous relationships between financing, firm size and performance. Further, we argue that the tendency of family owners to pursue SEW objectives will influence their financing decisions. These decisions will have a bearing on the size of the firm, which will ultimately be reflected in the firm's efficiency. This line of reasoning, outlined in Figure 3 is consistent with the central argument in Gomez-Mejia et al. (2011), except we acknowledge that firm size itself is also a function of ownership (Penrose 1959). By understanding these links, this thesis extends the work of Gomez-Mejia et al. (2011) and offers to bridge the current knowledge gap on how family ownership impacts firm performance.

The framework illustrated in Figure 3 highlights important, but fundamentally unexplored, channels through which the SEW considerations of family owners may affect their financing preferences as well as the firm's size and performance. In this chapter, we respectively operationalize these concepts as the composition of finance, scale of production, and efficiency.

Figure 3: Channels through which family ownership impacts the firm



	Proposed Relationship	***Operationalization***	***Testable Hypotheses***
(1)	Family ownership will affect financing preferences.	Composition of debt and equity financing	Hypotheses 1 to 4
(2)	Family ownership will affect firm size.	Scale of production	Hypotheses 5 to 7
(3)	Family ownership will affect firm performance.	Efficiency	Hypotheses 8 to 10

Illustrated by the dotted lines, we further expect fundamental interrelations between these variables. The basis of this framework is further developed in this chapter, which is organised as follows.

In Section 2 we explore the distinctive challenges related to the financing of SMEs. Section 3 then briefly discusses the literature pertaining to the nature of family firms and how they are considered to be a distinct class of SMEs in that family owners have a strong desire to pursue non-economic or SEW objectives. We then go on to Section 4 which outlines, and formulates testable hypotheses on, the connection between family ownership and the composition of debt and equity financing by associating the SME financing literature with existing family business literature. The discussion then proceeds to Section 5 where we explore, and formulate further hypotheses on, how family ownership might constrain the firm's scale, and Section 6 discusses how such constraints may ultimately affect the firm's efficiency. Section 7 summarises the chapter.

2.2 The distinctive challenges of SME finance

Given their economic importance[6], the issue of financing SMEs has played a central role in the economic, finance and managerial literature for decades (see for example MacMillan Committee 1931; Butters and Lintner 1945). During this period, many have argued that SMEs in particular have non-trivial difficulties in obtaining financing, either through debt or equity, leading to what is commonly referred to as an 'SME financing gap'. Although there is no generally accepted definition of this gap, the term refers to the sizeable share of economically significant SMEs that cannot obtain financing from banks, capital markets or other suppliers of finance (Organisation For Economic Co-operation And Development 2006;2007) [7].

From a theoretical point of view, the distinctive challenges that SMEs face in raising financial capital are rooted in themes of asymmetric information and agency costs (Leland and Pyle 1977; Barnea et al. 1981; Pettit 1985; Binks et al. 1992), the risk aversion of both the provider and recipient of finance (Knight 1965; Kihlstrom and Laffont 1979; Stiglitz and Weiss 1981), the desire of owners to maintain control of the firm (Cressy 1995; Chittenden et al. 1996; Berggren et al. 2000), and structural

[6] Although there are numerous accounts of the economic importance of SMEs, a notable study by Ayyagari et al. (2007) reports that, depending on the country, the SMEs sector is responsible for a significantly large share of formal and informal employment as well as a large contribution to GDP in most developed and developing economies. For example, in Australia, where this study's data is sourced, the SMEs sector's share of formal employment is greater than 50 percent and its contribution to total GDP is found to be 23 percent (Ayyagari et al. 2007).

[7] In an effort to determine the worldwide prevalence of an SME financing gap and to explore policies which foster an improved flow of financing to SMEs, the Organisation For Economic Co-operation And Development (2006;2007) published two books on the subject.

deficiencies in the broader market for finance[8]. Adding further complexity to the matter is the fact that these theoretical issues may be influenced by forces relating to both the supply of and the demand for financing.

On the supply side, asymmetric information between the recipient and provider of finance can be problematic for the functioning of credit markets (Leland and Pyle 1977). Perhaps the most prominent contribution on an SME financing gap in this regard stems from Stiglitz and Weiss (1981) who identify credit rationing by banks as a main impediment to SMEs wishing to access credit[9]. Since small business entrepreneurs possess inside information about their own projects for which they seek funding, it is difficult for financial institutions to evaluate the risks of such projects, leading to credit rationing (Jaffee and Russell 1976; Leland and Pyle 1977; Stiglitz and Weiss 1981). Worsening the asymmetric information problem, monitoring SME borrowers may be more difficult since they typically do not hold publicly visible contracts with stakeholders, or have audited financial statements that can be shared with providers of external finance, nor do they issue equity which is continuously priced in public markets (Berger and Udell 1998).

Information asymmetry and the obscure line between the firm and the entrepreneur observed in many SMEs (Man et al. 2002) also gives rise to potential agency problems. For example, once financing is received, the entrepreneur may be motivated to undertake excessively risky projects, since the entrepreneur, or agent, will reap the

---

[8] Supply and demand issues leading to an SME financing gap will be exacerbated in countries with low levels of economic and institutional development (Beck et al. 2004). For the purpose of this thesis, we only discuss the potential for an SME gap in those nations where there is a functioning legal, institutional and regulatory framework; the structure of the financial system is intact; and the domestic savings investment balance is sufficient to allow for financial intermediation between borrowers and lenders. Thus, hereafter we will not discuss the structural deficiencies in the broader market for finance and focus exclusively on the informational problems as well as the risk/control preferences of borrowers and lenders as reasons for an SME financing gap.

[9] Stiglitz and Weiss (1981) identify credit rationing to occur if 1) among identical loan applicants, some receive credit while others do not, or 2) there are identifiable groups in the population that are unable to obtain credit at any price. These undesirable outcomes are modelled as an equilibrium phenomenon where asymmetric information between borrowers and lenders creates the potential for adverse selection.

benefits of such risk taking, while the lender, or principal, prefers a less risky project that increases the probability that the loan will be repaid (Stiglitz and Weiss 1981). This principal-agent problem, which is potentially present in all lending, is more serious for smaller firms than for larger firms[10]. Additionally, the greater the exposure to risk associated with information asymmetries between various external financiers and the entrepreneur, the higher the return on capital demanded by each source (Cassar 2004).

In addition to increased evaluation, monitoring, and credit risks, the SME sector is characterised by greater fluctuations in profitability and growth. SMEs also generally have considerably lower survival rates than larger firms (Evans 1987a;b; Storey and Thompson 1995; Cressy 1996b). A higher risk profile, coupled with limited credit histories and collateralizable assets also lead to a higher likelihood of credit rationing, and a decrease in the supply of debt financing available overall for SMEs (Levenson and Willard 2000). Considering that banks are the single most important source of external credit to SMEs (Meyer 1998), credit rationing by banks has long been acknowledged as a main contributor to an SME financing gap.

For similar reasons, other sources of finance, such as equity, are also limited for SMEs. For example, according to Binks et al. (1992) the uneven distribution of information between external private equity providers and the firm decreases the level of trust between the two parties, leading to lost opportunities. The difficulties faced by small business owners in identifying potential sources of private equity also contribute to the problem (Hustedde and Pulver 1992), and, due to their smaller scale, structural limitations may exclude SMEs from issuing equity on publicly traded markets.

Additional limitations on SME debt and equity financing may interestingly arise from demand side constraints. That is to say, SMEs' preference for debt financing may be

---

[10] It has been argued that asymmetric information is a more serious problem in SMEs than in larger firms, since 1) the entrepreneur has access to better information concerning the operation of the business and has considerable leeway in sharing such information with outsiders; 2) the entrepreneur is also likely to have less training and experience in business than those in a larger company; and 3) the entrepreneur may have incentives to remain opaque to outsiders, which would cause difficulties for any outside provider of finance to accurately assess the associated lending risks (Organisation For Economic Co-operation And Development 2006;2007).

lower relative to larger firms (Kotey 1999). For example, the demand for SME debt may be dampened, as the fear of having their loan application rejected may discourage small business owners from applying for bank credit in the first place (Freel et al. 2012). Further, to avoid liquidity and bankruptcy risks, SMEs have a tendency to choose levels of debt that do not fully exploit the firm's economic potential (Hutchinson 1995). However, despite the potential for debt demand to be lower, the SME literature on the matter demonstrates that external debt financing is still preferred over external equity financing, as the former entails less monitoring and interference from outsiders than the latter.

For example, the Pecking Order Hypothesis (POH) developed by Myers and Majluf (1984), as suggested by the seminal work of Donaldson (1961), asserts that under conditions of asymmetric information, firms will prefer financing sources that minimise transaction costs, external interference, and ownership dilution. Accordingly, as a pecking order, firms prefer internal to external funds, and debt to equity if external funds are needed (Myers 1984). Although there is some debate as to whether the POH empirically holds for SMEs (see for example Frank and Goyal 2003), the overwhelming consensus is that SME financing decisions do in fact adhere to a preference hierarchy as predicted by the POH (Reid 1996; Jordan et al. 1998; Watson and Wilson 2002; Sánchez-Vidal and Martín-Ugedo 2005; J.S. Ramalho and da Silva 2009).

In many of these studies the underlying reason for the general avoidance of raising equity finance is the inherent information asymmetry between the potential providers of equity and the owners of the firm, which results in an increase in the cost of equity finance, and a reduction in the attractiveness or accessibility of such financing (Cassar and Holmes 2003; Brav 2009); however, another major factor is the loss of control that raising equity finance implies.

An aversion to the sale of equity to outsiders, coined as 'control aversion', is based on the theoretical notion that small businesses are run by fiercely independent owner-managers, suspicious of outside control (Cressy 1995; Cressy et al. 1996; Cressy and Olofsson 1997; Berggren et al. 2000). A strong control aversion, or control motive (the two terms are used interchangeably throughout this chapter) among SME owners would explain why the POH holds for SMEs, as the owners of such firms would prefer internally sourced equity, such as retained earnings, and equity from friends and family, more so than externally sourced equity (Berggren et al. 2000; Mueller 2008).

This line of reasoning leads us to the understanding that, under certain circumstances, financial explanations for an SME financing gap may be more closely associated with the characteristics of the owner-manager's *preference* for investment funds rather than any deficiency in supply. Supporting this view, Hutchinson (1995) asserts that, where the objective of an owner-manager is to maintain control of the firm, a suboptimal capital structure decision is made in the form of reduced demand for both equity and debt. Such demand side constraints arise from factors internal to the firm (Cressy 1996a; Cressy and Olofsson 1997), which implies that the personal motives and intent of owners matters in terms of the magnitude and scope of financing accessible to the firm.

In this regard, family ownership is an interesting form of ownership since family business owners are known to have very different objectives relative to non-family firms, many of which being non-economic in nature (Ward 1988; Harris et al. 1994; Sharma et al. 1997; Gomez-Mejia et al. 2007; Nelly and Rodríguez 2008; Gomez-Mejia et al. 2011). Considering that family run businesses are the prevalent form of business among OECD economies[11], any SME financing constraints specific to family firms will have broader economic consequences. Next we discuss the nature of family owned firms, their unique objectives, and how such objectives may manifest themselves in the financing preferences of family firms.

[11] Burns and Whitehouse (1996) report that 85 percent of businesses in the European Union and 90 percent of businesses in the United States are family controlled. It is also generally recognized that 'family control' is a predominant ownership structure in most developed and developing countries (see for example La Porta et al. 1999).

2.3 Family ownership and the pursuit of socio-emotional wealth

Despite family business being the focus of study for many years, the persisting challenge facing researchers is defining what exactly a family business is[12]. In an attempt to clarify this issue, two broad conceptual approaches have been established in the literature. Following the seminal work of Berle and Means (1932), the first approach focuses on a structural-based classification. For example, family firms have been defined as those which are either owned, controlled and/or managed by a family unit. Such a definition allows for a wide range of 'family firms' as the degree of family ownership, control and management can differ among individual firms, and studies have shown that varying degrees of family involvement does empirically matter (Villalonga and Amit 2006; Miller et al. 2007; Sciascia and Mazzola 2008).

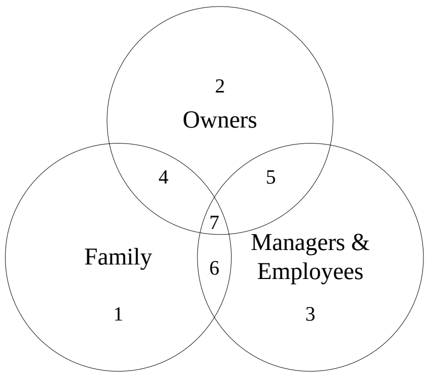
In fact, some researchers have come to realize that the components of family involvement do not necessarily determine whether a firm is a *family* firm as the structural based approach does not account for the possibility of intraorganisational aspirations within the firm to either increase or decrease the degree of family-based relatedness (Litz 1995). Thus, when attempting to narrow the definition of a family firm, an intention based approach can be useful. Indeed, the intangible desire of the family unit to transfer ownership through succession within the family is considered to be a unique characteristic of family firms. Handler (1994) describes the issue of succession as the most important issue that all family firms face; Chua et al. (2003) find that succession is the *number one* concern of family firms; and Ward (1987) goes so far as to define all family firms specifically as those that will be *"passed on for the family's next generation to manage and control"* pg. 252.

Regardless of the definitional approach taken, and without any consideration about the degree of family influence, family firms may be considered unique from other firms in the sense that there is an interaction between ownership, management as well as a third entity, the family. Gersick et al. (1997) helped to classify these interactions by

[12] In their review of more than 200 family business research articles, Sharma et al. (1996) count 21different definitions of family business that were used.

developing a ‘three-circle model’ which describes the family business system as three independent but overlapping subsystems. More recently, refined as: managers and employees, owners, and family (Moores 2009). Any individual can be placed in one of the seven sectors formed by the overlapping circles, as identified in Figure 4.

Figure 4: The three-circle model of family business



1. Only family members
2. Only owners
3. Only employees/managers
4. Family owners
5. Employee/manager owners
6. Family employees/managers
7. Family owners and employees/managers

Based on Figure 4, it is the interaction of the family unit on the business entity and owners, and/or individual family members, which can bring about unique system conditions which impact performance outcomes (Habbershon et al. 2003). It is for these reasons that Anderson and Reeb (2003) contend that family owners are a unique class of shareholder. More specifically, there is a strong identification by family owners between the family and the business (Gallo and Vilaseca 1996), and family business owners, unlike other companies, have to satisfy the current and future needs of family members in addition to the needs of the business (Dreux 1990).

We acknowledge that understanding family concerns and preferences are crucial for understanding family business behaviour (Ward 1988; Harris et al. 1994; Nelly and Rodríguez 2008); thus we also acknowledge that objectives other than profit may drive differences in behaviours between family and non-family firms. Although such non-pecuniary considerations also exist in non-family SMEs, they can be especially strong if the relationship between owner and company is closer (Mueller 2008). As a result, long term objectives akin to the continuity of the business, preservation of financial strength and maintenance of family control may receive greater precedence than immediate profits or other short-term aims. The role of these non-economic factors in the management of the firm is thus a key distinguishing feature that separates family firms from other organisational forms.

Recently, Gomez-Mejia et al. (2007) have comprehensively referred to these non-economic objectives as the preservation of SEW. As defined by the authors, SEW refers to the non-financial aspects of the firm that meet the family's affective needs, such as identity, the ability to exercise family influence, and the perpetuation of the family dynasty. More specifically, the SEW endowment of family firms consists of a variety of related forms, including the ability to exercise authority, the perpetuation of family values through the business, the preservation of the family dynasty, the conservation of the family firm's social capital, the fulfilment of family obligations based on blood ties rather than on strict criteria of competence, and the opportunity to be altruistic to family members (Gomez-Mejia et al. 2007).

Fundamental to this approach is the notion that firms make choices depending on the reference point of the firm's dominant principles; hence family owners evaluate problems in terms of assessing how actions will affect their socio-emotional endowment, or more broadly speaking, their stock of affect-related value that is ultimately derived from their control over the firm (Berrone et al. 2012). The approach is also consistent with a neo-classical behavioural view of the firm[13] and traditional utility theory, once one recognises that 'utility' may be a function of both economic and non-economic outcomes[14]. As the utility value derived by owners from either of these outcomes vary, so too will utility maximising actions (Jensen and Meckling 1976; Demsetz 1983; Demsetz and Lehn 1985).

---

[13] The behavioural view is based on the notion that bounded-rationality under uncertainty will yield 'satisficing' decision-making instead of an optimal solution (Simon 1955; Cyert et al. 1959; Cyert and March 1963).

[14] For example, 'affective decision-making' is a theory of choice, which generalizes expected utility theory by positing the existence of two cognitive processes – the rational and the emotional process (Bracha and Brown 2009).

Among family business researchers, the appeal of an overarching paradigm that can encompass the many documented characteristics and behaviours of family businesses is understandable[15], and recent publications in the literature clearly demonstrate that the concept of SEW has gained considerable momentum in the last few years (see for example Berrone et al. 2010; Stockmans et al. 2010; Zellweger and Dehlen 2011; Cruz et al. 2012).

Noticeably missing in the literature however, is how the pursuit of various SEW objectives might in turn influence the financing preferences of family owners, especially in the context of the previously mentioned challenges specific to SME financing. These challenges pertain to both family and non-family owned SMEs alike; however, as the theoretical basis for an SME financing gap relates to issues of asymmetric information, agency and transaction costs, as well as risk and control aversion, we expect that the behaviours associated with the maintenance of SEW might affect these financing challenges, particularly for family firms.

For example, using a socio-emotional reference point, family SMEs, relative to their non-family counterparts, are likely to have a more pronounced priority on maintaining family control. As extracting SEW benefits from the firm necessitates a high level of owner sovereignty, a fundamental condition to the maintenance of SEW is for family owners to retain control of the firm. Thus, in family firms, owners are expected to have a much stronger control motive than those in non-family firms. This and other family firm behaviour related to the preservation of SEW, such as an aversion to certain risk taking activities, an emphasis on the firm's reputation, and a long-term perspective on relationships and performance may in turn influence the information asymmetry, risk, and agency issues between would-be financiers and the firm.

As a result family owners may heavily favour, or have relatively better access to, certain sources of finance, while other sources may be precluded entirely. Such behaviours, which serve to maximise SEW objectives rather than the firm's profit, may not only

[15] See Moores (2009) for a discussion on the current state of the study of family business as a standalone discipline and paths to further develop a theory of the business family domain.

impact the firm's overall access to finance (Haynes et al. 1999), but also the scale and technology of its production process (Barbera and Moores 2013), and ultimately its performance (Sacristán-Navarro et al. 2011).

The notion that family ownership will influence various financing preferences is not necessarily new; however, the various literatures on the matter are mostly fragmented into investigations on specific anecdotal tendencies of family owners. Despite the apparent links, research to date has yet to integrate this body of literature as a means to explore how SEW objectives relate to the overall financing preferences of family firms. Even less research has been devoted to such matters for SMEs in particular, and given that the strong control motive associated with SEW might be a behavioural factor in both family and non-family SMEs (Mueller 2008), it is interesting to identify whether family firms, as a distinct sub-set of SMEs presumed to exhibit an even stronger control motive, are systematically subject to different financing, size, and performance outcomes.

From a SEW vantage point, in the following sections we associate the fragmented family business literature regarding the distinct behaviour displayed by family owners with the literature on the availability and use of both debt and equity SME financing. As a result, hypotheses relating to these proposed differences are formulated. Subsequent to this, we explore how the maintenance of SEW may affect firm size and performance, and develop additional testable hypotheses based on the economic efficiency literature pertaining to these issues.

2.4 Family ownership and the composition of debt and equity financing

In this section we review the literature pertaining to the access of debt and equity finance of family firms, and develop hypotheses based on a SEW vantage point. Since we acknowledge that family owners' SEW objectives will affect the strategic behaviour of those owners, the overarching theoretical framework can be linked to the basic neo-classical understanding of firm behaviour. That is, ownership will affect the conduct of the firm, which in turn will affect its performance (Simon 1955; Cyert et al. 1959; Cyert and March 1963; Bain 1968).

Following this logic, the conduct of the family firm, specifically their financing preferences, can be linked with various SEW objectives. In the following sections, we operationalize financing preferences by observing the composition of finance by debt and equity source. Further, the theoretical implications of most, if not all, of the family business literature cited can be connected to a strong desire by family owners to retain control of the firm. This intent is consistent with SEW maximizing behaviour since controlling ownership allows the family to pursue such non-economic goals with minimal outside interference.

As the concept of SEW preservation and a strong control motive are closely linked (Berrone et al. 2012), this section is dedicated to exploring the literature and developing hypotheses on how family SEW objectives, and the preservation of the sovereignty that is required to pursue them, might impact both the debt (Section 4.1) and equity (Section 4.2) financing composition of the firm. Specifically, both the composition of debt and equity as well as the quantum of finance available to or undertaken by the family firm is expected to be sensitive to family owners' desire to pursue various non-economic SEW objectives. In subsequent sections, we explore how such conduct may manifest itself in both size and performance outcomes for the family firm.

2.4.1 Family ownership and debt financing

Since SMEs do not have access to public debt markets, they typically rely on financial intermediaries, particularly commercial banks, as a primary source of debt finance (Petersen and Rajan 1994). Credit rationing by banks, as described previously, therefore poses a large problem in terms of constraining the supply of SME finance, including family owned firms; however, based on the family business literature, the asymmetric information problems which trigger credit rationing may be mitigated by family ownership.

For example, Berger and Udell (1995) suggest that the relationship between lender and borrower is an important mechanism for solving the asymmetric information problems associated with financing small enterprises[16]. In this regard, it has been suggested that family firms favour long-term win-win relationships over transactions-links with providers of capital and other stakeholders (Miller and Le Breton-Miller 2005). Since bank financing often involves a long-term relationship, and since upholding the identity/reputation of the family firm, which often carries their name, is considered to be a SEW objective of family owners, the long-term governance structure of family firms may be better suited to accommodate a closer relationship with their bank, leading to greater access to credit (Le Breton-Miller and Miller 2006; Chua et al. 2011).

Another potential alleviation of the credit rationing problem is the use of collateral in the credit contract (Jaffee and Russell 1976; Stiglitz and Weiss 1981). Hence, if personal commitments are prerequisites for bank financing, the wealth of small business owners will play a key role in successfully obtaining credit (Avery et al. 1998; Colombo and Grilli 2007). Again, family ownership may help in this regard since the extent of debt collateralisation is increased via the use of pooled personal family assets to secure bank loans (Steijvers et al. 2010), and such pooling is less likely to occur outside of family owned firms.

Finally, due to their long-term orientation (Lumpkin and Brigham 2011), based on the SEW objective of perpetuating the family dynasty, priorities such as the long-term survival and reputation of the firm receive a great deal of attention by family owners. Since ensuring the continuity of the firm pertains to SEW, these priorities have been said to lead to an overall culture of commitment in family firms (Zahra et al. 2008). Commitment to the firm is further enhanced by the fact that family owners have a majority of their wealth tied into the equity of the firm and therefore prefer more conservative investment strategies since they bear all the risk (Fama and Jensen 1983).

[16] So called 'relationship lending' may mitigate the common asymmetric information problems facing lenders since screening and monitoring functions are facilitated when there is a closer relationship between lender and borrower. For an overview of the relationship lending literature, see Boot (2000).

For this reason, it has been suggested that the typical agency problems between lender and borrower will be mitigated by family ownership (Chrisman et al. 2004).Long-term objectives combined with a greater commitment signal to lenders that family firms intend to repay their loans, reducing agency risks and increasing the likelihood of credit application approval (Blumberg and Letterie 2008).

The discussion thus far leads us to believe that, as far as the supply of debt financing is concerned, family ownership can mitigate the causes of credit rationing by banks. Previous findings have supported this belief, but it has yet to be tested directly. For example by examining family firms' propensity to take discounts on trade credit[17], Bopaiah (1998) suggested that family firms have better access to bank credit. More directly, if family firms in fact had better access to bank credit, all things being equal, we would expect family SMEs to utilise more debt financing from banks relative to their non-family counterparts, which can be tested under the following hypothesis:

Hypothesis 1a: *Bank debt, as a proportion of total debt, is greater for family firms relative to non-family firms.*

It is well known that SMEs which cannot secure bank credit often resort to trade credit[18] (Biais and Gollier 1997; Petersen and Rajan 1997); thus, if Hypothesis 1a is confirmed, it follows that we would also expect family firms to utilise relatively less trade credit than their non-family peers, this can be tested under the following hypothesis:

Hypothesis 1b: *Trade credit, as a proportion of total debt, is lower for family firms relative to non-family firms.*

---

[17] In the context of family firms, Bopaiah (1998) used the methodology of Petersen and Rajan (1994) which postulated that firms which take advantage of trade credit discounts, i.e. trade creditors usually offer a nominal discount if the debt is repaid in a relatively short time frame, use bank credit to do so and thus have better access to finance from banks.

[18] Trade credit, to some extent, alleviates the asymmetric information problem faced by credit rationing banks since suppliers may be better positioned to evaluate and control the credit risk of their buyers (Petersen and Rajan 1997).

Other, less orthodox, sources of debt financing may include loans from related or unrelated individuals and businesses (Harvey and Evans 1995). Successfully accessing such sources of debt finance can be related to what other researchers have called organizational 'social capital', which refers to goodwill and resources a firm amasses because of its connections and relationships with others (Arregle et al. 2007). For example, SME financing arrangements have been shown to be based first from social capital aspects between the borrower and lender, which in turn evolve to the organizational level as the relationship develops (Brush et al. 2002; Freear et al. 2002). In the case of SMEs, relations between the firm and its stakeholders are expected to reflect personal relationships to a much higher degree than in larger firms where such relationships are more likely to be formalised.

In this regard, family SMEs may be disadvantaged since, as a result of their tendency to focus on building interpersonal networks with internal contacts within the family, they may fail to cultivate external networks with more diverse stakeholders outside of the family (Salvato and Melin 2008). This implies that, although the depth of family SME networks may be quite deep, their breadth may be limited.

The notion that family firms have narrower external networks has lead researchers like Rosessl (2005) to hypothesise that family businesses tend to be less willing to enter into cooperative arrangements with outsiders, as many characteristics of family businesses have a hindering effect on such cooperation. On the supply side, Dawson (2011) finds that external private equity professionals are more likely to invest in firms in which family presence is reduced after the financing deal, and suggests that they associate the intertwinement of family and business with negative qualities, such as emotions, conflict, and misunderstandings. In other words, external sources of debt financing are often not well known by family firms, and their networks are poorly structured, making access to them difficult.

Further the aforementioned pecking order hypothesis developed by Myers and Majluf (1984) proposes that when firms have information that outside investors do not have, firms will prefer internal over external sources of finance. This approach can be explained by a desire to minimize the transaction costs of raising finance, which becomes especially important in the context of SME finance (Chittenden et al. 1996). Considering a pecking order, Romano et al. (2001) have found that small family businesses in particular tend to rely heavily on family loans, rather than loans from outsiders as a source of finance. Consistent with SEW maximising behaviour, these preferences protect the family's influence over the management and operation of the firm.

However, from a financing perspective, lower social capital with outsiders would hinder the family firm's ability to access these sources and limit it, to some extent, to internal sources of debt finance. This coupled with a strong control motive and resulting preference for internal loans from family implies that family firms will utilise more internal rather than external sources of debt finance. This can be tested under the following hypotheses:

Hypothesis 2a: *Loans from internal sources, as a proportion of total debt, are greater for family firms relative to non-family firms.*

Hypothesis 2b: *Loans from external sources, as a proportion of total debt, are lower for family firms relative to non-family firms.*

Since firm's can obtain finance by issuing both debt and equity, differences in debt composition alone cannot reveal the full extent of the influence that a SEW reference point might have on family owners' financing preferences. Thus, just as family owner preferences are expected to influence the firm's composition of debt, they are also expected to influence the firm's composition of equity. The reasons for these expectations, and subsequent hypotheses development, are presented in the next sub-section.

2.4.2 Family ownership and equity financing

As SMEs typically do not reach the required scale to issue shares on organised equity markets, they tend to rely heavily on private equity[19] and retained earnings. For SMEs, financing preferences consistent with a pecking order theory have empirically been shown to hold (Cassar and Holmes 2003). That is, the most commonly utilised sources of SME private equity are raised from internal resources, such as the principal owner themselves (including retained earnings), followed by their family and friends (Berger and Udell 1998). Lower on the order of preferred equity sources is equity raised from external resources, such as external private equity investors, venture capitalists, unrelated individuals and eventually organised equity markets (Myers and Majluf 1984). Similar to the case of debt financing, family ownership and a SEW reference point is also expected to influence the utilisation of these sources of equity financing.

On a positive note, as per the family business literature, patient capital is a valuable asset for family firms (Sirmon and Hitt 2003). Patient capital, a potential benefit of SEW preservation, refers to the equity holder's ability to focus on long-term, rather than immediate, returns. Family owners are thus not as focused on short-term results as nonfamily firms. For example, the presence of family owners, with their increased time horizon[20], may reduce the riskiness of an investment and hence the risk-equivalent cost of equity capital (Zellweger 2007). However, it is important to consider that a reduction of investment risk might also relate solely to internal, rather than external, equity providers. A tendency for internal equity providers to be more 'patient' could in turn translate to a greater availability of equity from such sources.

Further, due to an intermingling of business and family finances in family owned businesses, there are potentially more sources of internal working owner equity for

[19] Broadly speaking, private equity refers to equity securities that are not registered and not publicly traded on an exchange. Thus private equity can be sourced from both internal and external sources.

[20] Zellweger (2007) argues that family firms display a longer time horizon than most of their nonfamily counterparts, since family firms display a longer CEO tenure and strive for long-term independence and succession within the family.

family firms than in non-family firms. Sirmon and Hitt (2003) refer to this advantage as survivability capital, another potential benefit of SEW preservation, which represents the pooled personal resources that family members are willing to loan, contribute, or share for the benefit of the family business (Dreux 1990; Haynes et al. 1999).

Although it is understood that SMEs in general will rely heavily on such sources of equity, greater patient and survivability capital, along with the tendency to build a strong equity base over time through the retention of profits (Poutziouris 2001), would suggest that family firms may access internal equity, such as equity from working owners and retained earnings, more so than non-family SMEs. To test this, we formulate the following hypothesis.

Hypothesis 3: *Internal equity from working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.*

In addition to the reasons already discussed, and since we are curious about the composition of equity finance, we may also find Hypothesis 3 to be true due to the notion that family owners' first financing objective is not to lose control of the business (Lopez-Gracia and Sanchez-Andujar 2007). Thus, if the family firm were to raise external equity, it would be from related sources such as other non-working family members and friends, rather than unrelated individuals or businesses. Thus, on the negative side, family firms have limited sources of external financial capital because they avoid sharing equity with nonfamily members (Sirmon and Hitt 2003).

Although family ownership may reduce the asymmetric information problems associated with internal equity holders, asymmetric information between current family owners and prospective external investors may be enhanced due to the family firm's strong preference to maintain control (Schulze et al. 2003). Adherence to a pecking order of financing sources in itself would imply that family owners have information that outside investors do not, and in turn this would raise the transaction costs of external equity financing. The notion that family firms are more opaque[21] further enhances this information asymmetry problem (Anderson et al. 2009; Bianco et al. 2012). Evidence of this has been presented in the literature. For example, using different approaches, Mahérault (2000;2004), Poutziouris (2001), and Lopez-Gracia and Sanchez-Andujar (2007) all have found that the financial development of family firms in regards to equity is governed by a 'keep it in the family' tradition.

Together, these characteristics suggest that family SMEs tend to have a more limited external equity financing base, but a wider base of internally generated equity, excluding equity from working owners, which has been tested for separately in Hypothesis 3. This can be tested under the following hypotheses:

Hypothesis 4a: *Equity from internal sources other than working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.*

Hypothesis 4b: *Equity from external sources, as a proportion of total equity, is lower for family firms relative to non-family firms.*

Despite our expectations that there will be differences in the composition of debt and equity finance, we acknowledge that family ownership may also negatively impact the quantum of finance overall. For example, an over-reliance on internal or related sources of debt and equity may limit the total amount of finance the family firm can raise in the first place due to the likelihood that such sources are less endowed, in terms of capacity to finance, than external ones. While less endowed sources of debt and equity might limit the total amount of equity financing *available* to family firms, a strong control motive might also limit the total amount of equity that family firms are *willing* to issue externally.

---

[21] Anderson et al. (2009), by developing an index to gauge relative opaqueness, argue that information about firm activities is significantly less transparent in the presence of founder or 'heir ownership'.

The notion that access to financial resources is limited for small family-owned businesses is somewhat established (De Visscher et al. 1995; Harvey and Evans 1995; Coleman and Carsky 1999); however thus far we have attempted to link the numerous, but disconnected, existing family business financing literature with the relatively new overarching concept of SEW preservation. This connection, along with the results of our aforementioned hypotheses, will contribute to our overall understanding of how the pursuit of non-economic goals can impact the performance of family firms.

Referring back to Figure 3, to link SEW objectives to performance however, we first investigate how financing, firm size and performance are linked. Given these interrelationships, in the next sections we investigate how the SEW inspired financing compositions hypothesised here can lead to specific outcomes for family businesses, such as a size constraint, and in turn how a constraint on scale would impact the family firm's efficiency.

2.5 Family ownership and firm size

It is well known that firm size is highly related to the physical capital, or total assets, of the firm (Smyth et al. 1975; Shalit and Sankar 1977). Since, other things being equal, a firm with fewer assets will generate lower sales revenue and require less employees overall, the number of employees as well as total sales revenue, all proxy measures for firm size, are ultimately related to total assets. Thus, as per the accounting identity, owners' access, or lack thereof, to viable sources of debt and equity finance for the purpose of acquiring assets will naturally have a great influence on a firm's size.

The notion that varying financing preferences of owners will in turn impact firm size is not new in the economic and finance literature. In fact, there is a long-standing theory that growth and thus, from a static point of view, the size of most small firms is constrained by the available quantity of internally generated finance. Noticing that most small firms finance their growth almost exclusively through retained earnings, Butters and Lintner (1945) conclude that small firms, even those with promising growth opportunities, find it difficult to raise outside capital on reasonably favourable terms.

Less capital in turn implies diminished capital investment, and ultimately lower growth (Fazzari et al. 1988). Carpenter and Petersen (2002) defined this phenomenon as the 'internal finance theory of growth' and go on to suggest that small firms in particular will have growth constraints due to a large wedge between the cost of internal and external finance. Empirically, Oliveira and Fortunato (2006) have confirmed the link between access to finance and firm size by finding that smaller and young firms' growth are more limited in terms of the cash flow available, which signals greater financing constraints for these firms.

This literature clearly highlights that the availability and cost of finance is an important factor affecting the ability of a business to grow. It is important to note however that, although access to finance by itself will not cause a small business to grow, the inability to obtain or the restricted availability of, finance can definitely prevent or hinder growth (Binks 1996). From this understanding, we can link the availability of finance, and thus the size of the firm, to the various motives of firm owners.

In fact, the family firm behaviour proposed in the previous section has been theoretically linked to firm size in seminal economic works. For example, Kihlstrom and Laffont (1979), based on the work of Knight (1965), model how less risk averse entrepreneurs run larger firms. Demsetz and Lehn (1985) explain how an inverse relationship between firm size and concentration of ownership, based on a trade-off between 'shirking costs' and a 'risk neutral effect'[22], is consistent with stockholder wealth, or utility maximizing behaviour. Williamson (1967) combined an organizational theory and economic modelling approach to show how the expansion of firm size inevitably brings about some loss of control. Lucas (1978) argues that the distribution of managerial ability determines the distribution of firm size. Along these lines, Penrose

[22] Since a given degree of control generally requires a smaller share of the firm the larger is the firm, the greater diffuseness of ownership occurring in larger firms distributes any risk associated with a given degree of ownership across many shareholders. Demsetz and Lehn (1985) refer to this as the 'risk-neutral' effect of size on ownership.

(1959) describes how difficulties in obtaining capital is a main factor in preventing the expansion of small firms[23].

More recently, Cressy (1995) postulates that "independence of control is maintained at the expense of growth". In another paper, by Cressy (1996b), the so-called 'target income hypothesis' proposes that the objective of the entrepreneur is to produce an independent source of income to replace income from previous employment, thus SMEs may grow to the level required to achieve the lifestyle the managers were previously accustomed to, but often no further. Chittenden et al. (1996) observe how an over-reliance on internally available funds, in the case of unlisted small firms, is likely to be a major constraint on firm size. Beck and Demirguc-Kunt (2006) show that reduced access to formal sources of external finance causes smaller firms to face larger growth constraints. While Orser et al. (2000) describe how small firms are lacking in financial expertise, which limits their availability to external finance sources.

Based on this literature, firms which are constrained in terms of access to external finance have been found to be smaller and more likely to be owned by their founders than those firms that successfully applied for external finance (Levenson and Willard 2000). This is an interesting implication in the context of family businesses. For instance, considering our discussion in the previous section on how family owners, driven by SEW objectives, might influence the utilisation of various sources of debt and equity financing, family firm size in turn is also expected to be affected by these financing preferences.

---

[23] Interestingly, Penrose (1959) outlines how small firms often rely on a division of labour between the founder, referred to as the inventor or production manager, and a 'businessman', who can instil confidence in investors, and overcome the difficulties in raising capital. She goes on to suggest that a shortage of capital for small firms, and thus an inability to grow, is the result of a failure of such firms to successfully achieve this division of labour. In this regard, we can argue that an emphasis on SEW objectives by family owners may drive a strong preference to retain family members in key managerial roles, which in turn may hinder the family SMEs ability to divide labour in the manner Penrose describes. Thus, if the family does not have such a 'businessman' already employed in the family firm, they may find capital difficult to obtain, and in turn remain small.

A strong control motive, the avoidance of risk, and preferences for internal sources of financing, or as we have suggested more broadly, an emphasis on SEW objectives by family owners may result in non-trivial limits on how much debt and equity financing can be raised in total. Lower levels of financing available will result in less physical capital[24] the firm can feasibly acquire. Thus, Despite the expectation that there will be variations in the proportions of different sources of debt and equity due to ownership structure, we acknowledge that the SEW objectives of family owners may also negatively impact the general quantum of finance, and thus the total assets held by the firm.

For example, notwithstanding the potential for higher transaction costs already mentioned, family firms may demand less from external sources of debt since family owners wish to avoid being monitored by outside creditors (Schulze et al. 2001). As internal sources of finance, like family and friends, are likely to be less endowed, in terms of their capacity to provide finance, than external sources, such preferences may lead to less debt financing available overall for family firms.

Moreover, according to a model developed by Cressy (1995), there is a consequent trade-off between bank borrowing and control of the firm[25]. Utilising this model he finds that, if owner control aversion is strong enough, the firm's optimum will involve borrowing less than the amount that maximises profits. Using a similar line of reasoning, McConaughy and Mishra (1999) argue that increased leverage is associated with a higher probability of the loss of family control, leading to less use of debt in family firms.

---

[24] Here we refer to physical capital as the value of the assets held by the firm. As per the accounting identity, the value of total assets is calculated as the sum of the values of total debt and total equity.

[25] Cressy (1995) argues that although loan capital can be productive and increase the firm's revenue, the 'interference' by the lender into the affairs of the firm brings the business under the control of the bank. Although it is the more common perception of control, the vehicle of this interference need not take the form of an equity stake in the business.

In addition to the avoidance of monitoring from external creditors and loss of control, family owners may prefer less debt financing due to the fact that inside equity holders of family firms typically have undiversified portfolios and the intent to pass the firm on to their descendants, and are thus less willing to subject the firm to the future cash flow risks that result from financing via debt (Agrawal and Nagarajan 1990; McMahon and Stanger 1995; Zahra 2005). Schulze et al. (2003) further highlight how family firms are vulnerable to conflict and thus avoid the added risk that debt financing implies. Based on this, from an SEW standpoint Gomez-Mejia et al. (2011) suggest that, when family harmony is at stake, the demand for debt may be subdued.

Such risk avoidance is consistent with Shleifer and Vishny (1986) who observed that large, undiversified shareholders may force the firm to seek low risk projects and avoid high risk activities. Ward (1988) outlines how this risk aversion can limit the strategic aggressiveness of family firms, and Morck et al. (2000) also recognise the distaste for risk displayed by family owned firms arguing that they may be excessively risk averse.

Manifestations of lower debt demand have consistently been observed in that family firms have been found to be significantly less leveraged than non-family firms (Dreux 1990; Gallo and Vilaseca 1996; Anderson et al. 2003; Villalonga and Amit 2006). Thus, if it is true that family firms demand less debt financing relative to their non-family peers, we may observe less debt being held overall in family firms, which can be tested under the following hypothesis:

Hypothesis 5: *The quantum of total debt is lower for family firms relative to comparable non-family firms.*

Since assets can be financed via debt or equity, less family firm debt overall does not necessarily imply a smaller firm. To understand the full extent of any potential financing constraint for family firms, we first investigate how family ownership may impact the decision to use equity financing as a means to raise capital.

As already mentioned, one of the central themes in the family business literature, and one of the main points of distinction between family and non-family firms, is the intent of family owners to keep ownership, and thus control, within the family across several generations (Chrisman et al. 1999). This intent is consistent with SEW maximizing behaviour since controlling ownership allows the family to pursue such non-economic goals with little outside interference. In this regard, the dilution of ownership that raising equity finance entails in turn clearly poses a greater control risk than debt financing. Therefore, firms controlled by a major shareholder, as is the case with family firms, will be reluctant to use equity financing when doing so causes the controlling shareholder to risk losing control (Stulz 1988; Amihud et al. 1990).

As we have already stated, such control motives have been found to influence the financing decisions of family firms. For example, Croci et al. (2011) provide empirical evidence for the control motive by finding that equity issues are considerably lower in publicly listed family-controlled firms than in non-family firms. To test this in the context of SMEs, we formulate the following hypothesis.

Hypothesis 6: *The quantum of total equity is lower for family firms relative to comparable non-family firms.*

If, due to their specific financing preferences, family firms have lower values of both equity and debt, then such preferences could lead to a physical capital constraint.

Descriptively, numerous family business studies have provided incidental evidence that family firms are in fact relatively smaller than their non-family peers. In turn, these studies merely account for some measure of a firm's scale as a means to control for any potential size effect in their analysis. Notable examples include Coleman and Carsky (1999), who describe family-owned businesses as significantly smaller than non-family businesses in terms of sales, assets, and total employees. Bertrand (2006) who, when looking into the strategic choices of family firms, observed that family firms tended to be smaller, more self-employed, and less reliant on external finance. Romano et al. (2001) find that the use of internal family loans is significantly associated with small family businesses. Kets de Vries (1993) incidentally mentions how less access to financial markets may curtail family firms' growth. While Górriz and Fumás (1996) find that family firms have limitations on their portfolio diversification due to, among other characteristics, their smaller size.

A more direct relationship between firm size and the concept of SEW preservation in particular has only briefly been discussed in the literature. For example, Gomez-Mejia (2011) contends that firm size will moderate the family firm's ability to pursue SEW objectives since, as firms grow in size, they culturally display a greater 'distance' between the organization's identity and the founding family's identity; thus, *"as the family firm grows in size, the use of SEW as a primary reference point for guiding managerial choices tends to decrease"* pg. 687.

However, despite the well-established links between owners' financing preferences and firm size in the economic literature, as well as the descriptive links between family ownership and a smaller firm size, surprisingly very little research has investigated how firm size may be a direct outcome, rather than an antecedent or moderator of family owners' ability and willingness to maintain SEW. One of the reasons for this is that most comparisons between family and non-family firms focus on performance, rather than size, differentials.

One exception is Bach (2010) who argues that, large private benefits lead to a smaller firm size via a fear of control loss which directly reduces risk taking as well as the recourse to external finance. Specifically, his model predicts that, past a certain scale, *"family firms may hit the constraint that their dynastic benefits should be preserved, while regular firms at the same stage may go on growing according to the evolution of their productivity"* pg. 4. As a result, he finds that family firms choose a lower level of production, and, regarding his sample of private and listed French firms, family firms are on average 30 percent smaller in terms of sales.

This discussion leads us to the expectation that, in their pursuit of SEW objectives and resulting financial preferences, family SMEs will also be smaller in size[26] than their otherwise equivalent non-family peers, which can be tested under the following hypothesis.

Hypothesis 7: *Other things being equal, family firms are smaller than non-family firms.*

Based on the argument posed thus far, it is apparent that not only will a smaller firm size foster the necessary conditions for owners to better pursue SEW objectives, i.e. firm size moderates the ability to pursue the preservation of SEW, but what is also revealed from our discussion is how the financing behaviours associated with the preservation of SEW can lead to a smaller firm size, i.e. firm size is an outcome of SEW preservation. Gomez-Mejia (2011) has briefly discussed the potential for the former, but the latter channel, through which SEW objectives can affect firm outcomes, still remains largely unexplored.

The notion that family owners, via their tendency to pursue SEW objectives, may prevent the firm from growing larger, leading to a smaller scale of production is interesting in itself; however, what is potentially more interesting is how these tendencies can lead to certain performance outcomes for family firms. Based on this curiosity, we wish to identify how a constraint on their scale could be a source of inefficiency for family firms. By doing so, we are identifying an unexplored, but important channel through which SEW objectives and subsequent financing decisions affect the family firm's performance. These issues are discussed in the next section.

---

[26] In Chapter 3, we measure firm size by multiple measures of a firm's scale of production, namely the total amount of capital and labour inputs, and output.

2.6 Family ownership and firm efficiency

To date, only a modest amount of analysis has been dedicated towards determining the specific effects of family ownership on a firm's efficiency, as seen in Table 1. However, there is apparently some confusion surrounding the definition of efficiency, which in turn has led to inadequate measures and analysis of firm efficiency. A review of this literature reveals that a significant relationship between family involvement and a firm's productivity, which is related, but not equivalent to, efficiency, has empirically been found, yet there is little theoretical justification for such a relationship.

As a result, there is no consensus as to the direction of this relationship. Again, these analyses suffer from many of the methodological issues we have discussed in the previous chapter[27]. However, the inconsistencies demonstrated in the literature lead us to question the validity of comparing productivity measures which do not consider any potential differences in the overall 'productive efficiency' (PE), in the neo-classical sense, between family and non-family firms[28]. As we will explain in Chapter 4, PE is comprised of both 'scale efficiency' (SE) and 'technical efficiency'[29] (TE) (Banker 1984; Banker et al. 1984).

---

[27] A few studies listed in Table 1 have concentrated on the partial productivity of family firms in that they focus on the ratio of output to a single input factor, usually labour; however partial analysis only provides a general indication of total factor productivity, as it fails to consider trade-offs between other input factors.

[28] Performance at a firm level can be measured either by productivity or efficiency. Productivity is defined as the ratio of outputs over inputs. This ratio yields a relative measurement of performance that may be applied to any factor of production. The ratio can be calculated for a single input and output or by aggregating multiple inputs and outputs, as in Table 1. Since it is a relative measurement, external benchmarks are needed to interpret the productivity ratio. Moreover, there are many alternative productivity ratios and choosing from among them is somewhat arbitrary. All of these measurement limitations are overcome by the efficiency concept, which will be discussed in detail in Chapter 4.

[29] TE therefore refers to a net measure of the firm's efficient use of resources, such as capital and labour inputs, after the effect of any scale efficiencies have been considered. In the economic literature, this is commonly referred to as 'pure' TE. To avoid any confusion among the terms, this thesis refers to what Farrell (1957) originally called 'technical efficiency' as 'productive efficiency', and 'pure technical efficiency' simply as 'technical efficiency'.

Table 1: Previous investigations into the effects of family involvement on firm

Author(s)	*Study Time Period(s)*	*Data Source & Sample Size*	*Measure of Productivity & Methodology*	*Findings*
Kirchhoff and Kirchhoff (1987)	1978-1982	'University of Minnesota Data Base' data on 702 small businesses located in Minnesota, Ohio, Oregon and Washington.	Partial measure of productivity comparing sales per employee between family firms which use paid and unpaid family labour.	Positive and significant correlation between productivity and the use of family labour, both paid and unpaid.
McConaughy, Walker, Henderson, and Mishra (1998)	1986-1988	COMPUSTAT data on 219 publicly traded firms.	Partial measures of productivity such as sales per employee and total asset turnover. Matched-pairs method to compare family and non-family firms.	Founding family- as well as descendant-controlled firms are more efficient than non-family firms. Younger founder controlled firms are more efficient than older ones.
Wall (1998)	1994	Firm level survey data on 506 privately held companies in Western New York.	Cobb-Douglas production function using industry as a proxy for capital intensity and including an intercept dummy variable for family business. Factor elasticities are assumed to be equal for both family and non-family firms.	From a 'macro' perspective, family firms contribute less per firm in the examined regional economy than non-family firms. This is based on a lower level of sales generated by family firms.
Bosworth and Loundes (2002)	1994-1995 1997-1998	Australian Bureau of Statistics' 'Business Longitudinal Survey' of 4354 small and medium-sized Australian firms.	Cobb-Douglas production function controlling for technology, human resources and organizational characteristics, including family ownership. Factor elasticities are assumed to be equal for both family and non-family firms.	Focusing on the interaction of 'discretionary' investments, innovation, productivity and profitability, family firms are incidentally found to be significantly less productive than non-family firms.
Barth, Gulbrandsen, and Schønea (2005)	1996	Firm level survey data among 438 firms associated with the 'Confederation of Norwegian Business and Industry'.	Cobb-Douglas production function including intercept dummy variables for family owned as well as family managed firms. Factor elasticities are assumed to be equal for both family and non-family firms.	Family owned firms are less productive than non-family firms. This productivity gap can be explained by management regime in that family owned *and* managed firms are significantly less productive.
Martikainen, Nikkinen, and Vähämaa (2009)	1992-1999	S&P 500 firm data on 159 manufacturing firms. Source list originally compiled and classified by Anderson and Reeb (2003).	Cobb-Douglas production function including an intercept dummy variable for family business. Factor elasticities are tested for invariance and found to be equal for both family and non-family firm	Production technologies between family and non-family firms are found to be the same; however, based on a positive and significant intercept dummy variable, family firms are found to be more efficient in their production than comparable non-family firms.

Given this breakdown, another major gap in the family business literature is the lack of consideration for the specific effect of family ownership on firm size, and potentially how a resulting suboptimal scale of production itself might relate to family firm efficiency.

The term 'suboptimal scale' describes a condition in which the production capacity of some firms is too small, or even too large to be efficient (Weiss 1964). Specifically, for those suboptimal firms which are too small, economies of scale are achievable if the firm were to increase its production scale, and for those suboptimal firms which are too large, a diminishing marginal product means that efficiency gains are achievable if the firm were to decrease its production scale (Stigler 1958). If achieved, such efficiencies would serve to minimise the long run average cost of production, or in other words an optimally scaled firm would be producing at its so-called 'minimum efficient scale of production' (Saving 1961; Weiss 1964; Purvis 1976; Weiss 1979). However, optimal scale need not relate to production costs alone, as the theory of economies of scale is the theory of the relationship between the scale of use of a properly chosen combination of all productive services and the rate of output of the firm (Stigler 1958).

Based on the notion of an efficient size of firm, Stigler (1958) argues that the optimal scale of production is one that *"meets any and all problems the entrepreneur actually faces: strained labour relations, rapid innovation, government regulation, unstable foreign markets, and what not. This is, of course, the decisive meaning of efficiency from the viewpoint of the enterprise"* pg. 56. Thus, the optimum firm size is one where the scale of production maximises the firm's output efficiency, in terms of overcoming the various challenges posed by its economic environment[30].

Along these lines, the evolutionary models of learning-by-doing introduced by Jovanovic (1982) and Pakes and Ericson (1998) suggest that firms may initially enter an industry at a suboptimal scale in order to obtain the opportunity to learn and subsequently expand if successful; however, given our discussion in the previous

---

[30] In line with this definition, Saving (1961) describes an optimum firm size as the size which has minimum average costs of production in the light of its total economic environment.

sections, if the firm is facing constraints in terms of their access to finance, regardless of their potential capabilities, it may not be able to expand in size, and remain confined to a suboptimal scale of production. For example, it has been suggested that in most industries, the great majority of SMEs are in fact operating at a suboptimal level of production (Phillips and Kirchhoff 1989; Audretsch 1991; Geroski 1995). Such a statistic may very well be due to the previously discussed challenges of SME financing, which might serve to impose a suboptimal scale upon all SMEs. However, given their tendency towards the preservation of SEW, this discussion has very interesting implications for family businesses.

In conjunction with the previous section on how family ownership may bring about a smaller firm, the discussion thus far leads us to believe that family SMEs may particularly be susceptible to the potential inefficiencies related to a suboptimal scale of production. This can be tested under the following hypothesis.

Hypothesis 8: *Family firms will exhibit lower scale efficiency relative to their non-family counterparts.*

In addition to differences in SE, a potential size constraint on family owned firms may also manifest itself in other aspects of PE. For instance, the family firm's production process[31], and thus the resulting TE of production, i.e. how inputs are arranged to produce output, is likely to be influenced by any potential deficiency of physical capital available to the firm.

TE, as defined by the seminal work of Farrell (1957), refers to the firm's success in producing a given output from the smallest possible set of inputs; thus it denotes the efficiency of industrial organization in terms of resource use. From this perspective, and

[31] The means by which firms maintain, renew, and replace goods and services in the economy can be called the production process. To produce, a firm must purchase and allocate the necessary input resources, such as land, labour and physical capital (or lower order goods), and then transform them into outputs, or goods and services demanded by, and in turn sold to, consumers (or higher order goods); thus the transformation of a good from lower to higher order is what is meant by production. It has been broadly argued that all economic activity, which is not consumption, is production (Barnett and Block 2005).

given our previous discussion on how family ownership may limit the amount of capital available to the firm, choice of inputs, or more specifically the capital to labour mix utilised in the production processes of family owned SMEs are also expected to be different relative to their non-family counterparts.

For example, as a result of their reluctance to relinquish control of the firm via the issuance of external finance, family SMEs may ultimately prefer labour over capital inputs, even when the latter may result in superior production efficiency outcomes. Incidental evidence related to the tendency of family firms to exhibit a more labour-intensive production process, relative to their industry peers, has previously been shown in the literature (Górriz and Fumás 1996; Górriz and Fumás 2005; Barbera and Moores 2013), but how such input choices might impact the firm's TE have to date remained unexplored. This is mainly due to the fact that the vast majority of previous investigations into family firm performance have not appropriately handled the endogenous choice of firm size and production scale.

In terms of any direct relationship between a firm's size and the capital intensity of its production, the economic literature on the matter has consistently shown a positive relationship[32]. For example, Holthausen (1976) theoretically showed that, under the hypothesis of decreasing 'absolute risk aversion', an increase in firm size will also increase the firm's capital to labour ratio. Ghosal (1991) empirically reinforced this theory by finding a significant and positive relationship between the firm's capital to labour ratio and its size. The intuition behind these findings is that capital intensive firms, and those employing advanced technologies, have higher growth rates, eventually leading to a larger firm (Doms et al. 1995). Consistent with this intuition, this thesis has argued how smaller firms may have non-trivial difficulties in financing their physical capital, which also implies that such firms would employ more labour intensive technologies as an alternative means to produce.

---

[32] As observed by Marx (1976), firm size gets larger as the technical division of labour becomes more minute and as divisible labour is replaced by large-scale indivisible machines. Since production technologies with large economies of scale tend to be very capital-intensive and large capital outlays are usually required to exploit the economies of scale, the cross-industry variation in firm size will be related to capital-intensity.

If, as a result of behaviours associated with SEW objectives, family owned SMEs acquire less capital than their non-family industry peers, then we would expect this to be reflected in a lower capital to labour ratio in family firm production. This can be tested under the following hypothesis.

Hypothesis 9: Family firms will exhibit lower capital to labour ratios relative to their non-family counterparts.

A likely preference towards more labour intensive production itself would not necessarily deem family SMEs as technically inefficient, since an optimal capital to labour ratio used in production, would largely depend on, among other things, the good or service being produced; however, within a given industry, if family SMEs employ too much labour or not enough capital, then such resource allocations may result in a suboptimal production technology, which would in turn have measurable technical efficiency (TE) consequences.

For example, lower than optimal capital to labour ratios for family firms under capital constraints would imply that the costs of generating a dollar of revenue are higher for family, compared to unconstrained non-family, firms. From a TE reference point, such a scenario would imply that family firms require more input to produce one unit of output, which, compared to their non-family equivalents, would result in technical inefficiencies.

On the other hand, it has been suggested that, due to their constrained size, small firms, in general, might undertake actions that make them *more* technically efficient than large firms. Such a notion would help to explain how SMEs are able to endure market uncertainties, capital constraints, and other challenges mentioned in this chapter. For example, by estimating a Cobb-Douglas (1928) production function, Dhawan (2001) finds evidence to support the view that their leaner organizational structure allows small firms to take strategic actions as to exploit emerging market opportunities and to create a niche market position for themselves. Consistent with this explanation, Carlsson (1989) describes how, in part due to their labour intensive production, small firms are more flexible, which makes them better organized to respond to a changing market structure, which might shift production away from standardized mass-produced goods and towards stylized and personalized products. Based on this stream of literature, SMEs may achieve greater efficiencies than larger firms, but potentially at the cost of increasing their riskiness[33].

Across the SME population however, whether potentially capital constrained family owned firms can overcome scale inefficiencies by producing in a more technically efficient manner remains untested. This is mainly due to the fact that the vast majority of previous investigations comparing family and non-family efficiency (see Table 1) have utilised a Cobb-Douglas production function framework, which has the inherent assumption of constant returns to scale built into its functional form. Thus, while a total factor productivity measure is superior to partial measures of productivity, if scale efficiency varies across ownership structure, as has been suggested in this thesis, then cross-ownership estimates of total factor productivity may be flawed[34]. With that said, Górriz and Fumás (1996; 2005) model and, using a sample of 150 publicly traded family and non-family Spanish firms, empirically find that family firms might overcome capital constraints by being more 'efficient' from a total factor productivity standpoint.

Given their focus on non-economic objectives, Barbera and Moores (2013) offer a potential explanation for how family firms may be subject to different production technologies. They suggest that family firms are able to achieve greater TE during production by showing that the labour employed by family firms can potentially contribute more to production output relative to the labour employed by comparable non-family firms. More specifically, it is argued that family labour is less costly (Jensen

---

[33] Scherer (1991) has also noted that managers of small firms take higher risks making them more open to adoption of innovations, and Acs and Audretsch (1991) reinforce this by showing that small firms outperform large firms when it comes to their innovation rate.

[34] In the log transformed Cobb-Douglas production function, the value of the constant coefficient, more commonly known as Total Factor Productivity, is independent of labour and capital. This assumption has been made to ignore the qualitative effects of any force for which there is no quantitative data. The coefficient is thus made a 'catch-all' for the effects of such forces (Cobb and Douglas 1928).

and Meckling 1976), more committed (Ward 1988), and more flexible (Goffee and Scase 1985) than their non-family counterparts, which implies that family firms have a competitive advantage in labour resources (Habbershon and Williams 1999).

Based on this discussion, the literature offers little indication of whether family firms exhibit a higher, lower or the same TE as their non-family counterparts, especially once scale variations have been accounted for. However, to test Górriz and Fumás's (1996; 2005) model, our final hypothesis can be stated as

Hypothesis 10: *Controlling for production scale, family firms will exhibit greater technical efficiency relative to their non-family counterparts.*

Based on our discussion in Chapter 1, testing Hypotheses 8 and 10 will necessitate a measure of efficiency which can isolate SE separately from TE. To do so would address the problems mentioned in Chapter 1 regarding simultaneously occurring positive and negative family ownership effects on performance, while avoiding the inherent endogeneity issues associated with the relationship between financing preferences, firm size and efficiency. This measure, along with an in-depth discussion on the theoretical concept of efficiency, is further explored in Chapter 4.

2.7 Chapter Summary

In this chapter, we have explored the well-established reasons behind the unique challenges that SMEs face in terms of access to finance and linked them to the relatively new literature regarding family owners' tendency to pursue SEW objectives.

From this integration, we expect that family owners' pursuit of SEW objectives will have an effect on both the composition and quantum of debt and equity which is raised by family firms. Furthermore, based on the economic and finance literature on the size distribution of firms, we have explored how such preferences may lead to a potential size constraint specifically related to family ownership. In turn, family firms which are constrained in size may also face both scale and technical efficiency consequences. By connecting these separate bodies of literature, we have identified an important but overlooked channel through which the pursuit of SEW objectives by family owners might affect firm performance.

Also based on our discussion in this chapter, and for the purpose of verifying our expectations, we have developed testable hypothesis relating to the potential relationships between firm ownership, financing preferences, firm size, and performance. In this chapter, we have expressed these themes as the composition of finance, production scale, and efficiency. For the reader's convenience, these hypotheses are summarized by theme in Table 2.

Table 2 also illustrates the associations we have made in this chapter and clearly highlights the expected relationships pertaining to our overarching research questions, i.e. 1) the tendency of family owners to pursue SEW objectives via the financing preferences of the firm, 2) the resulting size implications which such decisions may have, and 3) how a reduced scale may manifest itself in the overall performance of the firm. Testing these hypotheses will require some quantification of concepts such as the firm's financing composition, production scale, efficiency, as well as family ownership itself. In the next chapter, we discuss the data set which we will use to do this.

Table 2: Proposed hypotheses by theme

Financing preferences	
Hypothesis 1a:	Bank debt, as a proportion of total debt, is greater for family firms relative to non-family firms.
Hypothesis 1b:	Trade credit, as a proportion of total debt, is lower for family firms relative to non-family firms.
Hypothesis 2a:	Loans from internal sources, as a proportion of total debt, are greater for family firms relative to non-family firms.
Hypothesis 2b:	Loans from external sources, as a proportion of total debt, are lower for family firms relative to non-family firms.
Hypothesis 3:	Equity from working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.
Hypothesis 4a:	Equity from internal sources other than working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.
Hypothesis 4b:	Equity from external sources, as a proportion of total equity, is lower for family firms relative to non-family firms.
Firm size	
Hypothesis 5:	The quantum of total debt is lower for family firms relative to non-family firms.
Hypothesis 6:	The quantum of total equity is lower for family firms relative to non-family firms.
Hypothesis 7:	Other things being equal, family firms are smaller than non-family firms.
Firm performance	
Hypothesis 8:	Family firms will exhibit lower scale efficiency relative to their non-family counterparts.
Hypothesis 9:	Family firms will exhibit lower capital to labour ratios relative to their non-family counterparts.
Hypothesis 10:	Controlling for production scale, family firms will exhibit greater technical efficiency relative to their non-family counterparts.

Chapter 3. Data and Preliminary Analysis

3.1 Chapter introduction

The arguments presented in in Chapter 2 linked the SEW objectives of family owners to the preference for internally sourced finance, a constrained firm size, and ultimately the efficiency of the firm. Testing these hypotheses will require some quantification of concepts such as owners' financing preferences, firm size, as well as family ownership itself. The calculation of efficiency, which we describe in detail in the next chapter, will also require data pertaining to the production inputs and output of both family and non-family firms. In this chapter we describe our data source, the 'Business Longitudinal Survey' (BLS), and explain how it will be used in this thesis.

Equipped with this data we further conduct a preliminary statistical analyses pertaining to our hypotheses related to the composition of debt and equity financing, firm size, and the relationship between them. Differentiating by ownership type, we tabulate key statistics across time and for the entire period; conduct a basic statistical analysis on the average differences between family and non-family firms, referred to herein as the 'family ownership effect' (FOE); and consider covariates such as the age of the firm as well as the industry in which the firm is operating.

We begin with Section 2 which describes the BLS and identifies the truncated sub-sample used in this thesis. Section 3 then highlights the strengths and weaknesses of the BLS data with respect to testing the hypotheses proposed in this thesis. Section 4 explains in detail the construction of the variables we will use in our analysis and in our efficiency measure, including any adjustments that were made. We then move on to our preliminary analysis in Section 5 which present key statistics on the composition of both debt and equity finance, firm size, and the correlation between them. Section 6 summarises our preliminary findings with relation to our hypotheses, and Section 7 concludes.

3.2 The Business Longitudinal Survey (BLS)

The Australian Bureau of Statistics' 'Business Longitudinal Survey' (BLS) was designed to provide information on the growth and performance of privately held Australian-based SMEs, i.e. firms with less than 200 employees, and was the first official longitudinal survey of businesses in Australia (Australian Bureau of Statistics 2000). The BLS is the longitudinal component of several waves of the 'Business Growth and Performance Survey'. As such, the structure of the data includes both a cross-sectional component and a longitudinal aspect for the years 1994-95 to 1997-98 inclusive[35].

The scope of the BLS encompasses almost all employing industries in Australia[36] and contains detailed firm-level information concerning micro-economic, behavioural and structural characteristics of more than 9000 SMEs[37]. As SMEs represent the majority of firms in the Australian economy[38], the BLS has the potential to inform many areas of

---

[35] The BLS samples were drawn from the ABS Business Register, with 8745 business units being selected for inclusion in the 1994–95 survey. For the 1995–96 survey, 4948 of the original selections for the 1994–95 survey were selected, and this was supplemented by 572 new business units added to the ABS Business Register during 1995–96. The sample for the 1996–97 survey included 4541 businesses which were previously sampled, and an additional sample of 529 new businesses from the 1995–96 interrogation of the Business Register, and 551 new businesses from the 1996–97 interrogation of the Business Register.

[36] The BLS does not include non-employing businesses, Government enterprises, or businesses classified to the following ANZSIC industries: Agriculture, forestry and fishing (ANZSIC division A), Electricity, gas and water supply (ANZSIC division D), Communication services (ANZSIC division J), Government administration and defence (ANZSIC division M), Education (ANZSIC division N), Health and community services (ANZSIC division O), Other services (ANZSIC subdivision 96), Private households employing staff (ANZSIC subdivision 97), and Libraries, museums, and parks and gardens (ANZSIC groups 921, 922 and 923) (Australian Bureau of Statistics 2000).

[37] The information collected in the BLS was sought under the authority of the *Census and Statistics Act 1905*, so that the provision of appropriate responses to the mailed questionnaires could be legally enforced by the Australian Bureau of Statistics. The BLS therefore exhibits response rates and accuracy well beyond conventional research standards (Australian Bureau of Statistics 2000).

[38] In Australia, 97 percent of all private sector businesses are SMEs according to generally accepted definitions (Australian Bureau of Statistics 2001).

research, including industrial relations, business, finance and economics (Hawke 2000; Pink and Jamieson 2000).

With that said, our analysis required some narrowing of the data for various reasons. For example, only those firms which reported positive values for our measures of output and inputs were included. Furthermore, to test our results over time, and to eliminate any selection or attrition bias, this study is exclusively focused on those firms which participated in all years of the study. Consequently, firms which did not participate in all waves of the BLS, from 1994 to 1998, were excluded[39]. Further, as some questions regarding the composition of finance became consistent only after the first wave of the survey, the 1994 to 1995 period was dropped from the sample[40]. This treatment has reduced our sample to 3450 firms per year for three years, which in a panel framework brings our total number of observations to 10,350. The numbers and distribution of firms in this sub-sample, classified by industry[41] and year, can be seen in Table 3.

Although the same firms are analysed in each year, their industry classification may change from one year to the next. This results in a slight variation in the total number of firms in each industry over time. Despite this, on average, manufacturing firms, as an overarching sector, represent approximately 40 percent of all firms sampled, followed

---

[39] Another justification for balancing the panel was the desire to avoid data which may be contaminated by statistical bias due to potentially unreliable information provided during the final year prior to bankruptcy (see for example Ohlson 1980; Lawrence 1983).

[40] We have also conducted the analysis presented in this chapter with our size and efficiency measures by including the dropped period. Doing so does not alter our findings in any significant way.

[41] Each business in the BLS has been coded to the 4 digit level of the Australian and New Zealand Standard Industrial Classifications (ANZSIC). The first two characters, which values range form 01-11, relate to the 11 ANZSIC Divisions and the second two characters relate to the ANZZSIC Sub-division, 2 digit, code. For businesses employing less than 100 people, the data are available at the Sub-division 2 digit level, and for those employing more than 100 people, industry detail has been collapsed to just the Division level.

Table 3: BLS Sub-sample by year and industry

	ANZSIC & Industry Category	Firms in 1995-96 sub-sample	Firms in 1996-97 sub-sample	Firms in 1997-98 sub-sample	Average proportions by industry from 96-98	Average number of family firms from 96-98	Average proportion of family firms from 96-98
100	**Mining**	**26**	**26**	**27**	**0.76%**	**6.33**	**24.03%**
	Manufacturing						
200	between 100 & 200 employees	92	97	90	2.70%	26.33	28.35%
221	Food, Beverage and Tobacco Manufacturing	140	134	136	3.96%	71.00	51.97%
222	Textile, Clothing, Footwear and Leather Manufacturing	107	109	111	3.16%	63.00	57.81%
223	Wood and Paper Product Manufacturing	67	68	68	1.96%	41.67	61.58%
224	Printing, Publishing and Recorded Media	103	102	97	2.92%	61.00	60.62%
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	169	164	164	4.80%	71.33	43.06%
226	Non-Metallic Mineral Product Manufacturing	60	60	57	1.71%	38.33	64.97%
227	Metal Product Manufacturing	185	186	188	5.40%	105.00	56.35%
228	Machinery and Equipment Manufacturing	347	348	345	10.05%	177.33	51.15%
229	Other Manufacturing	131	128	129	3.75%	80.00	61.86%
	Construction						
300	between 100 & 200 employees	5	7	9	0.20%	4.67	67.94%
341	General Construction	65	65	64	1.87%	43.33	67.01%
342	Construction Trade Services	126	125	124	3.62%	90.67	72.53%
	Wholesale Trade						
400	between 100 & 200 employees	30	27	38	0.92%	11.33	35.74%
445	Basic Material Wholesaling	132	132	129	3.80%	74.67	57.00%
446	Machinery and Motor Vehicle Wholesaling	226	230	228	6.61%	103.33	45.33%
447	Personal and Household Good Wholesaling	182	182	179	5.25%	106.33	58.75%
	Retail Trade						
500	between 100 & 200 employees	21	20	22	0.61%	9.67	46.18%
551	Food Retailing	77	79	80	2.28%	56.33	71.62%
552	Personal and Household Good Retailing	125	125	124	3.61%	71.33	57.22%
553	Motor Vehicle Retailing and Services	136	136	133	3.91%	78.33	58.03%
	Accommodation, Cafes and Restaurants						
600	between 100 & 200 employees	3	3	4	0.10%	1.67	50.00%
657	Accommodation, Cafes and Restaurants	119	120	121	3.48%	57.33	47.78%
700	**Transport and Storage**	**126**	**125**	**125**	**3.63%**	**70.67**	**56.38%**

	Finance and Insurance						
800	between 100 & 200 employees	2	1	1	0.04%	0.00	0.00%
875	Services to Finance and Insurance	71	73	75	2.12%	34.67	47.71%
	Property and Business Services						
900	between 100 & 200 employees	19	26	23	0.66%	3.33	14.74%
977	Property Services	105	105	107	3.06%	50.00	47.32%
978	Business Services	322	316	320	9.26%	95.67	29.96%
	Cultural and Recreational Services						
1000	between 100 & 200 employees	6	3	5	0.14%	0.00	0.00%
1091	Motion Picture, Radio and Television Services	36	37	37	1.06%	8.00	21.82%
1092	Libraries, Museums and the Arts	3	3	3	0.09%	0.00	0.00%
1093	Sport and Recreation	17	19	17	0.51%	8.00	45.41%
	Personal and Other Services						
1100	between 100 & 200 employees	1	1	1	0.03%	1.00	100.00%
1195	Personal Services	68	68	69	1.98%	36.00	52.69%
Total		**3450**	**3450**	**3450**	**100%**	**1758**	**50.95%**

by nearly a 17 percent representation of wholesale trade firms and a 13 percent representation of property and business service firms; whereas less than one percent of our sample is represented by mining firms, which is understandable considering we are focusing on SMEs. It is also important to note that the sector proportions drawn from our sub-sample are not significantly different from those drawn from the unabridged BLS sample[42].

Most importantly, given the context of this thesis, the BLS includes information on whether each firm is considered to be family owned, as defined in Section 4 of this chapter. Of the 3450 firms, 1,758, or 51 percent, were classified as family firms. Deeper Statistical analysis of our sub-sample is further provided in Section 5. Prior to this, the next sections discuss the strengths and weaknesses of the BLS data for our purposes, and outline how the data are used to operationalize the concepts of interest in this thesis.

3.3 Strengths and weaknesses of the BLS

One of the greatest strengths of the BLS is the ability of the researcher to classify firms as family or non-family owned. Despite the prevalence of family firms in the small businesses sector, the vast majority of previous family business studies have utilised data only on larger publicly traded firms (Gomez-Mejia et al. 2011). This is undoubtedly due the relative ease of being able distinguishing family from non-family firms via publicly available data regarding the ownership and control of the firm. For example, the degree of equity ownership by the family, or the presence of family members on the board of directors or in top-level management are key factors typically used to distinguish family firms from 'non-family' firms (see for example Villalonga and Amit 2006).

[42] In the unabridged sample, manufacturing firms, represent approximately 37 percent of all firms sampled, followed by nearly a 16 percent representation of wholesale trade firms and a 14 percent representation of property and business service firms; whereas mining firms represented 1.2 percent of all firms. Further, almost exactly as found in our sub-sample, family firms represent approximately 51 percent of the unabridged BLS sample.

Small businesses in general are a difficult group to access for research purposes. There is an inherent difficulty in identifying family firms among SMEs, because information on equity holdings or names of board members and key managers are not publicly available, or are intentionally withheld. Further, while it is true that family firms can come in all shapes and sizes, most of them are in fact SMEs[43], which means that one of the greatest obstacles for family business researchers is the difficulty in identifying and defining family SMEs (Daily and Dollinger 1993).

As we have already stated, in addition to key firm-level characteristics, the BLS is relatively useful in that it includes information on whether the observed firm is considered by respondents to be family owned. This is important in the context of this thesis since 1) The financing, size, and efficiency relationships proposed in Chapter 2 are expected to be more compelling among SMEs[44], 2) SMEs usually do not have the option of issuing additional equity to the public, and 3) most family firms are SMEs. Further to this, the few family business research studies which examine SMEs typically rely on data derived from much smaller samples, via surveys or firm-level case studies. The national breadth of the BLS allows us to empirically test our hypotheses in a much more robust manner as well as overcome the generalization problems associated with samples of limited geographic or industry scope.

With that said, the breadth offered by the BLS to some extent comes at the expense of depth, as our definition of a family firm has been reduced to a single dummy variable. Although we recognise that family ownership is ideally measured as a continuous variable, the survey does not allow us to measure family ownership beyond a present or absent characteristic. Further, although we are consistent with most, if not all, of the few

---

[43] In a recent report, the Commonwealth of Australia (2013) conveys that, among family businesses, 64 percent employ less than 20 employees; 32 percent are medium sized firms employing between 20 and 199 employees; and 4 percent are large businesses, employing 200 or more employees.

[44] Although our proposed relationships between SEW, financing and firm performance may very well be present in larger, publicly traded family firms, they will most likely be confounded by a broader market discipline mechanism, including ‘outside’ ownership and management, which may compel publicly traded family firms to be more prepared to recognise a broader range of funding options.

SEW studies to date which have presumed so, family ownership itself is not necessarily an ideal proxy for a larger SEW endowment. However, as the supposed dimensions of SEW, outlined in a more recent study by Berrone et al. (2012), are inherently qualitative, generic surveys such as the BLS are not particularly suited to capture the finer emotional idiosyncrasies within and across family owned firms. Even so, we recognise that such limitations will most likely be present in any large quantitative data set and take consolation in the fact that, by the sheer number of observations contained in the BLS, classifying family firms as a single group will still allow us to perform very robust empirical comparisons across family and non-family firms.

Another apparent limitation is that, as with the vast majority of prior studies, the BLS does not offer any direct data on output or inputs as far as production efficiency is concerned. As a result, we define proxy output-input measures using the data available in the BLS. With that said we do not take any liberties beyond what has already been established in the extant literature and whenever possible relate our operationalization of key concepts to previous studies.

3.4 Definition of variables

3.5 Family ownership

In order to conduct comparisons between family and non-family owned firms, we first need to identify family ownership. As discussed in Chapter 2, a family firm can be defined using both a structure and an essence based approach. The BLS data offer valuable information in this regard since the following 'yes' or 'no' questions were asked to all businesses which participated in the survey. We label these as questions 1 and 2.

1. *Do you consider the business to be a family business?*
2. *If yes, why do you consider this a family business? Family member are:*
    a. *Working directors or proprietors.*
    b. *Employed in the business.*
    c. *Not working, but contribute to decisions.*

d. Business acquired from parents.
e. Close working relationship between management and staff.
f. Other.

Based on these questions, a family firm is broadly defined by those respondents who answered 'yes' to question 1. Furthermore, considering one's business as a family firm could be due to one or more of the reasons listed under question 2. It seems that this list includes the structural definition of a family firm, captured in options *a* to *c*, other features indicative of family ownership such as multigenerational continuity, captured in option *d*, as well as cultural and relational aspects, captured in option *e*. Notwithstanding that nearly 95 percent of all family firms at least selected *a*, it is important to note that the options listed under question 2 are not mutually exclusive and thus identifying different 'types' of family firms using these options is not practical[45]; thus, for the purpose of our analysis we only consider the overarching question 1 to identify firms as family owned.

Since the BLS restricts our measure of family ownership to a binary variable, we cannot determine the degree of family ownership, nor do we have any way of measuring the SEW endowment of the firm. As per the majority of SEW studies to date, we therefore make the assumption that SEW is a latent construct synonymous with family ownership. Hence, given the limitations of the BLS data, our proxy for a greater SEW endowment in this thesis is the time invariant measure of family ownership itself[46].

---

[45] Of all family firms responding to question 2, 34.91 percent selected *a* only; 27.45 percent selected both *a* and *b*; 11.79 percent selected *a*, *b* and *e*; 4.39 percent selected *a* and *e*; 3.18 percent selected *a*, *b*, *d* and *e*; and 3.18 percent selected *a*, *b* and *e*. Based on this, and out of 64 possible permutations, nearly 95 percent of all family firms at least selected *a*, which is understandable since we would expect small and medium-sized family firms to have a more operational classification; however, not excluding these, approximately 37 percent also selected *d* and *e*, which are associated with multigenerational continuity and cultural aspects of the firm.

[46] Since participants of the BLS were asked question 1 once in 1995, family ownership is assumed to remain constant over the observed three year period. Despite this limitation, it is still within the conventional logic that the ownership type of the firm, i.e. family or non-family, is not expected to significantly change across a relatively short time frame, as the average CEO tenure at family-run businesses is said to range between 15 and 25 years (Breton-Miller et al. 2004).

3.5.1 Composition of debt and equity by source

This thesis proposes that the various SEW considerations of family owners will compel certain preferences for debt and equity finance. We test this by comparing the composition of debt and equity financing held by family and non-family firms. The BLS data are very useful in this regard as the following questions were asked of all participants in each wave of the survey. For our purposes, we will refer to these as questions 3 and 4.

3. *Please indicate the percentage breakdown of liabilities according to each source…*

    a. *Trade and other creditors*
    b. *Banks and other financial creditors*
    c. *Loans from a parent company*
    d. *Loans from individuals involved in the business or their families*
    e. *Loans from other individuals*
    f. *Loans from unrelated businesses*
    g. *Provisions*
    h. *Other*

4. *Please indicate the percentage breakdown of equity according to each source…*

    a. *Working owners*
    b. *Non-working owners – family members*
    c. *Non-working owners – non-family members*
    d. *Parent company*
    e. *Venture or development capitalists*
    f. *Other unrelated businesses*
    g. *Employees (excluding directors)*
    h. *Other (including shareholders)*

Since the responses to both of the above questions are already recorded in percentages, no further manipulation is required to measure the composition of finance. However, some judgement will still be required as far as determining which of the listed sources in questions 3 and 4 are considered internal or external. It is important to note here that we are not interested in short- versus long-term debt and equity but rather whether the funds were obtained from internal or external sources. We also acknowledge that some of the debt and equity sources listed in questions 3 and 4 are more frequently accessed by SMEs and refer to these as conventional sources, while other, less utilised, sources typically account for a lower proportion of finance in general.

Starting with the sources of debt listed in question 3, although inherently external, debt sources *a* and *b* are considered separately and not allocated an internal or external classification. We instead refer to these as conventional debt sources since, as we show in Section 5, on average both family and non-family SMEs obtain approximately three quarters of their debt from banks and trade creditors combined[47]. As far as other, less utilised sources of debt are concerned, debt source *d* is classified as internal and debt sources *e* and *f* are classified as external. We do not classify the remaining debt sources since for various reasons they are not as easily identified as purely internal or external[48].

Moving on to the sources of equity listed in question 4, although we consider equity from working owners to be internal, most SMEs primarily rely on this source of equity. As a result source *a* is considered separately. Equity sourced from working owners is considered the most conventional source of equity for SMEs, as on average nearly two thirds of all equity is comprised of working owners' equity for both family and non-family SMEs. Of the alternative equity sources, equity source *b* is classified as internal and equity sources *c*, *e* and *f* are classified as external. Again, we do not classify the remaining equity sources as they are not as easily identified as purely internal or

---

[47] It is also important to note that bank credit, while being more likely to exhibit longer maturity horizons, can vary widely in term. On the other hand, we can expect trade credit to be predominately short term i.e. typically 30 days. With that said, we do not have information on the length of maturities related to the debt proportions listed in question 3. Moreover, the focus of our analysis is *not* on the family/non-family differentials with respect to debt term, but rather on the proportion differentials between conventional and other, internal or external, debt sources.

[48] Provisions are a balance sheet item representing funds set aside by a company to pay for estimated expenses that are anticipated to occur in the future such as wages or taxes payable. As a liability under most accounting standards, provisions are included in the total debt of the firm, yet they are not representative of any actual financing activities affecting cash flow. Further, as per the argument proposed in this thesis, loans from a parent company, while seeming internal, imply more formalised monitoring conditions and are less likely to have the limitations on quantum that we argue are associated with 'internal' sources of financing and firm size. With that said, based on the data presented in the appendix to this chapter, it is implied that the vast majority of SMEs in our sample are not structured as a subsidiary to a parent company. Specifically, on average approximately 10 and 13 percent of all firms indicated that their proportion of debt and equity obtained from a parent company was respectively greater than zero. Of these, debt and equity sourced from a parent firm on average represented 4 and 14 percent respectively. With that said, when we include debt and equity sourced from a parent company in the financing mix, our main results do not significantly change (see Appendix A.1).

external[49]. Given this treatment, Table 4 summarises the classifications of debt and equity financing compositions which will be used in this thesis[50].

Table 4: Definitions of debt and equity financing compositions

Debt classifications	Proportion of total debt sourced from…
Bank credit	Banks and other financial creditors
Trade credit	Trade and other creditors
Internal debt	Individuals involved in the business or their families
External debt	Other individuals and unrelated businesses

Equity classifications	Proportion of total equity sourced from…
Working owners	Working owners
Internal equity	Related non-working owners i.e. family members
External equity	Unrelated non-working owners i.e. non-family members, venture or development capitalists, and other unrelated businesses

Further to question 4, we also employ the following 'yes' or 'no' BLS questions, numbered as 5, 6 and 7, which provide information on the source as well as the quantum of equity finance raised during the survey periods.

[49] Similar to the case of equity sourced from a parent company, equity sourced from employees and 'other' shareholders on average represent just 1 and 8 percent of total equity. With that said, when we include equity sourced from employees and 'other' shareholders in the financing mix, our main results do not significantly change (see Appendix A.1).

[50] As a result of the exclusion of some sources of total debt and equity, and to avoid any values being biased by our omitted proportions, we reweight the proportions provided in questions 3 and 4 according to Table 4 so that their sums equate to 1. Debt proportions were reweighted as per x_i*Total liabilities/$\sum x_i$*Total liabilities, where x represents the proportion of the i^{th} debt source. Equity proportions were reweighted as per y_j*Total equity/$\sum y_j$*Total equity, where y represents the proportion of the j^{th} equity source. By this measure it is possible that the denominator can equate to zero, i.e. all debt and/or equity has been obtained from sources excluded from Table 4, in which case a zero was assigned. In subsequent sections we also conduct preliminary data analysis on the unaltered proportions and find that our main results do not change in any significant way. See Tables A1 through to A9 presented in Appendix A.1.

5. *Was equity finance obtained during the financial year?*

6. *If yes, did you obtain finance from:*

    a. *Family.*
    b. *Acquaintances or business colleagues.*
    c. *People you did not previously know.*
    d. *Unrelated businesses.*
    e. *Parent company.*
    f. *Other related businesses.*
    g. *Employees.*
    h. *Banks.*
    i. *Other financial institutions.*
    j. *Venture or development capitalists.*
    k. *Existing shareholders.*

7. *If yes, what was the value of equity finance raised?*

    a. *Up to $20,000.*
    b. *$20,001 to $50,000.*
    c. *$50,001 to $100,000.*
    d. *$100,001 to $500,000.*
    e. *$500,001 to 1,000,000.*
    f. *Over $1,000,000.*

Although we cannot utilise questions 5, 6 and 7 in our full regression analysis, since on average, across the three years of our sub-sample, only 6 percent of all firms answered 'yes' to question 5, the responses do provide some evidence on differences in sources of financing and are further investigated in Section 3.6.1.2 of this chapter.

3.5.2 Firm Size

Although a comparison of the financing composition of family and non-family firms offers a glimpse into their different financing preferences, it does not provide any information on the potential size differentials across these groups. These are however related, as a firm's size can be directly associated to the quantum of finance being held at any given moment, which is in turn ultimately linked to the scale of its operations.
Quantum of finance can simply be measured by the total dollar value of all liabilities and equity on the observed firm i's balance sheet in time period t which is provided by the BLS data. these values are directly related to the scale of operations in the sense that total liabilities and total equity combined equate to total assets, a well-known measure of firm size (Smyth et al. 1975; Shalit and Sankar 1977). For the purpose of our

efficiency calculations described in the next section, this thesis also considers total assets as ‘capital’, an input in the production process.

Another production input of importance, and an alternate measure of firm size, is ‘labour’ (see for example Cabral and Mata 2003). As labour and capital are inputs in the production process, ‘output’, usually measured by total sales revenue, is subsequently another measure of firm size. However, rather than sales, we employ a more refined measure of output in this thesis called ‘value added’(Arrow 1974). Value added incorporates sales as well as changes in the inventory of final goods to also account for production output that was not sold during the period. Thus in this thesis we have multiple measures of firm size related to the firm’s scale of production, namely output, labour and capital. In addition to proxies of firm size, these are also standardised measures of output and input[51] to be used in our PE measurements. The definitions of these variables are described below.

3.5.2.1 Output

Considering that the BLS does not offer data on ‘output’ per se, value added is constructed and used as a proxy for total output. To do this we follow Kenneth Arrow’s (1974) generally accepted ‘real value added’ measure which is constructed by taking sales plus the change in inventories less purchases of intermediate inputs and other operating expenses.

(1) $$\text{Output}_{\text{it}} = \text{Value Added}_{\text{it}} = \text{Total Sales Revenue}_{\text{it}} + (\Delta\,\text{inventory}_{\text{it}} - \text{intermediate inputs purchased}_{\text{it}})$$

Measured in Australian dollars, the first term in (1), total sales revenue, captures all output produced by firm i in time period t which was subsequently sold. All unsold output for the same time period is captured in the second term, change in inventory,

[51] As the Agricultural, Forestry and Fishing sectors of the Australian economy have been excluded from the BLS, ‘land’ is omitted as a stand-alone factor of production in our efficiency measure. With that said, land is inherently included in our proxy measure for capital input under the classification of property, plant and equipment.

which is found as inventory at the end of the financial year less inventory at the beginning of the financial year. Any intermediate goods included in inventory are removed from our measure as these are not yet considered as output.

The value added ‘index’ allows us to analyse those firms which do not necessarily have a tangible output, such as the case of services rendered. Furthermore, the value added index has been found to accurately measure the dependent variable in the production function that explains value added in terms of the tangible and intangible primary factors, like labour and capital, and as such the function is independent of non-primary inputs (see Sato 1976).

3.5.2.2 Labour input

As the number of labour hours worked is not provided by the BLS, the number of full-time equivalent (FTE) workers employed in the firm is used as a measure of labour input. This figure is found via the sum of full-time workers and full-time equivalent part-time workers.

(2) $$\text{Labour input}_{it} = \text{FTE}_{it} = \text{Full time employees}_{it} + \text{part time employees}_{it} * \rho_t$$

Full-time equivalent part-time workers are found via the product of the number of part-time employees for each individual firm and an annual full-time equivalent ratio, ρ. The equivalent ratio is the Australian Bureau of Statistics’ estimate of average hours worked by part-time non-managerial employees per week in time t compared to full-time employees for all firms[52]. Since our sampled firms utilise both part- and full-time labour, the transformation of number of workers to FTE workers is essential in order to obtain a standardised, comparable measure of labour.

---

[52] The equivalent ratio is simply calculated as average part-time hours per week divided by average full-time hours per week for all non-managerial employees. This information is sourced from the Australian Bureau of Statistics’ ‘*Employee Earnings and Hours, Australia*’ report, as well as the previously known ‘*Earnings and Hours of Employees, Distribution and Composition, Australia*’ report.

3.5.2.3 Capital input

The difficulty in measuring capital and then applying such a measurement in a production function framework has been the cause of much controversy over the years. As per common practice, we measure capital as the value of all assets in the firm's possession.

(3) $\text{Capital input}_{\text{it}} = \text{Total assets}_{\text{it}} = \text{Total liabilities}_{\text{it}} + \text{Total equity}_{\text{it}}$

The BLS offers data on the net value of total assets, so depreciation is factored into the measurement. We allow for heterogeneity in capital type by controlling for firm industry, age and other covariates in our analysis. These control variables are discussed next.

3.5.3 Control variables

Independent of ownership type, a firm's production technology will depend on the industry in which it operates. In addition, we need to control for industry as the occurrence of family ownership is not evenly distributed across all industries (see Table 3). To control for heterogeneity across industry we include industry dummies using the 37 *Australian and New Zealand Standard Industrial Classifications* (ANZSIC). These codes and their corresponding industries are listed in Table 3.

A firm's measured efficiency may also depend on its age. Thus, further heterogeneity across the life cycles of different firms is also controlled for by including a firm age variable into our specification. As stated in Chapter 2, the evolutionary models of learning-by-doing introduced by Jovanovic (1982) and Pakes and Ericson (1998) suggest that SMEs may initially enter an industry at a suboptimal scale in order to obtain the opportunity to learn and subsequently expand if successful. While we do not have the age of each firm in terms of years, the following five age brackets are defined by the BLS

1. *Less than 2 years old*
2. *2 years to less than 5 years old*
3. *5 years to less than 10 years old*
4. *10 years to less than 20 years old*
5. *20 years or more*

Other variables of interest are capital structure and capital intensity. A firm's capital intensity will depend on its industry, as the input mix used in the production process will depend on the technology of the output being produced. This applies to all firms, but capital intensity may also be affected by ownership type as previously discussed. We measure capital intensity as

(4) $$\text{Capital intensity}_{\text{it}} = \text{Capital to labour ratio}_{\text{it}} = \frac{\text{Total assets}_{\text{it}}}{\text{FTE}_{\text{it}}}.$$

The overall indebtedness of the firm can also have a bearing on the availability of certain sources of finance. Further, the degree to which the firm is leveraged may impact the cost of finance and in turn the composition of debt and equity (see for example Titman and Wessels 1988). To account for this in our analysis, we use the debt ratio to measure the existing leverage in the firm's capital structure, defined as

(5) $$\text{Capital Structure}_{\text{it}} = \text{Debt ratio}_{\text{it}} = \frac{\text{Total liabilities}_{\text{it}}}{\text{Total assets}_{\text{it}}}$$

Although the impact of existing capital structure on financing considerations are expected to be more profound in larger, publicly traded firms which have better access to organised debt and equity markets, as the cost of equity in small privately held firms can be difficult to determine, financial leverage is an important indicator of the cost of debt and equity finance (Cotner and Fletcher 2000).

3.6 Descriptive statistics and preliminary data analysis

In the following sections we investigate family and non-family descriptive statistics in the composition of debt and equity finance (Sections 3.6.1.1 and 3.6.1.2 respectively), the relationship between financing composition and firm size (Section 3.6.2), and firm size itself (Section 3.6.3).

3.6.1 The composition of family and non-family finance

In Chapter 2, we argued that family ownership will influence the financing composition of the firm. In the following sub-sections, we report the findings of our preliminary data analysis with respect to the financing composition differentials between family and non-family firms. In order to simplify our commentary, we first focus on debt financing, then equity, and finally offer a summary based on aggregate figures.

3.6.1.1 Debt composition

As a starting point, we present Table 5 which shows the descriptive debt composition statistics for family and non-family firms for each year of our sample period. Since the BLS sample is comprised entirely of SMEs, it is not surprising that we observe the majority, approximately three-quarters, of total debt consists of bank and trade credit for both family (Panel B) and non-family firms (Panel C); however, when comparing the specific proportions, we find that family firm debt sourced from bank credit represents a slightly larger proportion of total debt than family debt sourced from trade credit. This is contrasted to the non-family situation where there is a marked preference for trade credit. This result is consistent across all time periods and is true for all distribution measures listed.

Despite the differences in the proportions of bank and trade credit across ownership structure, the combined level of these two conventional sources of debt is similar for both family and non-family SMEs. What is perhaps more interesting are the family/non-family proportion differentials across the remaining one-quarter of debt obtained from other less utilised debt sources[53].

---

[53] The percentile columns in Table 5 clearly demonstrate how unconventional it actually is for SMEs to access debt finance from sources other than bank and/or trade credit.

For example, moving to our measure of internal debt finance, family firms hold nearly double the proportion of debt obtained from internal sources than do non-family firms. Specifically, family firms on average and across all time periods source nearly 15 percent of their total debt from individuals involved in the business or their families. Compared to the non-family case of just 8 percent, the difference is quite large and stable across all time periods.

As far as external debt financing is concerned, the results shown in Table 5 are less consistent. Although the proportion of family firm debt obtained from external sources is generally smaller than non-family firms, the difference is not very large, nor is it consistently negative across all time periods. With that said, it is important to remember that the debt proportions presented in Table 5 are averaged across all firms without controlling for potential covariates such as industry, firm size, or firm age.

Table 5: Descriptive annual debt composition statistics for family and non-family firms by year

Variable (year)	Panel A: Full Sample (N = 3450/year) 25th Percentile	Mean	Median	75th Percentile	Panel B: Family Firms (N = 1758/year) 25th Percentile	Mean	Median	75th Percentile	Panel C: Non-Family Firms (N = 1692/year) 25th Percentile	Mean	Median	75th Percentile
Bank Credit (96)	0.0000	0.3264	0.2200	0.6094	0.0000	0.3808	0.3428	0.6701	0.0000	0.2699	0.0723	0.5400
Bank Credit (97)	0.0000	0.3244	0.2069	0.6300	0.0000	0.3675	0.3114	0.6786	0.0000	0.2796	0.0800	0.5611
Bank Credit (98)	0.0000	0.2975	0.1421	0.5928	0.0000	0.3312	0.2312	0.6364	0.0000	0.2625	0.0402	0.5323
Bank Credit (96-98)[a]	0.0000	0.3161	0.2000	0.6082	0.0000	0.3598	0.3000	0.6600	0.0000	0.2707	0.0637	0.5455
Trade Credit (96)	0.0974	0.4444	0.3483	0.8416	0.0630	0.3543	0.2514	0.5600	0.1421	0.5381	0.5000	1.0000
Trade Credit (97)	0.1000	0.4605	0.3704	0.9333	0.0619	0.3822	0.2733	0.6551	0.1412	0.5419	0.5205	1.0000
Trade Credit (98)	0.1283	0.5086	0.4444	1.0000	0.1000	0.4403	0.3333	0.8554	0.2000	0.5795	0.6250	1.0000
Trade Credit (96-98)[a]	0.1000	0.4712	0.3871	0.9589	0.0771	0.3923	0.2857	0.6770	0.1588	0.5532	0.5455	1.0000
Internal Debt (96)	0.0000	0.1271	0.0000	0.1061	0.0000	0.1675	0.0000	0.2312	0.0000	0.0851	0.0000	0.0000
Internal Debt (97)	0.0000	0.1138	0.0000	0.0714	0.0000	0.1418	0.0000	0.1642	0.0000	0.0847	0.0000	0.0000
Internal Debt (98)	0.0000	0.1059	0.0000	0.0524	0.0000	0.1349	0.0000	0.1366	0.0000	0.0757	0.0000	0.0000
Internal Debt (96-98)[a]	0.0000	0.1156	0.0000	0.0800	0.0000	0.1481	0.0000	0.1765	0.0000	0.0818	0.0000	0.0000
External Debt (96)	0.0000	0.0256	0.0000	0.0000	0.0000	0.0229	0.0000	0.0000	0.0000	0.0283	0.0000	0.0000
External Debt (97)	0.0000	0.0225	0.0000	0.0000	0.0000	0.0226	0.0000	0.0000	0.0000	0.0223	0.0000	0.0000
External Debt (98)	0.0000	0.0220	0.0000	0.0000	0.0000	0.0207	0.0000	0.0000	0.0000	0.0233	0.0000	0.0000
External Debt (96-98)[a]	0.0000	0.0233	0.0000	0.0000	0.0000	0.0221	0.0000	0.0000	0.0000	0.0246	0.0000	0.0000

[a] Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

In view of this, we further present Table 6 and Table 7, which show the significance levels of the mean FOEs between the proportions of debt financing obtained from our sources of interest across industry and age respectively. Throughout this chapter, FOEs are simply calculated by $x_{ff} - x_{nf}$, where x is the average value of the variable of interest and ff and nf denote family and non-family firms respectively. A positive FOE indicates that, relative to non-family firms, family firms exhibit a greater average value and a negative FOE indicates a lower average value for family firms. The significance levels of the FOEs are also reported using a standard two-tailed t-test with unequal variances[54].

Beginning with the proportion of debt sourced from bank credit, Table 6 shows that, when significantly different, the FOE is positive in 89 precent of the cases[55]. This effect is also positive and significant in all but the youngest of firms, as seen in Table 7, and increases as firms age. Moving to the next column in Table 6, the FOE derived from the proportions of debt financed from trade credit is also consistently negative and significant in 27 industries. Further, as shown in Table 7, this effect is consistently negative and significant across all age groups.

With respect to debt sourced from internal sources, family firms are on average found to hold a significantly greater proportion of internal debt than their non-family industry peers in 20 of 32 industries. Table 7 demonstrates that this positive FOE is significant in all but the youngest of firms. Moving on to the FOE with respect to the proportion of debt sourced from external sources, the results across industry are mixed, as we find significant effects in only 8 industries, half of which are positive and half are negative.

---

[54] Variance inequality in each industry was confirmed using an F-test. Where variances were found to be equal among family and non-family samples in any given industry, the t-statistic was adjusted accordingly.

[55] Although 37 industries are identified in our BLS sample, 5 have not been considered due to the inability to compare differences across ownership i.e. industries where there was either an absence of family or non-family firms are not considered.

Table 6: Family ownership effects on debt composition by industry (1996-1998)

ANZSIC & Industry Category		N	Family	Non-Family	Bank Credit FOE	Trade Credit FOE	Internal Debt FOE	External Debt FOE
100	**Mining**	**79**	**19**	**60**	**0.2164****	**-0.2950*****	**0.0987**	**-0.0613****
	Manufacturing							
200	between 100 & 200 employees	279	79	200	0.0652	-0.1657***	0.0744***	0.0030
221	Food, Beverage and Tobacco Manufacturing	410	213	197	0.1007***	-0.1348***	0.0454**	-0.0184*
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	0.0502	-0.1544***	0.1091***	-0.0051
223	Wood and Paper Product Manufacturing	203	125	78	0.0107	-0.1466***	0.0590*	0.0226
224	Printing, Publishing and Recorded Media	302	183	119	0.0580	-0.2159***	0.1282***	-0.0208
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	0.0993***	-0.2044***	0.0737***	0.0177
226	Non-Metallic Mineral Product Manufacturing	177	115	62	0.2146***	-0.2160***	0.0201	-0.0014
227	Metal Product Manufacturing	559	315	244	0.1178***	-0.2162***	0.0735***	0.0119*
228	Machinery and Equipment Manufacturing	1040	532	508	0.1064***	-0.1635***	0.1064***	-0.0036
229	Other Manufacturing	388	240	148	0.0711**	-0.0818**	0.0037	-0.0108
	Construction							
300	between 100 & 200 employees	21	14	7	-0.1680*	0.2464**	-0.0808*	0.0025
341	General Construction	194	130	64	0.1104*	-0.1272**	-0.0272	-0.0086
342	Construction Trade Services	375	272	103	0.0857**	-0.0816*	0.0569**	0.0011
	Wholesale Trade							
400	between 100 & 200 employees	95	34	61	0.0675	-0.1739***	0.0132	0.0050
445	Basic Material Wholesaling	393	224	169	-0.0083	-0.1143***	0.0886***	0.0069
446	Machinery and Motor Vehicle Wholesaling	684	310	374	0.0927***	-0.2092***	0.1121***	0.0005
447	Personal and Household Good Wholesaling	543	319	224	0.0647**	-0.1203***	0.0505***	-0.0219**
	Retail Trade							
500	between 100 & 200 employees	63	29	34	-0.1936**	0.0891	0.0765***	0.0179
551	Food Retailing	236	169	67	-0.0366	-0.1111*	0.0671**	0.0276**
552	Personal and Household Good Retailing	374	214	160	0.1401***	-0.2010***	0.0280	0.0097
553	Motor Vehicle Retailing and Services	405	235	170	0.0684*	-0.0825**	0.0059	-0.0144
	Accommodation, Cafes and Restaurants							
600	between 100 & 200 employees	10	5	5	-0.2232	-0.0910	0.2131**	0.1011*
657	Accommodation, Cafes and Restaurants	360	172	188	0.1061**	-0.1409***	0.0700***	-0.0118
700	**Transport and Storage**	**376**	**212**	**164**	**0.2159*****	**-0.2619*****	**0.0705*****	**-0.0180**

	Finance and Insurance							
800	between 100 & 200 employees	4	0	4	n/a	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	0.3079***	-0.2273***	0.0696**	-0.0007
	Property and Business Services							
900	between 100 & 200 employees	68	10	58	0.2256	-0.2018	0.0496	-0.0217*
977	Property Services	317	150	167	-0.0160	-0.1798***	0.1415***	0.0481**
978	Business Services	958	287	671	0.0135	-0.1650***	0.0931***	-0.0100
	Cultural and Recreational Services							
1000	between 100 & 200 employees	14	0	14	n/a	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	0.1719**	-0.2007**	0.0939	-0.0322*
1092	Libraries, Museums and the Arts	9	0	9	n/a	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	0.1605	-0.0828	0.0720	-0.0464
	Personal and Other Services							
1100	between 100 & 200 employees	3	3	0	n/a	n/a	n/a	n/a
1195	Personal Services	205	108	97	0.0878	-0.1167**	-0.0075	0.0090

Debt composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various debt sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 7: Family ownership effects on debt composition by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	Proportion of family firms	Bank Credit FOE	Trade Credit FOE	Internal Debt FOE	External Debt FOE
Less than 2 years (1)	126	38	88	30.16%	0.07	-0.24***	0.07	0.03
2 to less than 5 years (2)	1111	495	616	44.55%	0.05**	-0.17***	0.08***	-0.01
5 to less than 10 years (3)	2867	1339	1528	46.70%	0.07***	-0.16***	0.07***	0.00
10 to less than 20 years (4)	3428	1755	1673	51.20%	0.10***	-0.16***	0.05***	0.00
20 years or more (5)	2818	1647	1171	58.45%	0.11***	-0.18***	0.09***	-0.01*

Debt composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various debt sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 7 also confirms that across age we find no significant difference in the proportion of debt sourced from external sources between family and non-family firms except for older firms where the FOE is significantly negative.

The data thus far show that the average composition of family firm debt is significantly different from that of non-family firms, especially with respect to internal debt. In the next section, we investigate if this apparent preference for internal financing holds when considering the composition of equity.

3.6.1.2 Equity composition

Table 8 shows the descriptive equity composition statistics for family and non-family firms for each year of our sample period. Due to the fact our sample firms are SMEs, it is not surprising that equity from working owners is the most prevalent source of equity finance for both family (Panel B) and non-family SMEs (Panel C). In fact, Table 8 shows that 75 percent of all firms in our sample obtain 100 percent of their equity from working owners. With that said, when comparing means we find that, as expected, family firms obtain a much larger proportion of their total equity from working owners than do non-family firms. This differential is consistent across all time periods and on average nearly 25 percentage points. Similar to the composition of debt, Table 8 also demonstrates that, on average and consistent across all periods, family firms obtain a greater proportion of equity from what we classify as internal sources and less from external sources than do non-family firms.

Table 9 and Table 10 further report the FOE for our equity proportions across industry and firm age. When controlling for industry, Table 9 confirms that equity sourced from working owners is a much more common source of equity finance for family firms, as the FOE is found to be positive and significant in 25 of 32 industries. Across age brackets the FOE related to equity obtained from working owners is also consistently significant and positive and is largest in older firms.

With respect to internal equity sources other than equity from working owners, the FOE is positive and significant in 15 of 32 industries and significantly positive in all but the youngest of firms. It is also important to note that this effect is negative and significant in just one industry, namely General Construction. As expected, the proportion of equity obtained from external sources is significantly lower for family firms. Specifically, in nearly half of all industries we find a significant and negative FOE with respect to equity obtained from external sources. As per Table 10 these results also hold across firms of all ages.

Table 11 demonstrates that there is no significant difference between the number of family and non-family firms which obtained equity finance while the BLS data was being collected, yet the sources from which such equity was obtained were very different. Not surprisingly family firms accessed equity from family much more than did non-family firms. Of those firms which did issue new equity, around 60 percent of family firms did so through family as opposed to just 17 percent of non-family firms. Non-family firms also tended to issue equity to people they did not previously know and existing shareholders outside the family significantly more frequently than family firms.

Although we will closely examine the link between internally sourced finance and firm size in the next section, Table 11 shows that family firm equity issues are much lower in value than those of non-family firms. Specifically, family firm equity issues were approximately $200,000 lower on average. As there were too few firms issuing equity during the collection of the BLS, we do not control for covariates, however with this caveat in mind, we can infer from Table 11 that when issuing new equity family firms avoid external sources and raise less equity capital than do non-family firms. This further reinforces the family differentials found in our equity composition comparison and alludes to the link between the source of financing and firm size.

Table 8: Descriptive annual equity composition statistics for family and non-family firms by year

Variable (year)	Panel A: Full Sample (N = 3450/year) 25th Percentile	Mean	Median	75th Percentile	Panel B: Family Firms (N = 1758/year) 25th Percentile	Mean	Median	75th Percentile	Panel C: Non-Family Firms (N = 1692/year) 25th Percentile	Mean	Median	75th Percentile
Working Owners (96)	0.0000	0.6518	1.0000	1.0000	0.5000	0.7687	1.0000	1.0000	0.0000	0.5302	0.9000	1.0000
Working Owners (97)	0.0000	0.6683	1.0000	1.0000	0.6700	0.7891	1.0000	1.0000	0.0000	0.5427	1.0000	1.0000
Working Owners (98)	0.0000	0.6469	1.0000	1.0000	0.5000	0.7591	1.0000	1.0000	0.0000	0.5303	0.9800	1.0000
Working Owners (96-98)[a]	0.0000	0.6556	1.0000	1.0000	0.5325	0.7723	1.0000	1.0000	0.0000	0.5344	0.9900	1.0000
Internal Equity (96)	0.0000	0.0550	0.0000	0.0000	0.0000	0.0746	0.0000	0.0000	0.0000	0.0347	0.0000	0.0000
Internal Equity (97)	0.0000	0.0634	0.0000	0.0000	0.0000	0.0847	0.0000	0.0000	0.0000	0.0414	0.0000	0.0000
Internal Equity (98)	0.0000	0.0588	0.0000	0.0000	0.0000	0.0752	0.0000	0.0000	0.0000	0.0418	0.0000	0.0000
Internal Equity (96-98)[a]	0.0000	0.0591	0.0000	0.0000	0.0000	0.0782	0.0000	0.0000	0.0000	0.0393	0.0000	0.0000
External Equity (96)	0.0000	0.0492	0.0000	0.0000	0.0000	0.0259	0.0000	0.0000	0.0000	0.0734	0.0000	0.0000
External Equity (97)	0.0000	0.0483	0.0000	0.0000	0.0000	0.0198	0.0000	0.0000	0.0000	0.0779	0.0000	0.0000
External Equity (98)	0.0000	0.0444	0.0000	0.0000	0.0000	0.0224	0.0000	0.0000	0.0000	0.0673	0.0000	0.0000
External Equity (96-98)[a]	0.0000	0.0473	0.0000	0.0000	0.0000	0.0227	0.0000	0.0000	0.0000	0.0729	0.0000	0.0000

[a] Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

Table 9: Family ownership effects on equity composition by industry (1996-1998)

	ANZSIC & Industry Category	N	Family	Non-Family	Working Owners FOE	Internal Equity FOE	External Equity FOE
100	**Mining**	**79**	**19**	**60**	**0.5271*** **	**0.1137***	**-0.0320**
	Manufacturing						
200	between 100 & 200 employees	279	79	200	0.2536***	0.1979***	-0.0264
221	Food, Beverage and Tobacco Manufacturing	410	213	197	0.2312***	0.0751***	-0.0980***
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	0.2324***	0.0163	-0.0686**
223	Wood and Paper Product Manufacturing	203	125	78	0.0021	0.0706**	-0.0932***
224	Printing, Publishing and Recorded Media	302	183	119	0.2785***	0.0283	-0.0220
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	0.3477***	0.0746***	-0.0514**
226	Non-Metallic Mineral Product Manufacturing	177	115	62	0.5017***	-0.0528	-0.1140***
227	Metal Product Manufacturing	559	315	244	0.1370***	0.0535***	-0.0160
228	Machinery and Equipment Manufacturing	1040	532	508	0.2376***	0.0374***	-0.0679***
229	Other Manufacturing	388	240	148	0.0959**	0.0232	-0.0295*
	Construction						
300	between 100 & 200 employees	21	14	7	-0.1814	0.1671*	-0.2715
341	General Construction	194	130	64	0.1020	-0.0921**	-0.0387
342	Construction Trade Services	375	272	103	0.1196**	0.0294	-0.0638***
	Wholesale Trade						
400	between 100 & 200 employees	95	34	61	0.5675***	0.0271	-0.0271
445	Basic Material Wholesaling	393	224	169	0.2205***	0.0992***	-0.0588**
446	Machinery and Motor Vehicle Wholesaling	684	310	374	0.4307***	0.0294**	-0.0435***
447	Personal and Household Good Wholesaling	543	319	224	0.2797***	0.0273*	-0.0410**
	Retail Trade						
500	between 100 & 200 employees	63	29	34	0.2884***	0.0590	-0.0583
551	Food Retailing	236	169	67	0.0304	0.0576***	-0.0636
552	Personal and Household Good Retailing	374	214	160	0.1096***	-0.0091	-0.0048
553	Motor Vehicle Retailing and Services	405	235	170	0.0693	-0.0286	-0.0616***
	Accommodation, Cafes and Restaurants						
600	between 100 & 200 employees	10	5	5	0.4000	n/a	n/a
657	Accommodation, Cafes and Restaurants	360	172	188	0.4536***	0.0452**	-0.0484*
700	**Transport and Storage**	**376**	**212**	**164**	**0.2171*** **	**0.0540*** **	**-0.0808*** **

	Finance and Insurance						
800	between 100 & 200 employees	4	0	4	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	0.1777***	0.0192	-0.0174
	Property and Business Services						
900	between 100 & 200 employees	68	10	58	0.3745***	0.1428	n/a
977	Property Services	317	150	167	0.1601***	0.0559**	-0.1251***
978	Business Services	958	287	671	0.0900***	0.0184	-0.0426***
	Cultural and Recreational Services						
1000	between 100 & 200 employees	14	0	14	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	0.4593***	-0.0174	-0.0223
1092	Libraries, Museums and the Arts	9	0	9	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	0.6003***	-0.0101	-0.0601
	Personal and Other Services						
1100	between 100 & 200 employees	3	3	0	n/a	n/a	n/a
1195	Personal Services	205	108	97	0.0914	0.0314	-0.0320

Equity composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various equity sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 10: Family ownership effects on equity composition by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	Proportion of family firms	Working Owners FOE	Internal Equity FOE	External Equity FOE
Less than 2 years (1)	126	38	88	30.16%	0.19**	-0.01	-0.09**
2 to less than 5 years (2)	1111	495	616	44.55%	0.25***	0.02*	-0.07***
5 to less than 10 years (3)	2867	1339	1528	46.70%	0.19***	0.02***	-0.05***
10 to less than 20 years (4)	3428	1755	1673	51.20%	0.24***	0.02***	-0.05***
20 years or more (5)	2818	1647	1171	58.45%	0.32***	0.09***	-0.04***

Equity composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various equity sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 11: Annual new equity issues by equity source and quantum

	1995-1996			1996-1997			1997-1998		
	Family	Non-family	FOE[a]	Family	Non-family	FOE[a]	Family	Non-family	FOE[a]
Number of firms is sample	1758	1692	66	1758	1692	66	1758	1692	66
Number of firms which obtained equity finance during the financial year	173	158	15	94	87	7	61	80	-19
Proportion which obtained equity finance	0.098	0.093	0.005	0.053	0.051	0.002	0.035	0.047	-0.013
Average value of equity finance (by range)[b]	3.33	3.90	-0.57***	3.21	3.99	-0.78	3.41	4.05	-0.64
Average proxy value of equity finance (000)[c]	372.04	568.37	-196.33***	367.24	571.82	-204.58**	372.79	561.77	-188.99**
Source of Finance[d]									
Family	0.602	0.171	0.430***	0.653	0.229	0.425***	0.562	0.146	0.416***
Acquaintances or business colleagues	0.061	0.099	-0.038	0.020	0.057	-0.037	0.041	0.083	-0.042
People you did not previously know	0.005	0.033	-0.028*	0.000	0.029	-0.029	0.014	0.052	-0.038
Venture or development capitalists & other unrelated businesses	0.010	0.033	-0.023	0.020	0.038	-0.018	0.027	0.010	0.017
Parent company & other related businesses	0.077	0.155	-0.078**	0.139	0.181	-0.042	0.178	0.250	-0.072
Banks & other financial institutions	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Existing shareholders (outside of family)	0.245	0.508	-0.263***	0.168	0.419	-0.251***	0.151	0.365	-0.214***
Other (including employees)	0.000	0.000	0.000	0.000	0.048	-0.048**	0.027	0.094	-0.066*
Sum	1.000	1.000		1.000	1.000		1.000	1.000	

[a] FOE is found by x_{ff}-x_{ff}, where x are listed variables and ff and nf denote family and non-family firms respectively.
[b] As the 'distance' between each successive range of annual equity values are not equal there is some discrepancy between value by range and proxy value.
[c] Proxy mean value of annual equity finance is calculated as $\sum fx / \sum f$, where f and x are the frequency and mean value in any given range respectively.
[d] Sources are represented in proportions. i.e. of all firms which obtained finance during the calendar year, x proportion did so by source y.

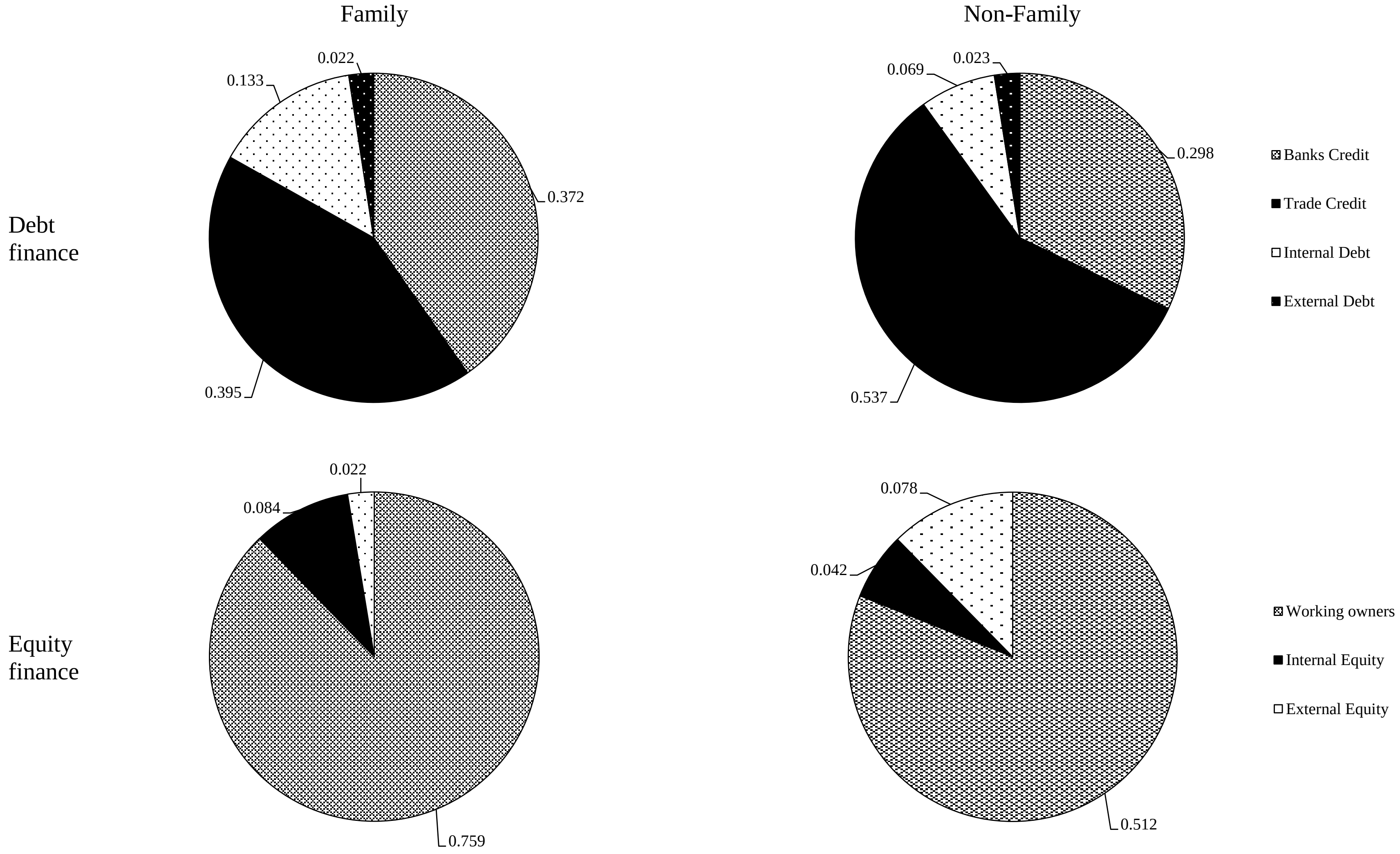
3.6.2 Aggregate financing composition and the link to firm size

Based on the above information we summarise our comparison of debt and equity financing across firm ownership by presenting Table 12 and Figure 5 which displays a single aggregate, averaged across industry and time, of the financing composition differences between family and non-family firms. When these aggregates are considered our previous results still hold, that is, relative to non-family firms, family firms are shown to hold a significantly greater proportion of debt obtained from bank credit and internal sources and less from trade credit. Consistent with the data reported in Section 3.6.1, there is no significant difference between the aggregate family and non-family external debt proportions.

With respect to aggregate equity composition, family firms are shown to hold a significantly greater proportion of equity obtained from working owners and internal sources and less from external sources. We have already shown that these differentials hold across time, industry and age. As per our discussion in Chapter 2, we argue that firms which prefer to generate a greater proportion of their finance from internal sources will also be more likely to obtain a lower quantum of finance, which may lead to a smaller firm size. As a result, the size of the firm will also be fundamentally linked to the preferred sources of both debt and equity finances by family owners. To investigate this further, Table 13 and Table 14 present the correlations between various measures of firm size and the sources of debt and equity respectively for all firms.

Beginning with Table 13, we can see that there is a positive and highly significant relationship between the quantum of total debt held by the firm and its size. This relationship is strongest with the total value of capital, which is to be expected as we measure capital as the value of total assets, but is also quite strong with other size measures such as output and labour.

Figure 5: Average aggregate family and non-family finance composition by debt and equity source[a]



[a] Aggregate finance compositions are averaged first by industry, then by ownership.

Table 12: Average aggregate family and non-family finance composition by debt and equity source

Source of debt finance:	FF	NF	FF-NF	%	z-stat
Bank credit	0.372	0.298	0.074	20.002	(8.054)***
Trade Credit	0.395	0.537	-0.142	-35.956	(-14.635)***
Internal Debt	0.133	0.069	0.064	48.039	(10.885)***
External Debt	0.022	0.023	-0.001	-3.117	(-0.238)
Source of equity finance:	**FF**	**NF**	**FF-NF**	**%**	**z-stat**
Working owners	0.759	0.512	0.247	32.534	(26.974)***
Internal Equity	0.084	0.042	0.042	50.161	(8.868)***
External Equity	0.022	0.078	-0.056	-247.325	(-12.985)***

Aggregate mean finance compositions are averaged first by industry, then by ownership. As Explained in Section 3.5.1 our reweighted debt and equity categories have increased the number of firms which are considered to have 0 debt or equity; thus the sum of the mean proportions for debt and equity are less than the sum of the unaltered proportions reported in Table A7 of Appendix A.1.

Table 13: Pearson's correlations between share of debt finance and firm size (1996-1998)

	Size Variables				*Share of debt finance (proportion)*			
	Output	Labour	Capital	Total debt	Bank credit	Trade credit	Internal debt	External debt
Output	1.000 -							
Labour	0.568 (70.174)***	1.000 -						
Capital	0.697 (99.002)***	0.304 (32.425)***	1.000 -					
Total debt	0.624 (81.286)***	0.295 (31.384)***	0.835 (154.301)***	1.000 -				
Share of Bank credit	-0.015 (-1.479)	-0.011 (-1.148)	0.022 (2.253)**	0.030 (3.012)***	1.000 -			
Share of trade credit	0.133 (13.685)***	0.190 (19.660)***	0.042 (4.250)***	0.036 (3.673)***	-0.565 (-69.613)***	1.000 -		
Share of Internal debt	-0.108 (-11.044)***	-0.143 (-14.723)***	-0.058 (-5.877)***	-0.058 (-5.890)***	-0.192 (-19.927)***	-0.356 (-38.779)***	1.000 -	
Share of external debt	-0.019 (-1.963)**	-0.036 (-3.624)***	0.001 (0.141)	0.006 (0.591)	-0.086 (-8.793)***	-0.138 (-14.128)***	-0.046 (-4.707)***	1.000 -

T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

Table 14: Pearson's correlations between share of equity finance and firm size (1996-1998)

	Size Variables				*Share of equity finance (proportion)*		
	Output	Labour	Capital	Total equity	Working owner's equity	Internal equity	External equity
Output	1.000 -						
Labour	0.568 (70.174)***	1.000 -					
Capital	0.697 (99.002)***	0.304 (32.425)***	1.000 -				
Total equity	0.552 (67.309)***	0.218 (22.715)***	0.853 (166.341)***	1.000 -			
Share of working owner's equity	-0.226 (-23.569)***	-0.253 (-26.621)***	-0.120 (-12.313)***	-0.066 (-6.752)***	1.000 -		
Share of internal equity	-0.022 (-2.235)**	0.014 (1.449)	-0.014 (-1.428)	-0.009 (-0.891)	-0.243 (-25.450)***	1.000 -	
Share of external equity	0.018 (1.878)*	0.041 (4.129)***	0.002 (0.219)	-0.001 (-0.052)	-0.308 (-32.988)***	-0.062 (-6.344)***	1.000 -

T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

Focusing on the quantum of total debt, we find there is a negative and significant relationship between the proportion of internal debt and total debt itself. In fact, we find that the proportion of internally sourced debt finance is negatively correlated and highly significant across all our measures of firm size, which reinforces our argument proposed in Chapter 2, i.e. a higher proportion of internal debt is synonymous with a lower quantity of debt and a smaller firm. Paradoxically, there is also a negative correlation between external debt and some, but not all, of our measures for firm size although the correlations themselves are much weaker. With that said, there is no significant correlation between the proportion of debt sourced from external sources and the quantum of total debt, although the coefficient itself is positive.

Moving on to Table 14, we can see that total equity is significant and positively correlated with all our measures of firm size. Focusing on the total equity column, there is a significant and negative relationship with the proportion of equity sourced from working owners. In fact, we find that the proportion of equity sourced from working owners is negatively correlated and highly significant across all our measures of firm size. Not including working owners, the proportion of internal equity is also negatively correlated and significant with output.

As far as externally sourced equity finance is concerned, although the proportion of external equity is not significantly correlated with capital or total equity, it is significant and positively correlated to firm size with respect to output and labour. These results also reinforce the arguments proposed in this thesis and demonstrate, albeit imperfectly, the links between the composition of finance, the quantum of debt and equity, and firm size. To explore this matter further, in the next section we investigate whether family firms, given their distinctive financing composition, are also systematically smaller relative to their non-family counterparts.

3.6.3 Family ownership and firm size

To recap our basic analysis of the data thus far, family firms have been found to obtain a significantly greater proportion of both their debt and equity finance from internal sources. We have also shown that a greater reliance on internally generated finance in general is associated with a lower quantum of debt and equity and a smaller firm. Thus, it stands to reason that family firms will hold less debt and equity finance and therefore will also be smaller in size relative to their non-family counterparts. In this section we further explore the BLS data with respect to this argument.

As a starting point, we compare summary statistics for both family and non-family firms across multiple measures of firm size, namely output, labour and capital inputs, as well as the total quantum of debt and equity. Table 15 presents these comparisons across all periods in our sample. Regardless of the size measure or time period, family firms are consistently smaller in size. That is, relative to their non-family counterparts, family firms are observed to produce less output, employ less labour and capital, and hold less debt and equity on their balance sheets. The specific values are compelling as non-family firms, on average, produce 134 percent more output, employ 51 percent more labour, own 168 percent more capital, and respectively hold 207 and 116 percent more debt and equity compared to family firms.

To determine if the results shown in Table 15 hold when covariates are considered, Table 16 and Table 17 give the value and significance levels of the FOEs with respect to firm size and the quantum of financing across industry and age respectively. Remarkably, Table 16 shows that no matter the industry or measure of firm size, family firms are nearly always found to be significantly smaller relative to their non-family industry peers. Table 17 reinforces this finding across various age categories as well.

These results give some credence to the argument that family firm size is potentially constrained. As we discussed in Chapter 2, a constrained firm size may imply a suboptimal scale of production, which will have a bearing on efficiency. We investigate this further in the next chapter.

Table 15: Descriptive annual firm size statistics for family and non-family firms by year

Variable (year)[a]	Panel A: Full Sample (N = 3450/year) 25th Percentile	Mean	Median	75th Percentile	Panel B: Family Firms (N = 1758/year) 25th Percentile	Mean	Median	75th Percentile	Panel C: Non-Family Firms (N = 1692/year) 25th Percentile	Mean	Median	75th Percentile
Output (96)	263.00	2767.80	918.00	2860.00	200.00	1652.26	635.50	1982.00	377.00	3926.86	1341.00	4225.50
Output (97)	266.00	2869.29	955.00	2932.00	206.25	1754.99	665.00	2056.75	379.50	4027.06	1354.50	4219.00
Output (98)	275.00	3013.76	971.00	3105.25	202.25	1813.88	688.00	2127.00	416.00	4260.44	1418.50	4484.25
Output (96-98)[b]	269.00	2883.62	948.00	2957.00	202.00	1740.37	666.50	2066.75	391.50	4071.45	1375.50	4298.75
Labour (96)	4.70	26.18	12.85	35.24	4.00	20.77	10.00	27.96	6.00	31.81	17.43	45.10
Labour (97)	4.70	26.24	13.00	35.43	4.00	20.99	10.00	28.53	6.00	31.70	17.52	44.87
Labour (98)	4.60	27.26	13.00	37.85	3.99	21.89	9.92	29.69	6.00	32.84	18.00	45.57
Labour (96-98)[b]	4.70	26.56	13.00	36.00	4.00	21.21	10.00	28.70	6.00	32.12	17.66	45.00
Capital (96)	194.25	4864.11	775.00	3339.50	160.25	2574.14	577.00	2034.50	250.50	7243.41	1148.00	5131.50
Capital (97)	205.00	5144.86	831.50	3439.75	158.00	2801.50	592.50	2133.00	272.00	7579.63	1193.50	5458.50
Capital (98)	211.25	5305.11	853.50	3547.50	164.00	3041.38	622.50	2252.50	274.50	7657.15	1259.50	5747.00
Capital (96-98)[b]	204.00	5104.70	820.00	3437.25	161.00	2805.67	594.00	2135.50	263.75	7493.40	1208.50	5405.75
Total Debt (96)	123.00	3013.23	487.50	1925.75	99.25	1460.52	371.50	1325.50	161.50	4626.51	677.00	2857.00
Total Debt (97)	118.00	3272.29	525.00	2035.50	97.00	1592.62	379.50	1398.50	154.75	5017.47	720.00	3260.75
Total Debt (98)	120.00	3223.50	520.50	2074.00	95.25	1674.12	389.00	1411.25	158.25	4833.32	731.50	3280.25
Total Debt (96-98)[b]	120.00	3169.67	509.00	2021.75	97.00	1575.75	381.00	1368.75	156.75	4825.77	709.50	3133.25
Total Equity (96)	10.00	1922.75	157.50	971.75	5.25	1173.99	111.00	591.25	18.00	2700.71	232.50	1599.00
Total Equity (97)	10.00	1874.12	153.00	967.75	7.00	1211.57	111.50	657.50	16.00	2562.51	223.00	1585.50
Total Equity (98)	9.00	2083.23	163.00	1036.00	6.00	1367.37	121.00	708.00	13.00	2827.01	233.00	1643.00
Total Equity (96-98)[a]	10.00	1960.03	157.50	991.00	6.00	1250.98	115.00	651.00	16.00	2696.75	229.00	1607.25

[a] Output, Capital, Total Debt, and Total Equity measured in 000. Labour measured in number of FTE workers.
[b] Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

Table 16: Family ownership effects on firm size by industry (1996-1998)

	ANZSIC & Industry Category	N	Family	Non-Family	Output FOE (000)	Labour FOE	Capital FOE (000)	Total Debt FOE (000)	Total Equity FOE (000)
100	**Mining**	**79**	**19**	**60**	**-25175.74*** **	**-48.10*** **	**-57278.64*** **	**-37594.93*** **	**-19319.61** **
	Manufacturing								
200	between 100 & 200 employees	279	79	200	-4819.63***	-10.77***	-12292.69***	-5143.43***	-7492.97***
221	Food, Beverage and Tobacco Manufacturing	410	213	197	-1241.76***	-6.12**	-3156.24***	-1828.36***	-1374.06***
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	-1711.75***	-10.55***	-4788.13***	-3583.80***	-1143.24***
223	Wood and Paper Product Manufacturing	203	125	78	-1595.50	-0.91	-658.86	-71.90	-598.92
224	Printing, Publishing and Recorded Media	302	183	119	-1787.49***	-12.83***	-2440.07***	-1206.73***	-1229.69***
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	-2570.52***	-10.99***	-5663.56***	-3500.82***	-2150.87***
226	Non-Metallic Mineral Product Manufacturing	177	115	62	-806.98*	-4.86	-1344.22*	-48.86	-1231.67**
227	Metal Product Manufacturing	559	315	244	-701.75***	-1.39	-2006.27***	-1293.14**	-738.37***
228	Machinery and Equipment Manufacturing	1040	532	508	-762.87***	-4.44***	-1347.29***	-1034.67***	-319.30**
229	Other Manufacturing	388	240	148	-216.64	0.77	-422.69**	-100.24	-325.13**
	Construction								
300	between 100 & 200 employees	21	14	7	-7545.86	4.03	19369.00**	-1145.00	20530.07**
341	General Construction	194	130	64	-900.64	-6.52**	-482.49	-489.99	2.82
342	Construction Trade Services	375	272	103	-13.63	-3.25	7.41	-77.14	85.37*
	Wholesale Trade								
400	between 100 & 200 employees	95	34	61	-9820.81***	-2.21	-19210.66***	-11833.63***	-7130.72***
445	Basic Material Wholesaling	393	224	169	-1436.11***	-2.13	-3343.14***	-2463.60***	-851.19**
446	Machinery and Motor Vehicle Wholesaling	684	310	374	-2650.66***	-9.76***	-7553.56***	-6896.19***	-740.79
447	Personal and Household Good Wholesaling	543	319	224	-1469.44***	-8.84***	-2694.82***	-1901.11***	-791.94***
	Retail Trade								
500	between 100 & 200 employees	63	29	34	-1139.31	-6.11	-8528.59**	-7945.78**	-556.01
551	Food Retailing	236	169	67	-154.57	-1.61	242.56	239.91	1.73
552	Personal and Household Good Retailing	374	214	160	-695.50***	-3.23*	-237.85	-153.42	-84.04
553	Motor Vehicle Retailing and Services	405	235	170	-584.69**	-3.98*	-1124.76**	-959.19***	-166.40
	Accommodation, Cafes and Restaurants								
600	between 100 & 200 employees	10	5	5	-6068.00***	-58.41**	-1841.20***	-1313.00	-527.60
657	Accommodation, Cafes and Restaurants	360	172	188	-719.48***	-4.63***	-1131.99***	-58.06	-1073.79***

700	**Transport and Storage**	**376**	**212**	**164**	**-3313.83*** **	**-15.35*** **	**-10551.55* **	**-6192.64* **	**-4526.67** **
	Finance and Insurance								
800	between 100 & 200 employees	4	0	4	n/a	n/a	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	-3099.29***	-16.38***	-6433.64***	-3689.47***	-2779.46***
	Property and Business Services								
900	between 100 & 200 employees	68	10	58	5232.35	-32.83**	243460.65	44181.78	207070.44*
977	Property Services	317	150	167	-2035.88**	-3.83**	-12132.94**	-4840.91	-7236.22**
978	Business Services	958	287	671	-1574.24***	-10.29***	-667.28	-1217.75**	543.01
	Cultural and Recreational Services								
1000	between 100 & 200 employees	14	0	14	n/a	n/a	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	-1729.67	-0.46	-7649.46**	-4830.41*	-2770.03**
1092	Libraries, Museums and the Arts	9	0	9	n/a	n/a	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	-122.55	-11.74***	-391.89	178.69	-565.69***
	Personal and Other Services								
1100	between 100 & 200 employees	3	3	0	n/a	n/a	n/a	n/a	n/a
1195	Personal Services	205	108	97	586.43**	2.79	168.79	335.28*	-166.19

Size FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various size measures compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 17: Family ownership effects on firm size by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	% of family firms	Output FOE (000)	Labour FOE (FTE)	Capital FOE (000)	Total Debt FOE (000)	Total Equity FOE (000)
Less than 2 years (1)	126	38	88	30.16%	-2553.88***	-19.92***	-4963.65***	-2834.93***	-2133.33***
2 to less than 5 years (2)	1111	495	616	44.55%	-2434.46***	-12.80***	-6184.62***	-4256.05***	-2041.70***
5 to less than 10 years (3)	2867	1339	1528	46.70%	-1966.88***	-10.35***	-3381.47***	-1802.60***	-1591.72***
10 to less than 20 years (4)	3428	1755	1673	51.20%	-2600.52***	-12.54***	-5082.91***	-3501.26***	-1553.08*
20 years or more (5)	2818	1647	1171	58.45%	-2899.00***	-13.90***	-5916.37***	-4756.16***	-1159.95**

Size FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various size measures compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

3.7 Summary of preliminary findings

Based on the preliminary data analysis conducted in this chapter, we are in a position to comment on many of the hypotheses developed in Chapter 2. In fact, we can state that most of our hypotheses pertaining to financing preferences and firm size are reinforced by the observed characteristics present in the data thus far.

Specifically, relative to their non-family counterparts, family firms hold a significantly larger proportion of debt obtained from banks and less from trade creditors, supporting Hypotheses 1a and 1b respectively. In line with Hypothesis 2a is the observation that family firms hold a significantly larger proportion of debt obtained from internal sources. For example, family firms on average hold more than double the proportion of debt sourced from individuals involved in the business or their families than do non-family firms. With that said, contrary to our expectations expressed in Hypothesis 2b, we have also observed that a preference for internal debt does not necessarily imply that family firms hold a lower proportion of debt obtained from what we have strictly defined as external sources. However, a larger proportion of internally sourced debt does automatically imply a lower proportion of debt obtained from other components of total debt (see Appendix A.1).

With respect to equity financing, family firms hold a significantly larger proportion of equity obtained from working owners and other internal sources, which is in line Hypothesis 3 and 4a respectively. For example, compared to non-family firms, family firms hold more than double the proportion of their equity sourced from the family of non-working owners. On the other hand, consistent with Hypothesis 4b, the proportion of external equity held by family firms is significantly lower relative to non-family firms. For example, on average family firms hold approximately half the proportion of equity sourced from unrelated non-working owners, unrelated businesses, and venture capitalists.

Consistent with the composition of equity financing results, we also show that when issuing new equity, family firms prefer internal sources and raise significantly less equity financing on average than do non-family firms. With that said, our data show that a greater proportion of debt and equity financing obtained from internal sources is significantly correlated with a lower quantum of total debt and equity as well as with a smaller firm size in general. As a result it is not surprising that, regardless of the measure, family firms are consistently found to be significantly smaller than their non-family counterparts, which is consistent with Hypotheses 5, 6 and 7. Specifically, family firms employ fewer workers, possess less capital, and consequently produce less output than non-family firms on average.

3.8 Chapter summary

Given the focus of this thesis, the BLS is a fitting data set. Specifically, the ability to identify family owned SMEs provides us with the rare opportunity to use a large, national, legally enforced, and longitudinal survey to test our hypotheses. Such scope and rigour will add to the external validity and robustness of our empirical findings. With that said, the BLS is also an established and reliable data source proving useful in multiple SME studies spanning various topics (see for example McMahon 2001; Watson 2002; Watson and Robinson 2003; Cassar 2004; McMahon 2004; Barbera and Moores 2013).

In this Chapter we have described the BLS in detail, specified our truncated sub-sample, and defined the variables used in this thesis. These variables and their definitions are summarised in Table 18. Using these variables, we presented descriptive statistics and performed preliminary data analysis on the composition of finance and size differences between family and non-family firms. Notwithstanding that more robust regression analysis will be conducted in Chapter 5, by controlling for multiple covariates and utilising preliminary statistical tests, we have highlighted that there are significant differences between family and non-family firms.

In addition to demonstrating the importance of accounting for variables like industry and age, we have also shown that financing composition and firm size are interrelated. It will be important to consider this reciprocal relationship as a potential source of endogeneity when designing our hypotheses tests in Chapter 5.

Table 18: Operationalization of BLS proxy variables

Concept	***Operationalization***	***Proxy Variable***[a]
Family ownership	Structure and essence based definition	Do you consider the business to be a family business? Yes = 1; No = 0
Financing preferences	Composition of debt and equity finance	Debt by source$_{it}$/Total liabilities$_{it}$ Equity by source$_{it}$/Total equity$_{it}$
Firm size	Scale of production	Capital$_{it}$ = Total assets$_{it}$ = Total liabilities$_{it}$ + Total equity$_{it}$ Labour$_{it}$ = FTE$_{it}$ = Full-time employees$_{it}$ + Part-time employees$_{it}$ * Equivalent ratio$_{t.}$ Output$_{it}$ = Value Added$_{it}$ = Sales$_{it}$ + Closing inventory$_{it}$ – Opening inventory$_{it}$ – Purchases$_{it}$
Performance	Efficiency[b]	Productive efficiency$_{it}$ = Technical efficiency$_{it}$ * Scale efficiency$_{it}$
Capital intensity	Capital to labour ratio	(K/L)$_{it}$ = Capital$_{it}$/Labour$_{it}$
Capital structure	Leverage ratio	Leverage$_{it}$ = Total liabilities$_{it}$/Total assets$_{it}$
Life cycle	Age range	(1) Less than 2 years; (2) 2 to less than 5 years; (3) 5 to less than 10 years; (4) 10 to less than 20 years; (5) 20 years or more.
Economic sector	Industry dummy	37 Australian and New Zealand Standard Industrial Classifications (ANZSIC).

[a] i denotes an individual firm in time period t.
[b] Productive efficiency and the exact calculation of Technical and Scale efficiency are discussed in Chapter 4.

As per our discussion in Chapter 2, the potential for family firm size to be constrained given rise to questions about the technical and scale efficiency of family firm production. As a result, we also expect a significant FOE with respect to efficiency. In the next chapter we draw upon the variables defined in this chapter to calculate and further compare the measure of efficiency used in this thesis.

Chapter 4. Measuring Efficiency and Preliminary Analysis

4.1 Chapter introduction

In the previous chapter we have shown that family firms have a tendency to utilise a greater proportion of internal finance and are smaller in size relative to comparable non-family firms. Throughout this thesis we have argued that such tendencies may lead to performance outcomes. Specifically, the concepts proposed in Chapter 2 linked the SEW objectives of family owners to the preference for internally sourced finance, a constrained firm size, and ultimately the efficiency of the firm. Although a small firm size alone does not necessarily deem the family firm an inefficient one, we can infer that a constrained family firm is one that is sub-optimally small. By this we mean that, if larger, the firm would be more efficient in terms of scale.

Another repercussion of a capital constraint on family owned firms is that the firm's choice of inputs, or more specifically the capital to labour mix utilised in the production processes may also be suboptimal. Again, suboptimal in the sense that if more capital intensive techniques were employed, the firm would reap efficiency benefits in terms of resource use. Potentially offsetting this problem, it is also possible that, due to their constrained size, family SMEs might undertake actions that make them more efficient in terms of their resource use.

With these complexities in mind, to test the efficiency related hypotheses proposed in Chapter 2, we require a performance measure that can disentangle the simultaneous impact of a FOE on both the productive scale as well as the technical efficiency of the firm, and in a way which avoids the endogeneity problems commonly associated with the task. In this chapter we present a well-established, theoretically founded measure of productive efficiency (PE), which has largely been overlooked in the family business literature. We also explain how this measure enables us to observe the efficiency impact of a suboptimal firm size separately from ‘pure’ technical efficiency in the firm’s internal resource use. For these reasons, PE is well suited to undertake the complexities mentioned above and adds rigor to the performance measure used in this thesis.

In Section 2 we discuss the measure of efficiency and why it is particularly well suited to test the framework proposed in the previous chapter. Section 3 defines PE and outlines how it may be decomposed into both scale efficiency (SE) and technical efficiency (TE). Section 4 briefly discusses the methods which can be used to estimate the efficient frontier itself and describes the theoretical foundations of our chosen frontier estimation method, Data Envelopment Analysis (DEA). Using this method, we then present descriptive statistics and conduct preliminary data analysis on family firm efficiency differentials in Section 5. Section 6 summarizes these preliminary findings, and Section 7 summarises the chapter.

4.2 Measurement of the efficiency construct

On a micro level, efficiency is a success indicator and a performance measure by which firms can be evaluated and compared. In a competitive environment, not unlike the kind most SMEs typically encounter, productive efficiency can even be a necessary condition for firm survival (Lovell 1993); thus, this thesis is concerned with measuring the performance of both family and non-family SMEs which convert inputs, such as physical capital and labour, into outputs, such as goods and services. The broad concept of efficiency is thus used to characterize the economical utilization of resources. Farrell’s (1957) seminal measure of PE conforms to this definition, and as such is a fundamental measure of a firm’s performance[56].

In simple terms, efficiency can be measured in two equivalent ways depending on the orientation. An output oriented measure gauges a firm’s success in producing as large as

[56] Efficiency can be considered a fundamental measure of a firm’s performance in the sense that efficiency is driven by increases in output while holding inputs constant, or decreasing inputs while holding output constant, which in turn positively impacts financial performance variables like sales revenue, operating expenses and net profit.

possible an output from a given set of inputs, or alternatively, and more relevant to the purpose of this thesis, the equivalent input oriented efficiency measure gauges a firm's success in producing a given output from the smallest possible set of inputs.

To investigate the impact of family ownership on the efficiency of the firm, we focus on an input oriented measure of efficiency since we assume that the SMEs in our sample have specific orders to fill, or in other words the 'choice' of output quantity is somewhat imposed on the firm. Therefore, the primary decision variable for management would be input quantities, i.e. how much labour and capital to employ. It is also worth noting that it has been shown that the choice of orientation will have only minor influences upon the efficiency scores obtained (see for example Coelli and Perelman 1999).

PE is preferred as a performance measure in this thesis as it is founded on well-established economic theory, and most importantly, it is comprised of both a SE and TE component, which can be decomposed as to allow the researcher to test the antecedents of both components separately. In Chapter 5 we perform these tests with an attention to whether the firm is family owned. PE is therefore a very useful performance measure when making comparisons between family and non-family firms, since, as per our discussion in Chapter 2, SEW inspired financing choices by family owners are expected to constrain firm size, which in and of itself will have efficiency consequences. Such efficiencies are considered distinct from any potential pure TE differences in resource use across family and non-family owned firms. In the following sections we elaborate on this in a more precise manner.

4.3 Productive efficiency

When discussing the performance of firms it is common to refer to them as being more or less 'efficient' or more or less 'productive'. Although these two terms are commonly used interchangeably and interrelated, they are in fact not the same. Understanding the relationship between productivity and efficiency will bring us closer to understanding how PE is measured.

The average productivity of a firm, which we will simply call productivity, can be measured by the ratio of its output to input, and can be stated as

(1) $\text{Productivity} = \frac{Y}{X}$

Where Y is a measure of actual outputs and X actual inputs. If the firm is using multiple inputs to produce multiple outputs, both the numerator and denominator in (1) must be aggregated in some economically meaningful way, so that the productivity measure is the ratio of two scalars. For example, a common firm-level productivity measure is sales per worker, which can be found by dividing total sales revenue by the total number of workers employed.

PE on the other hand is the comparison between observed productivity and 'optimal' productivity, which can be stated as

(2) $PE = 0 \leq \left(\frac{Y}{X}\right) / \left(\frac{Y}{X}\right)^{*} \leq 1$, depending on the orientation, we have

(2.1) $PE = 0 \leq Y/Y^{*} \leq 1$ for an output oriented measure, and

(2.2) $PE = 0 \leq X^{*}/X \leq 1$ for an input oriented measure.

Where $\left(\frac{Y}{X}\right)^{*}$ is an optimal, or best practice, level of productivity and provides a natural standard from which efficiency can be found. In fact, without some benchmark, productivity per se does not necessarily provide any useful information about firm performance[57].

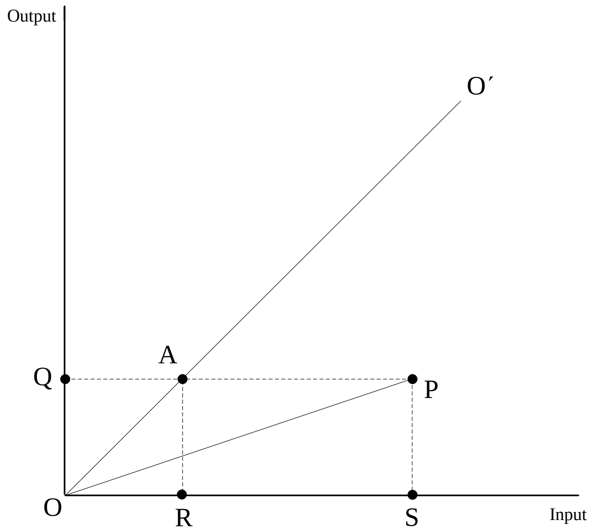
According to this measure, efficiency is determined as the distance to the best practice benchmark, also known as the efficient frontier. In other words, the efficiency of a firm is a comparative measure of its success in actually processing inputs to achieve its outputs, as compared to its maximum potential for doing so, represented by the efficient

[57] In the sales per worker example, one would have to compare this year's sales per worker with last year's, or perhaps with that of the nearest competitor, to obtain any meaningful indication of the firm's performance.

frontier. Thus, PE is a relative concept, which will take some value between 1 and 0, 1 being perfectly efficient and indicating that the firm's actual productivity is the same as the optimal level[58]. It is also worth noting that, unlike productivity, PE has the useful property of invariance with respect to changes in the unit of measurement.

Based on the work of Debreu (1951), Farrell (1957) suggested a measure of PE that, from an input orientation, can be interpreted as the ratio of technically minimal to actual inputs, given output and the input mix. For example, Figure 7 below illustrates a one input, one output scenario. If known and assuming constant returns to scale (CRS), the OO´ efficient frontier represents the maximum level of output attainable for a given level of input. These output-input combinations are accomplished by hypothetically efficient firms utilising best practices in their production process. The slope of the OO´ line therefore equates to the productivity exhibited by these efficient firms.

Figure 6: One input, one output measure of productive efficiency



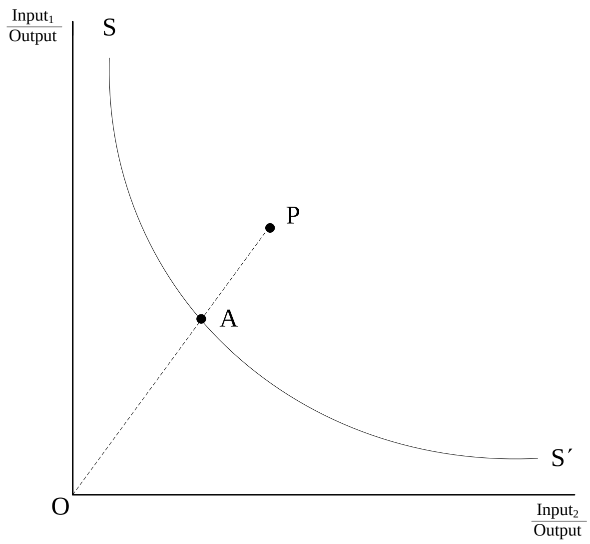
Point P represents the productivity of some inefficient firm, firm P, producing below the efficient frontier. Firm Ps productivity can be measured by the slope of the OP line

[58] The input-oriented technical efficiency measure denotes what proportion of the firm's observed inputs are actually necessary for producing its observed output. Unless this ratio representing efficiency equates to 1, the firm can be said to be wasting input.

which is clearly less than the slope of the efficient frontier. For example, holding output constant, if we compare firm P to firm A, we can see that firm As productivity is Q/R whereas firm Ps productivity is Q/S. From this Farrell (1957) defines the PE of firm P as R/S since firm A produces an output of Q using R inputs, while firm P produces an output of Q using S inputs, which corresponds to equation (2.2). This PE score can therefore also be represented by the distance QA/QP[59].

The calculation of PE becomes only slightly more complicated when more than one input is used in the productive process. For example, Figure 7 illustrates the input orientation case in two dimensions where firms employ two factors of production, inputs 1 and 2, to produce a single unit of output. If known, the frontier SS´ represents the various combinations of $input_1$ and $input_2$ that an efficient firm, one utilising best practices, might use to produce a single unit of output.

Figure 7: Two input, one output measure of productive efficiency



In the diagram, point P represents the observed inputs used by firm P to achieve one output unit. The ray from the origin, OP, has a slope equal to the factor proportions, or input mix, being used in the production process by firm P. A represents the observed

59 Intuitively, the ratio QA/QP has the properties of an efficiency measure since it takes the value of 100 percent for the perfectly efficient firm, and will become indefinitely small if the amount of inputs becomes indefinitely large. Also, provided that OO´ has a positive slope, a decrease in any input per unit of output, ceteris paribus, implies a higher PE (Farrell 1957).

inputs used by an efficient firm with the same factor proportions. A is more efficient than P since A uses the same ratio of inputs as P, but produces a single unit of output using only a fraction, OA/OP, as much of each input. It can also be inferred that A could produce OP/OA times as much output as P from the same inputs. From this Farrell (1957) defines the PE of firm P as OA/OP[60], this multiple input, one output scenario can more generally be stated as

(3) $\mathrm{PE} = \left(\frac{\mathrm{y}}{\bar{\mathrm{x}}}\right) / \left(\frac{\mathrm{y}}{\bar{\mathrm{x}}^*}\right)$, or holding output constant, as

(3.1) $\mathrm{PE} = 0 \leq \bar{\mathrm{x}}^*/\bar{\mathrm{x}} \leq 1.$

Where $\bar{\mathrm{x}}$ is a weighted average of all inputs used in the production process of the observed firm. $\bar{\mathrm{x}}^*$ is the weighted average of inputs used by the observed firm's efficient counterpart. It is also important to note that the two firms share the same input mix so that, as in Figure 7, they are both on the ray OP. It can be seen in Figure 7 that constant returns to scale (CRS) has been assumed by representing input 1 and 2 per unit of output on both axes. Although the CRS assumption allows us to represent the above measure of PE in two dimensions and facilitates the computation of PE, it also imposes the restriction that all firms are operating at their optimal scale. In reality, and considering our discussion in Chapter 2, this assumption may not hold for all firms, particularly family firms.

4.3.1 Decomposing the productive efficiency measure

From an input orientation, improving the PE measure in (3) would be accomplished by producing the same output while consuming less resources, or inputs, which is related to how efficiently the firm utilizes its resources. However, if not all firms are operating at their optimal scale, i.e. not all production technologies exhibit CRS, there will be other

---

[60] Similar to the previous example, the ratio OA/OP has the properties of an efficiency measure since it takes the value of 100 percent for the perfectly efficient firm, and will become indefinitely small if the amount of inputs becomes indefinitely large. Also, provided that SS′ has a negative slope, an increase in any input per unit of output, ceteris paribus, implies lower PE.

efficiency related influences confounding the measure specified in (3), such as whether an increase in input yields a proportionately larger increase in output, or whether a decrease in input yields a proportionately smaller reduction in output. These influences are related to scale efficiency and address whether the firm is optimally sized (Golany and Yu 1997). The need to untangle these two sources of potential inefficiency within Farrell's PE measure has long been recognised by economists working in the area of production efficiency (see for example Førsund and Hjalmarsson 1974; Färe and Lovell 1978).

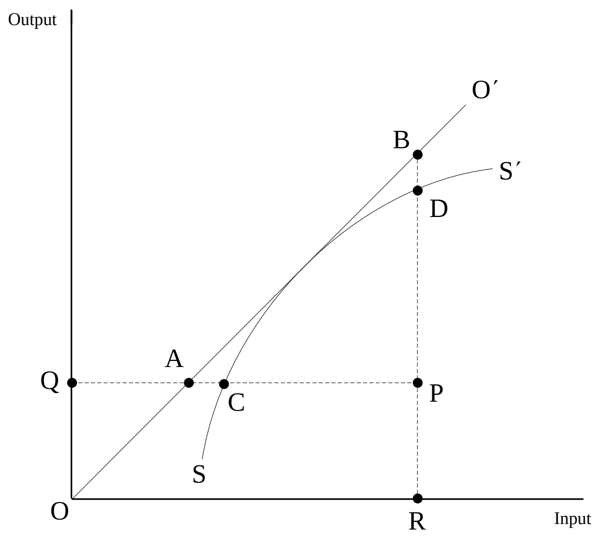
By imposing an additional convexity constraint on the underlying frontier technology, which allows for variable returns to scale (VRS) to be exhibited in the efficient frontier[61], Farrell's original measure can be used to compute efficiency devoid of any scale effects, which relate strictly to the firm's allocation of resources. As a result, it is possible to decompose Farrell's PE measure into two main components: 1) a 'pure' TE component, which refers to a net measure of the firm's efficient use of resources, and 2) a SE component, which refers to the firm's 'distance' from an optimal scale of production (Førsund and Hjalmarsson 1979; Banker et al. 1984; Førsund and Hjalmarsson 1987; Banker and Thrall 1992; Banker et al. 2004).

The TE measure incorporates various proportionate changes in outputs and inputs in the efficient frontier, and is best explained using a visual illustration. In order to represent the difference between the CRS and VRS frontiers in two dimensions, Figure 8 highlights a one input, one output case. If known, the efficient frontiers OO′ and SS′ represent the various input and output combinations of firms using best practices in their production processes which exhibit CRS and VRS respectively.

---

[61] Variable returns to scale (VRS) refers to increasing, constant, or decreasing returns to scale. A firm is said to exhibit increasing returns to scale (IRS) if increases in all inputs, keeping the input mix constant, results in a greater than proportionate increase in output. From this, decreasing returns to scale (DRS) can be observed if increases in all inputs, keeping the input mix constant, results in a less than proportionate increase in output. Constant returns to scale (CRS) are observed when a proportionate increase in inputs results in an increase in outputs by exactly the same proportion.

Figure 8: One input, one output measure of technical efficiency with constant and varying returns to scale



In the diagram, point P represents the observed input, R, and output, Q, of firm P. Given an output of Q, point A represents the most efficient input levels for a hypothetical firm which is optimally scaled, since it exhibits CRS in its production process; thus, the PE of firm P can be defined as QA/QP. Compared to firm C, which is sub-optimally scaled since it exhibits increasing returns to scale (IRS) in its production process, TE in the use of inputs can be defined as QC/QP and is devoid of any scale efficiency effects[62]. From these two definitions of efficiency, QA/QC measures SE, which represents the inefficiency due to the divergence of the actual size of P from the optimal scale[63]. An SE score of 1 indicates that the firm is operating at the most efficient production scale. These measures can be stated more generally as

---

[62] Equivalently, using an output oriented measure, the PE of P can be defined as RP/RB and TE can be defined as RP/RD. This implies that it is possible that firm P will be observed to exhibit either IRS or DRS in production depending on which orientation is used since they yield different projection points on the SS′ frontier (Golany and Yu 1997).

[63] The distance QA/QC measures SE itself since the firm could have achieved the same output with less input if the firm was producing at CRS, or in other words, if the firm was efficiently scaled.

(4) $\mathrm{PE} = \left(\frac{y}{x}\right) / \left(\frac{y}{x^{*}_{CRS}}\right) = 0 \leq \frac{x^{*}_{CRS}}{x} \leq 1$

(5) $\mathrm{TE} = \left(\frac{y}{x}\right) / \left(\frac{y}{x^{*}_{VRS}}\right) = 0 \leq \frac{x^{*}_{VRS}}{x} \leq 1$

(6) $\mathrm{SE} = \left(\frac{x^{*}_{CRS}}{x}\right) / \left(\frac{x^{*}_{VRS}}{x}\right) = 0 \leq \frac{x^{*}_{CRS}}{x^{*}_{VRS}} \leq 1.$

Where x denotes the input used by the observed firm to produce a given output y, and x^{*}_{CRS} and x^{*}_{VRS} represent the input quantities of best practice firms which produce the same output as the observed firm, but lie on the CRS and VRS efficient frontiers respectively. Due to the convexity constraint imposed on the VRS frontier, it will always be the case that TE ≥ PE, which is intuitive since unlike PE, TE has had any potential scale inefficiency effects removed.

From (4), (5) and (6) it is clear that Farrell's technical efficiency score, PE, is the product of pure technical efficiency, TE, and scale efficiency, SE. More specifically,

(7) $\mathrm{PE} = \mathrm{TE} * \mathrm{SE}.$

For the reasons discussed in Chapter 2, family owned firms are expected to exhibit greater inefficiencies related to a suboptimal scale of production compared to their non-family counterparts. These potential scale inefficiencies are separate from any potential inefficiency related to resource use. By decomposing technical efficiency as per (7), we can isolate the impact of family ownership on both components separately, which enables an otherwise difficult insight into potential efficiency differentials across firm ownership. Further, as we have shown, any efficiency comparisons across firm ownership which do not account for these simultaneous scale effects will be confounded by firm size and thus flawed.

As the measures of efficiency discussed thus far involve observing the degree to which the actual productivity of a firm differs from its maximum potential productivity, identified by the efficient frontier, great importance is placed on accurately computing the efficient frontier itself. Up to this point, we have assumed that the efficient frontier has been known, but in actuality the efficient frontier must be identified using a sample of real-world data.

4.4 Estimating the efficient frontier

To date, previous studies have utilised either a parametric or non-parametric approach to estimate the efficient frontier (Førsund et al. 1980). The parametric, or stochastic frontier approach developed by Aigner et al. (1977) is distinguished by the assumption of an explicit functional form for the production technology, as described in Bauer (1990). The frontier is then constructed based on the OLS estimation of the unknown parameters of, for example, a production, cost, or profit function. On the other hand, the non-parametric method, coined as Data Envelopment Analysis (DEA) by Charnes, Cooper, and Rhodes (1979;1981), builds on the individual firm evaluations of Farrell (1957) specified in (3). In contrast to the parametric approach, DEA does not require any assumptions about the functional form, as the efficiency of a firm is measured relative to all other firms in the sample with the simple restriction that all firms lie on or 'below' the efficient frontier.

The chief advantage of the DEA or mathematical programming approach is that no explicit functional form need be imposed on the data[64]. However, Seiford and Thrall (1990) highlight how the DEA calculated frontier is very sensitive to extreme values, and thus is susceptible to the potential measurement error of input and output values. Although the stochastic frontier or parametric approach can handle such measurement error more effectively via an error term, it imposes an explicit, and possibly overly restrictive, functional form for technology and the distribution of the error term (Cooper et al. 2004). As a result, we take steps to minimise the potential effects of measurement error by removing those firms which have reported a value of zero for their output, capital or labour. We also focus on simple, yet theoretically founded measures of both

[64] The validity of any estimated stochastic production frontier as a benchmark for measuring the efficiency of an observed firm crucially depends on the appropriateness of the functional form being used. Unfortunately, the choice of the functional specification is often arbitrary and is usually driven by computational simplicity (Färe and Lovell 1978).

input and output, defined in Chapter 3 using the BLS data. Finally, we further acknowledge that the risk of extreme values influencing the results is mitigated by our relatively large sample size.

Given our efforts to minimise the problems related to the DEA approach, we utilise the non-parametric method in this thesis as to realise the most important advantage of this approach, which is that we do not impose a specified production function or assume some probability distribution of the error terms. The basic DEA frontier estimation relies on a number of fairly general assumptions about the nature of the underlying production technology (see Appendix A.2). Using a sample of actually observed input-output data and these assumptions, it derives a benchmark with which the actual input-output ratio realised by a firm can be compared for the efficiency measurement. We illustrate this approach in the next section using a simple example.

4.4.1 Data Envelopment Analysis (DEA): A simple example

As we have discussed, technical efficiency is measured as the ratio of a firm's actual productivity to the productivity of the equivalent optimal, best practice, or efficient firm. In most cases, such an optimal firm may not actually exist within the sample data set, therefore the DEA frontier itself is the linear programming calculation of a hypothetical efficient firm which is then used to compute the TE score of the firm being evaluated. This can be accomplished with a sample of firm-level input/output data. In this section we describe a simple method of finding both the CRS and VRS efficient frontiers using a one input, one output example.

Suppose we observe the following input/output data for 10 firms in the same industry. These are listed in the first panel of Table 19 and illustrated in Figure 9. From the first panel of Table 19 alone we can make some basic observations about efficiency. For example, we can see that, as groups, firms C and B, F and E, and G, H and I, all use the same amount of input.

Table 19: Sample input/output data and efficiency scores

Panel 1: Production data			*Panel 2: Efficiency Scores*			
Firm	Input (x)	Output (y)	PE	TE	SE	RTS
A	3	8	0.53	1.00	0.53	IRS
B	6	20	0.67	0.77	0.86	IRS
C	6	30	1.00	1.00	1.00	CRS
D	7	14	0.40	0.55	0.73	IRS
E	8	22	0.55	0.61	0.90	IRS
F	8	32	0.80	0.85	0.94	DRS
G	10	40	0.80	1.00	0.80	DRS
H	10	30	0.60	0.60	1.00	CRS
I	10	16	0.32	0.41	0.78	IRS
J	12	24	0.40	0.43	0.93	IRS

With that said, we can easily determine that C is more efficient than B, F is more efficient than E, and G is more efficient than H and I since with the same input (x), they achieve a greater level of output (y). However, Table 19 and Figure 9 do not provide any information about the quantity of the efficiency differentials among our example firms, nor do they provide any information about any potential scale inefficiencies. In fact, as we shall see, firm C is perfectly efficient with respect to its scale and technology, while firm F exhibits some degree of both scale and technical inefficiency, and firm G is technically efficient, but exhibits scale inefficiencies. These results can only be derived by comparing each firm's distance to an efficient frontier.

In Figure 9 the efficient frontier can be found by constructing a non-parametric piecewise linear convex hull such that no observed point should lie to the left or above it. In our simple example we accomplish this by starting at the further most left point, firm A, and construct a straight line originating from A to all other firms which lie to the right. Note that the furthest most left firm is guaranteed to be on the frontier[65]. The slope of each line can then be calculated as the change in output divided by the change in input, or more specifically as

(8) $$\beta = (y_i - y_\gamma)/(x_i - x_\gamma)$$

[65] If there are more than one firm at the furthest point to the left, then the starting point is the firm with the highest input of the group.

Where γ is the starting point (in this case firm A) and i denotes all other firms to the right of the starting point (in this case firms B to J). The next firm on the frontier (and the next starting point) is the firm where the slope of the line between it and the starting point is the maximum of all other lines. In Figure 9 the line between A and C has the largest slope compared to all other lines originating from A. Therefore firm C is the next starting point and the process is repeated until all firms which lie on the efficient frontier are identified, i.e. no other firms lie to the right and above the starting point. The frontier itself is the connection of all linear segments between these frontier firms, as seen in Figure 10. We label this the VRS efficient frontier since it allows for variable returns to scale, i.e. its slope varies across x.

To find the CRS frontier, we further construct a ray starting from the x,y origin to all firms and again select the maximum slope. This will produce a second efficient frontier that is tangent with the VRS frontier. We label this the CRS frontier in Figure 11 since its slope is constant. This slope represents the change in output given a change in input of an optimally scaled production technology. Once we have identified the CRS and VRS frontiers, we can calculate PE, TE and SE as explained in Section 4.3.1.

Specifically focusing on firm B, to find the CRS and VRS benchmarks, while holding input constant we construct a straight line from the y axis (labelled as point K in Figure 12) to firm B's position. The intersection of this line with the CRS and VRS frontiers are firm B's hypothetical efficient counterparts exhibiting constant and variable returns to scale respectively. In Figure 12 these hypothetical firms are labelled B^{**} and B^{*} respectively. To find these points, we simply calculate the intercept (α) and slope (β) of both frontiers and solve for x when y is fixed using a standard straight line equation

(9) $$y = \alpha + \beta * x$$

Where y is output, x is input, α is the y intercept and β is the change in y divided by the change in x. In our example, the CRS frontier's $\alpha = 0$ and $\beta = 5$, while at the segment between firm A and C, the VRS frontier's $\alpha = -14$ and $\beta = 7.33$.

Figure 9: Input-Output coordinates

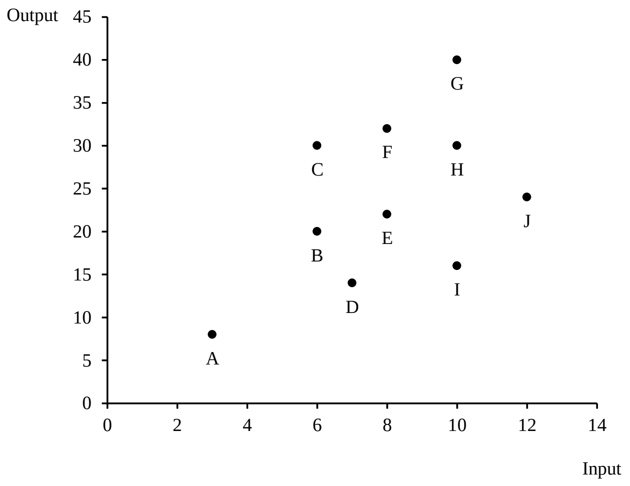


Figure 10: Efficient frontier with variable returns to scale

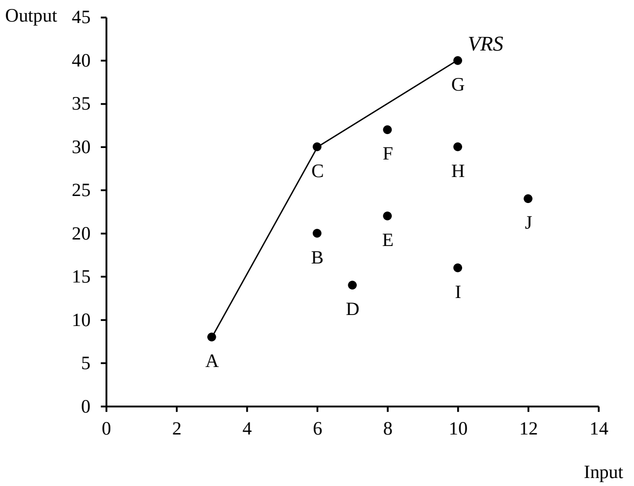


Figure 11: Efficient frontier with constant returns to scale

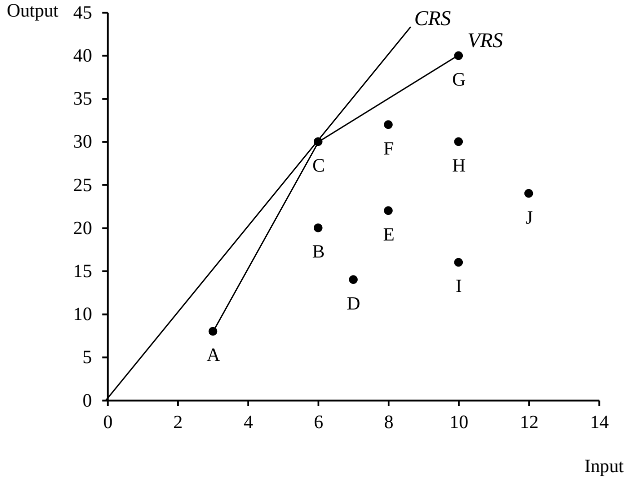
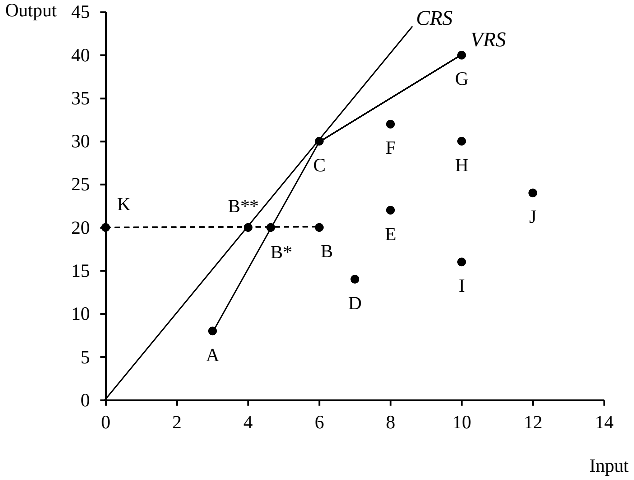


Figure 12: Measuring scale and technical efficiency of firm B



Given these two lines, to find the input values of firm B^* and B^{**}, we can substitute the fixed value of y (in this case 20) in equation (9) and solve for x. In our example the x,y values of firm B^* are [4.64, 20] and for firm B^{**} these are [4,20]. Since firm B's input/output coordinates are [6,20], we can see that firm B is clearly less efficient than B^* and B^{**} as it uses more input to produce the same level of output. Specifically, we can calculate B's efficiency scores as per equations (4), (5) and (6) from Section 4.3.1. Using these, we find

(10) $\mathrm{PE} = \mathrm{KB}^{**}/\mathrm{KB} = \frac{4}{6} = 0.667$,

(11) $\mathrm{TE} = \mathrm{KB}^{*}/\mathrm{KB} = \frac{4.64}{6} = 0.773$, and

(12) $\mathrm{SE} = \mathrm{KB}^{**}/\mathrm{KB}^{*} = \frac{4}{4.64} = 0.863$.

That is, firm B's efficiency is 67 percent of its optimally scaled and technically efficient counterpart B^{**} assuming CRS. Allowing for variable returns to scale, firm B's efficiency is 77 percent of its technically efficient, but sub-optimally scaled[66], counterpart B^*. Specifically, if firm B^* was optimally scaled, then it would be able to produce 20 units of output with 4, rather than 4.64 units of input. This implies that firm B is not perfectly scaled and this inefficiency can be quantified by a scale efficiency score of 86 percent. By this approach we can find the PE, TE and SE scores for firms A to J in our example. These are reported in the second panel of Table 19.

In this thesis we estimate the efficiency scores of family and non-family SMEs which use more than one input in their production process. As a result, the equivalent efficiency scores are found by the linear programming method developed by Charnes, Cooper, and Rhodes (1979;1981), which imposes some basic assumptions regarding the production technology of our sample firms. In Appendix A.2 we define these

---

[66] Firm B is observed to be exhibiting IRS since its technically efficient counterpart, B^*, lies on the increasing returns to scale portion of the VRS frontier, i.e. between firm A and C, the VRS frontier's slope is greater than the CRS frontier's slope. A firm is observed to exhibit decreasing returns to scale if its efficient counterpart lies on the segment of the VRS frontier where, holding input fixed, the slope is less than the CRS frontier's slope.

assumptions and specify the linear programming problems which are solved to find the efficient frontier and calculate the efficiency scores.

Using the BLS proxies for input and output defined in Chapter 3, and by identifying the VRS and CRS frontiers in each BLS industry[67], we obtain PE, TE and SE for each firm in our BLS sample. Before performing more robust empirical testing in the next chapter, we first conduct a preliminary analysis on these efficiency scores across family and non-family owned firms in the next section.

4.5 Descriptive statistics and preliminary data analysis

Similar to the preliminary analysis conducted in the previous chapter, we compare the efficiency measures detailed in this chapter to test for a FOE[68]. In the previous chapter, we observed significant FOEs with respect to the composition of finance and firm size. However, a greater reliance on internal finance and a smaller family firm alone do not necessarily imply a capital constraint unless suboptimal production in terms of scale and resource use is also demonstrated. As we have argued in this thesis, one way of demonstrating a suboptimal scale is to investigate whether efficiency, both technical and scale, is systematically different across ownership type.

Accordingly, we compare the summary statistics for our three derived measures of efficiency discussed in this chapter, namely PE, TE, and SE. Capital intensity of production, or K/L, is also compared across firm ownership in this section due to the theoretical link between capital intensity and efficiency[69].

---

[67] It is expected that the prevailing underlying production technology will be specific to the industry in which the firm is operating; therefore it is important to compare each firm to its industry specific frontier when calculating efficiency.

[68] As in Chapter 3, the FOE is calculated by $x_{ff} - x_{nf}$, where x is the average value of the efficiency variable of interest and ff and nf denote family and non-family firms respectively. A positive FOE indicates that, relative to non-family firms, family firms exhibit a greater average value and a negative FOE indicates a lower average value for family firms.

[69] As the DEA measure of efficiency is based on the distance to an efficient frontier while holding the input mix constant, differences in the capital to labour ratio will in turn cause differences in the efficiency score depending on the slope of the prevailing frontier.

Table 20: Descriptive annual efficiency statistics for family and non-family firms by year

	Panel A: Full Sample (N = 3450/year)				Panel B: Family Firms (N = 1758/year)				Panel C: Non-Family Firms (N = 1692/year)			
Variable (year)	25th Percentile	Mean	Median	75th Percentile	25th Percentile	Mean	Median	75th Percentile	25th Percentile	Mean	Median	75th Percentile
PE (96)	0.210	0.365	0.324	0.466	0.198	0.343	0.306	0.440	0.223	0.389	0.342	0.491
PE (97)	0.187	0.342	0.295	0.434	0.176	0.323	0.280	0.413	0.201	0.361	0.312	0.460
PE (98)	0.207	0.358	0.310	0.449	0.199	0.341	0.304	0.431	0.217	0.376	0.321	0.470
PE (96-98)[a]	0.201	0.355	0.310	0.452	0.190	0.336	0.296	0.429	0.213	0.375	0.325	0.477
TE (96)	0.296	0.478	0.423	0.608	0.289	0.465	0.415	0.582	0.302	0.492	0.436	0.636
TE (97)	0.265	0.451	0.391	0.567	0.261	0.443	0.386	0.555	0.268	0.458	0.395	0.580
TE (98)	0.277	0.471	0.411	0.612	0.274	0.458	0.399	0.583	0.281	0.485	0.420	0.648
TE (96-98)[a]	0.279	0.467	0.409	0.597	0.275	0.455	0.402	0.575	0.282	0.478	0.417	0.622
SE (96)	0.652	0.783	0.885	0.977	0.595	0.757	0.847	0.970	0.713	0.811	0.910	0.982
SE (97)	0.646	0.776	0.864	0.969	0.590	0.748	0.838	0.960	0.703	0.804	0.880	0.976
SE (98)	0.686	0.786	0.860	0.960	0.659	0.775	0.855	0.958	0.700	0.797	0.867	0.962
SE (96-98)[a]	0.661	0.782	0.868	0.969	0.614	0.760	0.847	0.962	0.702	0.804	0.887	0.974
K/L (96)	29.969	133.143	60.571	125.125	28.432	96.154	55.794	104.780	32.421	171.574	72.372	152.764
K/L (97)	31.506	147.000	65.160	131.542	29.409	105.700	58.038	110.825	34.741	189.911	73.573	162.807
K/L (98)	31.072	171.509	65.760	135.672	29.311	116.045	58.497	115.717	33.250	229.136	76.195	163.785
K/L (96-98)[a]	30.755	150.550	63.849	130.644	29.000	105.966	57.450	110.567	33.259	196.874	74.000	159.206

[a] Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

Regardless of the efficiency measure or time period, family firms consistently exhibit lower relative PE scores. These differences are most noticeable in the SE measure and less so in the TE measure. We can also see that family firms as a group consistently exhibit lower average K/L ratios in their production across all time periods. An interesting observation seen in Table 20 is the result that family firms consistently exhibit *lower* TE levels than non-family firms. Although the TE differences are noticeably smaller relative to the PE and SE differences, lower TE values for family firms is contrary to our expectations stated in Chapter 2. As with our previous results, Table 20 is only suggestive since average efficiencies are expected to be sensitive to the industry in which the firm is operating[70]. Using the entire BLS sample across three years, we investigate this further by comparing the average PE, TE, and SE, by industry for both family and non-family firms. The results, presented in order of the largest negative FOE first, can be seen in Figures 7, 8, and 9.

Figure 13 demonstrates that in 25 of 32 industries family firms on average exhibit lower PE than their non-family industry peers. As far as TE is concerned, the results displayed in Figure 14 are similar, with family firms on average exhibiting lower mean values in 24 out of 32 industries. Finally, in terms of SE, Figure 15 illustrates that in 26 of 32 industries, average family firm SE is lower than the average non-family firm score. There does not seem to be any discernible pattern as far as industry differentials are concerned, although we do see some repetition across these figures in the top and bottom industries. We explore this further later in this section, but first we note that the inter-industry differences in the average efficiency across family and non-family firms vary widely and are not necessarily statistically significant in all industries.

[70] For example, in the previous chapter we showed that the occurrence of family ownership is not distributed equally across all industries. As a result, if family ownership is observed to occur more often in industries where say the average efficiency scores are generally lower for *all* firms (i.e. due to the nature of the industry, both family and non-family firms are on average situated at a greater distance from the efficient frontier relative to other industries), then any average differences observed in Table 20 may be a result of an industry effect rather than any ownership effect per se.

Figure 13: Average family and non-family productive efficiency by industry (1996-1998)

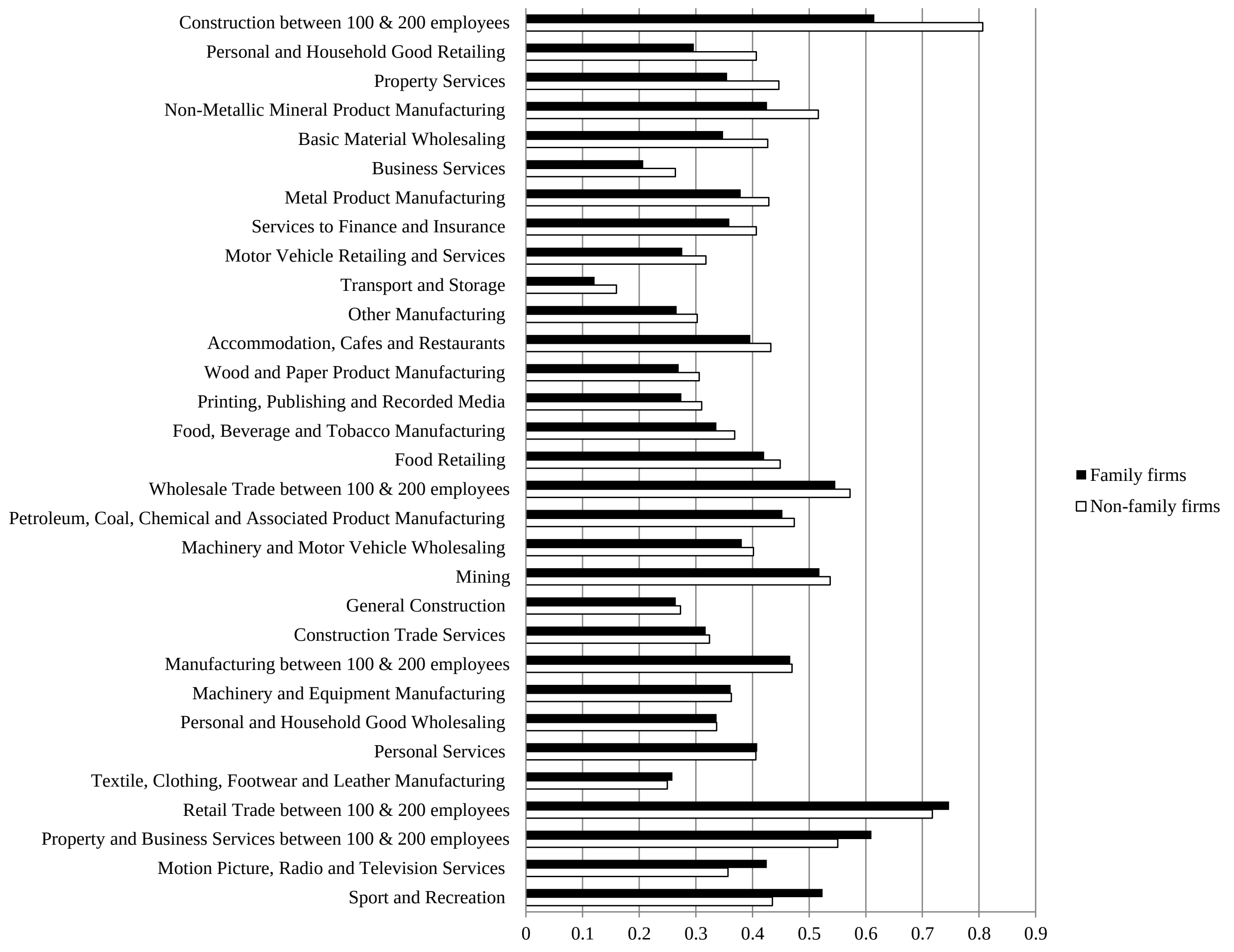


Figure 14: Average family and non-family technical efficiency by industry (1996-1998)

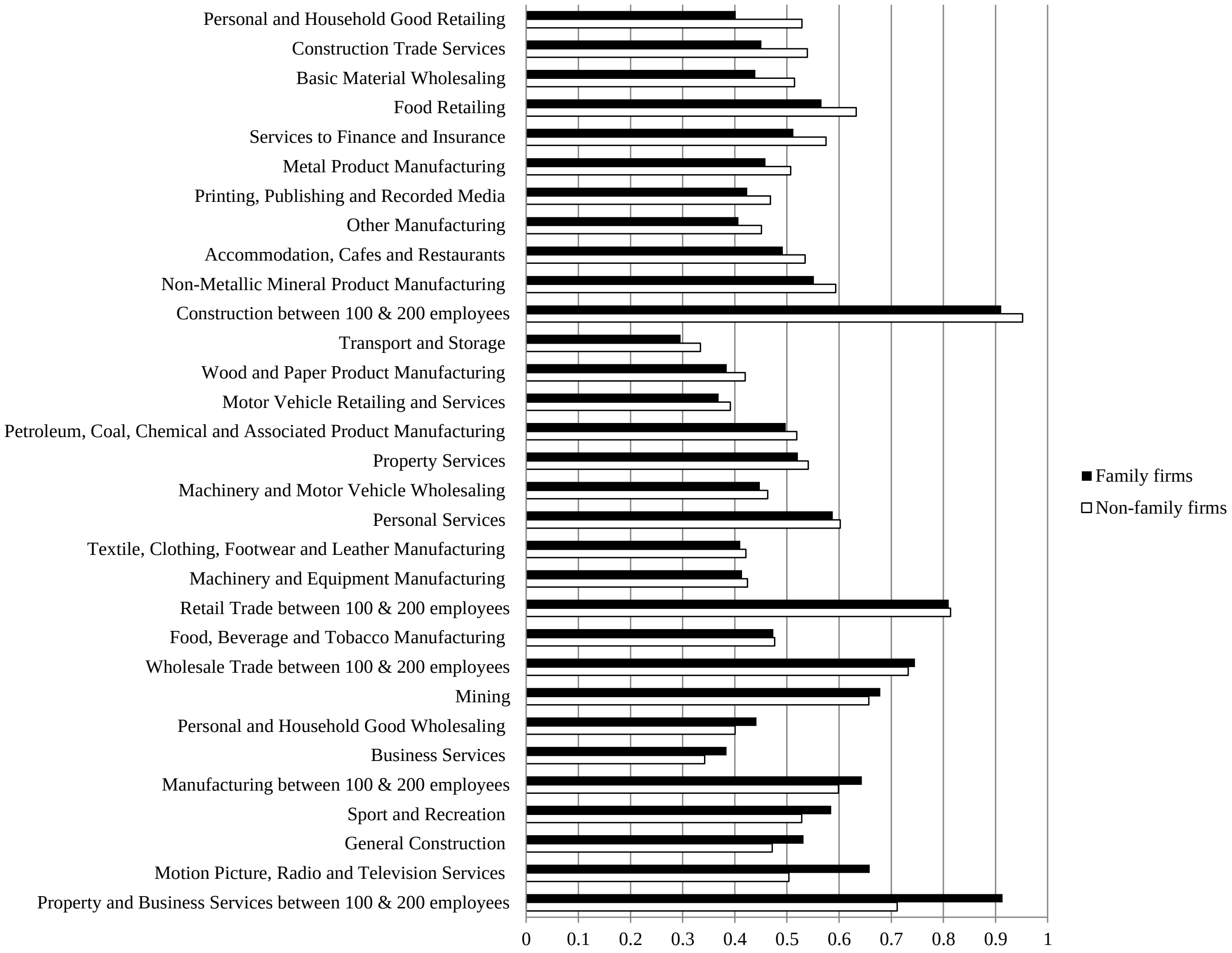
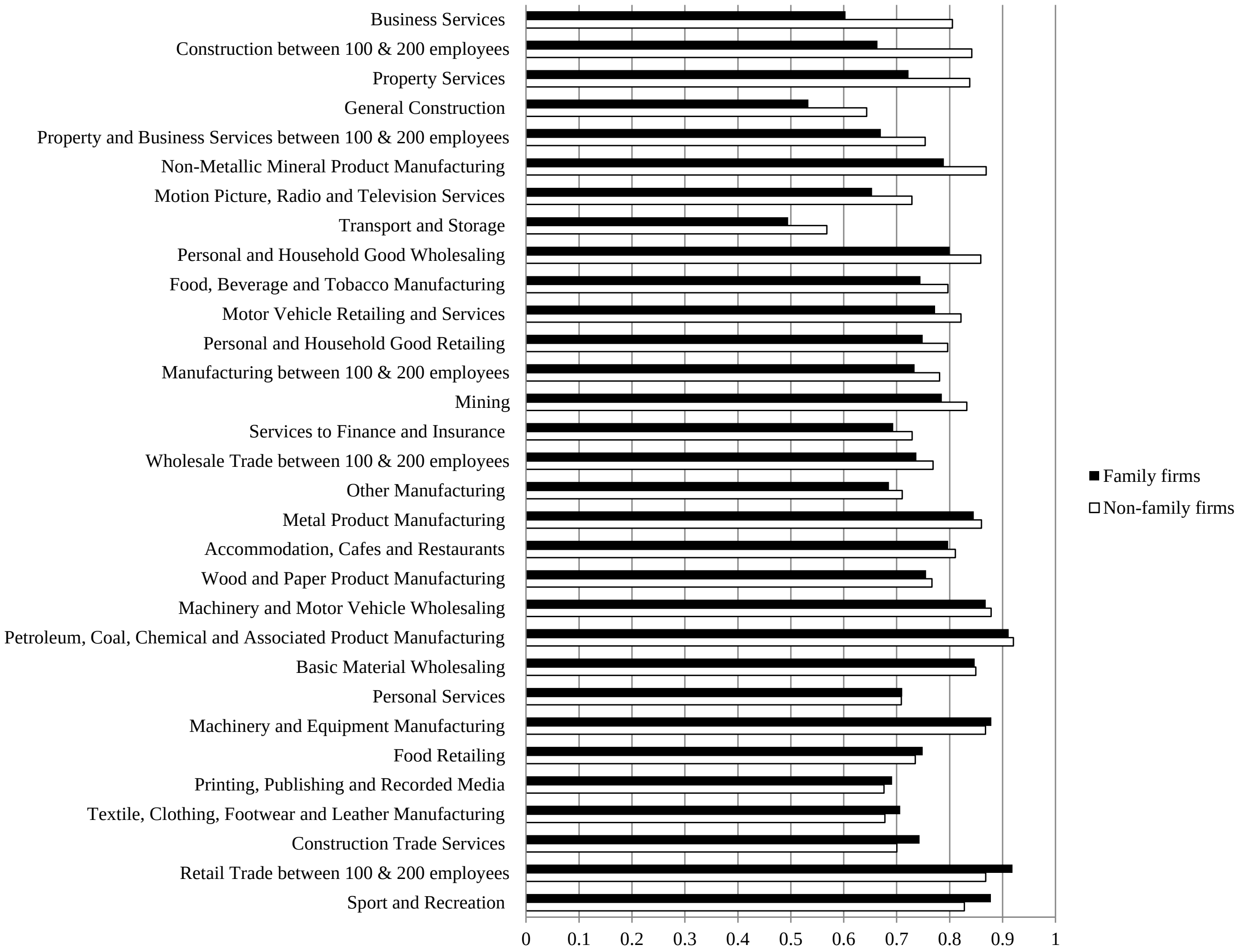


Figure 15: Average family and non-family scale efficiency by industry (1996-1998)



To investigate this further, Table 21 and Table 22 quantify the FOE with respect to efficiency and report its significance by industry and age respectively.

Table 21 reports that in 10 of 32 industries there is a significant difference between family and non-family PE. When significant the FOE is always negative. When considering firm age, the FOE with respect to PE is negative and significant in all but the youngest of firms. When we decompose the PE FOE into TE and SE, in 13 of 32 industries, there is a significant TE FOE, yet the effect itself is negative in 7 industries and *positive* in 5. Table 22 also shows that in the older age brackets, family firms are found to exhibit a significantly lower TE score, however in all other brackets, there is no significant difference between family and non-family firms. Contrary to our expectations, these mixed results show that family firms can on average be more or less, but are mostly equally, efficient in terms of pure resource use relative to non-family firms.

Moving on to SE, the FOE is consistently negative and found to be statistically significant in 9 of 32 industries. It is also important to note here that we do not find any industry where there is a positive and significant FOE with respect to SE, i.e. when significant, family firms are always found to be less scale efficient. There are also negative effects across firms of all ages which supports the notion that family firms face size constraints, i.e. if size was not constrained, these firms would adjust their size to receive the efficiency benefit. Reinforcing this notion, family firms may be forced to replace scarce capital with labour, as we also observe that family firm production is on average less capital intensive. For example, the capital to labour ratio, K/L, is significantly lower for family firms in 22 of 32 industries and in all age brackets.

Table 21 also reports what we will refer to as the ‘family participation rate’, which is the ratio of the number of family firms over the total number of all firms operating in any given industry. Not including those industries where family participation is either 0 or 100 percent, we can see that family firms represent very large proportions, i.e. 60

Table 21: Family ownership effect on efficiency by industry[a] (1996-1998)

	ANZSIC & Industry Category	N	Family	Non-Family	Family Participation	PE FOE	TE FOE	SE FOE	K/L FOE
100	**Mining**	**79**	**19**	**60**	**24.05%**	**-0.019**	**0.022**	**-0.047**	**-2039.05*** **
	Manufacturing								
200	between 100 & 200 employees	279	79	200	28.32%	-0.003	0.045*	-0.047	-71.26***
221	Food, Beverage and Tobacco Manufacturing	410	213	197	51.95%	-0.032*	-0.002	-0.052**	-76.31***
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	57.80%	0.009	-0.011	0.029	-58.73***
223	Wood and Paper Product Manufacturing	203	125	78	61.58%	-0.036	-0.036	-0.011	1.54
224	Printing, Publishing and Recorded Media	302	183	119	60.60%	-0.036	-0.045	0.016	-32.33*
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	43.06%	-0.021	-0.021	-0.009	-94.61***
226	Non-Metallic Mineral Product Manufacturing	177	115	62	64.97%	-0.091**	-0.042	-0.080***	-30.64**
227	Metal Product Manufacturing	559	315	244	56.35%	-0.049***	-0.048***	-0.015	-29.77***
228	Machinery and Equipment Manufacturing	1040	532	508	51.15%	-0.001	-0.010	0.011	-35.65***
229	Other Manufacturing	388	240	148	61.86%	-0.036*	-0.044	-0.025	-55.43**
	Construction								
300	between 100 & 200 employees	21	14	7	66.67%	-0.191	-0.041	-0.178	149.88**
341	General Construction	194	130	64	67.01%	-0.008	0.060	-0.11**	-104.23
342	Construction Trade Services	375	272	103	72.53%	-0.007	-0.088***	0.043	31.32***
	Wholesale Trade								
400	between 100 & 200 employees	95	34	61	35.79%	-0.026	0.013	-0.032	-147.84***
445	Basic Material Wholesaling	393	224	169	57.00%	-0.079***	-0.075***	-0.002	-122.32***
446	Machinery and Motor Vehicle Wholesaling	684	310	374	45.32%	-0.020	-0.015	-0.01	-129.19***
447	Personal and Household Good Wholesaling	543	319	224	58.75%	0.000	0.041**	-0.059***	-40.83***
	Retail Trade								
500	between 100 & 200 employees	63	29	34	46.03%	0.030	-0.003	0.05	-56.48*
551	Food Retailing	236	169	67	71.61%	-0.029	-0.067*	0.014	11.15
552	Personal and Household Good Retailing	374	214	160	57.22%	-0.110***	-0.127***	-0.047**	-80.22
553	Motor Vehicle Retailing and Services	405	235	170	58.02%	-0.042*	-0.022	-0.049**	-25.73**

	Accommodation, Cafes and Restaurants								
600	between 100 & 200 employees	10	5	5	50.00%	-0.055	n/a	-0.055	-10.18***
657	Accommodation, Cafes and Restaurants	360	172	188	47.78%	-0.036	-0.043*	-0.013	-54.25***
700	**Transport and Storage**	**376**	**212**	**164**	**56.38%**	**-0.039****	**-0.038**	**-0.073****	**-117.81****
	Finance and Insurance								
800	between 100 & 200 employees	4	0	4	0.00%	n/a	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	47.71%	-0.048	-0.063*	-0.036	-250.27*
	Property and Business Services								
900	between 100 & 200 employees	68	10	58	14.71%	0.059	0.202***	-0.084	1702.55
977	Property Services	317	150	167	47.32%	-0.091***	-0.020	-0.116***	-166.94
978	Business Services	958	287	671	29.96%	-0.057***	0.042***	-0.202***	-5.13
	Cultural and Recreational Services								
1000	between 100 & 200 employees	14	0	14	0.00%	n/a	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	21.82%	0.069	0.155***	-0.075	-429.94**
1092	Libraries, Museums and the Arts	9	0	9	0.00%	n/a	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	45.28%	0.089	0.057	0.050	-26.80
	Personal and Other Services								
1100	between 100 & 200 employees	3	3	0	100.00%	n/a	n/a	n/a	n/a
1195	Personal Services	205	108	97	52.68%	0.003	-0.014	0.002	8.29

[a] Efficiency FOEs by industry have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various efficiency measures compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 22: Family ownership effect on efficiency by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	% of family firms	PE FOE	TE FOE	SE FOE	K/L FOE
Less than 2 years (1)	126	38	88	30.16%	-0.047	-0.018	-0.120**	-53.148**
2 to less than 5 years (2)	1111	495	616	44.55%	-0.035**	0.025	-0.096***	-98.715***
5 to less than 10 years (3)	2867	1339	1528	46.70%	-0.041***	-0.011	-0.062***	-94.076***
10 to less than 20 years (4)	3428	1755	1673	51.20%	-0.041***	-0.020**	-0.048***	-135.571***
20 years or more (5)	2818	1647	1171	58.45%	-0.034***	-0.041***	-0.013*	-47.720***

Efficiency FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various efficiency measures compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table 23: Pearson's correlations between family industry participation rate and efficiency FOE (1996-1998)

	Family Participation	PE FOE	TE FOE	SE FOE	K/L FOE
Family Participation	1 -				
PE FOE	-0.441 (-2.691)**	1 -			
TE FOE	-0.718 (-5.648)***	0.636 (4.515)***	1 -		
SE FOE	0.214 (1.198)	0.483 (3.02)***	-0.283 (-1.616)	1 -	
K/L FOE	0.041 (0.226)	0.103 (0.568)	0.254 (1.436)	-0.069 (-0.377)	1 -

T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

precent or higher, in sectors such as Manufacturing, Construction, and Retail Trade. Lowering this threshold, we find that in more than half, or in 18 of 32 industries, the family firm participation rate is greater than 50 percent.

These proportions allow us to investigate whether family firms systematically cluster in industries where the potential efficiency consequences of family ownership are minimised, or put in other terms, family firms may gravitate to those industries where they are least inefficient. To provide some insight into this question, Table 23 reports the Pearson's correlations between the family participation rate and various efficiency differentials.

The correlations and corresponding significance tests in Table 23 show that there is in fact a significant negative correlation between the rate of family participation in a given industry and an efficiency FOE. Specifically, family owned firms tend to cluster in those industries where the PE FOE is lowest. When we decompose this into TE and SE, we find that this result is driven by a strong negative correlation between family firm participation and the TE FOE. This is a strong value at -0.718 and significant at the one percent level and supports the notion that family firms attempt to overcome their apparent scale disadvantages by actively pursuing improvements in TE. To accomplish this, they may gravitate to, or simply tend to survive in, those industries where the negative TE differentials are smallest.

When looking at the general relationships between our calculated efficiency scores, capital intensity, firm size and internal financing, Table 24 also demonstrates correlations in accordance with our discussion in Chapter 2. Specifically, there are clear interrelationships between a greater proportion of internal finance, a smaller firm, and lower capital intensity and efficiency.

Table 24: Pearson's correlations between efficiency, internal finance and firm size (1996-1998)

	PE	TE	SE	Share of internal finance[a]	Capital	Labour	Output	Capital intensity
PE	1.00 -							
TE	0.77*** (123.37)	1.00 -						
SE	0.43*** (48.36)	-0.16*** (-16.92)	1.00 -					
Share of internal finance[a]	-0.11*** (-11.13)	-0.06*** (-6.15)	-0.08*** (-8.41)	1.00 -				
Capital	0.10*** (10.52)	0.10*** (10.60)	0.02 (1.53)	-0.14*** (-14.11)	1.00 -			
Labour	0.15*** (15.41)	0.11*** (11.07)	0.10*** (10.68)	-0.27*** (-29.08)	0.30*** (32.42)	1.00 -		
Output	0.25*** (26.75)	0.24*** (25.30)	0.06*** (6.15)	-0.25*** (-26.66)	0.70*** (99.00)	0.57*** (70.17)	1.00 -	
Capital intensity	0.11*** (10.87)	0.09*** (9.55)	0.02* (1.85)	-0.11*** (-11.77)	0.54*** (65.89)	0.06*** (5.83)	0.43*** (48.02)	1.00 -

[a] Share of internal finance is found as the sum of the proportion of internal debt, internal equity, and working owner's equity. The sign and direction of these correlations do not change when we consider these variables separately. T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

For example, no matter the measure, a larger firm is significantly correlated with greater efficiency scores. We further observe that efficiency and capital intensity are also positively correlated, and as expected, a greater capital to labour ratio is also related to a larger firm. Finally, the share of internal finance is negatively correlated with both capital intensity and PE. Also, the correlation between internal finance and efficiency is stronger with respect to SE relative to that of TE.

These interrelations will need to be considered when designing our hypotheses tests in the next chapter, but first we further investigate how family ownership affects capital intensity while considering the above mentioned relationship between efficiency and capital intensity.

4.5.1 Capital intensity

The data presented thus far have also demonstrated that on average family firms exhibit significantly lower K/L ratios across time (Table 20), industry (Table 21) and firm age (Table 22). Although these results are consistent with a capital constraint specific to family firms, we recognise that any comparison of K/L ratios may be confounded by efficiency itself. For example, as seen in Table 24, family firms may exhibit a lower capital intensive means of production as a direct result of poor resource allocation rather than a size constraint; thus as a final comparison of capital intensity, Table 25

Table 25: Average family and non-family relative K/L by efficiency band (1996-1998)

Efficiency Band (PE)	0.9 to 1	0.8 to < 0.9	0.7 to < 0.8	0.6 to < 0.7	0.5 to < 0.6	0.4 to < 0.5	0.3 to < 0.4	0.2 to < 0.3	0.1 to < 0.2	< 0.1
1996										
All firms	161	41	96	150	280	497	684	752	548	241
Family firms	63	13	42	68	133	246	339	408	294	152
Non-family firms	98	28	54	82	147	251	345	344	254	89
All firms average rel K/L	2.125	1.122	1.270	0.797	0.738	0.719	0.746	0.746	0.868	0.767
Family average rel K/L	1.182	0.664	1.354	0.449	0.554	0.618	0.632	0.693	0.780	0.677
Non-family average rel K/L	2.731	1.335	1.204	1.085	0.905	0.817	0.858	0.808	0.969	0.921
FOE	-1.548**	-0.670	0.150	-0.636***	-0.351***	-0.199**	-0.226***	-0.116*	-0.188*	-0.244
1997										
All firms	145	42	90	118	218	420	658	780	707	272
Family firms	62	19	39	56	97	188	344	395	390	168
Non-family firms	83	23	51	62	121	232	314	385	317	104
All firms average rel K/L	2.202	1.224	0.915	0.895	0.935	0.716	0.725	0.822	0.808	0.879
Family average rel K/L	1.592	0.889	0.690	0.589	0.668	0.542	0.597	0.751	0.783	0.775
Non-family average rel K/L	2.658	1.501	1.086	1.171	1.149	0.857	0.867	0.894	0.837	1.045
FOE	-1.066	-0.612	-0.397	-0.582	-0.481**	-0.315***	-0.270***	-0.142	-0.054	-0.270
1998										
All firms	146	65	80	136	228	460	696	839	627	173
Family firms	58	18	35	72	108	232	366	427	346	96
Non-family firms	88	47	45	64	120	228	330	412	281	77
All firms average rel K/L	3.279	1.185	1.052	0.945	0.605	0.685	0.681	0.875	0.866	1.224
Family average rel K/L	1.895	0.810	0.807	0.755	0.575	0.550	0.585	0.766	0.767	1.016
Non-family average rel K/L	4.192	1.328	1.243	1.159	0.631	0.822	0.788	0.988	0.988	1.483
FOE	-2.297*	-0.518	-0.436	-0.404	-0.055	-0.273***	-0.203***	-0.222**	-0.221*	-0.467

The 'relative' K/L measure for firm i operating in industry j is calculated as $\frac{K_i}{L_i} / \frac{\sum_i K_{ij}}{\sum_i L_{ij}}$.

presents the difference between the average family and non-family 'relative K/L'[71] by efficiency band across all observed periods in our sample.

As seen in Table 25 regardless of efficiency band or time period being examined, family firms are on average found to exhibit a lower relative K/L than their non-family counterparts. This negative FOE is generally found to be statistically significant half of the time and largest for those firms near or directly on the efficient frontier. This further reinforces our previous findings and supports the notion that the lower capital intensity of family firm production may be a result of constrained capital, and not simply poor resource allocation.

4.5.2 Returns to scale

Another important factor yet to be considered in our comparisons of scale efficiency across family and non-family firms is scale returns. As outlined in Section 4.3.1, the assumption of variable returns to scale when estimating the efficient frontier implies that firms may exhibit either increasing, constant, or decreasing returns to scale. This will greatly impact the interpretation of our calculated SE scores.

An SE score of less than 1 implies that the firm is not exhibiting CRS and thus is inefficient in terms of scale; however, this inefficiency may be due to either the

---

[71] Since capital intensities vary widely across industry, we compare a relative K/L measure across ownership, which is found by the ratio of the observed firm's capital intensity over the industry total capital to labour ratio in which the observed firm is operating. The industry total K/L for industry j is found by $\frac{\sum_i K_{ij}}{\sum_i L_{ij}}$ and the relative K/L measure for firm i operating in industry j is calculated as $\frac{K_i}{L_i}\Big/\frac{\sum_i K_{ij}}{\sum_i L_{ij}}$. This treatment ensures that our comparisons of capital intensity across efficiency are not biased by any industry effects. By this measure, a relative K/L greater than (or less than) 1 indicates that firm i's production means are more (or less) capital intensive than the industry in which it operates. A relative K/L equating to 1 indicates that firm i's production is as capital intensive as its respective industry. It is important to note that an alternate measure of a relative K/L, using the *average* industry capital intensity as the denominator was also compared across ownership and did not significantly change the results presented in Table 25. In other words the relative K/L was also calculated as $\frac{K_i}{L_i}\Big/\left[\frac{\sum_i\left(\frac{K_i}{L_i}\right)_j}{n_j}\right]$, where n denotes the number of firms operating in industry j.

exhibition of IRS or DRS, i.e. scale inefficient firms should be optimally larger or smaller. As, the SE score defined in this Chapter itself does not discriminate between IRS or DRS firms, it would be inappropriate to simply compare the raw SE scores across family and non-family firms without considering returns to scale. For an explanation, see Appendix A.3.

This is especially important in the context of the arguments presented in this thesis, as we would expect sub-optimally scaled family firms to belong mostly to the IRS category, i.e. they are sub-optimally small. In fact, given our argument of a constrained firm size due to financing preferences, we further expect that any family firms in the DRS category, i.e. they are sub-optimally large, would exhibit *greater* scale efficiencies relative to their non-family DRS counterparts. In other words family firms in the DRS category are expected to be not as large as their sub-optimally large non-family counterparts.

To explore these expectations, Table 26 categorizes our sample into three sub-groups based on returns to scale and compares incidence of family owned firms, average SE, and average age across time. The statistical significance of the FOE is also reported. As no differences in scale efficiency will be found in the CRS sub-group by construction of the SE score, we focus our attention on the IRS and DRS sub-groups. Starting with firms exhibiting IRS, we find that, in every period, family firms are significantly greater in number and score lower in average SE. That is, of all sub-optimally small firms, family firms represent a greater proportion and tend to be even smaller.

With respect to firms exhibiting DRS, Table 26 shows that family firms are significantly lower in number and score higher in average SE. That is, of all sub-optimally large firms, family firms represent a lower proportion and again tend to be smaller. Table 26 demonstrates that, like their non-family counterparts, family firms can be sub-optimally small or large, however, the tendencies mentioned above support the

Table 26: Average annual family and non-family descriptive statistics by returns to scale

	1996				1997				1998			
Returns to scale (RTS)	Count	Sub-group proportion	Avg sub-group SE	Avg age[b]	Count	Sub-group proportion	Avg sub-group SE	Avg age[b]	Count	Sub-group proportion	Avg sub-group SE	Avg age[b]
All firms in IRS sub-group	2121	1.00	0.719	3.79	2123	1.00	0.738	3.88	1958	1.00	0.758	4.01
Family firms	1135	0.54	0.684	4.01	1134	0.53	0.703	4.10	1062	0.54	0.735	4.18
Non-family firms	986	0.46	0.760	3.60	989	0.47	0.777	3.68	896	0.46	0.784	3.86
FOE[a]	149	0.07***	-0.076***	0.41***	145	0.07***	-0.074***	0.42***	166	0.08***	-0.048***	0.31***
All firms in CRS sub-group	245	1.00	1.000	3.53	201	1.00	1.000	3.77	206	1.00	1.000	3.72
Family firms	116	0.47	1.000	3.74	88	0.44	1.000	3.85	97	0.47	1.000	3.79
Non-family firms	129	0.53	1.000	3.35	113	0.56	1.000	3.70	109	0.53	1.000	3.65
FOE[a]	-13	-0.05	-	0.39***	-25	-0.12*	-	0.15	-12	-0.06	-	0.14
All firms in DRS sub-group	1084	1.00	0.859	3.48	1126	1.00	0.807	3.70	1286	1.00	0.795	3.82
Family firms	507	0.47	0.864	3.54	536	0.48	0.802	3.77	599	0.47	0.810	3.89
Non-family firms	577	0.53	0.855	3.41	590	0.52	0.812	3.62	687	0.53	0.783	3.75
FOE[a]	-70	-0.06**	0.009*	0.13***	-54	-0.05	-0.010	0.15***	-88	-0.07**	0.027***	0.14***

[a] FOE is found by x_{ff}-x_{nf}, where x are listed variables and ff and nf denote family and non-family firms respectively.
[b] Age ranges are as follows: (1) Less than 2 years, (2) 2 to less than 5 years, (3) 5 to less than 10 years, (4) 10 to less than 20 years, (5) 20 years or more.

Table 27: Average family and non-family finance composition by source and returns to scale (1996-1998)

Returns to scale (RTS)	Count	Sub-group proportion	Average SE within sub-group	Average age range within sub-group[b]	Average % of internal debt	Average % of external debt	Average % of equity from working owners	Average % of internal equity	Average % of external equity
All firms in IRS sub-group	6201	1.00	0.738	3.66	0.135	0.025	0.699	0.056	0.039
Family firms	3331	0.54	0.707	3.73	0.165	0.022	0.789	0.068	0.019
Non-family firms	2870	0.46	0.773	3.59	0.100	0.029	0.595	0.042	0.062
FOE[a]	461	0.07***	-0.07***	0.14***	0.064***	-0.007*	0.193***	0.026***	-0.043***
All firms in CRS sub-group	653	1.00	1.000	3.66	0.079	0.021	0.569	0.064	0.053
Family firms	301	0.46	1.000	3.79	0.112	0.030	0.753	0.088	0.029
Non-family firms	352	0.54	1.000	3.56	0.051	0.013	0.412	0.043	0.073
FOE[a]	-51	-0.08**	-	0.23***	0.061***	0.017	0.341***	0.045**	-0.044***
All firms in DRS sub-group	3495	1.00	0.819	3.90	0.088	0.020	0.594	0.063	0.061
Family firms	1642	0.47	0.824	4.10	0.121	0.021	0.743	0.096	0.030
Non-family firms	1853	0.53	0.814	3.72	0.059	0.020	0.463	0.034	0.090
FOE[a]	-211	-0.06***	0.01*	0.38***	0.062***	0.000	0.279***	0.062***	-0.060***

[a] FOE is found by x_{ff}-x_{nf}, where x are listed variables and ff and nf denote family and non-family firms respectively.
[b] Age ranges are as follows: (1) Less than 2 years, (2) 2 to less than 5 years, (3) 5 to less than 10 years, (4) 10 to less than 20 years, (5) 20 years or more.

notion that family firm size is constrained. With respect to scale efficiency, such a constraint can potentially be harmful for IRS firms, but also beneficial for DRS firms. With this in mind, and as a final examination, we present Table 27 which depicts the same information as Table 26, but aggregates the time periods and includes the FOE in both internal and external financing composition across return to scale sub-groups.

Consistent with Table 26, Table 27 shows that family firms represent a significantly larger proportion of IRS firms and a lower proportion of DRS firms. Further, family firms exhibit a significantly lower SE in the IRS category and higher SE in the DRS category. Looking to debt and equity proportions, internally sourced debt and equity is significantly higher for family firms across all scale return categories. Consistent with our previous findings, there is no difference between family and non-family firms with respect to externally sourced debt except in the IRS category, where the FOE is significantly negative. Further, the FOE associated with externally sourced equity is negative and significant across nearly all scale returns sub-groups.

4.6 Summary of preliminary findings

Based on the preliminary results presented in the previous sections, we have supported the notion that the smaller scale exhibited by family firms (shown in Chapter 3) is due to limitations on their size. For example, family firms are found to be significantly less scale efficient than non-family firms, i.e. if optimally scaled they would reap efficiency benefits.

This finding reinforces Hypothesis 8 and remains even after considering returns to scale. For example, by identifying scale inefficient firms as either sub-optimally large or sub-optimally small, we continue to find significant differences across firm ownership. Specifically, of all sub-optimally small firms, family firms represent a greater proportion and tend to exhibit greater scale inefficiencies. Further, of all sub-optimally large firms, family firms represent a lower proportion and tend to exhibit lower scale inefficiencies. Additional to these results, controlling for time period, industry, age, and efficiency itself, family firms are consistently found to be significantly less capital intensive than non-family firms, which aligns with our expectations stated in Hypothesis 9. Lower capital to labour ratios may also indicate that family firm size is constrained.

With respect to TE in resource use, we show that, contrary to Hypothesis 10, family firms can be more, less but are mostly equally as efficient as their non-family counterparts. Although we do not find strong support for the notion that family firms compensate their scale inefficiencies by allocating their resources in a more efficient manner, we do find that family firms tend to cluster in those industries where the TE differential between family and non-family firms is lowest.

We have also shown that the proportion of internal finance, firm size, capital intensity and efficiency are interrelated. For example, a greater proportion of internal finance is negatively correlated with capital, labour, output and capital intensity. As these variables are all positively related to efficiency, a greater proportion of internal finance is also systematically related to lower levels of efficiency, both TE and SE. These correlations are consistent with the argument posed in Chapter 2 and demonstrate the endogenous relationships between the variables of interest in this thesis. Such endogeneity is addressed in the hypotheses tests performed in the next chapter.

4.7 Chapter summary

In this chapter we have explained the well-founded theoretical underpinnings and precise measurement of the efficiency construct which will be used in this thesis to compare family and non-family firm performance. As we have explained in this chapter, to test the efficiency hypotheses proposed in Chapter 2, we require a measure which enables the observation of efficiencies related to a suboptimal scale of production separately from those related to the suboptimal use of resources. We show here that PE is particularly well suited for this purpose since it can be decomposed into TE and SE. This is especially important in the context of family firms given that they have been shown to be smaller across numerous measures of production scale, and thus any superficial comparison of 'efficiency' may be confounded by the effect of firm size.

Taking these complexities into consideration we have calculated PE for each firm in the BLS sample according to the DEA method described here. This efficiency score is further decomposed into efficiency related to the technical use of resources (devoid of any scale effects) and efficiency related to production scale itself. With an attention to whether the firm is family owned, we presented descriptive statistics and performed preliminary data analysis on the efficiency score differentials between family and non-family firms. By controlling for multiple covariates and utilising preliminary statistical tests, we have shown that there are significant differences between family and non-family firms. In conjunction with the previous chapter, these findings reinforce our hypotheses related to family firm efficiency and encourage us to perform more robust econometric analysis.

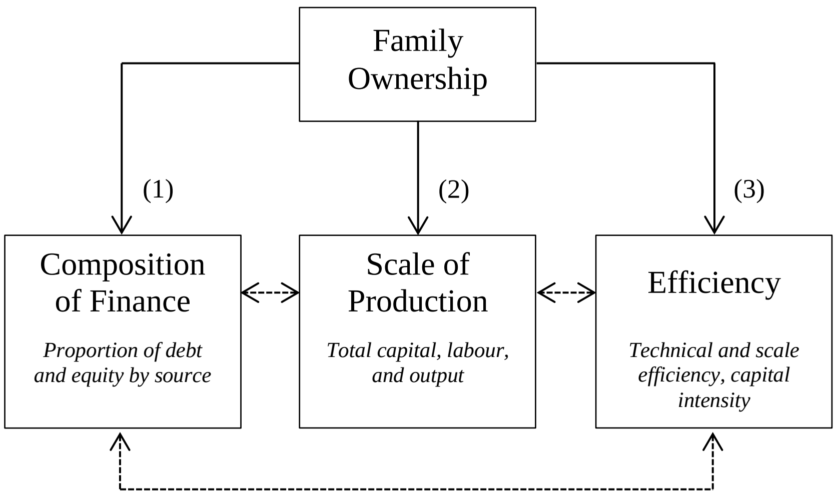
In line with the central arguments presented in Chapter 2, we have also shown that the proportion of internal financing, firm size, capital intensity and efficiency are interrelated. It will be important to consider these reciprocal relationships as a potential source of endogeneity when designing our hypotheses tests. In the next chapter, we outline these methods in detail and report the accompanying results.

Chapter 5. Panel Regression Analysis and Results

5.1 Chapter introduction

In Chapters 3 and 4 we revealed that family firms are comparatively different to non-family firms with respect to the composition of debt and equity finance, firm size and efficiency. This preliminary analysis supported many of our hypotheses and leads us to perform more robust empirical testing. The purpose of this chapter is to describe these tests and report our findings. We do this by specifying and subsequently testing each hypothesis according to the argument developed in Chapter 2 and outlined in Figure 16.

Figure 16: Channels through which family ownership impacts the firm



	Proposed Relationships	*Operationalization*	*Testable Hypotheses*
(1)	Family ownership will affect financing preferences.	Composition of debt and equity financing	Hypotheses 1 to 4
(2)	Family ownership will affect firm size.	Scale of production	Hypotheses 5 to 7
(3)	Family ownership will affect firm performance.	Efficiency	Hypotheses 8 to 10

As per Figure 16, we expect that family ownership will influence three main aspects of the firm 1) the composition of finance, 2) firm size, and 3) efficiency. This influence is again referred to herein as a FOE. With respect to each aspect we present the appropriate regression specification, describe how it relates to our proposed hypotheses, and subsequently present the FOE and other estimated coefficients of interest.

To facilitate this discussion, Section 2 describes various panel regression estimation techniques which we utilise to measure and statistically test for a FOE. These techniques are the fixed effects, random effects, and hybrid models. According to these models, Section 3 specifies very specific hypothesis tests and presents our results with respect to the composition of finance, firm size and efficiency. Section 4 specifies the full model which is designed to simultaneously test our framework while addressing potential endogenous variables, and Section 5 summarises our results.

5.2 Panel Regression Analysis: Testing for a family ownership effect

Given that the BLS data are longitudinal, we utilize both the cross-sectional and time-series dimensions to estimate the magnitude, direction and significance level of the relationships between family ownership, financing composition, firm size, and efficiency. These panel data improve the efficiency of our econometric estimates and enable us to effectively control for any unobserved individual firm and time heterogeneity. Specifically, any 'between-firm effects' are eliminated by specifying a firm-specific intercept parameter in the equation. With these benefits in mind, we test our hypotheses by estimating the following general fixed effects (FE) model

(13) $$y_{it} = \alpha_i + \gamma_t + \beta x'_{it} + e_{it} \qquad i = (1...n);\ t = (1...T).$$

Where y_{it} is a dependent variable associated with firm i in time period t, α_i is an intercept parameter specific to individual firm i and captures the average accumulated effects of all unobserved time invariant, or 'fixed', factors on the dependent variable, x'_{it} is a vector of exogenous time varying control variables pertaining to the i^{th} firm in time t, and β is a corresponding vector of estimated slope parameters which are restricted to remain constant across individuals and time. γ_t is a an intercept parameter specific to time period t and captures any overall year effect. e_{it} is assumed to be an independent and identically normally distributed error term over i and t[72].

Since the parameter α_i in (13) is firm specific, it represents the natural heterogeneity in the population and therefore controls for the impact of potentially omitted variables which are constant over time. If unaccounted for, these unobserved variables can lead to biased coefficient estimates. As our measure of family ownership is time invariant, from equation (13) it is understood that, in addition to other unobserved fixed effects which impact y, α_i will also contain the effect of family ownership. While observing this effect is central to testing our proposed hypotheses in this thesis, as a result of our time invariant measure of family ownership, the FOE is absorbed in α_i and cannot be directly estimated in (13) (Baltagi 2001).

To overcome this issue, we find the effect of family ownership by estimating α_i with an attention to whether the i^{th} firm is classified as a family firm or not. By doing so, we are further able to find the group average fixed effects for family and non-family firms. These averages can then be compared to determine the direction and significance of the FOE on the dependent variable.

Specifically, to find the average FOE on any given dependent variable, we divide the sample population into the total number of family firms, denoted as ff, and the total number of non-family firms, denoted as nf. We further define the *set* of all family and non-family firms as FF and NF respectively. After estimating α_i in (13), we can subsequently define the FOE as

[72] Heteroskedasticity of e_{it}, which is likely to occur in panel data, is accounted for by using a Panel Corrected Standard Error (PCSE) methodology (Beck and Katz 1995) to estimate the standard errors and p-values in (13). To account for potential serial correlation, we also estimate (1) to allow for within cluster correlations by clustering the standard errors by firm (Wooldridge 2002). Finally, we also account for any non-normality issues by bootstrapping the standard errors. In this chapter we present the PCSE and note that no differences within 4 significant digits were observed between the PCSE, clustered, and bootstrapped standard errors.

(14) Family ownership effect = $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$.

Where λ_{ff} and λ_{nf} denote the average individual firm fixed effect for family and non-family firms respectively. By this definition, the presence of a FOE would imply that $\lambda_{ff} \neq \lambda_{nf}$. Further, a positive (or negative) FOE would indicate that $\lambda_{ff} > \lambda_{nf}$ (or $\lambda_{ff} < \lambda_{nf}$). To test the statistical significance of the FOE, we perform an F-test which compares the sum of squared errors from the unrestricted model specified in (13) with that of a restricted model which assumes no difference between the average family and non-family fixed effect. In other words, the restricted model imposes the condition that $\lambda_{ff} - \lambda_{nf} = 0$. As per the standard F-test[73], if we find the sum of squared error for the unrestricted and restricted models to be substantially different from one another, we can reject the null hypothesis of no FOE.

Since all time invariant effects are absorbed into the firm specific intercept, an important issue to consider is that the FOE defined in (14) may be confounded by time invariant industry effects, as we have demonstrated in the Chapter 3 that family ownership is not equally distributed across all industries in our sample. Thus, to effectively control for industry, we also separately measure the FOE in each industry, denoted by j, by calculating

(15) Family ownership effect$_j$ = $\left(\frac{1}{ff_j}\sum_{i \in FF} \alpha_{ij}\right) - \left(\frac{1}{nf_j}\sum_{i \in NF} \alpha_{ij}\right) = \psi_{ff_j} - \psi_{nf_j}$.

Where ψ_{ffj} and ψ_{nfj} denote the average firm fixed effect for family and non-family firms operating in industry j respectively. As with (14), a positive (or negative) intra-industry FOE would indicate that $\psi_{ffj} > \psi_{nfj}$ (or $\psi_{ffj} < \psi_{nfj}$). As with the overall FOE in (14), we use an F-test to find the significance of the j^{th} intra-industry FOE by testing the following restriction that $\psi_{ffj} - \psi_{nfj} = 0$. If the equivalence of the restricted and

[73] The F-statistic is specifically found as $\frac{(SSR_r - SSR_{ur})/q}{SSR_{ur}/(n-k-1)}$. Where SSR is the sum of the squared residual for the restricted (r) and unrestricted (ur) models. q denotes the number on restrictions (in this case q = 1), n is the number of observations, and k the number of parameters.

unrestricted models is rejected, we can ascertain that the FOE in industry j is statistically significant.

5.2.1 Robustness checks

5.2.1.1 Random effects model

By further assuming that individual firm effects, α_i, in (13), are a function of family ownership, FF, and some random disturbance, u_i, the following random effects (RE) specification would allow us to test the FOE directly,

(16) $y_{it} = \alpha + \lambda FF_i + \gamma_t + \beta x'_{it} + (e_{it} + u_i)$ i = (1...n); t = (1...T).

Where y_{it}, x'_{it}, γ_t and e_{it} are as described in (13), except that we are now able to include industry dummies in x'_{it}. α is a *common* intercept which represents the fixed population average with respect to y_{it}. Based on this, time invariant effects on the dependent variable, like family ownership, can be directly estimated in (16). FF is therefore a time invariant, dichotomous dummy variable equating to 1 if the i^{th} firm is a family firm and 0 otherwise. As such, λ measures the FOE as it captures the average difference in y, from the population average, exhibited by family firms[74]. $(e_{it} + u_i)$ is the combined disturbance term which is composed of both u_i, the random unobserved individual effects pertaining to firm i, and e_{it}, the regression random error across time, t, and cross section, i.

The additional assumption found in (16) implies that the underlying sample has been randomly drawn from the population so that the disturbances u_i and e_{it} are uncorrelated. If this assumption holds then we prefer the estimates produced by (16), as these are

---

[74] Provided that λ is statistically significant, the population average for family firms can therefore be found by α + λ, which in turn would designate α as the non-family population average. If λ is statistically insignificant, i.e. there is no family ownership effect, then both family and non-family firms share the population average α.

unbiased *and* efficient. However, if the assumption is violated, as is commonly the case with panel data, the estimates derived form (16) may be biased (Greene 2012).

In this thesis we employ the test posed by Hausman and Taylor (1981) to determine the equivalence of the RE and FE estimates. If equivalent, we prefer the more efficient RE estimates in (16). On the other hand, if the test rejects equivalence, then we prefer the unbiased FE estimates in (13)[75].

5.2.1.2 Hybrid model

Based on the seminal work of Mundlak (1978), an alternate approach to estimating the family ownership effect, which combines the qualities of both the fixed and random effect methods, is what Allison (2009) refers to as the 'hybrid model'. This method produces coefficient estimates that are identical to those estimated in (13), but allows for the direct estimation of the FOE, as in (16).

In essence, using a random effects estimator, the hybrid model includes variables measuring both the firm specific means and deviations from those means for all time-varying variables. As a result, 'between-firm effects' are represented by the coefficients pertaining to firm specific means across time, $\bar{x}'_i$, while 'within-firm effects' are represented by the coefficients pertaining to the deviations from these means, $(x'_{it} - \bar{x}'_i)$. Specifically, we estimate

(17) $$y_{it} = \alpha + \lambda FF_i + \gamma_t + \beta(x'_{it} - \bar{x}'_i) + \delta\bar{x}'_i + (e_{it} + u_i) \qquad i = (1...n);\ t = (1...T).$$

Where x'_{it}, as defined in (13), is a vector of time varying control variables relating to firm i in time period t, and $\bar{x}'_i$ is a vector of the average value of these variables across time. As the β estimates in (17) capture the relationship between y_{it} and the 'group

[75] The Hausman χ^2 test statistic along with the relevant probability values are presented in Tables 28 to 30. It is worth noting here that the test is rejected in all estimations except for those associated with external debt and external equity. With that said there are little to no differences in the FE and RE estimates presented in Section 3.

mean centered’ x'_{it} variables, they are equivalent to those derived from the FE model in (13) (see for example Frondel and Vance 2010; Greene 2012 pg. 421). As in (4), to directly estimate the FOE, measured by λ, we impose the additional common intercept, α, and time invariant error, u_i, on (17), however, we can now observe the variable specific fixed effects directly in the model by also including the average individual time invariant effects; these are captured by a vector of coefficients denoted as δ.

In the next section we estimate the fixed, random, and hybrid models described here. Depending on the Hausman diagnostics reported in Tables 1 to 3, we then report our findings pertaining to the FOE as well as the interrelations relating to the composition of debt and equity, firm size, and efficiency.

5.2.2 Addressing endogeneity

For each fixed specification related to financing composition, firm size and efficiency, we use the standard Hausman (1978) test to identify endogenous explanatory variables in (13). These somewhat truncated tests are outlined in Appendix A.5. If we find no endogenous explanatory variables, we consider the results presented in the next Section to be unbiased and consistent. On the other hand, if we find evidence endogenous explanatory variables, we utilise the two-stage least squares technique when estimating (13) to deal with the endogeneity problem[76].

Further modelling of potentially endogenous relationships is performed in Section 5.4, where we specify and estimate the reduced-form of a system of equations which allows for the contemporaneous interrelation between internal finance proportions, firm size and efficiency.

---

[76] We address endogeneity in equation (1) by following the instrumental variable procedure for panel data developed by Griliches and Hausman (1986). They state that the biases introduced by errors in variables may become magnified by conventional within estimators, and they argue that one advantage of panel data is that lagged values of independent variables provide obvious choices for instruments.

5.3 Hypotheses testing

5.3.1 The composition of debt and equity

As a starting point, we conduct panel regression analysis to test hypotheses 1 through 4, which relate to the differences between the composition of finance held by family and non-family firms. These were developed in Chapter 2 and are as follows:

Hypothesis 1a:	*Bank debt, as a proportion of total debt, is greater for family firms relative to non-family firms.*
Hypothesis 1b:	*Trade credit, as a proportion of total debt, is lower for family firms relative to non-family firms.*
Hypothesis 2a:	*Loans from internal sources, as a proportion of total debt, are greater for family firms relative to non-family firms.*
Hypothesis 2b:	*Loans from external sources, as a proportion of total debt, are lower for family firms relative to non-family firms.*
Hypothesis 3:	*Equity from working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.*
Hypothesis 4a:	*Equity from internal sources other than working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.*
Hypothesis 4b:	*Equity from external sources, as a proportion of total equity, is lower for family firms relative to non-family firms.*

In the Chapter 3 we revealed that, on average and relative to their non-family counterparts, family firms hold a greater proportion of bank and internal debt as well as working owner and internal equity. Also, we revealed that the proportion of trade credit and external equity are lower in family firms. However, to test the above hypotheses we estimate equation (18) which describes the proportion of finance as a function of firm specific fixed effects, including family ownership, and other covariates

$$(18)\quad \mathrm{Composition}_{jit} = \alpha_{ji} + \beta_{1j}\mathrm{PE}_{it} + \beta_{2j}\mathrm{Size}_{it} + \beta_{3j}\mathrm{Age}_{it} + \beta_{4j}(\mathrm{K/L})_{it} + \beta_{5j}(\mathrm{TD/TA})_{it} + \gamma_{jt} + e_{jit} \qquad i = 1\ldots3350;\ t = 1\ldots3;\ j = 1\ldots7.$$

Where 'Composition' is a vector of specific debt and equity proportions by source, j, for the i^{th} firm in time period t. As a result, we estimate 7 separate regressions based on finance source. α_{ji} measures the i^{th} firm's fixed effect pertaining to composition j, and contains the FOE. As per our discussion in Chapter 3, in (18) we control for efficiency (measured by productive efficiency) firm size (measured by total assets), age (measured by range[77]), capital intensity (measured by the capital to labour ratio, K/L), and capital structure (measured by the debt ratio, TD/TA). As the benchmark year is 1996, overall time effects for the years 1997 and 1998 are captured in γ_{jt}.

To test hypotheses 1 through 4, we estimate (18) for all debt and equity proportions of interest and extract the FOE as described in Section 5.2. These results are presented in Table 28. Further, we confirm the direction, magnitude, and significance of the FOE by also estimating a random effects and hybrid model as described in Section 5.2.1. These results along with the FOE by industry are reported in Appendix A.4 in Tables A10 to A12. Confirming Hypotheses 1a and 1b, the first and second columns in Table 28 show that, relative to their non-family counterparts, family firms hold 8.9 percent more and 16.8 percent less debt sourced from banks and trade creditors respectively. These values are significant and are stable across alternate estimation techniques (see Appendix A.4, Table A10 and A11). We also see that these findings are consistent across most industries, as Table A11 shows that 71.88 percent of industries exhibit a positive and significant FOE with respect to bank credit proportions, while there is a negative and significant FOE with respect to the proportion of trade credit in 87.5 percent of all industries.

Looking to the other sources of debt finance, column 3 in Table 28 shows that family firms hold 7 percent more debt obtained from internal sources, confirming Hypothesis 2a. This finding is consistent across alternate estimation techniques and found to be significant and positive in nearly 71.88 percent of all industries. However, consistent with the descriptive results in Chapter 3, column 4 outlines that Hypothesis 2b is not supported since there is no significant difference in the average proportion of external

[77] Age ranges are as follows: (1) Less than 2 years, (2) 2 to less than 5 years, (3) 5 to less than 10 years, (4) 10 to less than 20 years, (5) 20 years or more.

debt between family and non-family firms. This is reinforced by our industry analysis, as our industry specific F-tests confirm that there are no significant FOEs with respect to external debt in 56.25 percent of all industries. With that said the estimated coefficient associated with the average FOE shown in column 4 is itself negative, which implies that family firms hold less debt sourced from external debt. It is important to note here that the FE estimates of internal equity are found to be equivalent to those estimated with the RE model. As seen in Table A10, the RE estimates are consistent with the conclusion that there is no FOE with respect to the proportion of external debt.

Moving on to equity proportions, Hypothesis 3 is supported as column 5 shows that family firms hold a significantly greater proportion, 22.3 percent, of equity sourced from working owners than do non-family firms. In fact positive and significant FOEs are found in 84.38 percent of all industries and are robust to multiple methods of estimation. With respect to other sources of equity finance, columns 6 and 7 respectively show that family firms hold 4 percent more internal equity and 3.6 percent less external equity. These differentials are robust, significant and confirm Hypotheses 4a and 4b respectively. In fact our industry analysis shows that in 68.75 percent of all industries there are positive and significant FOEs with respect to internal equity proportions, while in 65.63 percent of all industries, there are negative and significant FOEs with respect to external equity proportions. As seen in the insignificant χ^2 value in Table 28, column 7, we find once more that the FE estimates are equivalent to the RE estimates with respect to external equity. As a result we prefer the RE estimates in Table A10 which also confirm a negative and significant external equity FOE coefficient in the order of 3.8 percent.

Table 28: Debt and equity composition (fixed effect model)

	Share of debt finance				*Share of equity finance*		
	Bank credit	Trade credit	Internal debt	External debt	Working owner's equity	Internal equity	External equity
Constant	0.368***	0.353***	0.175***	0.026*	0.613***	0.083***	0.051***
	(0.035)	(0.040)	(0.024)	(0.014)	(0.039)	(0.021)	(0.016)
Productive efficiency	-0.069***	0.001	0.004	0.005	0.025	-0.011	0.010
	(0.022)	(0.024)	(0.014)	(0.008)	(0.024)	(0.013)	(0.007)
Firm size	-2.68E-07	2.68E-07	-1.04E-07	3.52E-07	2.05E-07	-1.46E-08	4.72E-09
	(3.13E-07)	(3.27E-07)	(9.30E-08)	(2.60E-07)	(7.60E-07)	(1.00E-07)	(1.05E-07)
Firm age	-0.009	0.033***	-0.017***	-0.002	0.013	-0.005	-0.007
	(0.009)	(0.010)	(0.006)	(0.004)	(0.010)	(0.005)	(0.004)
Capital intensity	1.95E-05**	-2.05E-05**	1.37E-06	-1.60E-06	-9.57E-06	4.85E-06	3.84E-06
	(7.73E-06)	(8.62E-06)	(3.28E-06)	(5.76E-06)	(1.23E-05)	(4.52E-06)	(2.94E-06)
Capital structure	0.005	-0.004	0.004	4.47E-04	1.15E-04	-7.80E-04	8.46E-04
	(0.004)	(0.002)	(0.003)	(5.00E-04)	(2.66E-03)	(1.88E-03)	(8.90E-04)
FOE[a]	**0.089*** **	**-0.168*** **	**0.070*** **	**-4.84E-04**	**0.223*** **	**0.040*** **	**-0.036*** **
	(0.005)	(0.006)	(0.004)	(0.002)	(0.006)	(0.003)	(0.002)
N	10350	10350	10350	10350	10350	10350	10350
R^2	0.69	0.69	0.69	0.53	0.77	0.65	0.69
Adjusted R^2	0.54	0.53	0.54	0.30	0.66	0.48	0.53
χ^2 (FE vs. RE)[b]	37.17***	66.37***	25.64***	1.33	19.96***	13.24**	4.17

Time effects not reported for brevity. Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%.

[a] FOE is found separately as per $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$. One-tail significance is determined by F-testing the restriction $\lambda_{ff} \neq \lambda_{nf}$.

[b] Tests the null hypothesis of no systematic differences in FE and RE coefficients.

Based on the arguments outlined in Figure 16, the difference in financing proportions found here are also expected to have a bearing on the quantum of finance and ultimately firm size. In the next section, we go on to test whether family firms are smaller than their non-family counterparts and also investigate the extent to which internally sourced finance is related to the quantum of debt and equity finance as well as various measures of firm size.

5.3.2 The quantum of finance and firm size

As per the arguments posed in Chapter 2, the finding that family firms obtain a relatively greater proportion of both their debt and equity finance from internal sources leads us to believe that they will hold a relatively lower *quantum* of debt and equity and therefore also be smaller in size. Specifically, the following hypotheses, numbered 5 through 7, were developed:

Hypothesis 5:	*The quantum of total debt is lower for family firms relative to non-family firms.*
Hypothesis 6:	*The quantum of total equity is lower for family firms relative to non-family firms.*
Hypothesis 7:	*Other things being equal, family firms are smaller than non-family firms.*

We test these hypotheses relating to firm size in very much the same way as the previous section. Specifically, we specify and estimate equations (19) and (20) which respectively describe the quantum of debt and equity as well as various measures of firm size as a function of firm specific effects, including family ownership, and other covariates. Beginning with equation (19), we specify

$$(19)\quad \mathrm{Quantum}_{jit} = \alpha_{ji} + \beta_{1j}\mathrm{PE}_{it} + \beta_{2j}\mathrm{ID}_{it} + \beta_{3j}\mathrm{IE}_{it} + \beta_{4j}\mathrm{WOE}_{it} + \beta_{5j}\mathrm{Age}_{it} + \beta_{6j}(\mathrm{K/L})_{it} + \beta_{7j}(\mathrm{TD/TA})_{it} + \gamma_t + e_{jit} \qquad i = 1\ldots3350;\ t = 1\ldots3;\ j = 1,2.$$

Where 'Quantum' is a j x 1 vector of the total dollar value of both debt and equity, denoted as j, for the i^{th} firm in time period t. Thus, we estimate two regressions independently. As with the previous specification, α_{ji} is the individual intercept term for firm i and contains the family ownership effect. In addition to what has already been defined in (18), the time varying control variables in (19) are productive efficiency (PE), and the shares of internal debt (ID), internal equity (IE), and working owner's equity (WOE) respectively. To test hypotheses 5 and 6, we estimate α_{ji} in (19) and measure the FOE as described in Section 5.2.

In addition to the quantum of debt and equity, a more direct estimate of firm size itself is predicted in equation (20), specified as

$$(20) \quad \text{Size}_{jit} = \alpha_{ji} + \beta_{1j}\text{PE}_{it} + \beta_{2j}\text{ID}_{it} + \beta_{3j}\text{IE}_{it} + \beta_{4j}\text{WOE}_{it} + \beta_{5j}\text{Age}_{it} + \beta_{6j}(\text{K/L})_{it} + \beta_{7j}(\text{TD/TA})_{it} + \gamma_t + e_{jit} \quad i = 1\ldots3350;\ t = 1\ldots3;\ j = 1\ldots3.$$

Where 'Size' is a j x 1 vector of various size measures, namely output, as well as labour and capital inputs, denoted as j, for the i^{th} firm in time period t. Three separate regressions are therefore estimated. Otherwise, all parameters and independent variables specified in (20) are identical to those in (19). With that said, the β coefficients associated with internal debt and equity proportions are of particular interest in both equations as these indicate the broader relationship between the proportion of finance obtained from internal sources and firm size.

To test Hypothesis 7, we estimate (20) and extract the FOE as described in Section 5.2. These results are presented in Table 29. Further, we confirm the direction, magnitude, and significance of the FOE by random effects, hybrid model, and inter-industry estimations as described in Section 5.2.1. These are presented in Table A13, Table A14 and Table A16 in Appendix A.4.

The first two columns in Table 29 confirm hypotheses 5 and 6 as family firms are shown to hold a significantly lower quantum of both debt and equity on their balance sheets. When analysing this FOE in each industry, Table A16 shows that family firms are found to hold a significantly lower quantum of debt and equity in half of all industries. In almost all remaining industries there is no significant difference between family and non-family firms. It is also worth noting that the direction and significance of these results hold across the RE estimations of the FOE (see Table A13 in Appendix A.4).

Moving on to Hypothesis 7, no matter the measure of firm size, family firms are found to be significantly smaller than their non-family counterparts. Columns 3, 4 and 5 in Table 29 respectively show that family ownership is associated with a significantly lower value of output, number of employees, and level of capital. On average, family firms relatively produce $2 million less in output, employ 11 fewer workers, and own $4 million less capital. These magnitudes are stable across alternate estimation techniques and support Hypothesis 7.

Looking to specific industries, we also find that in the vast majority of industries, family firms are significantly smaller across all measures of firm size. It is also important to note here that a standard Hausman (1978) test indicates that PE is endogenous in (20). As a result we also estimate (20) utilising a two-stage least squares estimator and present the results in Table A15 of Appendix A.4. Here it can be seen that this has not significantly changed our findings, as Table A15 also reports a negative and significant FOE with respect to output, labour and capital.

Table 29: Quantum of finance and firm size (fixed effect model)

	Quantum of finance		*Firm size*		
	Total Liabilities (000)	Total Equity (000)	Value added (000)	Labour (FTE)	Capital (000)
Constant	3215.23***	1791.02***	842.05***	23.90***	5002.86***
	(427.40)	(341.01)	(293.62)	(1.34)	(595.46)
Productive efficiency	-1539.67**	-395.22	3795.70***	-1.26	-2200.35**
	(770.43)	(343.79)	(491.51)	(0.96)	(1058.23)
Internal debt	-123.74	-9.12	-94.86*	-0.59*	-137.69
	(80.71)	(60.21)	(58.45)	(0.35)	(110.26)
Internal equity	70.51	20.82	-195.42	-0.41	43.23
	(255.09)	(97.51)	(141.74)	(0.74)	(313.72)
Working owner's equity	149.85	17.14	-285.40*	-0.39	117.03
	(362.54)	(90.71)	(153.46)	(0.46)	(469.11)
Firm age	-11.76	68.10	210.56***	1.06***	47.13
	(96.92)	(80.34)	(64.58)	(0.33)	(128.61)
Capital intensity	2.72	0.93	1.20	-0.01***	4.71
	(2.34)	(0.59)	(0.87)	(0.00)	(3.13)
Capital structure	58.23	-125.94**	-79.16***	0.10	-87.62
	(89.52)	(57.97)	(13.69)	(0.15)	(77.59)
FOE[a]	**-3055.68*** **	**-1789.72*** **	**-2103.74*** **	**-11.49*** **	**-4344.05*** **
	(110.64)	(74.43)	(45.21)	(0.19)	(133.70)
N	10350	10350	10350	10350	10350
R^2	0.94	0.97	0.94	0.95	0.97
Adjusted R^2	0.91	0.96	0.92	0.93	0.95
χ^2 (FE vs. RE)[b]	5162.89***	632.44***	1391.64***	455.15***	1788.51***

Time effects not reported for brevity. Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%.

[a] FOE is found separately as per $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$. One-tail significance is determined by F-testing the restriction $\lambda_{ff} \neq \lambda_{nf}$.

[b] Tests the null hypothesis of no systematic differences in FE and RE coefficients.

Although we do not directly hypothesize the relationship in this thesis[78], at this point we are able to observe the effect that internal finance has on firm size. Beginning with the fixed effects estimates in Table 29 and the two-stage least squares estimates in Table A15, whenever significant, the coefficients associated with internal finance demonstrate that the share of internal finance has a negative effect on firm size. Specifically, the proportions of internal debt and working owner's equity are significantly associated with lower output, and with respect to internal debt only, lower levels of labour as well. Looking to our random effects estimates in Table A13, the link between internal finance and firm size is much stronger, as most of the coefficients associated with internally sourced debt and equity are negative and significant with respect to total liabilities, output, labour, and capital.

With that said, the time varying effects of internal finance on firm size are not as strong as the 'internal finance theory of growth' would suggest. In this sense, the results related to the Hybrid model presented in Table A14 are particularly interesting. Here we can see that the time-invariant internal finance levels averaged across time are highly significant and negative across the quantum of debt and equity finance and nearly all measures of firm size. Furthermore, once these fixed effects are included in the model, the fixed FOEs are noticeably weakened. For example, the FOEs with respect to total equity and capital are no longer significant, while the magnitudes of the FOEs with respect to total debt, output, and labour are considerably lower relative to our previous findings. This suggests that our internal finance variables, although varying over time, are potentially slow-changing or 'sluggish'[79]. That is, we have shown that the main effects of internal finance on firm size are found 'between' firms rather than 'within' firms.

---

[78] In Chapter 2 we explained how the long-standing theory that the growth of small firms is constrained by the quantity of internal finance, otherwise known as the 'internal finance theory of growth', has already empirically been shown to hold (Carpenter and Petersen 2002).

[79] Sluggish refers to variables in panel data that do not vary much over time and thus exhibit little within-cluster variance. Since the FE model produces solely within-cluster effects, a noted disadvantage is that one cannot retrieve 'good' estimates of sluggish, or slowly-changing, variables (Beck and Katz 2001; Plümper and Troeger 2007). The slow moving nature of financing proportions are demonstrated in Table 5 of Chapter 3.

These results also suggest that the FOEs on firm size are (in part) due to the fact that family firms hold larger proportions of internal finance. Although still present, once the *fixed effects* of internal finance proportions are considered, the remaining FOEs on firm size are diminished. Such findings justify our overall conceptual framework with respect to the relationship between family ownership, financing composition, and firm size. However, in the next section we empirically test whether the size of a family firm is constrained and how such a constraint might impact efficiency.

5.3.3 Efficiency

Following the arguments presented in this thesis, the propensity for family SMEs to be smaller in size, which has been established in Table 29, is expected to have an effect on their scale and technical efficiency. In Chapter 2 we specifically developed the following hypotheses:

Hypothesis 8:	*Family firms will exhibit lower scale efficiency relative to their non-family counterparts.*
Hypothesis 9:	*Family firms will exhibit lower capital to labour ratios relative to their non-family counterparts.*
Hypothesis 10:	*Controlling for production scale, family firms will exhibit greater technical efficiency relative to their non-family counterparts.*

We test the above hypotheses by using a similar structure as our previous tests. Starting with hypothesis 8, equation (21) identifies scale efficiency as a function of family ownership,

$$(21) \quad \mathrm{SE}_{it} = \alpha_i + \delta_1 \mathrm{IRS}_{it} + \delta_2 \mathrm{DRS}_{it} + \lambda_1 \mathrm{IRS}_{it} * \mathrm{FF}_i + \lambda_2 \mathrm{DRS}_{it} * \mathrm{FF}_i + \beta_1 \mathrm{Size}_{it} + \beta_{2j} \mathrm{ID}_{it} + \beta_{3j} \mathrm{IE}_{it} + \beta_{4j} \mathrm{WOE}_{it} + \beta_{5j} \mathrm{Age}_{it} + \beta_{6j} (\mathrm{K/L})_{it} + \beta_{7j} (\mathrm{TD/TA})_{it} + \gamma_t + e_{it} \qquad i = 1 \ldots 3350;\ t = 1 \ldots 3.$$

Where 'SE' is our scale efficiency score, defined in Chapter 4, for the i^{th} firm in time period t. In equation (21) additional dummy intercept and slope parameters are specified to account for the distinction between those sub-optimally scaled firms which exhibit increasing and decreasing returns to scale, denoted as IRS and DRS respectively.

The IRS_{it} and DRS_{it} variables in (21) are dummy variables which equate to 1 if the i^{th} firm exhibits increasing or decreasing returns to scale in time period t respectively, and 0 otherwise. As they may vary across time, we are able to include these 'return to scale' dummies in the fixed effect estimation. By this approach, we are also able to isolate the magnitude, direction, and significance of any FOE among IRS and DRS firms separately by interacting each return to scale category with the family firm variable, FF_i, which equates to 1 if the i^{th} firm is a family firm and 0 otherwise. In addition to any unobserved firm fixed effects, α_i in (21) captures the average SE for the i^{th} firm, family or otherwise, which exhibits CRS in any time period t[80]. As with our previous specifications the β coefficients are time varying control variables which are expected to co-vary with SE, such as firm size, the proportion of internal finance, firm age, capital intensity and capital structure.

In this specification, δ_1 and δ_2 capture the average scale efficiency difference, from α_i, for IRS and DRS non-family firms respectively. Given the construction of the scale efficiency score, these coefficients are expected to be negative[81]. Further, λ_1 and λ_2 capture the average scale efficiency difference, from δ_1 and δ_2 respectively, associated with family ownership and thus measure the FOEs in each category. Based on hypothesis 8, we expect λ_1 to be negative and significant. That is, of all firms which are sub-optimally small, family firms are expected to be even *more* sub-optimally small. Furthermore, if family firm size is indeed constrained, we expect λ_2 to be positive and significant. That is, of all sub-optimally large firms, family firms are expected to be *less* sub-optimally large.

Moving on to Hypothesis 9, to investigate the potential family firm differences in the capital intensity of production, equation (22) expresses capital intensity as

---

[80] As all firms in the CRS category have a SE score of 1, i.e. they are perfectly scale efficient, there are no SE differences between family and non-family firms in this category.

[81] Any sub-optimally scaled firm, either too large or too small, will have a SE score less than 1; thus the difference from the optimal scale, i.e. a SE score of 1, will by definition always be negative.

$$(22) \quad (K/L)_{it} = \alpha_i + \beta_{1j}PE_{it} + \beta_{2j}Size_{it} + \beta_{3j}ID_{it} + \beta_{4j}IE_{it} + \beta_{5j}WOE_{it} + \beta_{6j}Age_{it} + \beta_{7j}(TD/TA)_{it} + \gamma_t + e_{it} \qquad i = 1\ldots3350;\ t = 1\ldots3.$$

Where 'K/L' is the capital to labour ratio for the i^{th} firm in time period t. Consistent with our hypotheses testing thus far, α_i contains the FOE. Time varying control variables pertaining to firm i in time period t which co-vary with the capital intensity of production have been specified as productive efficiency, firm size, the proportion of internal finance, firm age and capital structure.

Finally, to test Hypothesis 10, we investigate whether TE scores are systematically different across firm ownership. To do so, we further estimate

$$(23) \quad TE_{it} = \alpha_i + \beta_1 Size_{it} + \beta_{2j}ID_{it} + \beta_{3j}IE_{it} + \beta_{4j}WOE_{it} + \beta_{5j}Age_{it} + \beta_{6j}(K/L)_{it} + \beta_{7j}(TD/TA)_{it} + \gamma_t + e_{it} \qquad i = 1\ldots3350;\ t = 1\ldots3.$$

Where 'TE' is the technical efficiency score, as defined in Chapter 4, for the i^{th} firm in time period t. All other parameters in (23) are as explained previously. To test hypotheses 9 and 10, we estimate (22) and (23) respectively and extract the FOEs as described in Section 5.2. These results are presented in Table 30. Consistent with our analysis thus far, we also estimate the FOE via a random effect and hybrid model, and by industry. These results are presented in Table A17, Table A18 and Table A19 in Appendix A.4.

Table 30: Scale & technical efficiency and capital intensity (fixed effect model)

	Scale & Technical efficiency			*Capital intensity*
	SE	TE	PE	K/L
Constant	0.928***	0.461***	0.343***	-43.812
	(0.022)	(0.024)	(0.022)	(66.709)
Increasing returns	-0.155***	-	-	-
	(0.011)	-	-	-
Decreasing returns	-0.188***	-	-	-
	(0.011)	-	-	-
FOE_{IRS}	**-0.031****	-	-	-
	(0.016)	-	-	-
FOE_{DRS}	**0.015**	-	-	-
	(0.016)	-	-	-
Productive efficiency	-	-	-	184.768***
	-	-	-	(60.208)
Firm size	-2.8E-07	-1.22E-06***	-1.23E-06***	0.012*
	(2.95E-07)	(3.78E-07)	(5.17E-07)	(0.007)
Internal debt	0.003	0.008	0.003	4.801
	(0.010)	(0.012)	(0.010)	(10.987)
Internal equity	0.015	-0.019	-0.007	16.215
	(0.012)	(0.015)	(0.013)	(22.578)
Working owner's equity	0.003	0.003	0.006	-10.631
	(0.007)	(0.008)	(0.007)	(19.744)
Firm age	0.004	-0.002	-0.001	19.771*
	(0.005)	(0.006)	(0.006)	(12.014)
Capital intensity	1.20E-06	3.68E-05***	3.91E-05***	-
	(6.12E-06)	(8.23E-06)	(8.66E-06)	-
Capital structure	0.001	0.017***	0.015***	-4.426**
	(0.002)	(0.002)	(0.002)	(1.751)
FOE[a]	-	**-0.026*****	**-0.043*****	**-24.632*****
	-	(0.004)	(0.003)	(8.336)
N	10350	10350	10350	10350
R^2	0.77	0.74	0.73	0.83
Adjusted R^2	0.65	0.62	0.60	0.74
χ^2 (FE vs. RE)[b]	179.84***	19.09***	20.75***	25.56***

Time effects not reported for brevity. Panel corrected standard errors are reported in parentheses.
Level of significance: ***1%; **5%; *10%.

[a] FOE is found separately as per $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$. One-tail significance is determined by F-testing the restriction $\lambda_{ff} \neq \lambda_{nf}$.

[b] Tests the null hypothesis of no systematic differences in FE and RE coefficients.

Beginning with hypothesis 8, the negative and significant coefficient associated with the SE differential of family firms which exhibit increasing returns to scale in column 1, row 4, of Table 30 demonstrates that family firms are on average 3.1 percent sub-optimally smaller than their non-family counterparts. Although the coefficient is positive, Table 30 also shows that there is no significant FOE among firms exhibiting decreasing returns to scale. These results are consistent across alternate methods of estimation and industries (see Table A17, Table A18 and Table A19 in Appendix A.4) and to a large extent confirm Hypothesis 8. That is, of all sub-optimally small firms, family firms are found to exhibit greater inefficiencies related to a suboptimal scale of production relative to their non-family counterparts.

Column 4 in Table 30 also shows that family firms exhibit significantly lower capital to labour ratios (K/L) than non-family firms. The magnitude of the average FOEs are consistent across all estimation techniques (see Table A17 and Table A18) and support hypothesis 9. However, it is apparent when viewing Table A19 that family firms are significantly less capital intensive in certain industries only. Namely, in the Mining; Food, beverage and tobacco manufacturing; General construction; Personal and household good retailing; and Motion Picture, radio and television services industries. With that said, in all other industries there is no significant difference in family and non-family capital to labour ratios.

Based on our discussion in Chapter 2, it is no surprise that firm size, measured as the level of capital, is positively related to capital intensity no matter the estimation procedure. Further, when looking to the relationships depicted by the random and hybrid estimates in Table A17 and Table A18 respectively, we can see that, as expected, an increase in the proportion of internal finance in the form of working owner's equity significantly lowers the capital to labour ratio.

Moving on to our final hypothesis, Table 30 shows that the average technical efficiencies exhibited by family firms are significantly *lower* than their non-family counterparts. The magnitude of this negative TE FOE is 2.6 percent and is significant in both the FE and RE estimates presented in Table 30 and Table A17 respectively. However, the hybrid estimates in Table A18, show that the fixed effects of firm size, age, and the level of internal debt are better determinants of TE than family ownership. The industry analysis in Table A19 also shows that in 6 out of 32 industries, family firms are significantly more technically efficient in terms of resource use, whereas in 13 industries the FOEs are significantly negative, and in the remaining 13 industries there is no significant effect at all. These results do not support hypothesis 10 and demonstrate that family firms have a tendency to exhibit lower or equivalent pure technical efficiency scores relative to their non-family peers.

We also report in this section the FOE with respect to PE, which, as described in Chapter 4, encompasses both SE and TE. In column 3 of Table 30 we can see that the FOE is significantly negative by the order of 4.3 percent. This finding is consistent across our other methods of estimation (see Table A17 and Table A18) and is also evident across industries as well (see Table A19). When we decompose this PE differential, the magnitude of the coefficients presented in Table 30, Table A17, Table A18, and Table A19 imply that although family firms are less efficient with respect to both scale and resource use, the main driver of inefficiency for family firms is due to their deviation from an optimal scale.

5.4 Simultaneous reduced-form estimations

The results associated with equations (6) through to (11) confirm that, with the exception of Hypothesis 2b and 10, all of our hypotheses are supported. With that said, up to this point we have estimated the family ownership effect related to each of our individual hypotheses in isolation. However, the argument posed in this thesis proposes that our dependent variables are also interdependent. For example, in our tests thus far, we have expressed internal finance as a function of size and efficiency, size as a function of internal finance and efficiency, and efficiency as a function of internal finance and size. These specifications are inherently endogenous.

Further, as an additional robustness measure, we also consider the potential time lag between these relationships. For example, it is feasible that previous values of financing, firm size and efficiency will have a significant effect on their current values. Specifically, the proportion of this year's internally sourced finance may depend on last year's proportions, and as we have shown in Section 5.3.2, the composition of financing is potentially slow moving across time. Similar arguments can be made about firm size and efficiency across time for various reasons.

If values of financing composition, firm size, and efficiency are in fact jointly determined, or if their previous values have a significant effect on their current values, then our hypotheses tests may suffer from endogeneity or misspecification issues. To address this in our analysis, our overall framework is condensed into a system of equations, which specify the following structural simultaneous relationships

$$(24)\quad IF_{it} = \alpha_{1_i} + \alpha_2 IF_{it-1} + \alpha_3 Size_{it} + \alpha_4 Size_{it-1} + \alpha_5 PE_{it} + \alpha_6 PE_{it-1} + \alpha_7 Age_{it} + \alpha_8 (K/L)_{it} + \alpha_9 (TD/TA)_{it} + e_{it},$$

$$(25)\quad Size_{it} = \beta_{1_i} + \beta_2 Size_{it-1} + \beta_3 IF_{it} + \beta_4 IF_{it-1} + \beta_5 PE_{it} + \beta_6 PE_{it-1} + \beta_7 Age_{it} + \beta_8 (K/L)_{it} + \beta_9 (TD/TA)_{it} + u_{it}, \text{ and}$$

$$(26)\quad PE_{it} = \gamma_{1_i} + \gamma_2 PE_{it-1} + \gamma_3 IF_{it} + \gamma_4 IF_{it-1} + \gamma_5 Size_{it} + \gamma_6 Size_{it-1} + \gamma_7 Age_{it} + \gamma_8 (K/L)_{it} + \gamma_9 (TD/TA)_{it} + v_{it}.$$

Where 'IF', 'Size' and 'PE' respectively denote the i^{th} firm's proportion of internally sourced debt and equity finance[82], firm size[83], and productive efficiency[84] in time period t. As in our previous fixed effect specifications, the time-invariant FOEs with respect to internal finance, firm size, and efficiency are contained in α_{1i}, β_{1i} and γ_{1i} respectively. Consistent across all specifications, we control for the contemporaneous effects of firm age, capital intensity and capital structure.

As seen in the above system, the proportion of internal finance, firm size, and efficiency are presumed to be jointly determined. We have also imposed a lag structure to account for the possibility that the relationships proposed in Chapter 2 are occurring across multiple periods of time. Solving the equations by substitution, the reduced-form system of equations can be specified as

---

[82] As our main focus in this thesis is the propensity of family firms to prefer debt and equity obtained from internal sources, the 'IF' variable is measured by the sum of internal debt and equity as a proportion of total liabilities and equity respectively.

[83] Although we have multiple measures of firm size, it is necessary at this point in the analysis to specify one measure of firm size; thus the 'Size' variable is measured by the value of capital. It is important to note that our findings are consistent when repeating the analysis using total output and labour as alternate proxy measures of firm size.

[84] Overall PE has been selected to capture performance in the model, as it embodies both SE and TE.

$$(27) \quad IF_{it} = \delta_{1_i} + \delta_2 IF_{it-1} + \delta_3 Size_{it-1} + \delta_4 PE_{it-1} + \delta_5 Age_{it} + \delta_6 (K/L)_{it} + \delta_7 (TD/TA)_{it} + \phi_{it},$$

$$(28) \quad Size_{it} = \varepsilon_{1_i} + \varepsilon_2 Size_{it-1} + \varepsilon_3 IF_{it-1} + \varepsilon_4 PE_{it-1} + \varepsilon_5 Age_{it} + \varepsilon_6 (K/L)_{it} + \varepsilon_7 (TD/TA)_{it} + \psi_{it}, \text{ and}$$

$$(29) \quad PE_{it} = \zeta_{1_i} + \zeta_2 PE_{it-1} + \zeta_3 IF_{it-1} + \zeta_4 Size_{it-1} + \zeta_5 Age_{it} + \zeta_6 (K/L)_{it} + \zeta_7 (TD/TA)_{it} + \omega_{it}.$$

Where the reduced form parameters δ_i, ε_i, and ζ_i all incorporate α_i, β_i and γ_i as well as the error terms e_{it}, u_{it}, and v_{it} (see Appendix A.6). As a result, the above system accounts for the *full* effect of the contemporaneous relationships between internal finance, size, and efficiency. The FOEs contained in δ_{1i}, ε_{1i}, and ζ_{1i} of (15.1), (16.1) and (17.1) respectively are extracted as per the method described in Section 5.2. These results are presented in Table 31.

Table 31 shows that after controlling for any endogenous relationships, the FOEs are significant and consistent with the results presented in the previous section. For example, Column 1 shows that family firms on average hold 44.1 percent (out of a possible 200 percent) more internal debt and equity finance. At the same time, column 2 shows that family firms are significantly smaller than non-family firms, and column 3 confirms that family firms are 5.5 percent less technically efficient. When we decompose this inefficiency into SE and TE, we see that family firm inefficiency is

Table 31: Family ownership effect on internal finance, firm size and efficiency (full model with lagged variables)

	Main model			*Efficiency decomposed*[a]		
	Internal finance	Firm size	PE	SE_{IRS}	SE_{DRS}	TE
Constant	1.310***	6043.047***	0.419***	0.740***	0.899***	0.474***
	(0.073)	(1303.874)	(0.036)	(0.053)	(0.085)	(0.041)
Internal finance $_{t-1}$	-0.354***	-368.640	0.003	-0.027**	0.005	0.012
	(0.015)	(271.468)	(0.007)	(0.011)	(0.017)	(0.008)
Firm Size $_{t-1}$	-1.13E-06	-0.281***	-4.78E-07	-2.73E-06	-9.64E-07	-1.04E-07
	(7.76E-07)	(0.014)	(3.77E-07)	(1.94E-06)	(9.57E-07)	(4.31E-07)
Technical efficiency $_{t-1}$	-0.030	736.858	-0.370***	-0.277***	-0.192***	-0.302***
	(0.036)	(632.848)	(0.017)	(0.029)	(0.040)	(0.020)
Firm age	-0.037**	94.059	0.012	0.036***	-0.016	0.018*
	(0.018)	(325.259)	(0.009)	(0.013)	(0.020)	(0.010)
Capital intensity	-6.58E-06	2.358***	4.57E-05***	1.32E-05	1.22E-04***	3.39E-05***
	(1.44E-05)	(0.257)	(7.01E-06)	(1.11E-05)	(4.59E-05)	(8.02E-06)
Capital structure	-0.002	-115.751	0.010***	-0.011**	0.030	0.012***
	(0.005)	(80.231)	(0.002)	(0.005)	(0.027)	(0.003)
FOE[b]	**0.441*** **	**-6348.92*** **	**-0.055*** **	**-0.048*** **	**-0.002**	**-0.035*** **
	(0.010)	(177.69)	(0.005)	(0.009)	(0.014)	(0.005)
N	6900	6900	6900	2540	1690	6900
R^2	0.87	0.99	0.82	0.90	0.83	0.83
Adjusted R^2	0.74	0.97	0.65	0.73	0.43	0.65

Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%.

[a] IRS and DRS subscripts denote increasing and decreasing return to scale subgroups respectively.

[b] FOE is found separately as per $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$. One-tail significance is determined by F-testing the restriction $\lambda_{ff} \neq \lambda_{nf}$.

primarily related to a suboptimal scale, as column 4 demonstrates that SE is significantly lower by 4.8 percent for those family firms in the increasing returns to scale category (SE_{IRS}). It is also interesting to note that although the lagged value of internal finance is not significant in the determination of firm size, it does have a significant negative effect on SE_{IRS}.Similar to the results in Table 30, no significant efficiency differentials are found with respect to SE in the decreasing returns to scale category (SE_{DRS}).

These findings are also supported when evaluating the FOEs by industry (see Table A20 in Appendix A.4). For example, the FOEs with respect to internal finance are found to be positive and significant in 90.63 percent of all industries. The FOE with respect to firm size is found to be negative and significant in 68.75 percent of all industries. In 46.88 percent of all industries the FOE with respect to PE is negative and significant. When this is decomposed, we find that in 90.32 percent of all industries the FOEs with respect to SE_{IRS} are negative and significant, while in 84.62 percent of industries the SE_{DRS} differentials are insignificant. Finally, consistent with our previous findings, while in the majority of industries the FOEs with respect to TE are negative and significant, there is also a large proportion of industries in which positive and significant or insignificant FOEs are found.

5.5 Chapter Summary

In this chapter we define the econometric specifications designed to test our hypotheses related to the effect that family ownership has on internal financing, firm size and efficiency, as well as the interrelationships between these variables. Using these specifications we find that we support most of our hypotheses. These results are robust across alternate methods of estimation and hold after controlling for unobserved heterogeneity as well as identified covariates. It is also worth mentioning that our results are not being driven by any industry effects, as we have supported our findings by estimating the FOEs in each industry. We have also produced similar findings after addressing the endogeneity issue by estimating the reduced-form parameters representing the simultaneous effects of internal financing, firm size and efficiency. A summary of our findings can be seen in Table 32.

Based on these empirical comparisons, we find that family ownership is related to significantly higher proportions of debt financing from banks and lower proportions of debt financing from trade creditors, which supports Hypotheses 1a and 1b. Confirming Hypotheses 2a, 4a and 3 respectively, we further find that family firms carry significantly higher proportions of internal debt and equity finance, including equity from working owners. We also observe that family firms hold significantly lower proportions of equity obtained from external sources, which supports Hypothesis 4b; although inconsistent with Hypothesis 2b, we find no significant FOE with respect to externally sourced debt.

We also report strong evidence that higher proportions of internal finance in general are negatively related to firm size, as the proportion of internal debt and working owner's equity are all negatively related to various measures of firm size. Another interesting finding which resulted from our hybrid estimates is that the across time average values of internal debt and equity, as well as working owner's equity, are all significantly related to a lower value of debt and equity and a smaller firm. These results support the notion that family firm size may be constrained by their tendencies to hold internally sourced finance. In fact, confirming Hypotheses 5, 6 and 7, we have observed that family firms hold significantly lower quantities of debt and equity on their balance sheets and are significantly smaller than non-family firms in terms of output levels, number of employees, and total value of capital.

We find that family firms on average are significantly less capital intensive than non-family firms, which supports Hypothesis 9. While this is occurring in certain industries only, it is worth noting that we only observe two industries in which family firms are producing with a significantly higher capital to labour ratio relative to their non-family peers. This finding further supports the notion that the level of capital in family firms is constrained, as family firms may be forced to substitute scarce capital with labour.

Table 32: Summary of results for hypotheses tests

	Composition of finance	Test result
Hypothesis 1a:	Bank debt, as a proportion of total debt, is greater for family firms relative to non-family firms.	Supported
Hypothesis 1b:	Trade credit, as a proportion of total debt, is lower for family firms relative to non-family firms.	Supported
Hypothesis 2a:	Loans from internal sources, as a proportion of total debt, are greater for family firms relative to non-family firms.	Supported
Hypothesis 2b:	Loans from external sources, as a proportion of total debt, are lower for family firms relative to non-family firms.	Unsupported
Hypothesis 3:	Equity from working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.	Supported
Hypothesis 4a:	Equity from internal sources other than working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.	Supported
Hypothesis 4b:	Equity from external sources, as a proportion of total equity, is lower for family firms relative to non-family firms.	Supported
	Firm Size	**Test result**
Hypothesis 5:	The quantum of total debt is lower for family firms relative to non-family firms.	Supported
Hypothesis 6:	The quantum of total equity is lower for family firms relative to non-family firms.	Supported
Hypothesis 7:	All things being equal, family firms are smaller than non-family firms.	Supported
	Firm Efficiency	**Test result**
Hypothesis 8:	Family firms will exhibit lower scale efficiency relative to their non-family counterparts.	Supported
Hypothesis 9:	Family firms will exhibit lower capital to labour ratios relative to their non-family counterparts.	Supported
Hypothesis 10:	Controlling for production scale, family firms will exhibit greater technical efficiency relative to their non-family counterparts.	Unsupported

As we find a positive and significant relationship between capital intensity and TE, family firm performance is found to be affected by a smaller, more labour intensive firm.

For example, when comparing efficiency across family and non-family firms, we find that the average PE score of family owned firms is significantly lower. After decomposing this score into TE and SE, we discover that the main source of family firm inefficiency is related to a suboptimal scale of production, confirming Hypothesis 8. Despite our expectation that family firms compensate any potential size constraint by arranging their production inputs in a more efficient manner, we do not find any evidence that family firms exhibit higher TE scores. In fact, on average family firms are *less* efficient in terms of their resources use. Although weaker, this finding holds across all methods of estimation. Relatively speaking, we can conclude from the tests performed here that family firms can be more, less or equivalently efficient in terms of resource use, which is contrary to Hypothesis 10.

A tendency for family firms to exhibit lower scale *and* technical efficiency score gives rise to questions regarding the long-run survivability of family SMEs in competitive environments. These and other implications of the results shown in this chapter are important to our understanding of how family ownership may impact firm performance and further discussed in the next chapter.

Chapter 6. Discussion and Conclusion

6.1 Chapter introduction

Given that family owned firms are economically significant and known to pursue non-economic objectives, this thesis is motivated to understand and quantify the effect of family ownership on firm performance. In particular, Gomez-Mejia et al. (2011) examine how family firms differ from non-family firms along five broad categories of SEW inspired behaviour, which in turn influence firm performance. Noticeably missing among the behaviours listed, are inferences into how the pursuit of various SEW objectives might in turn influence the various financing decisions of family owners.

In this thesis we have examined the links between the performance of family firms, their size, and their owners' financing preferences. Utilising a large panel of Australian SMEs and applying PE as a performance measure, we further quantified and tested the significance of these family ownership effects. Specifically, we have addressed the following research questions:

1) What is the effect of family ownership on firm performance?
2) How does family ownership affect productive efficiency?
3) Why is productive efficiency affected by family ownership?

In Table 33 we summarise these findings regarding the hypotheses developed in Chapter 2. Specifically, Table 33 shows the magnitude, direction and significance of the FOEs measured in this thesis across three main themes: 1) the composition of finance, 2) firm size, and 3) firm efficiency[85].

[85] As there were no discrepancies between the results derived from both preliminary descriptive statistics, conducted in Chapters 3 and 4, and the more robust panel data regression analysis conducted in Chapter 5, Table 33 does not report our descriptive findings.

Table 33: Summary of panel regression results by theme and estimation technique

Composition of finance		**Expectation**	**Test result**	**FOE[a]**	**FOE[b]**	**FOE[c]**	**FOE[d]**	**Inter-industry[e]**
Hypothesis 1a:	Bank debt	Higher	Supported	8.9%	8.2%	7.7%	7.2%	Pos
Hypothesis 1b:	Trade credit	Lower	Supported	-16.8%	-16.3%	-15.5%	-15.5%	Neg
Hypothesis 2a:	Internal debt	Higher	Supported	7.0%	7.2%	6.8%	7.0%	Pos
Hypothesis 2b:	External debt	Lower	Unsupported	-	-	-	0	Insig
Hypothesis 3:	Working owner's equity	Higher	Supported	22.3%	21.4%	21.3%	23.2%	Pos
Hypothesis 4a:	Internal equity	Higher	Supported	4.0%	3.5%	3.3%	5.4%	Pos
Hypothesis 4b:	External equity	Lower	Supported	-3.6%	-3.8%	-3.8%	-3.9%	Neg
Firm Size[f]								
Hypothesis 5:	The quantum of total debt	Lower	Supported	-$3055.68	-$2173.15	-$651.34	-$3362.89	Neg
Hypothesis 6:	The quantum of total equity	Lower	Supported	-$1789.72	-$2085.52	-	-$1130.92	Neg
Hypothesis 7:	Production scale:							
	Value added	Lower	Supported	-$2103.74	-$1653.59	-$684.27	-$2323.08	Neg
	Capital	Lower	Supported	-$4344.05	-$3244.24	-	-$4692.23	Neg
	Labour	Lower	Supported	-11.49	-9.27	-4.73	-7.34	Neg
Firm Efficiency								
Hypothesis 8:	Scale efficiency							
	Increasing returns to scale	Lower	Supported	-3.1%	-5.8%	-5.2%	-4.7%	Neg
	Decreasing returns to scale	Higher	Unsupported	-	-	-	0.9%	Pos
Hypothesis 9:	Capital intensity	Lower	Supported	-24.63	-32.07	-25.92	-65.72	Insig
Hypothesis 10:	Technical efficiency	Higher	Unsupported	-2.6%	-1.3%	-1.0%	-0.1%	Neg

Insignificant FOEs not reported.

[a] Fixed effects estimates: $y_{it} = \alpha_i + \gamma_t + \beta x'_{it} + e_{it}$, **FOE** = $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right)$

[b] Random effects estimates: $y_{it} = \alpha + \lambda FF_i + \gamma_t + \beta x'_{it} + (e_{it} + u_i)$, **FOE** = λ

[c] Hybrid model estimates: $y_{it} = \alpha + \lambda FF_i + \gamma_t + \beta(x'_{it} - \bar{x}'_i) + \delta \bar{x}'_i + (e_{it} + u_i)$, **FOE** = λ

[d] Inter-industry fixed effects estimates (on average): $y_{it} = \alpha_i + \gamma_t + \beta x'_{it} + e_{it}$, $\mathbf{FOE_j} = \left(\frac{1}{ff_j}\sum_{i \in FF} \alpha_{ij}\right) - \left(\frac{1}{nf_j}\sum_{i \in NF} \alpha_{ij}\right)$, where j =industry.

[e] The direction and significance most frequently observed in FOEs across all industries, i.e. Positive and significant (Pos), Negative and significant (Neg), and Insignificant (Insig).

[f] Total debt, equity, value added and capital measured in 000's. Labour is measured in FTE.

In the following sections, we discuss these results and their meaning in greater depth beginning with our overarching research question.

6.2 What is the effect of family ownership on firm performance?

Our results show that family firms are on average less productively efficient than their non-family counterparts. In particular, the FOE approximately ranges from - 2 to - 4 percent depending on the estimation method[86]. This finding corresponds with what Stewart and Hitt (2012) noticed in their brief review of 59 empirical studies regarding the effect of family involvement on performance. By distinguishing between studies with samples of public firms from those with private firms, the authors find that, although the effects varied, *"overall, the performance of privately held family firms does not compare favorably with privately held nonfamily firms"* pg. 62.

Although we similarly report a significant negative average FOE in our sample of privately held SMEs, when we probe deeper into the inter-industry efficiency FOEs, we also find mixed results. That is, we observe some instances where the FOE on PE is positive and significant. These seemingly random positive effects are found across all sectors of the economy. As these results reinforce the diverse findings found in the family business literature to date, beyond an overall negative effect, they do not necessarily add to our understanding of how family ownership impacts PE (Carney et al. 2010; Gomez-Mejia et al. 2011; Sacristán-Navarro et al. 2011; Stewart and Hitt 2012).

However, as we have shown, PE is a particularly useful measure of performance since it can be disaggregated into two components, scale and technical efficiency. These are respectively related to the firm's scale and means of production, which we argued might be impacted by family ownership in different ways.

[86] These were presented in Chapter 5 (Table 30) and Appendix A.4 (Tables A17, A18, A19).

6.3 How does family ownership affect productive efficiency?

Investigating the FOEs on scale and technical efficiency independently provided a richer understanding of the overall negative FOEs found with respect to PE. Our analysis yielded three interesting and related findings: 1) There are negative FOEs on both scale and technical efficiency, 2) FOEs on technical efficiency are not as consistently negative as those on scale efficiency, and 3) the largest component of family firm inefficiency is due to a suboptimal scale of production. At this point, we discuss these and other results derived from this thesis in light of our hypotheses. For convenience, these are discussed in reverse.

6.3.1 Hypothesis 10: family firms will exhibit greater technical efficiency relative to their non-family counterparts.

Starting with technical efficiency, we do not find much support for Hypothesis 10, as depending on the method of estimation, the average FOEs range from - 0.1 to - 2.6 percent and are statistically significant. With that said, the inter-industry results show that family firms on occasion can be more technically efficient than non-family firms. For example, although family firms exhibit significantly lower TE scores in 50 percent of all industries, we also find that they exhibit equivalent or significantly higher PE scores in 31 and 19 percent of the cases respectively[87].

This translates to 7 industries where on average family firms are found to be more technically efficient than non-family firms[88]. Though these industries represent the minority of all cases, the FOEs are still based on a relatively large sample of 1,989

[87] The significant positive FOEs are even more pronounced in our reduced-form estimates where we find that family firms exhibit significantly lower TE scores in 50 percent of all industries, and equivalent or significantly higher TE scores in 28 and 22 percent of the cases respectively.

[88] These are (ANZSIC code in brackets) the General construction (341), Personal and household good wholesaling (447), Large wholesale trade (500), Large property and business services (900), Business services (978), Motion picture, radio and television services (1091), and Sport and recreation (1093) industries.

observations in total, which represents 663 firms across three years. Interestingly, in 4 of these 7 industries (341, 447, 900, and 978) the FOE on TE is significantly positive while the FOE on SE is significantly negative.

Although this may give some credence to notions put forward by Górriz and Fumás (1996; 2005) about how family firms might overcome the disadvantage of size-growth constraints by being more technically efficient, in the vast majority of industries, we do not find this to be the case. We do however find that family firms tend to cluster in those industries where the negative effects of family ownership on technical efficiency are minimised, which may be indicative of a more long-run scenario where family firms gravitate to, or simply tend to survive in, those industries where the technical efficiency FOEs are smallest.

Systematically lower FOE on TE may be caused by many family ownership factors beyond the scope of this thesis[89]. Notwithstanding that we have laid the groundwork for future research to investigate these issues in greater depth, one possible explanation put forward by this thesis is that the means by which family firms produce may be overly labour intensive due to potential capital constraints.

6.3.2 Hypothesis 9: Family firms will exhibit lower capital to labour ratios relative to their non-family counterparts.

If capital constraints were binding, and labour was used as a substitute, then family firms may utilise a suboptimal input mix. We argued how this in turn could impact TE in the sense that a heavier reliance on labour might in turn translate to a technically inefficient level of capital in production. On average, we find strong support for Hypothesis 9 since, no matter the estimation method, family firms are found to consistently be less capital intensive than their non-family peers. Our findings further

[89] In our analysis, we have controlled for age, industry, internal finance, size, efficiency, capital intensity, and capital structure; however, TE may also be affected by other unobserved factors, such as the ability of management, and the quality of inputs (i.e. the ability of labour and the condition of capital).

show that capital intensity itself is positively related to TE, thus we provide some evidence of the relationship between the two FOEs.

Based on our inter-industry analysis, whenever a significant capital intensity FOE does exist, the effect is negative in all but one industry, namely large manufacturing firms (200). However, we also observe that in 63 percent of all industries, there are no significant FOEs with respect to the capital-labour ratio. Specifically, the average negative capital intensity FOE is being driven by 11 key industries spanning across many broad sectors of the economy[90]. These instances represent 31 percent of the cases and consist of 1,329 firms across three years. Interestingly, in many of these, the FOE with respect to TE is also significantly negative[91].

Based on this discussion, despite an overall significant negative FOE on both TE and capital intensity, our analysis thus far has emphasized average tendencies rather than definitive widespread differences between family and non-family firms. These weaker findings to some extent explain the mixed FOEs found with PE, which are mirrored by our inter-industry fixed effects estimates regarding technical efficiency and capital intensity. However, this is not the case when analysing the FOEs with respect to scale efficiency.

6.3.3 Hypothesis 8: Family firms will exhibit lower scale efficiency relative to their non-family counterparts.

This thesis provides strong evidence that family firms are consistently less scale efficient than their non-family peers. We also find that the main component of family

---

[90] Specifically, the FOE with respect to capital intensity is significantly negative in Mining (100), Food, Beverage and Tobacco Manufacturing (221), Machinery and Equipment Manufacturing (228), Other Manufacturing (229), General construction (341), Large wholesale trade (400), Basic material wholesaling (445), Machinery and Motor Vehicle Wholesaling (446), Personal and Household Good Retailing (552), Services to Finance and Insurance (875), and Motion Picture, Radio and Television Services (1091).

[91] With the notable exceptions of the General construction (341), and Motion picture, radio and television services (1091) industries.

firm productive inefficiency is a result of a sub-optimal scale of production. For example, Depending on the estimation method, we report significant average scale efficiency FOEs which range from - 3.1 to - 5.8 percent. These values support Hypothesis 8 and are much larger in magnitude than the FOEs concerning TE. As expected, a negative FOE on SE is significant among firms in the increasing returns to scale category.

The inter-industry effects also show that, whenever significant, the FOE on SE is almost always negative. Specifically, there is a negative and significant FOE on SE in 49 percent of all industries, and a positive and significant FOE on SE in just 2 percent of the cases. This translates to a single industry where family firms are observed to exhibit higher levels of SE, namely large retail trade (500)[92]. Given that we find an overall insignificant FOE on SE among firms in the decreasing returns to scale category, our results demonstrate that the main source of scale inefficiency for family firms is a lack of both capital and labour inputs employed in the production process. In other words, family firms are not reaching the most productive scale size, and as a result are paying a measurable efficiency penalty.

Our findings also imply that, compared to non-family firms, family firm size is systematically constrained. A smaller family firm has anecdotally been observed in many family business studies; however, previous family business studies have rarely used firm size as an outcome of family ownership. Rather, size is most commonly considered as a control, antecedent or moderating variable situated on the right-hand-side of the equation. This thesis has shown that firm size can also be considered an endogenous choice variable that is simultaneously determined with family owners' chosen financing arrangements.

---

[92] The significant negative FOEs are even more pronounced in our reduced-form estimates where we find that family firms exhibit significantly lower SE scores in 90 percent of all industries, and equivalent SE scores 10 percent of the time. Based on these results, there were no instances where we found a significant positive FOE on SE.

6.4 Why is productive efficiency affected by family ownership?

A sub-optimally smaller family firm would in turn explain the systematically lower scale efficiency scores we have discussed thus far. This thesis has offered and tested an explanation on why this phenomenon might be occurring. In this regard, our econometric comparisons have yielded three related findings: 1) Family firms rely more heavily on internal sources of finance, 2) internal sources of debt and equity finance are related to a lower quantum of debt and equity, as well as a smaller firm, and 3) FOEs on various measures of firm size are consistently negative.

These findings support the notion that a smaller family firm size is a result of an owner-imposed dependence on internally sourced finance, which may ultimately limit the quantum of debt and equity finance that family firms are able or willing to raise. Less finance in turn implies less capital and labour used, and output generated, in the production process. All of these production scale variables are also traditional measures of a firm's size.

6.4.1 Hypothesis 7: Other things being equal, family firms are smaller than non-family firms.

No matter the measure of firm size, we consistently find strong evidence which supports Hypothesis 7. For example, the FOEs on output, and capital and labour inputs are all negative and significant on average as well as in the majority of all industries. Since these size measures are all related to the scale of production, there is a clear link between firm size and PE[93]. In fact, PE is found to be endogenous in the determination of firm size, however, our two-stage least squares estimates still indicate negative and significant FOEs. Interestingly, our hybrid model estimates, which separate the fixed effects of the average level of internal finance from the fixed effects of family ownership, indicate weaker negative FOEs on size.

---

[93] For example, PE is measured as the distance between the firm's actual output/input ratio relative to the optimal output/input ratio.

We therefore acknowledge that the significant fixed effects of internal finance explain a substantial part of the FOE on size, which is in accordance with the long-standing 'internal finance theory of growth' (Carpenter and Petersen 2002). This theory states that the growth of most small firms is constrained by the unavailability of external finance. Specifically, these firms will rely more heavily on internally sourced finance, which is subject to stricter limits in quantity.

6.4.2 Hypothesis 6: The quantum of total equity is lower for family firms relative to non-family firms.

6.4.3 Hypothesis 5: The quantum of total debt is lower for family firms relative to non-family firms.

Our expectations with respect to the quantum of debt and equity of family firms are confirmed, as we provide strong support for Hypotheses 5 and 6. Thus in addition to being significantly smaller, we also find that family firms hold a lower quantum of both debt and equity finance. Specifically, the FOEs approximately range from - $2 million to - $3 million with respect to debt, and - $1 million to - $ 2 million with respect to equity. These negative FOEs are also consistent across the majority of industries. As with our firm size estimates, the magnitude of the FOEs on the quantum of debt and equity are considerably weakened after controlling for the fixed effects of internal finance in the hybrid model, although we still observe significant negative effects. This further reinforces the notion that the level of internal finance is in fact negatively related to the size of and the quantum of finance held by the firm.

It is important to keep in mind that our sample consists entirely of SMEs, which are already well known to face internal financing constraints. However, based on the dispersed family business literature on the subject, we argued family owners' SEW-inspired financing preferences will translate to a *higher* level of internally sourced finance relative to non-family SMEs. This thesis has therefore attempted to capture these preferences in various compositional FOEs on both debt and equity finance by source.

In the remaining discussion, we focus on the Hypotheses related to the financing preferences of family owners and infer how such observed tendencies could be related to SEW objectives. In this way we further shed light on how family ownership can impact behaviour, which can further impact real performance outcomes for the firm.

6.4.4 Hypothesis 4a: Equity from internal sources other than working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.

6.4.5 Hypothesis 4b: Equity from external sources, as a proportion of total equity, is lower for family firms relative to non-family firms.

Beginning with equity finance, we find that the FOEs on internal and external finance support Hypothesis 4a and b. Specifically, the significant and positive FOEs on internal equity range from 3.3 to 5.4 percent, while the significant and negative FOEs on external equity range from - 3.6 to - 3.9 percent. Based on the averages presented in Chapter 3, family firms obtain more than double the proportion of internal equity, and less than half the proportion of external equity, relative to comparable non-family firms. Focusing on internal equity, our inter-industry analysis demonstrates that the FOEs on internal equity proportions are positive and significant in 67 percent of the cases and rarely negative[94].

In this thesis we defined ‘internal equity’ as equity sourced from *related* non-working owners such as other family members. By this definition it is not surprising that ‘family firms’ would exhibit greater proportions of internal equity; however, the lower proportions of ‘external equity’ – which is defined as equity sourced from *unrelated* non-working owners, venture capitalists and other unrelated business – also give credence to the notion that family owners prefer internally sourced equity as a means to preserve their control, minimise transactions costs, and avoid the external monitoring that external equity implies (Lopez-Gracia and Sanchez-Andujar 2007). These findings

---

[94] This is reinforced in our external equity FOEs, which across industry are *always* negative when significant.

are in line with the SEW behaviours discussed in this thesis and further reinforce conjectures made in the literature about the limitations to external equity faced by private family firms in particular (Sirmon and Hitt 2003; Dawson 2011).

Overall, our results suggest that family SMEs tend to have a more limited external equity financing base, but a wider base of internally generated equity, excluding equity from working owners, which has been tested for separately in Hypothesis 3.

6.4.6 Hypothesis 3: Equity from working owners, as a proportion of total equity, is greater for family firms relative to non-family firms.

Although it is understood that SMEs in general will rely heavily on equity from working owners, we find that family firms in particular rely much more heavily on working owners as a source of equity finance. In particular, the positive and significant FOEs on the proportion of working owner's equity range from 21 to 23 percent. The positive FOEs are significant in the vast majority of industries and support Hypothesis 3. As with our findings on internal equity, these results are consistent with our current understanding of SEW. For example, internal equity financing sourced from family and working owners implicitly prevents the loss of control and external monitoring, which may ultimately threaten family owners' ability to actively preserve their SEW endowment (Gomez-Mejia et al. 2007; Gomez-Mejia et al. 2011; Berrone et al. 2012). With that said, these results also reinforce our arguments about the relative convenience of owner's equity in family firms given greater patient and survivability capital (Sirmon and Hitt 2003), which also suggest that family firms might have greater access to equity sourced from working owners in general.

However, the consequences of relying too heavily on internally sourced equity have been highlighted in this thesis. For example, in the various regression models that were estimated in the previous chapter, we have observed that the estimated coefficients associated with internal and working owner's equity are significantly related to a lower quantum of equity finance, a smaller firm, a lower capital to labour ratio, and lower levels of both scale and technical efficiency. As this thesis has been concerned with the total financing preferences of family owners, we have also observed similar findings with respect to debt financing.

6.4.7 Hypothesis 2a: Loans from internal sources, as a proportion of total debt, are greater for family firms relative to non-family firms.

6.4.8 Hypothesis 2b: Loans from external sources, as a proportion of total debt, are lower for family firms relative to non-family firms.

Similar to the case of internal equity, our analysis supports Hypothesis 2a. Specifically, the FOEs on internal debt range from - 6.8 to - 7.2 percent. This translates to family firms holding double the proportion of internal debt financing on average relative to non-family firms. The significant negative FOEs are consistent across the majority of industries. As internal debt is defined in this thesis as the proportion of total debt sourced from individuals involved in the business or their families, it comes as no surprise that family firms hold a greater proportion of internal debt; however, contrary to our expectations expressed in Hypothesis 2b, we observed an overall insignificant FOE on external debt proportions. Our inter-industry analysis has confirmed this finding since an insignificant effect is noticeable in most industries, and when significant, the FOEs can be positive or negative[95].

These results provide strong evidence that family owners have a preference for internal providers of both debt and equity finance; however, given the Hypothesis 2b result, we further explore this in terms of the composition of ‘conventional’ external debt. Based on this, we reported that all SMEs rely primarily on banks and trade creditors as sources of debt. Interestingly we have also found significant FOEs on the proportions of these sources as well.

---

[95] Although we have also observed that a preference for internal debt does not necessarily imply that family firms hold a lower proportion of debt obtained from what we have strictly defined as external sources, i.e. the proportion of total debt sourced from ‘other’ individuals and unrelated businesses, a larger proportion of internally sourced debt does automatically imply a lower proportion of debt obtained from other components of total debt (see Appendix A.1).

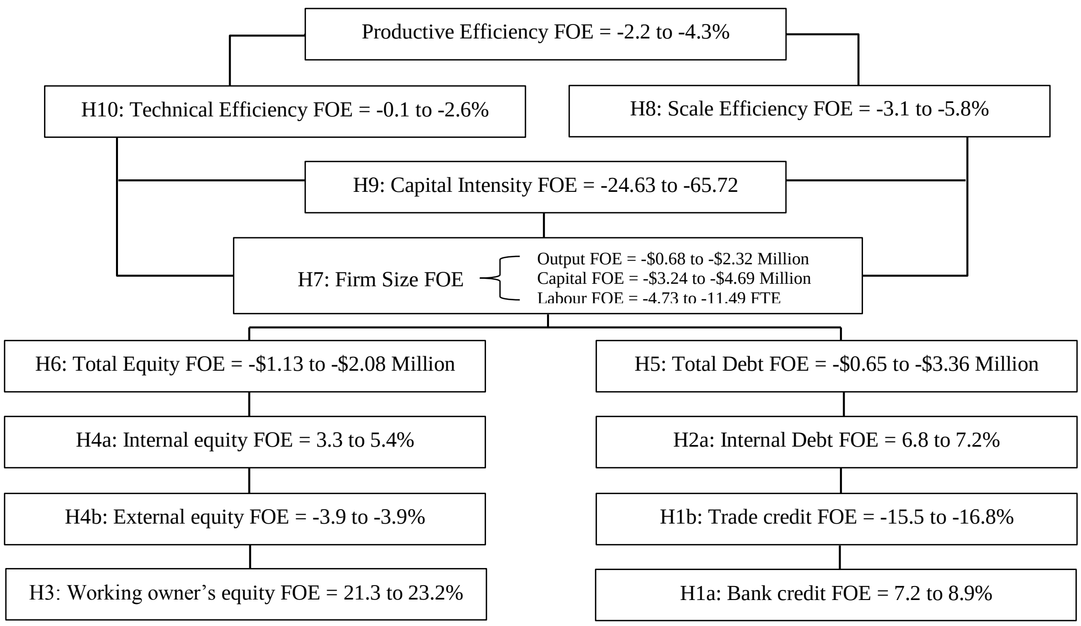
6.4.9 Hypothesis 1a: Bank debt, as a proportion of total debt, is greater for family firms relative to non-family firms.

6.4.10 Hypothesis 1b: Trade credit, as a proportion of total debt, is lower for family firms relative to non-family firms.

We report that family SMEs prefer bank credit over trade credit. These findings reinforce the literature which outlines how family owners may accommodate a closer relationship with their bank (Miller and Le Breton-Miller 2006; Chua et al. 2011). These findings also support the notion that a larger SEW endowment motivates a long-term commitment by family owners, which can alleviate the inherent asymmetric information problems between banks and SME borrowers (Bopaiah 1998). As there is a well-established understanding that trade credit is a direct substitute for bank credit (Biais and Gollier 1997; Petersen and Rajan 1997), we also find that family firms utilise less trade credit in their financing mix. However, this thesis has shown that family and non-family firms alike hold similar proportions of bank and trade credit combined.

As a final summary of our findings, Figure 17 provides an illustration of the significant links investigated in this thesis.

Figure 17: Summary of significant family ownership effects



6.5 Implications of the results

The national breadth and quantity of the data used in this thesis helps to overcome the generalization problems associated with many family business studies which use samples of limited geographic or industry scope. Accordingly we are confident about the external validity of our results, which pertain to the effect of family ownership on financing preferences, firm size and efficiency. Externally valid insights into such matters contribute to our understanding of how non-economic objectives might affect family firm performance and have implications for family business researchers, policy makers, family firm owners as well as the providers of external finance.

6.5.1 For family business researchers

By exploring how SEW considerations affect how family owners finance the firm and employing DEA which has yet to be used in this context, we contribute to family business research on both a conceptual and methodological level. The links between family ownership, financing arrangements, firm size and efficiency proposed in this thesis strengthen the arguments posed by Gomez-Mejia et al. (2011). SMEs in general are known to have difficulty accessing finance, but this thesis highlights an additional behavioural outcome of family ownership not yet associated with the SEW literature. Unlike other studies which have treated firm size as an exogenous control variable, we modify the theory presented by Gomez-Mejia et al. (2011) by considering how firm size is also an *outcome* of SEW preservation. We further quantify these effects on family firm performance and outline the procedure to allow for future researchers to replicate our analysis.

Using longitudinal data derived from Australian SMEs, this thesis specifically addresses previous difficulties with determining the impact of family ownership on firm performance by measuring family and non-family technical efficiency via the popular non-parametric technique known as Data Envelopment Analysis. Since the original Charnes, Cooper, and Rhodes (1979) paper, the DEA method has had rapid and continuous growth in its use across multiple disciplines (Emrouznejad et al. 2008). This is accredited to the fact that DEA, by design, is naturally suited for the complex multi-input/output structure that measuring efficiency and productivity entails. Yet, despite its growing popularity over the past 30 plus years, studies which use DEA to compare efficiency across various ownership structures have been few and far between (see Seiford 1996 for an extensive bibliography of past DEA studies).

Some notable exceptions include Brockett et al. (1998) who compare efficiency across stock and mutual ownership in the insurance industry, and Byrnes et al. (1986) who compare efficiency across public and privately owned water utilities. That said, as far as we can ascertain, this thesis is the first study to utilise a DEA method to compare various efficiency differentials across family and non-family owned SMEs, despite the inherent advantages of this approach.

By using economic theory to derive a performance measure which has not previously been used in a family firm context, and by implementing robust econometric techniques to compare family and non-family performance, we also address the issue of improving the rigor of the measures and techniques used in empirical family business research (Richard et al. 2009; Pearson and Lumpkin 2011). With that said, the accurate measurement of SME efficiency is important for many economic reasons beyond academic curiosity alone. Therefore, the research presented in this thesis also has implications for policy makers, and both family and non-family businesses.

6.5.2 For policy makers

By accurately measuring efficiency, policy makers can target incentives concerning the sources of efficiency differentials, which is essential to the development of public and private policies designed to improve firm performance. Further, improvements in aggregate efficiency in the long run are an important source of economic growth, rising living standards, and increases in the overall welfare of society (Solow 1957; Baumol

1986). With that said, given their economic significance[96], any financing driven size constraint specific to family firms can bring about a wide range of economic consequences. This has implications for policy-makers, as broader economic efficiencies could potentially be gained by understanding the arguments and analysis presented in this thesis.

For example, in relation to an SME financing gap, much policy emphasis has been placed on supply-side issues i.e. resolving the apparent problem that SMEs cannot obtain financing due to deprived access; however, this thesis draws attention to the unique demand-side issues specifically related to family owned firms i.e. family owners have a strong aversion to relinquishing control, which may result in sub-optimal levels of both debt and equity financing by choice. Policy designed to overcome issues related to an SME financing gap could therefore be more effective by acknowledging the distinctive financing outcomes related to family ownership.

Specifically, economic benefits could be realised by policies which encourage and facilitate entrepreneurship and new venture creation within families given that family businesses rely heavily on the family unit itself as a primary source of finance (Rogoff and Heck 2003). Other policy initiatives would ideally target education to both family owned firms and the providers of external finance.

6.5.3 For family firm owners and providers of external finance

As we have discussed, family owners are known to make decisions which are grounded in preserving their SEW endowment. When there is a threat to that endowment, the family is willing to make decisions that are not driven solely by economic considerations. In fact family owners would even be willing to put the firm at risk if this is what it would take to preserve their SEW endowment (Gomez-Mejia et al. 2011). In

[96] Based on the BLS data presented in Chapter 3, of all private firms sampled, just over half are family owned. Further, family SMEs employ more than 40 percent of all full-time equivalent employees, own 30 percent of all assets, and contribute nearly 32 percent towards total output in all sectors in Australia.

other words, there are times when family owners face economic trade-offs when pursuing their non-economic objectives.

It is possible for family owners to exercise control, and extract the associated SEW benefits, by keeping the firm small and decisions centralised. As size increases family owners are physically unable to maintain control in this manner and, therefore, is forced to decentralise, e.g. hire professional directors, implement management control systems, or carry out formal training of both family and non-family employees (Stewart and Hitt 2012). Gomez-Mejia et al. (2011) explain that greater decentralization may lower levels of psychological ownership among family owners and thus reduce the incentive and ability to pursue SEW objectives. Another way of looking at the same issue has been highlighted in this thesis. That is, the SEW objectives of family owners are preventing family firms from growing, which will have implicit costs.

In particular, we have measured the trade-off between maintaining control of the firm, via internally sourced finance, and the efficiency consequences related to such financing preferences. We therefore enable a better understanding of the dilemmas faced by family business owners when making the apparent trade-off between non-economic and economic objectives, which family owners themselves may or may not be fully aware of. With the understanding that family firms are subject to the same efficiency requirements that other forms of ownership face (Pollak 1985), the results presented in this thesis provoke questions about the long-run viability of family SMEs in those industries where the FOE on TE and SE are both negative.

In the context of an SME financing gap, economic growth could be promoted by providing education to family owners in terms of enhancing their ability to recognise viable external sources of finance, how to attract such finance, and the potential efficiency benefits associated with such partnerships. By doing so, a potential solution is to broaden the family firm's capital through external private debt or equity investors. However, despite the available efficiency gains shown in this thesis, external finance professionals are likely to associate the combination of family and business with negative qualities, such as emotions, conflict, and misunderstandings (Dawson 2011).

The inefficiencies linked to family ownership quantified in this thesis represent profit opportunities for external finance investors. As a result, they would benefit from investing in family owned firms, but prefer those that are already ‘professionalized’ or those that reduce the family’s presence after the external finance transaction (Dawson 2011). The results in this thesis suggest that many family SMEs are not willing or able to make this trade-off. However, given the control priorities and resulting financing preferences of family owners, we provide insight to external suppliers of finance in terms of the means to successfully target, penetrate and exploit the family business market. This can potentially be accomplished by catering to the family’s need to preserve their SEW in ways that complement the external investor’s need to pursue economic objectives.

6.6 Future research and limitations of the thesis

While this thesis was being written, Berrone et al. (2012) attempted to address the issue of how to measure the SEW construct. Based on their review of prior research, the authors propose that there are five major dimensions of SEW, and collectively labelled them as FIBER[97]. These identified dimensions are consistent with our reasoning throughout this thesis, i.e. family control is a primary factor in, and a necessary condition for, a larger SEW endowment. With that said, our data do not allow for the direct measurement of SEW. Instead, as with the vast majority of prior studies to date, our proxy for a greater SEW endowment is the presence or absence of family ownership itself. Although this measure is clearly problematic as there is no variation within it, there are numerous reasons which reinforce the notion that SEW is strictly a family firm phenomenon (Gomez-Mejia et al. 2011). Nevertheless, this thesis provides the foundations for future research which would preferably show how the *degree* of a SEW endowment might impact the degree of firm inefficiency related to both production scale and technology.

---

[97] The FIBER acronym stands for 1) Family control and influence, 2) Family members’ identification with the firm, 3) Binding social ties, 4) Emotional attachment, and 5) Renewal of family bonds to the firm through dynastic succession.

Also, despite the many strengths of the BLS data outlined in Chapter 3, there are some who would call attention to their age. On this point we would argue that the relationships investigated in this thesis are somewhat unaffected by time, and although we would like to see future replications of this study that use more recent data, the age of the BLS data is outweighed by their quality and representative nature. Moreover, the BLS has proven to still be relevant today, as demonstrated by recent studies which have utilised the data (Cassar 2004; Watson 2007; Eberhard and Craig 2012; Barbera and Hasso 2013; Barbera and Moores 2013). With that said, a quantitative study of this nature requires a large number of data, the likes of which are difficult to access, especially in a family SME context.

Finally, our calculation of the efficiency scores used to compare family and non-family firm performance are predicated on the assumption that both firm types share the same (albeit industry specific) efficient frontier. This frontier reflects a profit maximisation objective, which may be criticised on the basis that family and non-family owners have different objectives, i.e. non-family owners wish to maximise profit, while family owners also have non-economic objectives. If family owners are maximising a different objective function, then using a single benchmark to compare family firms with their profit maximising non-family counterparts may overstate the efficiency differentials quantified in this thesis. According to this argument, the choices of family owners may be consistent with their distinct SEW objectives. If the utility gained from SEW objectives outweighed the utility lost in diminished efficiency, then such utility maximising behaviour can still be considered rational (Becker and Murphy 1988), albeit inefficient from a profit maximisation perspective.

Future research could account for this by measuring family and non-family efficiency using separate benchmarks for each group. However, the single benchmark used in this thesis helps us to understand the economic value of the trade-off between SEW and performance. For example, ‘inefficiency’ as measured in this thesis is a sign that family owners are less interested in maximising profits. Specifically, if family owners are willing to take actions which forego a given level of efficiency – for the purpose of maintaining their SEW endowment – then we might conclude that the perceived value of the SEW 'gained' by such actions should be equal to or greater than their associated efficiency costs.

6.7 Concluding remarks

Given their economic significance, and a known tendency to pursue non-economic objectives, the overarching purpose of this thesis is to quantify the effect of family ownership on firm performance. Based on an investigation of the economic, finance and family business literatures, the use of a theoretically founded measure of performance, and robust panel regression analysis, three main themes have emerged.

First, family SMEs do not finance their assets in the same way as their non-family counterparts. Specifically, compared to their non-family counterparts, family SMEs rely more heavily on internally sourced finance. Second, these financing decisions have a simultaneous effect on the size of the firm. In particular, family firms own less capital, employ fewer workers, and produce less output. Finally, firm size in and of itself has measurable efficiency consequences which are separate from those related to the efficiency of how resources are arranged in the production process. Specifically, family firms are relatively more labour intensive and exhibit greater inefficiencies related to a suboptimal scale of production. Contrary to our expectations, family SMEs are not compensating for their smaller size by being more technically efficient in their resource use.

By quantifying these effects, we enable a better understanding of the dilemmas faced by family business owners and managers when making the apparent trade-off between non-economic and economic objectives. In the broader context of the challenges specific to SME financing, this thesis yields new insights into how, why and to what extent family ownership affects firm performance.

Appendices

A.1 Comparison of unaltered financing compositional FOEs

In Chapter 3, Section 3.6 we presented the descriptive statistics and performed preliminary data analysis on the compositional differences between family and non-family debt (sub-section 3.6.1.1) and equity (sub-section 3.6.1.2). We also reported key statistics on aggregate financing composition and linked it to firm size (sub-section 3.6.3). The results reported in these sections were based on reweighted proportions of debt and equity after removing those variables that are not a part of the focus of this thesis. The purpose of this appendix is to demonstrate that, even without reweighting, the results presented in Section 3.6 remain unaltered.

Starting with the composition of debt, sub-section 5.1.1, the following list outlines seven debt source variables used in our analysis and the shortened codes we will use in the tables presented in this appendix.

Debt source code		Proportion of total debt sourced from…
1	BANK	Banks and other financial creditors
2	TRADE	Trade and other creditors
3	RELIND	Individuals involved in the business or their families
4	UNREL	Other individuals & unrelated businesses
5	PAR	Parent company
6	PROV	Provisions
7	OTHER	Other Sources

As per our discussion in Section 3.5.1, debt sources 1 and 2 are considered separately and not allocated an internal or external classification. Debt source 3 is classified as internal and debt source 4 is classified as external. We do not classify debt sources 5, 6, and 7 for the reasons already explained. We present the tabulated statistics on all of the

7 debt sources identified in our sample, but for the sake of brevity we will only comment on the first 4 sources in this appendix.

As a starting point, we present Table A1 which corresponds to Table 5 reported in Section 3.6.1.1 and presents the descriptive debt composition statistics for family and non-family firms for each year of our sample period. As we can see in Table A1, bank and trade credit represent the majority of all debt financing for both family and non-family SMEs. When comparing between family and non-family firms we can see that our results are consistent with the reweighted comparisons reported in Table 5. Compared to non-family firms, family bank credit and internal debt proportions are higher, and family external debt proportions are generally the same. As with the reweighted compositions, these results also hold across industry and age. In fact the unweighted debt composition differentials are nearly identical to the reported reweighted values. These can be seen in Table A2 and Table A3, which correspond to Table 6 and Table 7 in Section 3.6.1.1 respectively.

Table A1: Descriptive annual debt composition statistics for family and non-family firms by year

Variable (year)	Panel A: Full Sample (N = 3450/year) 25th Percentile	Mean	Median	75th Percentile	Panel B: Family Firms (N = 1758/year) 25th Percentile	Mean	Median	75th Percentile	Panel C: Non-Family Firms (N = 1692/year) 25th Percentile	Mean	Median	75th Percentile
ST BANK (96)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST BANK (97)	0.0000	0.1144	0.0000	0.1600	0.0000	0.1316	0.0000	0.2000	0.0000	0.0966	0.0000	0.1100
ST BANK (98)	0.0000	0.1057	0.0000	0.1400	0.0000	0.1187	0.0000	0.1900	0.0000	0.0922	0.0000	0.0925
ST BANK (96-98)[a]	0.0000	0.0734	0.0000	0.1000	0.0000	0.0834	0.0000	0.1300	0.0000	0.0629	0.0000	0.0675
LT BANK (96)	0.0000	0.2935	0.2000	0.5400	0.0000	0.3485	0.3000	0.6000	0.0000	0.2363	0.0500	0.4500
LT BANK (97)	0.0000	0.1717	0.0000	0.2800	0.0000	0.2003	0.0000	0.3475	0.0000	0.1420	0.0000	0.1700
LT BANK (98)	0.0000	0.1531	0.0000	0.2200	0.0000	0.1780	0.0000	0.3000	0.0000	0.1273	0.0000	0.1400
LT BANK (96-98)[a]	0.0000	0.2061	0.0667	0.3467	0.0000	0.2423	0.1000	0.4158	0.0000	0.1685	0.0167	0.2533
TRADE (96)	0.0900	0.3756	0.2800	0.6000	0.0700	0.3194	0.2200	0.5000	0.1100	0.4340	0.3500	0.7600
TRADE (97)	0.0900	0.3855	0.2800	0.6300	0.0700	0.3456	0.2400	0.5500	0.1000	0.4269	0.3400	0.7225
TRADE (98)	0.1025	0.4291	0.3200	0.7600	0.1000	0.3987	0.2700	0.7000	0.1400	0.4606	0.3700	0.8400
TRADE (96-98)[a]	0.0800	0.3725	0.2700	0.6000	0.0600	0.3292	0.2200	0.5000	0.1000	0.4175	0.3200	0.7100
RELIND (96)	0.0000	0.1200	0.0000	0.1000	0.0000	0.1585	0.0000	0.2000	0.0000	0.0800	0.0000	0.0000
RELIND (97)	0.0000	0.1072	0.0000	0.0700	0.0000	0.1349	0.0000	0.1400	0.0000	0.0784	0.0000	0.0000
RELIND (98)	0.0000	0.0973	0.0000	0.0500	0.0000	0.1226	0.0000	0.1200	0.0000	0.0710	0.0000	0.0000
RELIND (96-98)[a]	0.0000	0.1057	0.0000	0.0700	0.0000	0.1364	0.0000	0.1500	0.0000	0.0738	0.0000	0.0000
UNREL (96)	0.0000	0.0227	0.0000	0.0000	0.0000	0.0207	0.0000	0.0000	0.0000	0.0248	0.0000	0.0000
UNREL (97)	0.0000	0.0195	0.0000	0.0000	0.0000	0.0203	0.0000	0.0000	0.0000	0.0186	0.0000	0.0000
UNREL (98)	0.0000	0.0182	0.0000	0.0000	0.0000	0.0175	0.0000	0.0000	0.0000	0.0189	0.0000	0.0000
UNREL (96-98)[a]	0.0000	0.0201	0.0000	0.0000	0.0000	0.0195	0.0000	0.0000	0.0000	0.0207	0.0000	0.0000
PAR (96)	0.0000	0.0421	0.0000	0.0000	0.0000	0.0225	0.0000	0.0000	0.0000	0.0625	0.0000	0.0000
PAR (97)	0.0000	0.0409	0.0000	0.0000	0.0000	0.0235	0.0000	0.0000	0.0000	0.0590	0.0000	0.0000
PAR (98)	0.0000	0.0436	0.0000	0.0000	0.0000	0.0253	0.0000	0.0000	0.0000	0.0626	0.0000	0.0000
PAR (96-98)[a]	0.0000	0.0420	0.0000	0.0000	0.0000	0.0236	0.0000	0.0000	0.0000	0.0610	0.0000	0.0000
PROV (96)	0.0000	0.0707	0.0000	0.1500	0.0000	0.0575	0.0000	0.0600	0.0000	0.0845	0.0000	0.1000
PROV (97)	0.0000	0.0616	0.0000	0.1300	0.0000	0.0488	0.0000	0.0500	0.0000	0.0748	0.0000	0.0900
PROV (98)	0.0000	0.0655	0.0000	0.1400	0.0000	0.0515	0.0000	0.0500	0.0000	0.0800	0.0000	0.0900
PROV (96-98)[a]	0.0000	0.0657	0.0000	0.0700	0.0000	0.0523	0.0000	0.0500	0.0000	0.0797	0.0000	0.1000
OTHER (96)	0.0000	0.0753	0.0000	0.0300	0.0000	0.0730	0.0000	0.0000	0.0000	0.0778	0.0000	0.0000
OTHER (97)	0.0000	0.0992	0.0000	0.1700	0.0000	0.0950	0.0000	0.0200	0.0000	0.1036	0.0000	0.0400
OTHER (98)	0.0000	0.0876	0.0000	0.1500	0.0000	0.0876	0.0000	0.0175	0.0000	0.0875	0.0000	0.0500
OTHER (96-98)[a]	0.0000	0.0858	0.0000	0.0100	0.0000	0.0835	0.0000	0.0000	0.0000	0.0881	0.0000	0.0200

Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

Table A2: Family ownership effects on debt composition by industry (1996-1998)

	ANZSIC & Industry Category	N	Family	Non-Family	BANK FOE	TRADE FOE	RELIND FOE	UNREL FOE	OTHER FOE
100	**Mining**	**79**	**19**	**60**	**0.230*** **	**0.075**	**0.099**	**-0.036** **	**-0.318*** **
	Manufacturing								
200	between 100 & 200 employees	279	79	200	0.079**	-0.068*	0.062***	0.002	-0.065*
221	Food, Beverage and Tobacco Manufacturing	410	213	197	0.106***	-0.075**	0.042**	-0.016*	-0.057**
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	0.056*	-0.154***	0.093***	-0.005	0.004
223	Wood and Paper Product Manufacturing	203	125	78	0.035	-0.118**	0.052	0.028**	-0.001
224	Printing, Publishing and Recorded Media	302	183	119	0.051	-0.114***	0.112***	-0.017	-0.092**
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	0.098***	-0.087***	0.059***	0.014	-0.088***
226	Non-Metallic Mineral Product Manufacturing	177	115	62	0.207***	-0.136**	0.014	-0.001	-0.087*
227	Metal Product Manufacturing	559	315	244	0.110***	-0.133***	0.074***	0.011**	-0.072***
228	Machinery and Equipment Manufacturing	1040	532	508	0.118***	-0.090***	0.097***	-0.001	-0.101***
229	Other Manufacturing	388	240	148	0.069**	-0.065*	0.000	-0.011	0.013
	Construction								
300	between 100 & 200 employees	21	14	7	-0.072	0.186	-0.035*	0.001	-0.080
341	General Construction	194	130	64	0.096*	-0.087	-0.012	-0.007	-0.012
342	Construction Trade Services	375	272	103	0.086**	-0.043	0.054**	0.001	-0.052*
	Wholesale Trade								
400	between 100 & 200 employees	95	34	61	0.047	-0.067	0.013	0.004	0.003
445	Basic Material Wholesaling	393	224	169	0.008	-0.031	0.088***	0.008	-0.091***
446	Machinery and Motor Vehicle Wholesaling	684	310	374	0.102***	-0.105***	0.108***	0.001	-0.105***
447	Personal and Household Good Wholesaling	543	319	224	0.060**	-0.059**	0.046***	-0.021**	-0.028
	Retail Trade								
500	between 100 & 200 employees	63	29	34	-0.155**	0.065	0.070**	0.017	0.003
551	Food Retailing	236	169	67	-0.023	-0.060	0.065**	0.027**	-0.041
552	Personal and Household Good Retailing	374	214	160	0.136***	-0.133***	0.043	0.006	-0.061**
553	Motor Vehicle Retailing and Services	405	235	170	0.047	-0.090**	0.007	-0.009	0.052**
	Accommodation, Cafes and Restaurants								
600	between 100 & 200 employees	10	5	5	-0.274	-0.114	0.198**	0.098*	0.092*
657	Accommodation, Cafes and Restaurants	360	172	188	0.108***	-0.081**	0.072***	-0.012	-0.083**
700	**Transport and Storage**	**376**	**212**	**164**	**0.198*** **	**-0.171*** **	**0.067*** **	**-0.012**	**-0.094*** **

	Finance and Insurance								
800	between 100 & 200 employees	4	0	4	n/a	n/a	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	0.281***	-0.158***	0.059*	-0.005	-0.103**
	Property and Business Services								
900	between 100 & 200 employees	68	10	58	0.290*	-0.059	0.054	-0.018*	-0.215***
977	Property Services	317	150	167	0.018	-0.146***	0.135***	0.023	-0.004
978	Business Services	958	287	671	0.020	-0.139***	0.084***	-0.004	-0.009
	Cultural and Recreational Services								
1000	between 100 & 200 employees	14	0	14	n/a	n/a	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	0.193**	-0.127**	0.110	-0.025*	-0.146*
1092	Libraries, Museums and the Arts	9	0	9	n/a	n/a	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	0.115	0.049	0.072	-0.033	-0.134*
	Personal and Other Services								
1100	between 100 & 200 employees	3	3	0	n/a	n/a	n/a	n/a	n/a
1195	Personal Services	205	108	97	0.088*	-0.108**	-0.010	0.019	0.015

Debt composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various debt sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table A3: Family ownership effects on debt composition by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	Proportion of family firms	BANK FOE	TRADE FOE	RELIND FOE	UNREL FOE	PAR FOE	PROV FOE	OTHER FOE
Less than 2 years (1)	126	38	88	30.16%	0.06	-0.16**	0.08	0.04	-0.06**	-0.05**	0.05
2 to less than 5 years (2)	1111	495	616	44.55%	0.06***	-0.10***	0.08***	0.00	-0.05***	-0.03***	0.00
5 to less than 10 years (3)	2867	1339	1528	46.70%	0.08***	-0.10***	0.07***	0.00	-0.03***	-0.02***	0.00
10 to less than 20 years (4)	3428	1755	1673	51.20%	0.11***	-0.08***	0.05***	0.00	-0.04***	-0.04***	-0.01
20 years or more (5)	2818	1647	1171	58.45%	0.10***	-0.09***	0.08***	-0.01	-0.04***	-0.03***	-0.01

Debt composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various debt sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

With respect to equity composition, the following list outlines seven equity source variables and the shortened codes we will use in the tables presented in this appendix.

Equity source code		Proportion of equity sourced from…
1	WO	Working owners
2	NWOF	Non-working owners (family members)
3	NWONF	Non-working owners (non-family)
4	PAR	Parent company
5	VC & URB	Venture or development capitalists & other unrelated businesses
6	EMP	Employees (excluding directors)
7	OTHER	Other sources (including shareholders)

As in the previous section, at this point we define what constitutes an internal or external equity source. Equity source 1 is considered separately and not allocated an internal or external classification. Equity source 2 is classified as internal and equity sources 3 and 5 are classified as external. We do not classify debt sources 4, 6, and 7 and thus for the sake of brevity do not focus on them the body of the text.

Table A4 shows the unaltered equity composition statistics for family and non-family firms for each year of our sample period and corresponds to Table 8 in Section 3.6.1.2. Table A4 shows that on average and consistent across all periods, family firms obtain a greater proportion of equity from working owners and what we classify as internal sources, and less from external sources, than do non-family firms. Considering industry and age, Table A5 and Table A6 report the FOEs on our equity proportions of interest across industry and firm age. These correspond to Table 9 and Table 10 presented in Section 3.6.1.2. Again we can see that the reweighting has not significantly influenced the results as the effects reported in Table A5 and Table A6 are nearly identical in terms of relative size and significance to those found using the reweighted proportions.

Moving on to the aggregates reported in Section 3.6.2, Table A7 and Figure A1 correspond to Table 12 and Figure 5 respectively. These display a single aggregate, averaged across industry and time, of the financing composition differences between family and non-family firms. When these unaltered aggregates are considered the results presented in Section 3.6.2 still hold. Finally, Table A8 and Table A9 correspond to the correlations between firm size and financing presented in Table 13 and Table 14 respectively. Again we demonstrate that the reweighting performed in Section 3.6 has not significantly changed our reweighted results, as the relative strength and significance of the relationship between firm size and finance composition are consistent with what we report in Chapter 3.

Table A4: Descriptive annual equity composition statistics for family and non-family firms by year

Variable (year)[a]	Panel A: Full Sample (N = 3450/year)				Panel B: Family Firms (N = 1758/year)				Panel C: Non-Family Firms (N = 1692/year)			
	25th Percentile	Mean	Median	75th Percentile	25th Percentile	Mean	Median	75th Percentile	25th Percentile	Mean	Median	75th Percentile
WO (96)	0.0850	0.6802	1.0000	1.0000	0.7500	0.8032	1.0000	1.0000	0.0000	0.5524	0.7500	1.0000
WO (97)	0.0500	0.6670	1.0000	1.0000	0.6525	0.7911	1.0000	1.0000	0.0000	0.5382	0.6000	1.0000
WO (98)	0.0000	0.6680	1.0000	1.0000	0.6050	0.7837	1.0000	1.0000	0.0000	0.5478	0.7500	1.0000
WO (96-98)[b]	0.0000	0.6432	1.0000	1.0000	0.5000	0.7611	1.0000	1.0000	0.0000	0.5208	0.5000	1.0000
NWOF (96)	0.0000	0.0558	0.0000	0.0000	0.0000	0.0754	0.0000	0.0000	0.0000	0.0355	0.0000	0.0000
NWOF (97)	0.0000	0.0622	0.0000	0.0000	0.0000	0.0797	0.0000	0.0000	0.0000	0.0441	0.0000	0.0000
NWOF (98)	0.0000	0.0608	0.0000	0.0000	0.0000	0.0768	0.0000	0.0000	0.0000	0.0442	0.0000	0.0000
NWOF (96-98)[b]	0.0000	0.0582	0.0000	0.0000	0.0000	0.0761	0.0000	0.0000	0.0000	0.0397	0.0000	0.0000
NWONF (96)	0.0000	0.0209	0.0000	0.0000	0.0000	0.0085	0.0000	0.0000	0.0000	0.0339	0.0000	0.0000
NWONF (97)	0.0000	0.0191	0.0000	0.0000	0.0000	0.0058	0.0000	0.0000	0.0000	0.0330	0.0000	0.0000
NWONF (98)	0.0000	0.0169	0.0000	0.0000	0.0000	0.0070	0.0000	0.0000	0.0000	0.0272	0.0000	0.0000
NWONF (96-98)[b]	0.0000	0.0184	0.0000	0.0000	0.0000	0.0071	0.0000	0.0000	0.0000	0.0301	0.0000	0.0000
PAR (96)	0.0000	0.1470	0.0000	0.0000	0.0000	0.0583	0.0000	0.0000	0.0000	0.2393	0.0000	0.0000
PAR (97)	0.0000	0.1456	0.0000	0.0000	0.0000	0.0618	0.0000	0.0000	0.0000	0.2327	0.0000	0.0000
PAR (98)	0.0000	0.1463	0.0000	0.0000	0.0000	0.0613	0.0000	0.0000	0.0000	0.2345	0.0000	0.0000
PAR (96-98)[b]	0.0000	0.1454	0.0000	0.0000	0.0000	0.0605	0.0000	0.0000	0.0000	0.2337	0.0000	0.0000
VC & URB (96)	0.0000	0.0090	0.0000	0.0000	0.0000	0.0058	0.0000	0.0000	0.0000	0.0123	0.0000	0.0000
VC & URB (97)	0.0000	0.0083	0.0000	0.0000	0.0000	0.0036	0.0000	0.0000	0.0000	0.0131	0.0000	0.0000
VC & URB (98)	0.0000	0.0077	0.0000	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0134	0.0000	0.0000
VC & URB (96-98)[b]	0.0000	0.0083	0.0000	0.0000	0.0000	0.0038	0.0000	0.0000	0.0000	0.0129	0.0000	0.0000
EMP (96)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
EMP (97)	0.0000	0.0204	0.0000	0.0000	0.0000	0.0193	0.0000	0.0000	0.0000	0.0215	0.0000	0.0000
EMP (98)	0.0000	0.0118	0.0000	0.0000	0.0000	0.0149	0.0000	0.0000	0.0000	0.0087	0.0000	0.0000
EMP (96-98)[b]	0.0000	0.0106	0.0000	0.0000	0.0000	0.0113	0.0000	0.0000	0.0000	0.0100	0.0000	0.0000
OTHER (96)	0.0000	0.0871	0.0000	0.0000	0.0000	0.0489	0.0000	0.0000	0.0000	0.1266	0.0000	0.0000
OTHER (97)	0.0000	0.0774	0.0000	0.0000	0.0000	0.0388	0.0000	0.0000	0.0000	0.1174	0.0000	0.0000
OTHER (98)	0.0000	0.0885	0.0000	0.0000	0.0000	0.0542	0.0000	0.0000	0.0000	0.1241	0.0000	0.0000
OTHER (96-98)[b]	0.0000	0.0809	0.0000	0.0000	0.0000	0.0438	0.0000	0.0000	0.0000	0.1194	0.0000	0.0000

[a] All values are represented as proportions. i.e. value of financing source x divided by total equity.
[b] Total sample across 1996 to 1998 consists of 10350 firms of which 5274 are family and 5076 are non-family.

Table A5: Family ownership effects on equity composition by industry (1996-1998)

	ANZSIC & Industry Category	N	Family	Non-Family	WO FOE	NWOF FOE	NWONF FOE	VC & URB FOE	OTHER FOE
100	**Mining**	**79**	**19**	**60**	**0.593*** **	**0.126** **	**-0.036**	**-0.004**	**-0.679*** **
	Manufacturing								
200	between 100 & 200 employees	279	79	200	0.237***	0.180***	-0.013	0.002	-0.408***
221	Food, Beverage and Tobacco Manufacturing	410	213	197	0.268***	0.070***	-0.032***	-0.038**	-0.272***
222	Textile, Clothing, Footwear and Leather Manufacturing	327	189	138	0.190***	0.010	-0.016	-0.013	-0.148***
223	Wood and Paper Product Manufacturing	203	125	78	-0.017	0.077**	-0.066**	0.000	-0.037
224	Printing, Publishing and Recorded Media	302	183	119	0.298***	0.020	-0.016	0.003	-0.272***
225	Petroleum, Coal, Chemical and Associated Product Manufacturing	497	214	283	0.341***	0.069***	-0.012	-0.020*	-0.372***
226	Non-Metallic Mineral Product Manufacturing	177	115	62	0.508***	-0.049	-0.071**	-0.036*	-0.320***
227	Metal Product Manufacturing	559	315	244	0.162***	0.056***	-0.015	0.010	-0.211***
228	Machinery and Equipment Manufacturing	1040	532	508	0.219***	0.036***	-0.019***	-0.013***	-0.219***
229	Other Manufacturing	388	240	148	0.099**	0.016	-0.011	-0.005	-0.065*
	Construction								
300	between 100 & 200 employees	21	14	7	-0.241	0.167*	-0.046	0.000	0.119
341	General Construction	194	130	64	0.103*	-0.099**	-0.017	0.001	-0.049
342	Construction Trade Services	375	272	103	0.118**	0.020	-0.044**	-0.006	-0.106***
	Wholesale Trade								
400	between 100 & 200 employees	95	34	61	0.614***	0.034	0.021	-0.035*	-0.618***
445	Basic Material Wholesaling	393	224	169	0.237***	0.101***	-0.057***	-0.015*	-0.257***
446	Machinery and Motor Vehicle Wholesaling	684	310	374	0.448***	0.027*	-0.022***	-0.005**	-0.479***
447	Personal and Household Good Wholesaling	543	319	224	0.287***	0.031**	-0.019**	0.009	-0.310***
	Retail Trade								
500	between 100 & 200 employees	63	29	34	0.308***	0.059	-0.032	0.000	-0.369***
551	Food Retailing	236	169	67	0.057	0.044**	-0.029	-0.021*	-0.051
552	Personal and Household Good Retailing	374	214	160	0.142***	-0.007	0.001	-0.006	-0.134***
553	Motor Vehicle Retailing and Services	405	235	170	0.062	-0.036*	-0.024**	-0.018*	0.010
	Accommodation, Cafes and Restaurants								
600	between 100 & 200 employees	10	5	5	0.400	0.000	0.000	0.000	-0.400
657	Accommodation, Cafes and Restaurants	360	172	188	0.451***	0.041**	-0.035**	-0.020**	-0.479***
700	**Transport and Storage**	**376**	**212**	**164**	**0.195*** **	**0.050** **	**-0.030*** **	**-0.027** **	**-0.197*** **

	Finance and Insurance								
800	between 100 & 200 employees	4	0	4	n/a	n/a	n/a	n/a	n/a
875	Services to Finance and Insurance	218	104	114	0.225***	0.019	-0.009	0.000	-0.288***
	Property and Business Services								
900	between 100 & 200 employees	68	10	58	0.439***	0.143	0.000	0.000	-0.530***
977	Property Services	317	150	167	0.120***	0.047**	-0.063***	-0.007*	-0.101***
978	Business Services	958	287	671	0.084***	0.017	-0.019***	-0.008***	-0.085***
	Cultural and Recreational Services								
1000	between 100 & 200 employees	14	0	14	n/a	n/a	n/a	n/a	n/a
1091	Motion Picture, Radio and Television Services	110	24	86	0.467***	-0.017	-0.013	0.000	-0.414***
1092	Libraries, Museums and the Arts	9	0	9	n/a	n/a	n/a	n/a	n/a
1093	Sport and Recreation	53	24	29	0.558***	-0.010	-0.061*	0.000	-0.570***
	Personal and Other Services								
1100	between 100 & 200 employees	3	3	0	n/a	n/a	n/a	n/a	n/a
1195	Personal Services	205	108	97	0.095*	0.033	-0.026*	0.000	-0.057

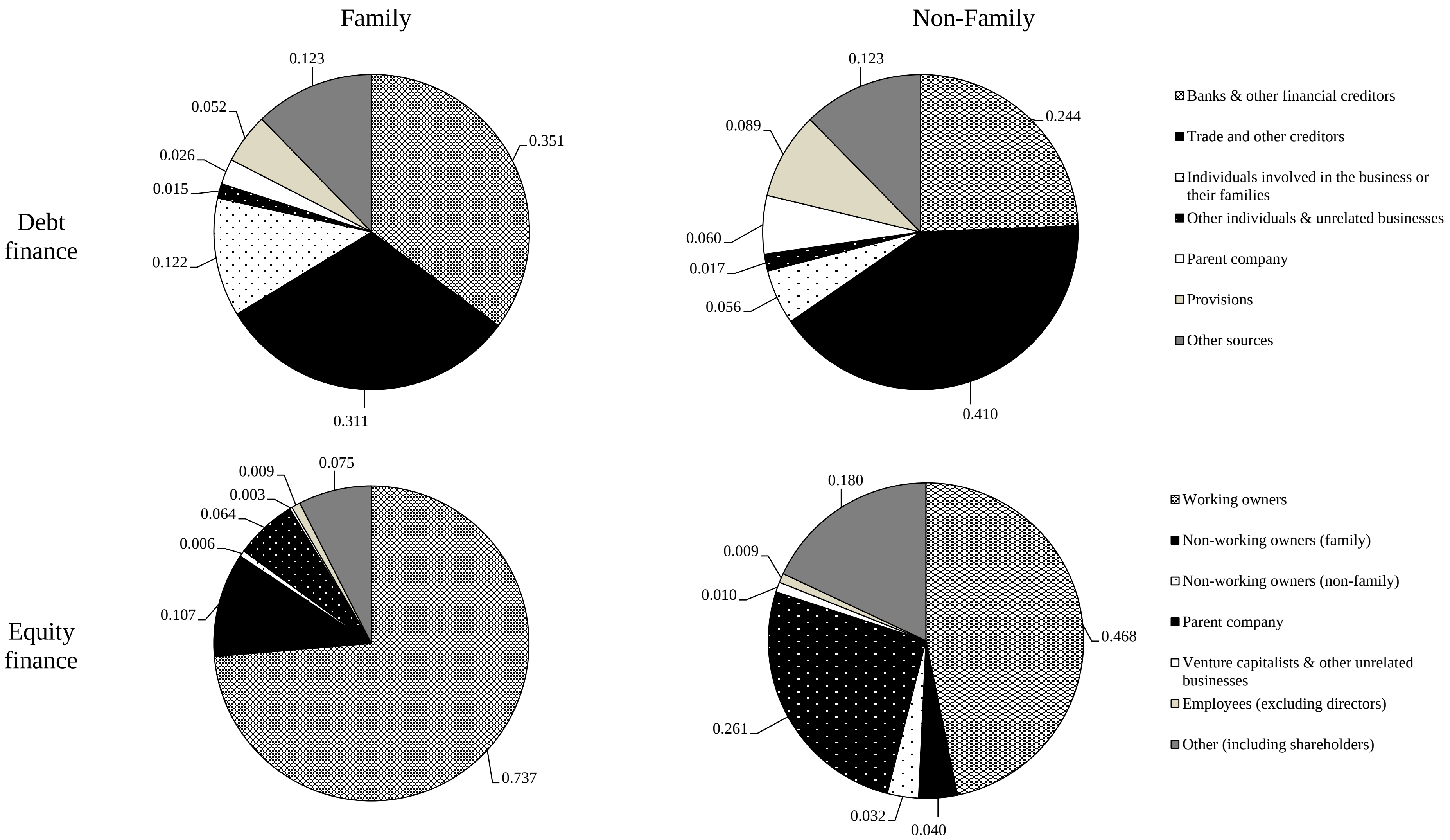
Equity composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various equity sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Table A6: Family ownership effects on equity composition by age (1996-1998)

Age Range (bracket)	N	Family	Non-Family	Proportion of family firms	WO FOE	NWOF FOE	NWONF FOE	PAR FOE	EMP FOE	VC & URB FOE	OTHER FOE
Less than 2 years (1)	126	38	88	30.16%	0.21**	-0.06	-0.02	-0.20***	-0.02*	-0.02*	0.02
2 to less than 5 years (2)	1111	495	616	44.55%	0.26***	0.03**	0.02***	-0.20***	0.00	-0.02***	-0.07***
5 to less than 10 years (3)	2867	1339	1528	46.70%	0.19***	0.01***	0.02***	-0.13***	0.00	-0.01***	-0.05***
10 to less than 20 years (4)	3428	1755	1673	51.20%	0.24***	0.01**	0.01***	-0.17***	0.00	-0.01***	-0.06***
20 years or more (5)	2818	1647	1171	58.45%	0.32***	0.08***	0.08***	-0.23***	0.00	-0.01**	-0.14***

Equity composition FOEs have been determined by $x_{ff} - x_{nf}$, where x is the mean of the various equity sources compared, and ff and nf denote family and non-family firms respectively. T-tests are performed on x_{ff} and x_{nf}. Level of significance: ***1%; **5%; *10%.

Figure A1: Average aggregate family and non-family finance composition by debt and equity source



Aggregate finance compositions are averaged first by industry, then by ownership.

Table A7: Average aggregate family and non-family finance composition by debt and equity source

	Average finance composition by source[a]	FF	NF	FF-NF	%	z-stat
	Source of debt finance					
BANK	Banks & other financial creditors	0.351	0.244	0.108	44.3	(12.095)***
TRADE	Trade and other creditors	0.311	0.410	-0.099	-24.1	(-10.518)***
RELIND	Individuals involved in the business or their families	0.122	0.056	0.065	116.1	(11.799)***
UNREL	Other individuals & unrelated businesses	0.015	0.017	-0.002	-14.0	(-0.982)
PAR	Parent company	0.026	0.060	-0.034	-56.3	(-8.453)***
PROV	Provisions	0.052	0.089	-0.038	-42.2	(-7.486)***
OTHER	Other sources	0.122	0.123	-0.001	-0.5	(-0.096)
	Source of equity finance					
WO	Working owners	0.737	0.468	0.269	57.4	(29.019)***
NWOF	Non-working owners (family)	0.107	0.040	0.067	169.9	(13.293)***
NWONF	Non-working owners (non-family)	0.006	0.032	-0.026	-80.6	(-9.563)***
PAR	Parent company	0.064	0.261	-0.197	-75.6	(-28.071)***
VC & URB	Venture capitalists & other unrelated businesses	0.003	0.010	-0.008	-75.2	(-4.905)***
EMP	Employees (excluding directors)	0.009	0.009	0.000	-4.4	(-0.223)
OTHER	Other (including shareholders)	0.075	0.180	-0.105	-58.3	(-16.167)***

[a] Aggregate finance compositions are averaged first by industry, then by ownership.

Table A8: Pearson's correlations between source of debt finance and firm size (1996-1998)

	Size Variables				*Share of debt finance (proportion)*						
	Output	Labour	Capital	Total Debt	BANK	TRADE	PROV	PAR	RELIND	UNREL	OTHER
Output	1 -										
Labour	0.568 (70.174)***	1 -									
Capital	0.697 (99.002)***	0.304 (32.425)***	1 -								
Total Debt	0.624 (81.286)***	0.295 (31.384)***	0.835 (154.301)***	1 -							
BANK	-0.042 (-4.298)***	-0.052 (-5.250)***	0.008 (0.776)	0.012 (1.171)	1 -						
TRADE	0.018 (1.806)*	0.069 (7.019)***	-0.012 (-1.235)	-0.02 (-2.043)**	-0.432 (-48.688)***	1 -					
PROV	0.175 (18.031)***	0.183 (18.899)***	0.064 (6.506)***	0.03 (3.065)***	-0.178 (-18.427)***	-0.072 (-7.298)***	1 -				
PAR	0.131 (13.423)***	0.167 (17.191)***	0.081 (8.276)***	0.135 (13.840)***	-0.162 (-16.684)***	-0.15 (-15.399)***	0.009 (0.894)	1 -			
RELIND	-0.11 (-11.242)***	-0.15 (-15.411)***	-0.058 (-5.925)***	-0.059 (-5.967)***	-0.159 (-16.390)***	-0.284 (-30.170)***	-0.104 (-10.620)***	-0.109 (-11.168)***	1 -		
UNREL	-0.024 (-2.429)**	-0.041 (-4.219)***	-0.002 (-0.169)	0.003 (0.304)	-0.07 (-7.167)***	-0.107 (-10.951)***	-0.04 (-4.090)***	-0.041 (-4.139)***	-0.04 (-4.099)***	1 -	
OTHER	0.006 (0.660)	-0.004 (-0.413)	-0.004 (-0.443)	-0.012 (-1.269)	-0.218 (-22.675)***	-0.273 (-28.918)***	-0.074 (-7.564)***	-0.072 (-7.292)***	-0.136 (-14.002)***	-0.046 (-4.671)***	1 -

T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

Table A9: Pearson's correlations between source of equity finance and firm size (1996-1998)

	Size Variables				*Share of equity finance (proportion)*						
	Output	Labour	Capital	Total Equity	WO	NWOF	NWONF	PAR	VC & URB	EMP	OTHER
Output	1 -										
Labour	0.568 (70.174)***	1 -									
Capital	0.697 (99.002)***	0.304 (32.425)***	1 -								
Total Equity	0.552 (67.309)***	0.218 (22.715)***	0.853 (166.341)***	1 -							
WO	-0.24 (-25.134)***	-0.273 (-28.881)***	-0.13 (-13.293)***	-0.072 (-7.370)***	1 -						
NWOF	-0.023 (-2.294)**	0.014 (1.444)	-0.015 (-1.486)	-0.01 (-1.022)	-0.242 (-25.369)***	1 -					
NWONF	-0.011 (-1.106)	0.005 (0.540)	-0.013 (-1.347)	-0.01 (-0.997)	-0.137 (-14.048)***	-0.023 (-2.388)**	1 -				
PAR	0.285 (30.216)***	0.351 (38.076)***	0.137 (14.071)***	0.069 (7.007)***	-0.592 (-74.763)***	-0.124 (-12.690)***	-0.067 (-6.879)***	1 -			
VC & URB	0.027 (2.767)***	0.038 (3.880)***	0.013 (1.347)	0.007 (0.708)	-0.12 (-12.258)***	-0.025 (-2.532)**	-0.009 (-0.943)	-0.024 (-2.437)**	1 -		
EMP	0 (0.013)	0.006 (0.643)	0.003 (0.332)	0.001 (0.144)	-0.12 (-12.312)***	-0.031 (-3.148)***	-0.015 (-1.475)	-0.048 (-4.936)***	-0.009 (-0.959)	1 -	
OTHER	0.08 (8.135)***	0.031 (3.111)***	0.07 (7.168)***	0.056 (5.680)***	-0.414 (-46.283)***	-0.088 (-8.989)***	-0.047 (-4.823)***	-0.116 (-11.867)***	-0.022 (-2.199)**	-0.033 (-3.406)***	1 -

T-statistics in parentheses. Level of significance: ***1%; **5%; *10%.

A.2 DEA Linear Programming

Based on the method developed by Charnes, Cooper, and Rhodes (1979;1981), The DEA frontier itself is the linear programming calculation of a hypothetical, or virtual, efficient firm which is then used to compute the TE score of the firm being evaluated. This can be accomplished with a sample of input-output data and by imposing some basic assumptions regarding the production technology of our sample firms. Here we define these assumptions and specify the linear programming problems which are solved to find the efficient frontier and calculate the efficiency scores.

We begin by defining the production possibility set. Any production technology transforming an input bundle, x, into an output bundle, y, can be characterised by the production possibilities set, T, which consists of

(1) $$\mathrm{T} = \{(\mathrm{x},\mathrm{y}): \mathrm{y}\ \text{can be produced from}\ \mathrm{x}; \mathrm{x} \geq 0; \mathrm{y} \geq 0\}$$

That is, obtaining y is feasible by using x, provided that input and output bundles are not negative. In the one input, one output case, the efficient frontier is defined by the production function

(2) $$\mathrm{g}(\mathrm{x}) = \max \mathrm{y}: (\mathrm{x},\mathrm{y}) \in \mathrm{T}$$

That is, an efficient firm would obtain the maximum y for any given x. Specifically, for any input bundle x^0, $\mathrm{g}(\mathrm{x}^0)$ is the maximum quantity of y that can be produced. Based on (2), we can define the equivalent production possibilities set as

(3) $$\mathrm{T} = \{(\mathrm{x},\mathrm{y}): \mathrm{y} \leq \mathrm{g}(\mathrm{x}); \mathrm{x} \geq 0; \mathrm{y} \geq 0\}$$

The previously mentioned parametric approach arbitrarily chooses a functional form for the underlying technology $\mathrm{g}(\mathrm{x})$, for example the Cobb-Douglas (1928) production function is commonly utilised, whereas in DEA, the following assumptions are made regarding $g(x)$, which are consistent with any functional form, but no particular function is imposed.

1. All actually observed input-output bundles are feasible. That is, every input-output combination (x^j, y^j) $(j = 1,2,\dots,N)$ in the sample of N firms is in T.
2. The production possibility set is convex. That is, if (x^1, y^1) and (x^2, y^2) are both feasible, then any weighted average of the two input bundles can produce the corresponding weighted average of the two output bundles. This would be true for any number of feasible input-output bundles; hence $\bar{x} = \sum_{j=1}^{N} \lambda_j x^j$ can produce $\bar{y} = \sum_{j=1}^{N} \lambda_j y^j$ for any set of non-negative weights λ_j $(j = 1,2,\dots,N)$ such that $\sum_{j=1}^{N} \lambda_j = 1$.
3. Inputs are freely disposable. That is, increasing any input without reducing any other input would not cause a decrease in output produced. More formally, if $(x^0, y^0) \in T$ and $x^1 \geq x^0$, in other words, no element of the x^1 bundle is smaller than the corresponding element x^0 bundle, then $(x^1, y^0) \in T$.
4. Outputs are freely disposable. That is if x^0 can produce y^0, then it can always produce a smaller output bundle $y^1 \leq y^0$. Formally, if $(x^0, y^0) \in T$ and $y^1 \leq y^0$, then $(x^0, y^1) \in T$.

Using a sample of actually observed input-output data and four assumptions above, DEA derives a benchmark input-output quantity with which the actual input-output used by a firm can be compared for an efficiency measurement. In other words, the efficient frontier can be constructed with the observations from the sample data set $D = \{(x^j, y^j); j = 1,2,\dots,N\}$. Using this data, the production possibilities set for the VRS case is defined as

(4) $$S^{VRS} = \left\{(x,y): x \geq \sum_{j=1}^{N} \lambda_j x^j; y \leq \sum_{j=1}^{N} \lambda_j y^j; \sum_{j=1}^{N} \lambda_j = 1; \lambda_j \geq 0 \ (j = 1,2,\dots,N)\right\}$$

A linear programming problem is then solved to construct a best practice piecewise linear envelope, or free disposal convex hull, over the observed input-output data by assigning the λ_j weights to other peer firms in the sample data. As per the $\sum_{j=1}^{N} \lambda_j = 1$ constraint seen in (4), which imposes the condition that all weights must sum to 1, the estimated frontier from the set S^{VRS}will exhibit VRS. However, if one assumes that CRS holds everywhere along the frontier, the definition of the production possibilities set and the resulting measure of PE will also change. With the observations from the same sample data set $D = \{(x^j, y^j); j = 1,2, \dots, N\}$, the production possibilities set for the CRS case is defined as

(5) $$S^{CRS} = \{(x, y): x \geq \sum_{j=1}^{N} \lambda_j x^j; y \leq \sum_{j=1}^{N} \lambda_j y^j; \lambda_j \geq 0 \ (j = 1,2, \dots, N)\}$$

An implication of the CRS assumption is that if any input-output bundle (x, y) is feasible, so would the bundle (tx, ty) for any non-negative t. As a result, the λ_j weights are not restricted to add up to unity[98]. This equality constraint is also removed from the DEA linear programming problems when CRS is assumed. The removal of this constraint makes the CRS DEA problems less restrictive than the corresponding VRS models. As a result it will always be the case that $TE \geq PE$, as stated in Section 4.3.1.

Given (4) and (5), a firm's input oriented efficiency is determined by minimizing the distance between the actual inputs used in its production and the inputs used by the best practice, or virtual firm, constructed as a weighted average of the input decisions made by the nearest peer firms on the best practice convex hull. The TE_{RTS} score, $(RTS = VRS, CRS)$, for any firm k, can now be formally stated as the optimal solution to θ

(6) $$TE_{RTS} = \theta^* = \min \theta: (\theta x^k, y^k) \in S^{RTS}$$

With an input orientation in mind, the minimization of the scalar, θ, is carried out along a ray of the observed input proportions holding output fixed. Starting with the CRS

[98] For a more technical discussion on the CRS, VRS restrictions, see Rajiv D. Banker et al. (2004).

scenario, relative to the best practice hull, the TE_{CRS} (which we refer to as PE) measure of firm k is found by solving the following linear programming problem for each of the j firms in the sample

(7) $\min \theta$

s.t $\sum_{j=1}^{N} \lambda_j x_{ij} \leq \theta x_{ik}$ $(i = 1,2, \ldots, n)$;

$\sum_{j=1}^{N} \lambda_j y_{rj} \geq y_{rk}$ $(r = 1,2, \ldots, m)$;

$\lambda_j \geq 0$ $(j = 1,2, \ldots, N)$

Although θ is unrestricted in (7), it can be seen from (5) that if (x^k, y^k) is in the sample, it will always be true that $0 \leq \theta \leq 1$. Similarly, the TE_{VRS} measure (which we refer to as TE) of firm k is found for each of the j firms in the sample by solving the same linear programming problem as (7), but with the added convexity constraint seen in (4), which can be stated as

(8) $\min \theta$

s.t $\sum_{j=1}^{N} \lambda_j x_{ij} \leq \theta x_{ik}$ $(i = 1,2, \ldots, n)$;

$\sum_{j=1}^{N} \lambda_j y_{rj} \geq y_{rk}$ $(r = 1,2, \ldots, m)$;

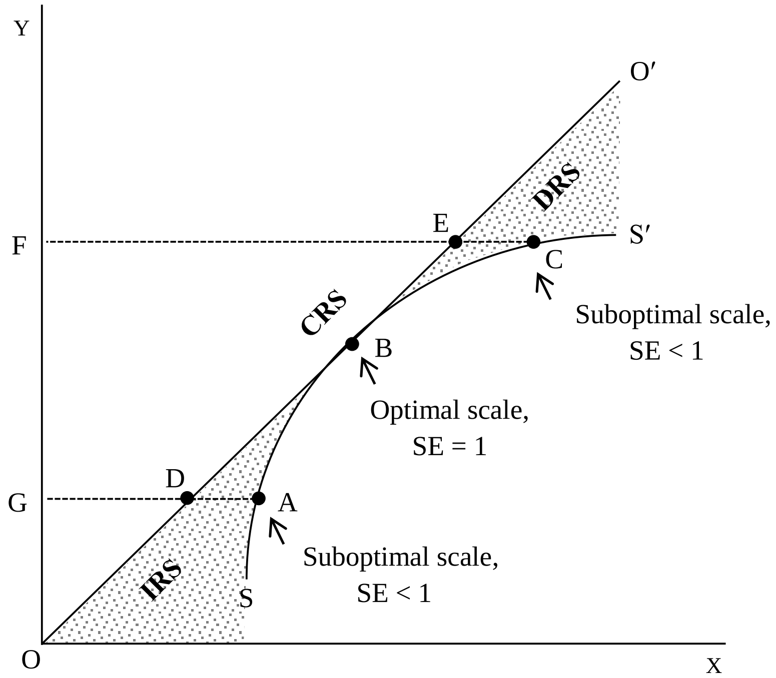
$\sum_{j=1}^{N} \lambda_j = 1; \lambda_j \geq 0$ $(j = 1,2, \ldots, N)$

As stated, θ^* from the CRS problem in (7) will always be higher or equal to the solution found under the VRS scenario in (8). From these, we can compute scale efficiency as described in Section 4.3.1.

A.3 Identifying scale returns

In Section 4.5.2 we compared the average family and non-family scale efficiency scores across scale return categories. In Table 26 and Table 27, we find that, of all firms which exhibit increasing returns to scale (IRS), family firms on average are *less* scale efficient, or in other words are relatively further from the optimal scale; and, of all firms which exhibit decreasing returns to scale (DRS), family firms are *more* scale efficient, or in other words are relatively closer to the optimal scale. Figure A 2 illustrates how these different scenarios can be interpreted.

Figure A 2: One input, one output measure of technical efficiency with constant and varying returns to scale



As seen in the diagram, efficient frontiers OO´ and SS´ represent the various input (Y) and output (X) combinations of firms using best practices in their production processes which exhibit constant and variable returns to scale respectively. When evaluating the efficiency of firms using the SS´ benchmark, the point labelled CRS denotes constant returns to scale and represents the optimally scaled firm. The shaded regions to the left and right of the optimal scale point identify the degree of sub-optimality in scale for firms which exhibit increasing and decreasing returns to scale respectively.

For example, firms A, B and C are all efficient with respect to pure technical efficiency as they lie on the SS´ efficient frontier, but only firm B is scale efficient as it also lies on the OO´ efficient frontier. As a result, firm Bs scale efficiency will equate to 1 while firms A and Cs scale efficiency will be less than 1.

Using an input orientation, firm A and Cs scale inefficiency can be measured as the relative horizontal distance between their position on the SS´ efficient frontier and their scale efficient counterpart's position on the OO´ efficient frontier. Specifically GD/GA and FE/FC respectively measure A and Cs inefficiency due to the divergence of their actual size from the optimal scale. Given this calculation, as firms 'move away' from the optimal scale point, the scale efficiency score decreases. With that said, while both A and C are sub-optimally scaled, we can see in the diagram that firm A is sub-optimally small and firm C is sub-optimally large; thus differentiating between IRS and DRS firms is crucial when comparing scale efficiency scores.

A.4 Robustness checks of panel regression analysis

In Chapter 5 we specified our hypotheses tests based on the Fixed effects, Random effects and Hybrid models. We also conducted a fixed effects analysis of the FOEs in each industry. However, for brevity, we only reported our fixed effects estimates. The purpose of this appendix is to present the results based on the random effects, hybrid model and inter-industry fixed effects estimates. These tables are presented in the order specified below. No commentary is included in this appendix, as these Tables have already been discussed in Sections 5.3 and 5.4 of Chapter 5.

List of Table presented in this Appendix

Table A10: Debt and equity composition (random effect model)

	Share of debt finance				*Share of equity finance*		
	Bank credit	Trade credit	Internal debt	External debt	Working owner's equity	Internal equity	External equity
Constant	0.294***	0.380***	0.176***	0.033***	0.731***	-0.003	0.055***
	(0.023)	(0.025)	(0.018)	(0.007)	(0.029)	(0.013)	(0.010)
FOE	**0.082*****	**-0.163*****	**0.072*****	**-0.001**	**0.214*****	**0.035*****	**-0.038*****
	(0.010)	(0.010)	(0.007)	(0.003)	(0.013)	(0.006)	(0.004)
PE	-0.116***	0.089***	-0.022*	-0.001	0.022	-0.023**	0.005
	(0.017)	(0.020)	(0.011)	(0.006)	(0.020)	(0.010)	(0.007)
Firm size	2.18E-07	2.06E-07	-3.02E-07***	2.13E-08	-8.71E-07*	-8.80E-08*	1.02E-08
	(1.94E-07)	(2.18E-07)	(7.47E-08)	(9.88E-08)	(4.93E-07)	(4.84E-08)	(1.16E-07)
Firm age	0.000	0.018***	-0.006**	-0.002	-0.017***	0.010***	-0.008***
	(0.004)	(0.005)	(0.003)	(0.001)	(0.006)	(0.003)	(0.002)
Capital intensity	1.78E-05**	-8.97E-06	2.77E-06	5.79E-08	-2.15E-05**	2.87E-06	3.81E-08
	(8.53E-06)	(7.79E-06)	(3.11E-06)	(2.71E-06)	(9.60E-06)	(3.64E-06)	(2.33E-06)
Capital structure	0.012***	-0.011***	0.008***	4.30E-04	-0.001	-4.28E-04	5.96E-04
	(0.004)	(0.002)	(0.003)	(4.73E-04)	(0.002)	(0.002)	(0.001)
N	10350	10350	10350	10350	10350	10350	10350
R^2	0.03	0.06	0.02	0.01	0.06	0.02	0.02
Adjusted R^2	0.03	0.05	0.02	0.00	0.05	0.01	0.01

Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE significance has been established using a one-tail T-test. For all other coefficients, a two-tailed T-test was used. Level of significance: ***1%; **5%; *10%.

Table A11: Debt and equity composition (hybrid model)

	Share of debt finance				*Share of equity finance*		
	Bank credit	Trade credit	Internal debt	External debt	Working owner's equity	Internal equity	External equity
Constant	0.291***	0.362***	0.171***	0.035***	0.798***	-0.014	0.060***
	(0.026)	(0.027)	(0.020)	(0.008)	(0.033)	(0.014)	(0.011)
FOE	**0.077*** **	**-0.155*** **	**0.068*** **	**-0.002**	**0.213*** **	**0.033*** **	**-0.038*** **
	(0.010)	(0.011)	(0.007)	(0.003)	(0.013)	(0.006)	(0.004)
PE $(x'_{it} - \bar{x}'_i)$	-0.077***	-0.002	0.008	0.005	0.042*	-0.015	0.010
	(0.021)	(0.024)	(0.013)	(0.008)	(0.024)	(0.013)	(0.008)
PE $(\bar{x}'_i)$	-0.199***	0.254***	-0.082***	-0.007	-0.033	-0.035**	-0.006
	(0.028)	(0.032)	(0.020)	(0.009)	(0.037)	(0.016)	(0.012)
Firm size $(x'_{it} - \bar{x}'_i)$	-3.31E-07	2.57E-07	-7.12E-08	3.76E-07	2.47E-07	2.82E-08	5.27E-09
	(3.33E-07)	(5.95E-07)	(1.64E-07)	(3.30E-07)	(9.62E-07)	(7.74E-08)	(9.98E-08)
Firm size $(\bar{x}'_i)$	4.14E-07***	-4.43E-08	-3.27E-07***	-2.59E-08	-7.60E-07*	-1.26E-07*	6.41E-08
	(1.99E-07)	(2.34E-07)	(8.03E-08)	(6.19E-08)	(4.29E-07)	(6.58E-08)	(1.39E-07)
Firm age $(x'_{it} - \bar{x}'_i)$	-0.010	0.033***	-0.017***	-0.002	0.013	-0.005	-0.007*
	(0.009)	(0.010)	(0.006)	(0.004)	(0.010)	(0.005)	(0.004)
Firm age $(\bar{x}'_i)$	0.003	0.015***	-0.003	-0.002	-0.030***	0.014***	-0.008***
	(0.005)	(0.005)	(0.004)	(0.002)	(0.007)	(0.003)	(0.003)
Capital intensity $(x'_{it} - \bar{x}'_i)$	2.08E-05**	-1.71E-05*	-5.17E-07	-3.30E-06	-8.10E-06	4.61E-07	3.15E-06
	(9.98E-06)	(1.03E-05)	(3.49E-06)	(4.64E-06)	(1.20E-05)	(3.24E-06)	(3.01E-06)
Capital intensity $(\bar{x}'_i)$	1.31E-05	2.79E-06	6.96E-06	2.48E-06	-5.01E-05***	5.80E-06	-4.66E-06
	(1.13E-05)	(1.09E-05)	(5.74E-06)	(2.83E-06)	(1.34E-05)	(5.68E-06)	(2.99E-06)
Capital structure $(x'_{it} - \bar{x}'_i)$	0.006	-0.003	0.004	4.24E-04	-3.42E-04	-0.001	0.001
	(0.005)	(0.003)	(0.003)	(5.71E-04)	(0.003)	(0.002)	(0.001)
Capital structure $(\bar{x}'_i)$	0.029***	-0.029***	0.019***	4.56E-04	-0.005	-7.10E-04	1.49E-04
	(0.006)	(0.004)	(0.005)	(7.12E-04)	(0.005)	(0.003)	(0.001)
N	10350	10350	10350	10350	10350	10350	10350
R^2	0.03	0.06	0.03	0.005	0.06	0.02	0.02
Adjusted R^2	0.03	0.06	0.02	0.000	0.05	0.01	0.01

Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE significance has been established using a one-tail T-test. For all other coefficients, a two-tailed T-test was used. Level of significance: ***1%; **5%; *10%.

Table A12: Family ownership effect by industry (debt and equity proportions)

Industry	Share of debt finance: Bank Credit	Trade Credit	Internal Debt	External Debt	Share of equity finance: Working Owners Equity	Internal Equity	External Equity
100	0.21***	-0.33***	0.11**	-0.04*	0.50***	0.15***	-0.04*
	(0.07)	(0.08)	(0.05)	(0.03)	(0.08)	(0.04)	(0.03)
200	0.08***	-0.16***	0.08***	0.01	0.29***	0.27***	-0.02
	(0.01)	(0.04)	(0.03)	(0.02)	(0.04)	(0.02)	(0.02)
221	0.10***	-0.16***	0.06***	-0.02**	0.21***	0.07***	-0.07***
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.01)	(0.01)
222	0.06**	-0.16***	0.11***	0.00	0.21***	0.03**	-0.05***
	(0.03)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
223	-0.02	-0.15***	0.08***	0.03**	-0.02	0.08***	-0.07***
	(0.03)	(0.04)	(0.02)	(0.01)	(0.04)	(0.02)	(0.01)
224	0.05**	-0.22***	0.13***	-0.01	0.25***	0.03**	-0.01
	(0.03)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
225	0.10***	-0.22***	0.08***	0.02**	0.34***	0.08***	-0.06***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)
226	0.20***	-0.23***	0.01	0.00	0.52***	-0.06***	-0.12***
	(0.04)	(0.04)	(0.03)	(0.01)	(0.04)	(0.02)	(0.02)
227	0.12***	-0.23***	0.08***	0.01**	0.13***	0.05***	-0.01
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
228	0.10***	-0.17***	0.11***	0.00	0.19***	0.04***	-0.03***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
229	0.07***	-0.09***	0.01	-0.01	0.07***	0.02*	-0.01*
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.01)	(0.01)
300	-0.19	0.21	-0.06	0.00	-0.39**	0.26***	-0.09*
	(0.16)	(0.18)	(0.11)	(0.06)	(0.17)	(0.10)	(0.07)
341	0.14***	-0.14***	-0.04**	-0.01	0.08**	-0.11***	-0.02
	(0.04)	(0.04)	(0.03)	(0.01)	(0.04)	(0.02)	(0.02)
342	0.10***	-0.10***	0.06***	0.00	0.12***	0.01	-0.05***
	(0.03)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
400	0.02	-0.19***	0.03	0.02	0.54***	0.03	-0.02
	(0.06)	(0.07)	(0.04)	(0.02)	(0.07)	(0.04)	(0.03)
445	-0.02	-0.13***	0.10***	0.01	0.21***	0.10***	-0.07***
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
446	0.10***	-0.22***	0.11***	0.01	0.41***	0.03***	-0.03***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
447	0.06***	-0.14***	0.06***	-0.02**	0.26***	0.03***	-0.02**
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
500	-0.20***	0.04	0.06	0.03	0.29***	0.05	0.00
	(0.07)	(0.08)	(0.05)	(0.03)	(0.08)	(0.04)	(0.03)
551	-0.06**	-0.11***	0.10***	0.03**	0.03	0.06***	-0.07***
	(0.03)	(0.04)	(0.02)	(0.01)	(0.04)	(0.02)	(0.02)
552	0.14***	-0.22***	0.03**	0.01*	0.11***	-0.01	0.00
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
553	0.07***	-0.09***	0.01	-0.02*	0.03	-0.02*	-0.04***
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.01)	(0.01)
600	-0.50***	0.05	0.27**	0.17**	0.67***	0.00	0.00
	(0.19)	(0.21)	(0.13)	(0.07)	(0.21)	(0.12)	(0.08)
657	0.08***	-0.12***	0.06***	-0.01	0.49***	0.04***	-0.07***
	(0.03)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
700	0.22***	-0.29***	0.08***	-0.01	0.20***	0.06***	-0.06***
	(0.02)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
875	0.31***	-0.22***	0.08***	0.00	0.14***	0.03*	-0.01
	(0.03)	(0.04)	(0.02)	(0.01)	(0.04)	(0.02)	(0.01)
900	0.60***	-0.49**	-0.04	0.00	0.19	0.31***	0.01
	(0.23)	(0.26)	(0.10)	(0.06)	(0.16)	(0.09)	(0.06)
977	-0.01	-0.20***	0.14***	0.05***	0.10***	0.06***	-0.07***
	(0.03)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)
978	0.01	-0.16***	0.08***	-0.01**	0.07***	0.02**	-0.03***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
1091	0.18***	-0.20***	0.09**	-0.03*	0.44***	-0.01	-0.01
	(0.05)	(0.06)	(0.04)	(0.02)	(0.06)	(0.03)	(0.02)
1093	0.09*	0.00	0.10**	-0.06**	0.52***	-0.01	-0.07***
	(0.07)	(0.08)	(0.05)	(0.03)	(0.08)	(0.04)	(0.03)
1195	0.08***	-0.13***	-0.01	0.01	0.07**	0.03*	-0.03**
	(0.03)	(0.04)	(0.02)	(0.01)	(0.04)	(0.02)	(0.01)
Average FOE	**0.07**	**-0.15**	**0.07**	**0.00**	**0.23**	**0.05**	**-0.04**
Negative and significant	9.38%	87.50%	3.13%	21.88%	3.13%	9.38%	65.63%
Positive and significant	71.88%	0.00%	71.88%	21.88%	84.38%	68.75%	0.00%
Insignificant	18.75%	12.50%	25.00%	56.25%	12.50%	21.88%	34.38%

Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%

Table A13: Quantum of finance and firm size (random effect model)

	Quantum of finance		*Firm size*		
	Total Liabilities (000)	Total Equity (000)	Value added (000)	Labour (FTE)	Capital (000)
Constant	4348.31***	2085.52*	1026.22**	18.65***	6946.16**
	(1523.13)	(1235.04)	(456.75)	(1.33)	(3306.28)
FOE	**-2173.15*** **	**-1012.46** **	**-1653.59*** **	**-9.27*** **	**-3244.24*** **
	(396.18)	(561.71)	(166.19)	(0.74)	(826.48)
PE	-1483.75**	-440.40	3947.14***	-5.63***	-2140.84**
	(752.56)	(336.11)	(407.89)	(0.70)	(954.70)
Internal debt	-396.55***	-61.93	-299.56***	-1.53***	-368.61***
	(105.98)	(68.60)	(61.41)	(0.39)	(119.09)
Internal equity	-344.23	-52.57	-399.92***	-0.74	-251.03
	(268.07)	(115.15)	(116.62)	(0.68)	(330.04)
Working owner's equity	-551.28	-101.91	-700.92***	-2.04***	-448.06
	(384.69)	(120.31)	(115.13)	(0.40)	(489.40)
Firm age	179.80	77.70	333.01***	2.55***	191.27
	(114.55)	(80.34)	(49.21)	(0.22)	(135.25)
Capital intensity	5.51***	1.91*	1.94**	-0.002***	7.63***
	(1.46)	(0.98)	(0.82)	(0.000)	(2.43)
Capital structure	276.74	-181.66**	-68.03***	0.29**	-66.65
	(174.42)	(89.57)	(17.09)	(0.14)	(62.17)
N	10350	10350	10350	10350	10350
R^2	0.10	0.03	0.18	0.35	0.11
Adjusted R^2	0.10	0.03	0.18	0.35	0.10

Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE significance has been established using a one-tail T-test. For all other coefficients, a two-tailed T-test was used. Level of significance: ***1%; **5%; *10%.

Table A14: Quantum of finance and firm size (hybrid model)

	Quantum of finance		*Firm size*		
	Total Liabilities (000)	Total Equity (000)	Value added (000)	Labour (FTE)	Capital (000)
Constant	596.59	1119.81	548.36	14.27***	1990.02
	(1488.65)	(2016.14)	(492.50)	(2.06)	(1875.33)
FOE	**-651.34****	**546.58**	**-684.27*****	**-4.73*****	**-137.72**
	(292.59)	(559.70)	(128.07)	(0.73)	(809.56)
PE ($x'_{it} - \bar{x}'_i$)	-1857.01**	-663.42**	3583.80***	-7.26***	-2687.30***
	(803.34)	(311.52)	(428.05)	(0.74)	(952.95)
PE ($\bar{x}'_i$)	1609.75	6240.21**	7411.50***	12.28***	7950.00**
	(1606.41)	(3021.30)	(836.24)	(2.56)	(3834.04)
Internal debt ($x'_{it} - \bar{x}'_i$)	-78.13	24.45	-88.30	-0.24	-76.55
	(100.82)	(66.48)	(60.69)	(0.38)	(116.77)
Internal debt ($\bar{x}'_i$)	-3341.93***	-676.78	-1835.01***	-13.85***	-4010.55***
	(858.70)	(1235.29)	(241.52)	(1.34)	(875.19)
Internal equity ($x'_{it} - \bar{x}'_i$)	136.74	60.49	-115.78	0.15	160.16
	(292.69)	(115.60)	(124.97)	(0.70)	(341.90)
Internal equity ($\bar{x}'_i$)	-3081.11***	-1558.32*	-2578.85***	-8.50***	-4574.28***
	(790.44)	(903.09)	(408.23)	(2.36)	(1210.54)
Working owner’s equity ($x'_{it} - \bar{x}'_i$)	159.88	46.01	-280.73**	0.04	145.37
	(423.84)	(94.74)	(127.97)	(0.41)	(492.90)
Working owner’s equity ($\bar{x}'_i$)	-2907.19***	-644.29	-2898.12***	-16.16***	-3654.85**
	(676.93)	(970.81)	(294.17)	(1.14)	(1469.42)
Firm age ($x'_{it} - \bar{x}'_i$)	-38.84	54.02	180.22***	0.75***	13.89
	(101.42)	(82.18)	(61.34)	(0.27)	(136.55)
Firm age ($\bar{x}'_i$)	374.58	-41.48	503.66***	5.41***	374.66
	(238.51)	(254.35)	(81.68)	(0.41)	(298.26)
Capital intensity ($x'_{it} - \bar{x}'_i$)	3.05	1.04	1.29	0.00***	5.16*
	(1.90)	(0.95)	(0.86)	(0.00)	(2.87)
Capital intensity ($\bar{x}'_i$)	16.44***	13.97***	4.87***	0.00	29.90***
	(4.54)	(4.34)	(1.52)	(0.00)	(9.14)
Capital structure ($x'_{it} - \bar{x}'_i$)	78.05	-108.35	-72.35***	0.32**	-57.08
	(147.50)	(100.38)	(11.78)	(0.14)	(64.58)
Capital structure ($\bar{x}'_i$)	2709.69*	-2986.25	9.60	0.07	-254.04
	(1439.19)	(2004.69)	(179.16)	(0.39)	(329.21)
N	10350	10350	10350	10350	10350
R^2	0.20	0.11	0.23	0.39	0.21
Adjusted R^2	0.19	0.10	0.22	0.38	0.20

Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE significance has been established using a one-tail T-test. For all other coefficients, a two-tailed T-test was used. Level of significance: ***1%; **5%; *10%.

Table A15: Two-stage least squares fixed effects model (Firm size)

	Value added (000)	Labour (FTE)	Capital (000)
Constant	-2827.37***	28.44***	6690.14***
	(1018.51)	(2.48)	(1448.02)
Productive Efficiency[a]	24716.84***	-25.37***	-9026.36***
	(1159.37)	(3.17)	(1856.12)
Internal debt	-102.08	-0.42	107.65
	(418.60)	(1.01)	(589.47)
Internal equity	-242.60	-0.77	143.14
	(484.36)	(1.17)	(682.13)
Working owner's equity	-867.90***	-0.42	340.94
	(268.29)	(0.65)	(378.02)
Firm age	581.17**	1.95***	344.57
	(251.78)	(0.61)	(355.28)
Capital intensity	1.25***	0.00***	0.92***
	(0.19)	(0.00)	(0.28)
Capital structure	-319.87***	0.59***	-26.20
	(63.36)	(0.15)	(89.90)
FOE[b]	**-438.70*** **	**-9.58*** **	**-4662.85*** **
	(213.48)	(1.05)	(826.53)
N	6900	6900	6900
R^2	0.87	0.96	0.98
Adjusted R^2	0.74	0.93	0.97

Time effects not reported for brevity. Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%.

[a] Instrument variable for PE_t is PE_{t-1}.

[b] FOE is found separately as per $\left(\frac{1}{ff}\sum_{i \in FF} \alpha_i\right) - \left(\frac{1}{nf}\sum_{i \in NF} \alpha_i\right) = \lambda_{ff} - \lambda_{nf}$. One-tail significance is determined by F-testing the restriction $\lambda_{ff} \neq \lambda_{nf}$..

Table A16: Family ownership effect by industry (quantum of finance and firm size)

Industry	Quantum of finance: Total Debt	Quantum of finance: Total Equity	Firm Size: Value Added	Firm Size: Labour	Firm Size: Capital
100	-32004.61***	-17330.22***	-22735.72***	-56.58***	-47538.71***
	(1375.90)	(925.87)	(562.23)	(2.32)	(1662.64)
200	-4031.61***	-8907.61***	-4603.60***	-12.87***	-11962.24***
	(828.70)	(557.65)	(356.42)	(0.89)	(1245.06)
221	-1450.23***	-1153.46***	-813.11***	-3.66***	-2469.08***
	(506.92)	(341.12)	(207.14)	(0.85)	(612.56)
222	-2800.84***	-1042.63***	-1421.71***	-7.95***	-3845.92***
	(571.02)	(384.25)	(233.33)	(0.96)	(690.02)
223	-356.05	-916.36**	-1818.58***	-3.16***	-1254.98*
	(731.97)	(492.56)	(299.10)	(1.23)	(884.52)
224	-889.94*	-1174.13***	-1552.54***	-12.03***	-2054.72***
	(600.37)	(404.00)	(245.33)	(1.01)	(725.49)
225	-3070.10***	-1811.54***	-2271.62***	-10.48***	-4794.07***
	(459.15)	(308.97)	(187.62)	(0.77)	(554.84)
226	-475.00	-1503.30***	-763.04***	-8.51***	-2019.16**
	(788.08)	(530.32)	(322.03)	(1.33)	(952.32)
227	-1215.53***	-801.80***	-447.94***	-0.01	-1967.63***
	(432.63)	(291.13)	(176.78)	(0.73)	(522.79)
228	-732.71**	-228.31	-573.99***	-3.54***	-913.76***
	(319.86)	(215.24)	(130.70)	(0.54)	(386.52)
229	2.71	-205.38	-1.93	0.73	-149.12
	(516.65)	(347.66)	(211.12)	(0.87)	(624.32)
300	3276.12	27764.86***	5106.14***	8.36*	30564.37***
	(3275.53)	(2204.17)	(1338.46)	(5.51)	(3958.16)
341	-170.00	117.73	-459.33*	-5.85***	71.65
	(770.53)	(518.51)	(314.86)	(1.30)	(931.11)
342	-257.18	-0.77	-244.73	-5.47***	-289.30
	(579.62)	(390.04)	(236.85)	(0.98)	(700.41)
400	-11950.43***	-8074.20***	-11488.61***	-1.91	-20110.87***
	(1225.52)	(824.68)	(500.78)	(2.06)	(1480.92)
445	-2245.36***	-341.91	-843.95***	-2.51***	-2497.63***
	(525.93)	(353.91)	(214.91)	(0.89)	(635.53)
446	-6758.11***	-633.47***	-2591.79***	-11.12***	-7160.89***
	(391.54)	(263.48)	(159.99)	(0.66)	(473.14)
447	-1874.49***	-773.88***	-1550.59***	-9.68***	-2603.59***
	(435.23)	(292.87)	(177.85)	(0.73)	(525.93)
500	-11314.03***	-445.17	-714.16	1.71	-11622.50***
	(1524.44)	(1025.83)	(622.92)	(2.57)	(1842.13)
551	188.58	-25.95	-62.61	-0.88	151.51
	(735.57)	(494.98)	(300.57)	(1.24)	(888.87)
552	58.36	-56.92	-27.97	-2.42***	64.06
	(524.60)	(353.01)	(214.36)	(0.88)	(633.93)
553	-761.59*	-179.49	-351.29**	-3.10***	-921.55*
	(502.38)	(338.06)	(205.28)	(0.85)	(607.07)
600	-469.52	-745.43	-5031.42***	-21.62***	-1191.20
	(3987.40)	(2683.20)	(1629.35)	(6.71)	(4818.38)
657	34.39	-1012.30***	-369.31**	-4.24***	-932.66*
	(536.32)	(360.90)	(219.15)	(0.90)	(648.09)
700	-6142.61***	-4613.48***	-3226.93***	-16.80***	-10471.60***
	(517.12)	(347.98)	(211.31)	(0.87)	(624.89)
875	-3153.39***	-2663.94***	-2502.67***	-16.56***	-5496.37***
	(678.72)	(456.73)	(277.34)	(1.14)	(820.17)
900	-11011.72***	-300.46	14185.14***	-11.65***	438023.30***
	(2966.48)	(1996.20)	(925.69)	(3.81)	(2737.48)
977	-1974.35***	-5346.62***	-785.82***	-3.86***	-7310.85***
	(565.36)	(380.44)	(231.02)	(0.95)	(683.19)
978	-392.56	-164.41	-1047.25***	-8.74***	-549.76
	(354.83)	(238.77)	(144.99)	(0.60)	(428.77)
1091	-2945.86***	-1905.73***	-1039.80**	-0.48	-4418.27***
	(1134.29)	(763.29)	(463.50)	(1.91)	(1370.68)
1093	638.13	-582.19	-235.00	-7.79***	134.91
	(1461.25)	(983.30)	(597.10)	(2.46)	(1765.78)
1195	282.69	-195.90	559.94**	2.28**	77.61
	(676.42)	(455.18)	(276.40)	(1.14)	(817.38)
Average FOE	**-3362.89**	**-1130.92**	**-2323.08**	**-7.34**	**-4692.23**
Negative and significant	59.38%	53.13%	71.88%	75.00%	65.63%
Positive and significant	0.00%	3.13%	9.38%	6.25%	6.25%
Insignificant	40.63%	43.75%	18.75%	18.75%	28.13%

Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%

Table A17: Scale & Technical efficiency and capital intensity (random effect model)

	Scale & Technical efficiency			*Capital intensity*
	SE	TE	PE	K/L
Constant	0.884***	0.405***	0.271***	-45.728
	(0.016)	(0.016)	(0.013)	(32.901)
FOE	-	**-0.013****	**-0.028*****	**-32.072****
	-	(0.007)	(0.006)	(14.965)
Increasing returns	-0.169***	-	-	-
	(0.008)	-	-	-
Decreasing returns	-0.185***	-	-	-
	(0.008)	-	-	-
FOE_{IRS}	**-0.058*****	-	-	-
	(0.007)	-	-	-
FOE_{DRS}	**1.76E-05**	-	-	-
	(0.008)	-	-	-
Productive efficiency	-	-	-	165.669***
	-	-	-	(21.668)
Firm size	-2.43E-08	-1.56E-08	-6.82E-08	0.011***
	(1.12E-07)	(1.27E-07)	(1.08E-07)	(0.000)
Internal debt	-0.013	0.001	-0.015*	9.316
	(0.008)	(0.009)	(0.008)	(18.069)
Internal equity	0.009	-0.027**	-0.020*	-5.922
	(0.010)	(0.012)	(0.010)	(22.430)
Working owner’s equity	-0.003	0.005	0.002	-28.231**
	(0.005)	(0.006)	(0.005)	(11.600)
Firm age	0.014***	-0.020***	-0.008***	17.150***
	(0.003)	(0.003)	(0.003)	(6.115)
Capital intensity	-3.77E-06	2.96E-05***	3.08E-05***	-
	(4.34E-06)	(4.89E-06)	(4.26E-06)	-
Capital structure	1.22E-04	0.018***	0.016***	-6.185*
	(0.001)	(0.002)	(0.001)	(3.223)
N	10350	10350	10350	10350
R^2	0.15	0.10	0.14	0.24
Adjusted R^2	0.15	0.10	0.13	0.24

Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE significance has been established using a one-tail T-test. For all other coefficients, a two-tailed T-test was used. Level of significance: ***1%; **5%; *10%.

Table A18: Scale & Technical efficiency and capital intensity (hybrid model)

	Scale efficiency[a]			*Technical efficiency*			*Capital intensity*
	SE_{DRS}	SE_{IRS}	SE_{CRS}	TE	PE		K/L
Constant	0.850***	0.719***	1.00***	0.425***	0.286***	Constant	9.124
	(0.015)	(0.020)	(0.00)	(0.018)	(0.014)		(42.899)
FOE	**-0.001**	**-0.052*** **	**4.15E-05**	**-0.010***	**-0.022*** **	**FOE**	**-25.922*** **
	(0.007)	(0.009)	(8.23E-05)	(0.007)	(0.006)		(9.44)
Firm size $(x'_{it} - \bar{x}'_i)$	6.52E-07	-1.42E-06**	-4.46E-10	-1.37E-06***	-1.33E-06***	Firm size $(x'_{it} - \bar{x}'_i)$	0.012**
	(5.81E-07)	(6.88E-07)	(4.65E-10)	(3.46E-07)	(4.37E-07)		(0.005)
Firm size $(\bar{x}'_i)$	-1.48E-06***	2.75E-07	-1.41E-10	3.31E-07*	1.86E-07	Firm size $(\bar{x}'_i)$	0.011***
	(2.17E-07)	(2.37E-07)	(2.29E-10)	(1.81E-07)	(1.91E-07)		(0.003)
Internal debt $(x'_{it} - \bar{x}'_i)$	0.038*	-0.011	-2.23E-04**	0.010	0.005	Internal debt $(x'_{it} - \bar{x}'_i)$	1.296
	(0.021)	(0.013)	(1.05E-04)	(0.012)	(0.010)		(10.794)
Internal debt $(\bar{x}'_i)$	0.085***	-0.057***	-2.00E-04	-0.015	-0.051***	Internal debt $(\bar{x}'_i)$	36.106
	(0.018)	(0.021)	(2.00E-04)	(0.016)	(0.013)		(25.711)
Internal equity $(x'_{it} - \bar{x}'_i)$	0.003	0.021	-1.52E-04*	-0.017	-0.005	Internal equity $(x'_{it} - \bar{x}'_i)$	-0.648
	(0.022)	(0.016)	(1.00E-04)	(0.014)	(0.013)		(21.676)
Internal equity $(\bar{x}'_i)$	0.005	-0.035	-3.07E-04	-0.049**	-0.048**	Internal equity $(\bar{x}'_i)$	-21.549
	(0.021)	(0.028)	(1.83E-04)	(0.023)	(0.019)		(31.332)
Working owner's equity $(x'_{it} - \bar{x}'_i)$	-0.012	0.004	-3.20E-05	0.006	0.008	Working owner's equity $(x'_{it} - \bar{x}'_i)$	-9.930
	(0.013)	(0.009)	(5.33E-05)	(0.008)	(0.007)		(16.625)
Working owner's equity $(\bar{x}'_i)$	0.021**	-0.050***	-8.71E-05	0.004	-0.005	Working owner's equity $(\bar{x}'_i)$	-72.769***
	(0.010)	(0.012)	(9.03E-05)	(0.010)	(0.008)		(26.055)
Firm age $(x'_{it} - \bar{x}'_i)$	-0.052***	0.027***	-4.30E-05	-0.005	-0.003	Firm age $(x'_{it} - \bar{x}'_i)$	20.321**
	(0.010)	(0.007)	(4.65E-05)	(0.006)	(0.005)		(9.400)
Firm age $(\bar{x}'_i)$	-0.007**	0.033***	-1.01E-04**	-0.025***	-0.010***	Firm age $(\bar{x}'_i)$	14.052***
	(0.003)	(0.004)	(4.04E-05)	(0.004)	(0.003)		(4.530)
Capital intensity $(x'_{it} - \bar{x}'_i)$	-4.40E-05	1.27E-06	1.12E-08	3.78E-05	3.82E-05	PE $(x'_{it} - \bar{x}'_i)$	185.245***
	(3.56E-05)	(9.06E-06)	(7.34E-09)	(8.18E-06)	(8.21E-06)		(58.284)
Capital intensity $(\bar{x}'_i)$	2.48E-05	-1.02E-05	7.67E-08	1.68E-05	2.08E-05	PE $(\bar{x}'_i)$	111.997*
	(1.46E-05)	(1.05E-05)	(2.07E-08)	(1.02E-05)	(9.74E-06)		(65.813)
Capital structure $(x'_{it} - \bar{x}'_i)$	-0.011	0.004	4.64E-06	0.017	0.016	Capital structure $(x'_{it} - \bar{x}'_i)$	-5.861***
	(0.004)	(0.004)	(4.80E-06)	(0.003)	(0.002)		(2.101)
Capital structure $(\bar{x}'_i)$	-0.008	-0.001	2.40E-05	0.019	0.017	Capital structure $(\bar{x}'_i)$	-7.972
	(0.004)	(0.007)	(7.65E-06)	(0.004)	(0.004)		(5.237)
N	3496	6202	652	10350	10350	N	10350
R^2	0.04	0.03	0.04	0.11	0.14	R^2	0.24
Adjusted R^2	0.04	0.02	0.02	0.10	0.14	Adjusted R^2	0.23

[a] return to scale subgroups DRS, IRS, and CRS account for decreasing, increasing and constant returns to scale. Panel corrected standard errors are reported in parentheses. Time and industry effects not reported for brevity. FOE tested using one-tail T-test. Level of significance: ***1%; **5%; *10%

Table A19: Family ownership effect by industry (Efficiency and capital intensity)

Industry	*Scale & Technical efficiency*				*Capital intensity*
	SE_{IRS}	SE_{DRS}	TE	PE	K/L
100	-0.059	0.050*	0.05	0.01	-1328.65***
	(0.058)	(0.031)	(0.05)	(0.04)	(89.52)
200	-0.038	-0.029	0.02	-0.01	85.09*
	(0.031)	(0.023)	(0.03)	(0.02)	(52.52)
221	-0.072**	-0.035*	0.01	-0.02*	-53.31**
	(0.036)	(0.023)	(0.02)	(0.01)	(31.79)
222	-0.037	0.039	-0.01	0.00	-4.11
	(0.046)	(0.031)	(0.02)	(0.02)	(35.76)
223	-0.016	0.032	-0.02	-0.03*	12.20
	(0.042)	(0.029)	(0.02)	(0.02)	(45.54)
224	-0.043	0.040*	-0.05***	-0.04***	14.51
	(0.052)	(0.029)	(0.02)	(0.02)	(37.57)
225	-0.033**	0.029*	-0.02**	-0.03**	-29.68
	(0.016)	(0.021)	(0.01)	(0.01)	(29.29)
226	-0.146**	-0.051**	-0.04**	-0.09***	6.98
	(0.064)	(0.023)	(0.03)	(0.02)	(49.59)
227	-0.044**	-0.001	-0.05***	-0.05***	-1.28
	(0.027)	(0.013)	(0.01)	(0.01)	(27.04)
228	0.011	0.001	-0.01	0.00	-27.17*
	(0.017)	(0.009)	(0.01)	(0.01)	(20.14)
229	-0.073**	0.008	-0.04***	-0.04***	-47.61*
	(0.044)	(0.032)	(0.02)	(0.01)	(32.16)
300	-0.187*	n/a	-0.08	-0.35***	-113.21
	(0.133)	-	(0.10)	(0.09)	(204.68)
341	-0.074*	-0.019	0.07***	0.00	-105.33**
	(0.053)	(0.066)	(0.02)	(0.02)	(47.92)
342	0.032	0.024	-0.09***	-0.01	31.19
	(0.039)	(0.051)	(0.02)	(0.02)	(36.11)
400	-0.014	n/a	-0.03	-0.07**	103.56*
	(0.035)	-	(0.04)	(0.04)	(77.69)
445	-0.041	0.047**	-0.07***	-0.08***	-85.36***
	(0.037)	(0.026)	(0.02)	(0.02)	(32.98)
446	-0.028*	0.022**	-0.02*	-0.03**	-34.59*
	(0.021)	(0.013)	(0.01)	(0.01)	(25.55)
447	-0.068***	-0.007	0.03***	-0.01	-9.11
	(0.019)	(0.018)	(0.01)	(0.01)	(27.43)
500	0.158***	-0.063***	0.04	0.10**	37.68
	(0.053)	(0.026)	(0.05)	(0.04)	(95.23)
551	0.033	-0.007	-0.06***	-0.02	5.79
	(0.044)	(0.046)	(0.02)	(0.02)	(45.77)
552	-0.064***	0.056*	-0.11***	-0.09***	-69.96**
	(0.025)	(0.036)	(0.02)	(0.01)	(32.66)
553	-0.077***	0.001	-0.02*	-0.04***	-12.48
	(0.026)	(0.023)	(0.02)	(0.01)	(31.26)
600	n/a	n/a	-0.01	-0.02	13.76
	-	-	(0.13)	(0.11)	(248.25)
657	0.038	-0.017	-0.04***	-0.04***	-16.82
	(0.030)	(0.020)	(0.02)	(0.02)	(34.23)
700	-0.098***	0.064*	-0.03**	-0.04***	29.21
	(0.034)	(0.046)	(0.02)	(0.02)	(32.99)
875	-0.024	0.249***	-0.04**	-0.03**	-176.16***
	(0.044)	(0.041)	(0.02)	(0.02)	(42.37)
900	-0.166**	n/a	0.31***	0.01	27.62
	(0.080)	-	(0.09)	(0.08)	(184.75)
977	-0.136***	-0.033*	-0.03**	-0.10***	32.66
	(0.040)	(0.021)	(0.02)	(0.02)	(35.51)
978	-0.221***	0.022	0.04***	-0.06***	11.69
	(0.020)	(0.033)	(0.01)	(0.01)	(22.11)
1091	0.013	-0.174***	0.15***	0.06**	-348.85***
	(0.079)	(0.066)	(0.04)	(0.03)	(70.78)
1093	-0.070	0.082	0.14***	0.13***	-56.94
	(0.118)	(0.082)	(0.05)	(0.04)	(91.22)
1195	0.041	-0.043	-0.03*	-0.01	5.70
	(0.038)	(0.040)	(0.02)	(0.02)	(42.10)
Average FOE	**-0.05**	**0.01**	**0.00**	**-0.03**	**-65.72**
Negative and significant	49.39%	17.86%	50.00%	56.25%	31.25%
Positive and significant	2.23%	28.57%	18.75%	9.38%	6.25%
Insignificant	48.38%	53.57%	31.25%	34.38%	62.50%

Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%

Table A20: Family ownership effect by industry (full model with lags)

Industry	IF	Size	PE	SE_{IRS}	SE_{DRS}	TE
100	1.04***	-65802.87***	0.08**	-0.241***	n/a	0.12**
	(0.10)	(1786.52)	(0.05)	(0.054)	-	(0.05)
200	0.91***	-15089.31***	0.00	-0.176***	-0.180	0.03
	(0.06)	(1012.92)	(0.03)	(0.063)	(0.143)	(0.03)
221	0.41***	-3293.78***	-0.02	-0.193***	-0.146*	0.02
	(0.03)	(620.15)	(0.02)	(0.083)	(0.110)	(0.02)
222	0.47***	-5230.77***	0.01	-0.190***	-0.062	0.00
	(0.04)	(689.13)	(0.02)	(0.042)	(0.112)	(0.02)
223	0.15***	-1503.80**	-0.02	-0.145***	-0.085	-0.03
	(0.05)	(873.41)	(0.02)	(0.058)	(0.119)	(0.03)
224	0.54***	-2435.59***	-0.07***	-0.180***	-0.060	-0.09***
	(0.04)	(728.97)	(0.02)	(0.054)	(0.111)	(0.02)
225	0.67***	-6313.69***	-0.03**	-0.183***	0.019	-0.04***
	(0.03)	(578.76)	(0.02)	(0.041)	(0.114)	(0.02)
226	0.66***	-2277.37***	-0.14***	-0.372***	-0.151*	-0.09***
	(0.05)	(949.52)	(0.03)	(0.116)	(0.114)	(0.03)
227	0.35***	-2206.32***	-0.07***	-0.168***	-0.108	-0.08***
	(0.03)	(524.68)	(0.01)	(0.054)	(0.110)	(0.02)
228	0.48***	-1276.25***	0.00	-0.129**	-0.090	-0.02*
	(0.02)	(397.83)	(0.01)	(0.061)	(0.109)	(0.01)
229	0.14***	-217.51	-0.05***	-0.230***	-0.123	-0.06***
	(0.03)	(617.68)	(0.02)	(0.040)	(0.112)	(0.02)
300	-0.29*	42072.02***	-0.60***	-0.372	n/a	-0.24**
	(0.22)	(3948.59)	(0.11)	(0.431)	-	(0.12)
341	-0.12**	-407.35	0.01	-0.197***	-0.174*	0.11***
	(0.05)	(918.80)	(0.03)	(0.079)	(0.121)	(0.03)
342	0.24***	-213.61	-0.02	-0.118***	0.028	-0.15***
	(0.04)	(696.13)	(0.02)	(0.044)	(0.118)	(0.02)
400	0.83***	-24662.29***	0.00	-0.107	n/a	0.02
	(0.08)	(1501.59)	(0.04)	(0.086)	-	(0.05)
445	0.57***	-3310.64***	-0.09***	-0.144***	-0.042	-0.09***
	(0.04)	(647.46)	(0.02)	(0.055)	(0.111)	(0.02)
446	0.74***	-9419.13***	-0.02*	-0.183***	-0.033	-0.02
	(0.03)	(504.56)	(0.01)	(0.058)	(0.110)	(0.02)
447	0.45***	-3240.68***	0.00	-0.199***	-0.110	0.04***
	(0.03)	(532.56)	(0.01)	(0.050)	(0.112)	(0.02)
500	0.48***	-16157.58***	0.09**	-0.026	-0.134	0.03
	(0.10)	(1832.59)	(0.05)	(0.043)	(0.146)	(0.06)
551	0.26***	290.44	-0.02	-0.107***	-0.144	-0.08***
	(0.05)	(879.12)	(0.02)	(0.036)	(0.116)	(0.03)
552	0.17***	198.17	-0.15***	-0.210***	-0.057	-0.17***
	(0.04)	(634.09)	(0.02)	(0.044)	(0.119)	(0.02)
553	-0.01	-1114.28**	-0.05***	-0.195***	-0.108	-0.02
	(0.03)	(603.30)	(0.02)	(0.054)	(0.114)	(0.02)
600	1.53***	-1192.13	-0.02	n/a	n/a	-0.02
	(0.27)	(4763.42)	(0.13)	-	-	(0.14)
657	0.79***	-1044.65*	-0.05***	-0.103**	-0.136	-0.06***
	(0.04)	(676.44)	(0.02)	(0.063)	(0.114)	(0.02)
700	0.44***	-13740.23***	-0.04***	-0.226***	-0.034	-0.04**
	(0.04)	(641.54)	(0.02)	(0.047)	(0.112)	(0.02)
875	0.41***	-7896.88***	-0.07***	-0.160**	n/a	-0.06***
	(0.05)	(815.12)	(0.02)	(0.096)	-	(0.02)
900	0.61***	-15163.43***	-0.04	-0.440***	n/a	0.42***
	(0.20)	(3547.15)	(0.10)	(0.043)	-	(0.11)
977	0.40***	-8956.40***	-0.14***	-0.254***	-0.134	-0.05***
	(0.04)	(692.89)	(0.02)	(0.066)	(0.112)	(0.02)
978	0.21***	-424.63	-0.08***	-0.361***	-0.084	0.05***
	(0.02)	(426.28)	(0.01)	(0.042)	(0.115)	(0.01)
1091	0.71***	-8291.47***	0.10***	-0.165***	-0.245**	0.21***
	(0.08)	(1360.96)	(0.04)	(0.053)	(0.131)	(0.04)
1093	0.87***	-301.31	0.14***	-0.464***	-0.082	0.16***
	(0.10)	(1756.49)	(0.05)	(0.199)	(0.135)	(0.05)
1195	0.09**	159.04	-0.01	-0.109***	-0.124	-0.05**
	(0.05)	(807.81)	(0.02)	(0.046)	(0.129)	(0.02)
Average FOE	**0.47**	**-5577.01**	**-0.04**	**-0.20**	**-0.08**	**-0.01**
Negative and significant	6.25%	68.75%	46.88%	90.32%	15.38%	50.00%
Positive and significant	90.63%	3.13%	12.50%	0.00%	0.00%	21.88%
Insignificant	3.13%	28.13%	40.63%	9.68%	84.62%	28.13%

Panel corrected standard errors are reported in parentheses. Level of significance: ***1%; **5%; *10%

A.5 Hausman tests of structural equations

This appendix outlines our tests for endogeneity using the approach suggested by Hausman (1978). Using instrument variables, the test involves estimating our equations with both the actual variable and an estimate of the suspected ednogeneous variable. In this appendix, we test for endogenous variables in the estimation of 1) internal finance, 2) firm size, and 3) productive efficiency.

A.5.1 Internal Finance

We test for the endogeneity of size and efficiency in the determination of internal finance (both debt and equity) by specifying

(1) $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + e_{it}.$

To generate the appropriate residual terms, we estimate $\widehat{Size}_{it}$ and $\widehat{PE}_{it}$ with a t-1 instrument, as per

(1.1) $\widehat{Size}_{it} = \delta_{1_i} + \delta_2 Size_{it-1} + \delta_3 PE_{it} + \delta_4 x'_{it} + \omega_{it}$, and

(1.2) $\widehat{PE}_{it} = \varepsilon_{1_i} + \varepsilon_2 Size_{it} + \varepsilon_3 PE_{it-1} + \varepsilon_4 x'_{it} + \psi_{it}.$

The Hausman test for endogeneity is performed by estimating the effect of both residual terms within equation (1) simultaneously by way of

(1.3) $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \widehat{\omega}_{it} + \alpha_6 \widehat{\psi}_{it} + e_{it}.$

The results of (1.3) are presented in column 1 of Table A21.

Table A21: Hausman tests on internal finance estimation

	Test 1	*Test 2*	*Test 3*
Intercept	0.23***	0.25***	0.24***
Size	9.62E-07	8.11E-07	2.12E-07
PE	0.0471	-0.013872	0.044751
Age	-0.021026	-0.019466	-0.020886
Leverage ratio	0.000921	0.001661	0.000846
Capital intensity	1.71E-06	4.66E-06	2.18E-06
ω	-8.41E-07	-7.25E-07	-
ψ	-0.068915	-	-0.067148
N	6900	6900	6900
R^2	0.801441	0.801396	0.801433
Adj R^2	0.602133	0.602158	0.602232

Test 1 = $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \omega_{it} + \alpha_6 \psi_{it} + e_{it}$
Test 2 = $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \omega_{it} + e_{it}$
Test 3 = $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \psi_{it} + e_{it}$
Level of significance: ***1%; **5%; *10%

As seen in Table A21, The coefficients associated with ω_{it} and ψ_{it} are insignificant; therefore, all variables in (1) are considered to be exogenous. To confirm the above endogeneity test, we also estimate the effect of each residual term in (1) individually as per

(1.4) $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \widehat{\omega}_{it} + e_{it}$, and

(1.5) $IF_{it} = \alpha_{1_i} + \alpha_2 Size_{it} + \alpha_3 PE_{it} + \alpha_4 x'_{it} + \alpha_5 \widehat{\psi}_{it} + e_{it}$.

The results of (1.4) and (1.5) are respectively presented in columns 2 and 3 of Table A21 and confirm that all variables in (1) are exogenous.

A.5.2 Firm Size

We test for the endogeneity of internal finance and efficiency in the determination of firm size (measured by capital) by specifying

(2) $Size_{it} = \beta_{1_i} + \beta_2 IF_{it} + \beta_3 PE_{it} + \beta_4 x'_{it} + u_{it}$

To generate residual terms, we estimate $\widehat{IF}_{it}$ and $\widehat{PE}_{it}$ with a t-1 instrument, as per

(2.1) $\widehat{IF}_{it} = \zeta_{1_i} + \zeta_2 IF_{it-1} + \zeta_3 PE_{it} + \zeta_4 x'_{it} + \chi_{it}$, and

(2.2) $\widehat{PE}_{it} = \eta_{1_i} + \eta_2 IF_{it} + \eta_3 PE_{it-1} + \eta_4 x'_{it} + \phi_{it}$.

The Hausman test is performed by estimating the effect of both residual terms within equation (2) simultaneously by way of

(2.3) $Size_{it} = \beta_{1_i} + \beta_2 IF_{it} + \beta_3 PE_{it} + \beta_4 x'_{it} + \beta_5 \hat{\chi}_{it} + \beta_6 \hat{\phi}_{it} + u_{it}$.

These estimates are presented in column 1 of Table A22.

Table A22: Hausman tests on firm size estimation

	Test 1	*Test 2*	*Test 3*
Intercept	5756.40***	5013.30***	5815.41***
IF	318.43	327.71	80.41
PE	-4187.60**	-1048.30*	-4188.76**
Age	219.12	139.82	214.46
Leverage ratio	-87.27	-126.49	-86.93
Capital intensity	0.68**	0.53**	0.68**
χ	-275.21	-261.09	-
ϕ	3557.15*	-	3554.50***
N	6900	6900	6900
R^2	0.99	0.99	0.99
Adj R^2	0.97	0.97	0.97

Test 1 = $Size_{it} = \beta_{1_i} + \beta_2 IF_{it} + \beta_3 PE_{it} + \beta_4 x'_{it} + \beta_5 \chi_{it} + \beta_6 \phi_{it} + u_{it}$
Test 2 = $Size_{it} = \beta_{1_i} + \beta_2 IF_{it} + \beta_3 PE_{it} + \beta_4 x'_{it} + \beta_5 \chi_{it} + u_{it}$
Test 3 = $Size_{it} = \beta_{1_i} + \beta_2 IF_{it} + \beta_3 PE_{it} + \beta_4 x'_{it} + \beta_5 \phi_{it} + u_{it}$
Level of significance: ***1%; **5%; *10%

The coefficients associated with χ_{it} are insignificant, however the coefficients associated with ϕ_{it} are significant; therefore, PE is endogenous in (2). To confirm this finding, we also estimate

(2.4) $\text{Size}_{it} = \beta_{1_i} + \beta_2 \text{IF}_{it} + \beta_3 \text{PE}_{it} + \beta_4 \text{x}'_{it} + \beta_5 \hat{\chi}_{it} + u_{it}$, and

(2.5) $\text{Size}_{it} = \beta_{1_i} + \beta_2 \text{IF}_{it} + \beta_3 \text{PE}_{it} + \beta_4 \text{x}'_{it} + \beta_5 \hat{\phi}_{it} + u_{it}$.

The results of (2.4) and (2.5), respectively presented in columns 2 and 3 of Table A22, confirm that PE is endogenous in (2).

A.5.3 Productive Efficiency

Finally, we test for endogeneity of internal finance and firm size in the determination of PE (which embodies pure TE and SE) by specifying

(3) $\text{PE}_{it} = \gamma_{1_i} + \gamma_2 \text{IF}_{it} + \gamma_3 \text{Size}_{it} + \gamma_4 \text{x}'_{it} + v_{it}$

We find the residuals by estimating $\widehat{\text{IF}}_{it}$ and $\widehat{\text{Size}}_{it}$ with t-1 instrument, as per

(3.1) $\widehat{\text{IF}}_{it} = \theta_{1_i} + \theta_2 \text{IF}_{it-1} + \theta_3 \text{Size}_{it} + \theta_4 \text{x}'_{it} + \upsilon_{it}$, and

(3.2) $\widehat{\text{Size}}_{it} = \iota_{1_i} + \iota_2 \text{IF}_{it} + \iota_3 \text{Size}_{it-1} + \iota_4 \text{x}'_{it} + \tau_{it}$.

We then perform the Hausman test by estimating

(3.3) $\text{PE}_{it} = \gamma_{1_i} + \gamma_2 \text{IF}_{it} + \gamma_3 \text{Size}_{it} + \gamma_4 \text{x}'_{it} + \gamma_5 \hat{\upsilon}_{it} + \gamma_6 \hat{\tau}_{it} + v_{it}$.

These estimates are presented in of

Table A23. As seen in column 1 of

Table A23, the coefficients associated with υ_{it} and τ_{it} are insignificant; therefore, all variables in (3) are considered to be exogenous. To confirm this finding, we also estimate

(3.4) $PE_{it} = \gamma_{1_i} + \gamma_2 IF_{it} + \gamma_3 Size_{it} + \gamma_4 x'_{it} + \gamma_5 \hat{\upsilon}_{it} + v_{it}$, and

(3.5) $PE_{it} = \gamma_{1_i} + \gamma_2 IF_{it} + \gamma_3 Size_{it} + \gamma_4 x'_{it} + \gamma_5 \hat{\tau}_{it} + v_{it}$.

The results of (3.4) and (3.5) are respectively presented in columns 2 an 3 of

Table A23, and confirm that all variables in (3) are exogenous.

Table A23: Hausman tests on efficiency estimation

	Test 1	*Test 2*	*Test 3*
Intercept	0.24***	0.24***	0.24***
IF	-1.65E-03	-1.66E-03	-6.84E-03
Size	-1.08E-07	-7.91E-07*	-1.09E-07
Age	0.03***	0.03***	0.03***
Leverage ratio	0.01***	0.01***	0.01***
Capital intensity	4.73E-05***	4.76E-05***	4.73E-05***
υ	-6.00E-03	-5.91E-03	-
τ	-7.66E-07	-	-7.65E-07
N	6900	6900	6900
R^2	0.80	0.80	0.80
Adj R^2	0.60	0.60	0.60

Test 1 = $PE_{it} = \gamma_{1_i} + \gamma_2 IF_{it} + \gamma_3 Size_{it} + \gamma_4 x'_{it} + \gamma_5 \upsilon_{it} + \gamma_6 \tau_{it} + v_{it}$
Test 2 = $PE_{it} = \gamma_{1_i} + \gamma_2 IF_{it} + \gamma_3 Size_{it} + \gamma_4 x'_{it} + \gamma_5 \upsilon_{it} + v_{it}$
Test 3 = $PE_{it} = \gamma_{1_i} + \gamma_2 IF_{it} + \gamma_3 Size_{it} + \gamma_4 x'_{it} + \gamma_5 \tau_{it} + v_{it}$
Level of significance: ***1%; **5%; *10%

A.6 Reduced-form equations and reduced form-parameters

In Chapter 5, Section 5.4 we solved our system of equations by substitution, the reduced-form system of equations are specified as

(27) $\mathrm{IF}_{it} = \delta_{1_i} + \delta_2 \mathrm{IF}_{it-1} + \delta_3 \mathrm{Size}_{it-1} + \delta_4 \mathrm{PE}_{it-1} + \delta_5 x'_{it} + \phi_{it}$,

(28) $\mathrm{Size}_{it} = \varepsilon_{1_i} + \varepsilon_2 \mathrm{Size}_{it-1} + \varepsilon_3 \mathrm{IF}_{it-1} + \varepsilon_4 \mathrm{PE}_{it-1} + \varepsilon_5 x'_{it} + \psi_{it}$, and

(29) $\mathrm{PE}_{it} = \zeta_{1_i} + \zeta_2 \mathrm{PE}_{it-1} + \zeta_3 \mathrm{IF}_{it-1} + \zeta_4 \mathrm{Size}_{it-1} + \zeta_5 x'_{it} + \omega_{it}$.

Based on these specifications, after substitution the reduced-form parameters for (27) are

$$\delta_{1i} = \left[\frac{\alpha_{1i}+\alpha_3\beta_{1i}+\alpha_5\beta_{1i}\gamma_5+\alpha_5\gamma_{1i}+\alpha_3\beta_5\gamma_{1i}-\alpha_{1i}\beta_5\gamma_5}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \delta_2 = \left[\frac{\alpha_2+\alpha_3\beta_4+\alpha_5\gamma_4+\alpha_3\beta_5\gamma_4+\alpha_5\beta_4\gamma_5-\alpha_2\beta_5\gamma_5}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\delta_3 = \left[\frac{\alpha_4+\alpha_5\gamma_6+\alpha_3\beta_2+\alpha_5\beta_2\gamma_5+\alpha_3\beta_5\gamma_6-\alpha_4\beta_5\gamma_5}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \delta_4 = \left[\frac{\alpha_6+\alpha_3\beta_6+\alpha_5\gamma_2+\alpha_3\beta_5\gamma_2+\alpha_5\beta_6\gamma_5-\alpha_6\beta_5\gamma_5}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\delta_5 = \left[\frac{\alpha_7+\alpha_3\beta_7+\alpha_5\gamma_7+\alpha_5\beta_7\gamma_5-\alpha_7\beta_5\gamma_5+\alpha_3\beta_5\gamma_7}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \text{ and } \phi_{it} = \left[\frac{e_{it}-e_{it}\beta_5\gamma_5+u_{it}\alpha_3+u_{it}\alpha_5\gamma_5+v_{it}\alpha_5+v_{it}\alpha_3\beta_5}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right].$$

The reduced-form parameters for (28) are

$$\varepsilon_{1i} = \left[\frac{\alpha_{1i}\beta_3+\alpha_{1i}\beta_5\gamma_3+\beta_{1i}+\beta_5\gamma_{1i}+\alpha_5\beta_3\gamma_{1i}-\alpha_5\beta_{1i}\gamma_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \varepsilon_2 = \left[\frac{\beta_2+\alpha_4\beta_3+\beta_5\gamma_6+\alpha_5\beta_3\gamma_6+\alpha_4\beta_5\gamma_3-\alpha_5\beta_2\gamma_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\varepsilon_3 = \left[\frac{\beta_4+\alpha_2\beta_3+\beta_5\gamma_4+\alpha_5\beta_3\gamma_4+\alpha_2\beta_5\gamma_3-\alpha_5\beta_4\gamma_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \varepsilon_4 = \left[\frac{\beta_6+\alpha_6\beta_3+\beta_5\gamma_2+\alpha_5\beta_3\gamma_2+\alpha_6\beta_5\gamma_3-\alpha_5\beta_6\gamma_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\varepsilon_5 = \left[\frac{\beta_7+\beta_5\gamma_7+\alpha_7\beta_3+\alpha_7\beta_5\gamma_3+\alpha_5\beta_3\gamma_7-\alpha_5\beta_7\gamma_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \text{ and } \psi_{it} = \left[\frac{e_{it}\beta_3+e_{it}\beta_5\gamma_3+u_{it}-u_{it}\alpha_5\gamma_3+v_{it}\beta_5+v_{it}\alpha_5\beta_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right].$$

Finally the reduced-form parameters for (29) are

$$\zeta_{1_i} = \left[\frac{\alpha_{1i}\gamma_3+\alpha_{1i}\beta_3\gamma_5+\beta_{1i}\gamma_5+\alpha_3\beta_{1i}\gamma_3+\gamma_{1i}-\alpha_3\beta_3\gamma_{1i}}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \zeta_2 = \left[\frac{\gamma_2+\beta_6\gamma_5+\alpha_6\gamma_3+\alpha_3\beta_6\gamma_3+\alpha_6\beta_3\gamma_5-\alpha_3\beta_3\gamma_2}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\zeta_3 = \left[\frac{\gamma_4+\alpha_2\gamma_3+\beta_4\gamma_5+\alpha_2\beta_3\gamma_5+\alpha_3\beta_4\gamma_3-\alpha_3\beta_3\gamma_4}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \zeta_4 = \left[\frac{\gamma_6+\alpha_4\gamma_3+\beta_2\gamma_5+\alpha_4\beta_3\gamma_5+\alpha_3\beta_2\gamma_3-\alpha_3\beta_3\gamma_6}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right],$$

$$\zeta_5 = \left[\frac{\gamma_7+\beta_7\gamma_5+\alpha_7\gamma_3+\alpha_3\beta_7\gamma_3+\alpha_7\beta_3\gamma_5-\alpha_3\beta_3\gamma_7}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right], \text{ and } \omega_{it} = \left[\frac{e_{it}\gamma_3+e_{it}\beta_3\gamma_5+u_{it}\gamma_5+u_{it}\alpha_3\gamma_3+v_{it}-v_{it}\alpha_3\beta_3}{1-\alpha_3\beta_3-\alpha_5\gamma_3-\alpha_3\beta_5\gamma_3-\alpha_5\beta_3\gamma_5-\beta_5\gamma_5}\right].$$

As a result the above system accounts for the full effect of the contemporaneous relationships between internal finance, size, and efficiency i.e. the reduced form parameters δ_i, ε_i, and ζ_i all incorporate αi, βi and γi as well as the error terms e_{it}, u_{it}, and v_{it} from the structural equations (27), (28), and (29).

References

Agrawal, A., & Nagarajan, N. J. (1990). Corporate Capital Structure, Agency Costs, and Ownership Control: The Case of All-Equity Firms. *American Finance Association, Journal of Finance*, 45(4), 1325-1331.

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, 6(1), 21-37.

Allison, P. D. (2009). *Fixed Effects Regression Models*. Thousand Oaks, USA: SAGE Publications.

Amihud, Y., Lev, B., & Travlos, N. G. (1990). Corporate Control and the Choice of Investment Financing: The Case of Corporate Acquisitions. *The Journal of Finance*, 45(2), 603-616.

Anderson, R. C., Duru, A., & Reeb, D. M. (2009). Founders, heirs, and corporate opacity in the United States. *Journal of Financial Economics*, 92(2), 205-222.

Anderson, R. C., Mansi, S. A., & Reeb, D. M. (2003). Founding family ownership and the agency cost of debt. *Journal of Financial Economics*, 68(2), 263-285.

Anderson, R. C., & Reeb, D. M. (2003). Founding-Family Ownership and Firm Performance: Evidence from the S&P 500. *Journal of Finance*, 58(3), 1301-1328.

Arregle, J.-L., Hitt, M. A., Sirmon, D. G., & Very, P. (2007). The Development of Organizational Social Capital: Attributes of Family Firms. *Journal of Management Studies*, 44(1), 73-95.

Arrow, K. J. (1974). *The Measurement of Real Value Added*. New York, NY: Academic Press.

Audretsch, D. B. (1991). New-Firm Survival and the Technological Regime. *The Review of Economics and Statistics*, 73(3), 441-450.

Audretsch, D. B., & Acs, Z. J. (1991). Innovation and Size at the Firm Level. *Southern Economic Journal*, 57(3), 739-744.

Australian Bureau of Statistics. (2000). Business longitudinal survey confidentialised unit record file: 1994-95, 1995-96, 1996-97 and 1997-98. *Australian Bureau of Statistics, Canberra, Australia.*

Australian Bureau of Statistics. (2001). Small Business in Australia *Catalogue Number 1321.0* (October).

Avery, R. B., Bostic, R. W., & Samolyk, K. A. (1998). The role of personal wealth in small business finance. *Journal of Banking and Finance*, 22(6–8), 1019-1061.

Ayyagari, M., Beck, T., & Demirguc-Kunt, A. (2007). Small and Medium Enterprises Across the Globe. *Small Business Economics*, 29(4), 415-434.

Bach, L. (2010). Why are Family Firms So Small? *Paris December 2010 Finance Meeting EUROFIDAI - AFFI.*

Bain, J. S. (1968). *Industrial organization* (Vol. 2nd edition). Ney York: Wiley.

Baltagi, B. H. (2001). *Econometric Analysis of Panel Data*. Chichester, UK: Wiley and Sons.

Banker, R. D. (1984). Estimating most productive scale size using data envelopment analysis. *European Journal of Operational Research*, 17(1), 35-44.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, 30(9), 1078-1092.

Banker, R. D., Cooper, W. W., Seiford, L. M., Thrall, R. M., & Zhu, J. (2004). Returns to scale in different DEA models. *European Journal of Operational Research*, 154(2), 345-362.

Banker, R. D., & Thrall, R. M. (1992). Estimation of returns to scale using data envelopment analysis. *European Journal of Operational Research*, 62(1), 74-84.

Barbera, F., & Hasso, T. (2013). Do We Need to Use an Accountant? The Sales Growth and Survival Benefits to Family SMEs. *Family Business Review*.

Barbera, F., & Moores, K. (2013). Firm ownership and productivity: a study of family and non-family SMEs. *Small Business Economics*, 40(4), 953-976.

Barnea, A., Haugen, R. A., & Senbet, L. W. (1981). Market Imperfections, Agency Problems, and Capital Structure: A Review. *Financial Management (1972)*, 10(3), 7-22.

Barnett, W., & Block, W. (2005). Money: Capital Good, Consumers' Good, or (Media of) Exchange Good? . *The Review of Austrian Economics*, 18(2), 179-194.

Barth, E., Gulbrandsen, T., & Schønea, P. (2005). Family ownership and productivity: the role of owner-management. *Journal of Corporate Finance*, 11(1-2), 107-127.

Bauer, P. W. (1990). Recent developments in the econometric estimation of frontiers. *Journal of Econometrics*, 46(1-2), 39-56.

Baumol, W. J. (1986). Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show. *The American Economic Review*, 76(5), 1072-1085.

Beck, N., & Katz, J. N. (2001). Throwing Out the Baby with the Bathwater: A Comment on Green, Yoon and Kiman *International Organizations*, 55, 487-495.

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with Time-Series Cross-Section Data. *The American Political Science Review*, 89(3), 634-647.

Beck, T., & Demirguc-Kunt, A. (2006). Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & Finance*, 30(11), 2931-2943.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2004). Bank Competition and Access to Finance: International Evidence. *Journal of Money, Credit and Banking*, 36(3), 627-648.

Becker, G. S., & Murphy, K. M. (1988). A Theory of Rational Addiction. *The Journal of Political Economy*, 96(4), 675-700.

Berger, A. N., & Udell, G. F. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, 22(6–8), 613-673.

Berger, A. N., & Udell, G. F. (1995). Relationship Lending and Lines of Credit in Small Firm Finance. *The Journal of Business*, 68(3), 351-381.

Berggren, B., Olofsson, C., & Silver, L. (2000). Control Aversion and The Search for External Financing in Swedish SMEs. *Small Business Economics*, 15(3), 233-242.

Berle, A., & Means, G. (1932). *The Modern Corporation and Private Property*. New York, NY: Harcourt, Brace, & World.

Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional Wealth in Family Firms: Theoretical Dimensions, Assessment Approaches, and Agenda for Future Research. *Family Business Review*, 25(3), 258-279.
Berrone, P., Cruz, C., Gomez-Mejia, L. R., & Larraza-Kintana, M. (2010). Socioemotional Wealth and Corporate Responses to Institutional Pressures: Do Family-Controlled Firms Pollute Less? *Administrative Science Quarterly*, 55(1), 82-113.
Bertrand, M. A. (2006). The Role of Family in Family Firms. *Journal of Economic Perspectives*, 20(2), 73-96.
Biais, B., & Gollier, C. (1997). Trade Credit and Credit Rationing. *The Review of Financial Studies*, 10(4), 903-937.
Bianco, M., Bontempi, M., Golinelli, R., & Parigi, G. (2012). Family firms' investments, uncertainty and opacity. *Small Business Economics*, 1-24.
Binks, M. (1996). Growing Firms and the Credit Constraint. *Small Business Economics,* 8(1), 17-25.
Binks, M. R., Ennew, C. T., & Reed, G. V. (1992). Information Asymmetries and the Provision of Finance to Small Firms. *International Small Business Journal*, 11(1), 35-46.
Blumberg, B. F., & Letterie, W. A. (2008). Business Starters and Credit Rationing. *Small Business Economics*, 30(2), 187-200.
Boot, A. W. A. (2000). Relationship Banking: What Do We Know? *Journal of Financial Intermediation*, 9(1), 7-25.
Bopaiah, C. (1998). Availability of Credit to Family Businesses. *Small Business Economics*, 11(1), 75-86.
Bosworth, D., & Loundes, J. (2002). The Dynamic Performance of Australian Enterprises. *Melbourne Institute of Applied Economic and Social Research, The University of Melbourne* (Melbourne Institute Working Paper Series).
Bracha, A., & Brown, D. J. (2009). Affective Decision Making: A Behavioral Theory of Choice. *Cowles Foundation Discussion Papers NO. 1633* Cowles Foundation for Research in Economics, Yale University.
Brav, O. (2009). Access to Capital, Capital Structure, and the Funding of the Firm. *The Journal of Finance*, 64(1), 263-308.
Breton-Miller, I. L., Miller, D., & Steier, L. P. (2004). Toward an Integrative Model of Effective FOB Succession. *Entrepreneurship Theory and Practice*, 28(4), 305-328.
Brockett, P. L., Cooper, W. W., Golden, L. L., Rousseau, J. J., & Wang, Y. (1998). DEA evaluations of the efficiency of organizational forms and distribution systems in the US property and liability insurance industry. *International Journal of Systems Science*, 29(11), 1235-1247.
Brush, C. G., Carter, N. M., Greene, P. G., Hart, M. M., & Gatewood, E. (2002). The role of social capital and gender in linking financial suppliers and entrepreneurial firms: a framework for future research. *Venture Capital*, 4(4), 305-323.
Burns, P., & Whitehouse, O. (1996). Family ties. *Special Report of the 3 i European Enterprise Center*.
Butters, J. K., & Lintner, J. V. (1945). *Effect of Federal Taxes on Growing Enterprises*. Boston: Harvard University.

Byrnes, P., Grosskopf, S., & Hayes, K. (1986). Efficiency and Ownership: Further Evidence. *The Review of Economics and Statistics*, 68(2), 337-341.
Cabral, L. M. B., & Mata, J. (2003). On the Evolution of the Firm Size Distribution: Facts and Theory. *The American Economic Review*, 93(4), 1075-1090.
Carlsson, B. (1989). Flexibility and the theory of the firm. *International Journal of Industrial Organization*, 7(2), 179-203.
Carney, M., Van Essen, M., Gedajlovic, E., & Heugens, P. (2010). What do we know about private family firm performance? A meta-analytical review. *Unpublished manuscript*.
Carpenter, R. E., & Petersen, B. C. (2002). Is the Growth of Small Firms Constrained by Internal Finance? *Review of Economics and Statistics*, 84(2), 298-309.
Cassar, G. (2004). The financing of business start-ups. *Journal of Business Venturing*, 19(2), 261-283.
Cassar, G., & Holmes, S. (2003). Capital structure and financing of SMEs: Australian evidence. *Accounting & Finance*, 43(2), 123-147.
Charnes, A., Cooper, W. W., & Rhodes, E. (1981). Evaluating Program and Managerial Efficiency: An Application of Data Envelopment Analysis to Program Follow Through. *Management Science*, 27(6), 668-697.
Charnes, A., Cooper, W. W., & Rhodes, E. (1979). Measuring the efficiency of decision-making units. *European Journal of Operational Research*, 3(4), 339-339.
Chittenden, F., Hall, G., & Hutchinson, P. (1996). Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation. *Small Business Economics*, 8(1), 59-67.
Chrisman, J. J., Chua, J., H. , & Litz, R., A. . (2004). Comparing the Agency Costs of Family and Non-Family Firms: Conceptual Issues and Exploratory Evidence. *Entrepreneurship Theory and Practice*, 28(4), 335-354.
Chua, J. H., Chrisman, J. J., Kellermanns, F., & Wu, Z. (2011). Family involvement and new venture debt financing. *Journal of Business Venturing*, 26(4), 472-488.
Chua, J. H., Chrisman, J. J., & Sharma, P. (2003). Succession and Nonsuccession Concerns of Family Firms and Agency Relationship with Nonfamily Managers. *Family Business Review*, 16(2), 89-107.
Cobb, C. W., & Douglas, P. H. (1928). A Theory of Production. *The American Economic Review*, 18(1), 139-165.
Coelli, T., & Perelman, S. (1999). A comparison of parametric and non-parametric distance functions: With application to European railways. *European Journal of Operational Research*, 117(2), 326-339.
Coleman, S., & Carsky, M. (1999). Sources of Capital for Small Family-Owned Businesses. *Family Business Review*, 12(1), 73-84.
Colombo, M., & Grilli, L. (2007). Funding Gaps? Access To Bank Loans By High-Tech Start-Ups. *Small Business Economics*, 29(1), 25-46.
Commonwealth of Australia. (2013). Family Businesses in Australia – different and significant: why they shouldn't be overlooked. *Senate Committee Report, March 20*.
Cooper, W. W., Seiford, L. M., & Zhu, J. (2004). *Data Envelopment Analysis* (Vol. 71): Springer US.
Cotner, J. S., & Fletcher, H. D. (2000). Computing the cost of capital for privately held firms. *American Business Review*, 18(2), 27.

Cressy, R. C. (1996a). Are Business Startups Debt-Rationed? *The Economic Journal*, 106(438), 1253-1270.
Cressy, R. C. (1995). Business Borrowing and Control: A Theory of Entrepreneurial Types. *Small Business Economics*, 7(4), 291-300.
Cressy, R. C. (1996b). Pre-entrepreneurial Income, Cash-flow Growth and Survival of Startup Businesses: Model and Tests on U.K. Data. *Small Business Economics*, 8(1), 49-58.
Cressy, R. C., Gandemo, B., & Olofsson, C. (1996). *Financing of SMEs: A Comparative Perspective*. Stockholm, Sweden.
Cressy, R. C., & Olofsson, C. (1997). European SME Financing: An Overview. *Small Business Economics*, 9(2), 87-96.
Croci, E., Doukas, J. A., & Gonenc, H. (2011). Family Control and Financing Decisions. *European Financial Management*, 17(5), 860-897.
Cruz, C., Justo, R., & De Castro, J. O. (2012). Does family employment enhance MSEs performance?: Integrating socioemotional wealth and family embeddedness perspectives. *Journal of Business Venturing*, 27(1), 62-76.
Cyert, R. M., Feigenbaum, E. A., & March, J. G. (1959). Models in a behavioral theory of the firm. *Behavioral Science*, 4(2), 81-95.
Cyert, R. M., & March, J. G. (1963). A behavioral theory of the firm. *Englewood Cliffs, NJ*, 2.
Daily, C. M., & Dollinger, M. J. (1993). Alternative methodologies for identifying family- versus nonfamily-managed businesses. *Journal of Small Business Management*, 31(2), 79-91.
Dawson, A. (2011). Private equity investment decisions in family firms: The role of human resources and agency costs. *Journal of Business Venturing*, 26(2), 189-199.
De Visscher, F. M., Aronoff, C. F., & Ward, J. L. (1995). *Financing transitions: Managing capital and liquidity in the family business.* Marietta, GA: Business Owner Resources.
Debreu, G. (1951). The Coefficient of Resource Utilization. *Econometrica*, 19(3), 273-292.
Demsetz, H. (1983). The Structure of Ownership and the Theory of the Firm. *Journal of Law and Economics*, 26(2), 375-390.
Demsetz, H., & Lehn, K. (1985). The Structure of Corporate Ownership: Causes and Consequences. *The Journal of Political Economy*, 93(6), 1155-1177.
Dhawan, R. (2001). Firm size and productivity differential: theory and evidence from a panel of US firms. *Journal of Economic Behavior & Organization*, 44(3), 269-293.
Doms, M., Dunne, T., & Roberts, M. J. (1995). The role of technology use in the survival and growth of manufacturing plants. *International Journal of Industrial Organization*, 13(4), 523-542.
Donaldson, G. (1961). *Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity*. Boston: Harvard Graduate School of Business Administration.
Dreux, D. R. I. V. (1990). Financing Family Business: Alternatives to Selling Out or Going Public. *Family Business Review*, 3(3), 225-243.
Eberhard, M., & Craig, J. (2012). The evolving role of organisational and personal networks in international market venturing. *Journal of World Business*.

Emrouznejad, A., Parker, B. R., & Tavares, G. (2008). Evaluation of research in efficiency and productivity: A survey and analysis of the first 30 years of scholarly literature in DEA. *Socio-Economic Planning Sciences*, 42(3), 151-157.
Evans, D. S. (1987a). The Relationship Between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries. *The Journal of Industrial Economics*, 35(4), 567-581.
Evans, D. S. (1987b). Tests of Alternative Theories of Firm Growth. *Journal of Political Economy*, 95(4), 657-674.
Fama, E. F., & Jensen, M. C. (1983). Separation of Ownership and Control. *Journal of Law and Economics*, 26(2), 301-325.
Färe, R., & Lovell, C. A. K. (1978). Measuring the technical efficiency of production. *Journal of Economic Theory*, 19(1), 150-162.
Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society. Series A (General)*, 120(3), 253-290.
Fazzari, S. M., Hubbard, R. G., Petersen, B. C., Blinder, A. S., & Poterba, J. M. (1988). Financing Constraints and Corporate Investment. *Brookings Papers on Economic Activity*, 1988(1), 141-206.
Førsund, F. R., & Hjalmarsson, L. (1987). *Analysis of Industrial Structure: A Putty-Caly Approach*. Stockholm: Industrial Institute for Economic and Social Research.
Førsund, F. R., & Hjalmarsson, L. (1979). Generalised Farrell Measures of Efficiency: An Application to Milk Processing in Swedish Dairy Plants. *The Economic Journal*, 89(354), 294-315.
Førsund, F. R., & Hjalmarsson, L. (1974). On the Measurement of Productive Efficiency. *The Swedish Journal of Economics*, 76(2), 141-154.
Førsund, F. R., Lovell, C. A. K., & Schmidt, P. (1980). A survey of frontier production functions and of their relationship to efficiency measurement. *Journal of Econometrics*, 13(1), 5-25.
Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics*, 67(2), 217-248.
Freear, J., Sohl, J. E., & Wetzel, W. (2002). Angles on angels: financing technology-based ventures--a historical perspective. *Venture Capital*, 4(4), 275.
Freel, M., Carter, S., Tagg, S., & Mason, C. (2012). The latent demand for bank debt: characterizing “discouraged borrowers”. *Small Business Economics*, 38(4), 399-418.
Frondel, M., & Vance, C. (2010). Fixed, random, or something in between? A variant of Hausman's specification test for panel data estimators. *Economics Letters*, 107(3), 327-329.
Gallo, M. A., & Vilaseca, A. (1996). Finance in Family Business. *Family Business Review*, 9(4), 387-401.
Geroski, P. A. (1995). What do we know about entry? *International Journal of Industrial Organization*, 13(4), 421-440.
Gersick, K., Davis, J. A., Hampton, M. C., & Lansberg, I. (1997). *Generation to Generation: Life Cycles of Family Business*. Cambridge, MA: Harvard University Press.
Ghosal, V. (1991). Demand Uncertainty and the Capital-Labor Ratio: Evidence from the U.S. Manufacturing Sector. *The Review of Economics and Statistics*, 73(1), 157-161.

Goffee, R., & Scase, R. (1985). Proprietorial control in family firms: some functions of 'quasi-organic' management systems. *Journal of Management Studies*, 22(1), 53-68.
Golany, B., & Yu, G. (1997). Estimating returns to scale in DEA. *European Journal of Operational Research*, 103(1), 28-37.
Gomez-Mejia, L. R., Cruz, C., Berrone, P., & De Castro, J. (2011). The Bind that Ties: Socioemotional Wealth Preservation in Family Firms. *The Academy of Management Annals* 5(1), 653-707.
Gomez-Mejia, L. R., Takacs Haynes, K., Nunez-Nickel, M., Jacobson, K. J. L., & Moyano-Fuentes, J. (2007). Socioemotional Wealth and Business Risks in Family-controlled Firms: Evidence from Spanish Olive Oil Mills. *Administrative Science Quarterly*, 52(1), 106-137.
Górriz, C. G., & Fumás, V. S. (2005). Family Ownership and Performance: the Net Effect of Productive Efficiency and Growth Constraints. *European Corporate Governance Institute Working Paper* No. 66/2005.
Górriz, C. G., & Fumás, V. S. (1996). Ownership structure and firm performance: Some empirical evidence from Spain. *Managerial and Decision Economics*, 17(6), 575-586.
Greene, W. H. (2012). *Econometric Analysis* (7th Edition ed.). New York: Pearson.
Griliches, Z., & Hausman, J. A. (1986). Errors in variables in panel data. *Journal of Econometrics*, 31(1), 93-118.
Habbershon, T. G., Williams, M., & MacMillan, I. C. (2003). A unified systems perspective of family firm performance. *Journal of Business Venturing*, 18(4), 451-465.
Habbershon, T. G., & Williams, M. L. (1999). A Resource-Based Framework for Assessing the Strategic Advantages of Family Firms. *Family Business Review*, 12(1), 1-25.
Handler, W. C. (1994). Succession in Family Business: A Review of the Research. *Family Business Review*, 7(2), 133-157.
Harris, D., Martinez, J. I., & Ward, J. L. (1994). Is Strategy Different for the Family-Owned Business? *Family Business Review*, 7(2), 159-174.
Harvey, M., & Evans, R. (1995). Forgotten Sources of Capital for the Family-Owned Business. *Family Business Review*, 8(3), 159-176.
Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica*, 46(6), 1251-1271.
Hausman, J. A., & Taylor, W. E. (1981). Panel Data and Unobservable Individual Effects. *Econometrica*, 49(6), 1377-1398.
Hawke, A. (2000). The Business Longitudinal Survey. *The Australian Economic Review*, 33(1), 94-99.
Haynes, G. W., Walker, R., Rowe, B. R., & Hong, G.-S. (1999). The Intermingling of Business and Family Finances in Family-Owned Businesses. *Family Business Review*, 12(3), 225-239.
Holthausen, D. M. (1976). Input Choices and Uncertain Demand. *The American Economic Review*, 66(1), 94-103.
Hustedde, R. J., & Pulver, G. C. (1992). Factors affecting equity capital acquisition: The demand side. *Journal of Business Venturing*, 7(5), 363-374.

Hutchinson, R. W. (1995). The capital structure and investment decisions of the small owner-managed firm: Some exploratory issues. *Small Business Economics*, 7(3), 231-239.
J.S. Ramalho, J., & da Silva, J. V. (2009). A two-part fractional regression model for the financial leverage decisions of micro, small, medium and large firms. *Quantitative Finance*, 9(5), 621-636.
Jaffee, D. M., & Russell, T. (1976). Imperfect Information, Uncertainty, and Credit Rationing. *The Quarterly Journal of Economics*, 90(4), 651-666.
Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360.
Jordan, J., Lowe, J., & Taylor, P. (1998). Strategy and Financial Policy in UK Small Firms. *Journal of Business Finance & Accounting*, 25(1-2), 1-27.
Jovanovic, B. (1982). Selection and the Evolution of Industry. *Econometrica*, 50(3), 649-670.
Kets de Vries, M. F. R. (1993). The dynamics of family controlled firms: The good and the bad news. *Organizational Dynamics*, 23(3), 59-71.
Kihlstrom, R. E., & Laffont, J.-J. (1979). A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion. *Journal of Political Economy*, 87(4), 719-748.
Kirchhoff, B. A., & Kirchhoff, J. J. (1987). Family Contributions to Productivity and Profitability in Small Businesses. *Journal of Small Business Management*, 25(4), 25-31.
Knight, F. H. (1965). *Risk, Uncertainty and Profit*. New York: Harper & Row.
Kotey, B. (1999). Debt Financing and Factors Internal to the Business. *International Small Business Journal*, 17(3), 11-29.
La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (1999). Corporate Ownership Around the World. *The Journal of Finance*, 54(2), 471-517.
Lawrence, E. C. (1983). Reporting Delays for Failed Firms. *Journal of Accounting Research*, 21(2), 606-610.
Le Breton-Miller, I., & Miller, D. (2006). Why Do Some Family Businesses Out-Compete? Governance, Long-Term Orientations, and Sustainable Capability. *Entrepreneurship Theory and Practice*, 30(6), 731-746.
Leland, H. E., & Pyle, D. H. (1977). Informational Asymmetries, Financial Structure, and Financial Intermediation. *The Journal of Finance*, 32(2), 371-387.
Levenson, A. R., & Willard, K. L. (2000). Do Firms Get the Financing They Want? Measuring Credit Rationing Experienced by Small Businesses in the U.S. *Small Business Economics*, 14(2), 83-94.
Litz, R. A. (1995). The Family Business: Toward Definitional Clarity. *Family Business Review*, 8(2), 71-81.
Lopez-Gracia, J., & Sanchez-Andujar, S. (2007). Financial Structure of the Family Business: Evidence From a Group of Small Spanish Firms. *Family Business Review*, 20(4), 269-287.
Lovell, C. A. K. (1993). *The Measurement of Productive Efficiency: Techniques and Applications*. Oxford Oxford University Press.
Lucas, R. E., Jr. (1978). On the Size Distribution of Business Firms. *The Bell Journal of Economics*, 9(2), 508-523.

Lumpkin, G. T., & Brigham, K. H. (2011). Long-Term Orientation and Intertemporal Choice in Family Firms. *Entrepreneurship Theory and Practice*, 35(6), 1149-1169.
MacMillan Committee. (1931). *Report of the Committee on Finance and Industry*. London: HMSO.
Mahérault, L. (2000). The Influence of Going Public on Investment Policy: An Empirical Study of French Family-Owned Businesses. *Family Business Review*, 13(1), 71-79.
Mahérault, L. (2004). Is there Any Specific Equity Route for Small and Medium-Sized Family Businesses? The French Experience. *Family Business Review*, 17(3), 221-235.
Man, T. W. Y., Lau, T., & Chan, K. F. (2002). The competitiveness of small and medium enterprises: A conceptualization with focus on entrepreneurial competencies. *Journal of Business Venturing*, 17(2), 123-142.
Martikainen, M., Nikkinen, J., & Vähämaa, S. (2009). Production functions and productivity of family firms: Evidence from the S&P 500. *The Quarterly Review of Economics and Finance*, 49(2), 295-307.
Marx, K. (1976). *Capital Volume 1*. Harmondsworth: Penguin.
McConaughy, D. L., Walker, M. C., Henderson, G. V., & Mishra, C. S. (1998). Founding family controlled firms: Efficiency and value. *Review of Financial Economics*, 7(1), 1-19.
McMahon, R. G. P. (2004). Equity Agency Costs Amongst Manufacturing SMEs. *Small Business Economics*, 22(2), 121-140.
McMahon, R. G. P. (2001). Growth and Financial Profiles Amongst Manufacturing SMEs from Australia's Business Longitudinal Survey. *Entrepreneurship: Theory & Practice*, 26(2), 51-61.
McMahon, R. G. P., & Stanger, A. M. J. (1995). Understanding the Small Enterprise Financial Objective Function. *Entrepreneurship: Theory and Practice*, 19(4), 21-39.
Meyer, L. H. (1998). The present and future roles of banks in small business finance. *Journal of Banking & Finance*, 22(6–8), 1109-1116.
Miller, D., & Le Breton-Miller, I. (2006). Family Governance and Firm Performance: Agency, Stewardship, and Capabilities. *Family Business Review*, 19(1), 73-87.
Miller, D., & Le Breton-Miller, I. (2005). *Managing for the long run*. Boston: Harvard Business School Press.
Miller, D., Le Breton-Miller, I., Lester, R. H., & Cannella Jr., A. A. (2007). Are family firms really superior performers? *Journal of Corporate Finance*, 13(5), 829-858.
Moores, K. (2009). Paradigms and Theory Building in the Domain of Business Families. *Family Business Review*, 22(2), 167-180.
Morck, R. K., Stangeland, D. A., & Yeung, B. (2000). *Inherited Wealth, Corporate Control and Economic Growth: The Canadian Disease?* Chicago, IL: University of Chicago Press.
Mueller, E. (2008). Benefits of control, capital structure and company growth. *Applied Economics*, 40(21), 2721-2734.
Mundlak, Y. (1978). On the Pooling of Time Series and Cross Section Data. *Econometrica* 46(1), 69.
Myers, S. C. (1984). Capital Structure Puzzle. *Journal of Finance*, 39(3), 575-592.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.

Nelly, R., & Rodríguez, T. (2008). *Strategic Planning and Organizational Integrity in Family Firms: Drivers for Successful Postintegration Outcomes in M&A Procedures*. Charlotte, NC: Information Age Publishing Inc.

Ohlson, J. A. (1980). Financial Ratios and the Probabilistic Prediction of Bankruptcy. *Journal of Accounting Research*, 18(1), 109-131.

Oliveira, B., & Fortunato, A. (2006). Firm Growth and Liquidity Constraints: A Dynamic Analysis. *Small Business Economics*, 27(2), 139-156.

Organisation For Economic Co-operation And Development. (2007). *The SME Financing Gap: Proceedings of the Brasilia Conference, 27-30 March 2006* (Vol. II): OECD Publishing.

Organisation For Economic Co-operation And Development. (2006). *The SME Financing Gap: Theory and Evidence* (Vol. 1): OECD Publishing.

Orser, B. J., Hogarth-Scott, S., & Riding, A. L. (2000). Performance, Firm Size, and Management Problem Solving. *Journal of Small Business Management*, 38(4), 42-58.

Pakes, A., & Ericson, R. (1998). Empirical Implications of Alternative Models of Firm Dynamics. *Journal of Economic Theory*, 79(1), 1-45.

Pearson, A. W., & Lumpkin, G. T. (2011). Measurement in Family Business Research. *Family Business Review*, 24(4), 287-291.

Penrose, E. (1959). *The Theory of the Growth of the Firm*. New York, NY: John Wiley and Sons.

Petersen, M., & Rajan, R. (1997). Trade credit: theories and evidence. *Review of Financial Studies*, 10(3), 661-691.

Petersen, M. A., & Rajan, R. G. (1994). The Benefits of Lending Relationships: Evidence from Small Business Data. *The Journal of Finance*, 49(1), 3-37.

Pettit, R. R. R. F. (1985). Small Business Finance: A Research Agenda. *Financial Management (1972)*, 14(3), 47-60.

Phillips, B. D., & Kirchhoff, B. A. (1989). Formation, growth and survival; Small firm dynamics in the U.S. Economy. *Small Business Economics*, 1(1), 65-74.

Pink, B., & Jamieson, C. (2000). *A portrait of Australian exporters: A report based on the Business Longitudinal Survey*. Canberra, Australia: Australian Bureau of Statistics, Australian Trade Commission.

Plümper, T., & Troeger, V. E. (2007). Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects. *Political Analysis*, 15(2), 124-139.

Pollak, R. A. (1985). A Transaction Cost Approach to Families and Households. *Journal of Economic Literature*, 23(2), 581-608.

Poutziouris, Z. P. (2001). The Views of Family Companies on Venture Capital: Empirical Evidence from the UK Small to Medium-Size Enterprising Economy. *Family Business Review*, 14(3), 277-291.

Purvis, D. D. (1976). The Neoclassical Theory of the Firm: A Note on the Production and Investment Decisions. *The Canadian Journal of Economics / Revue canadienne d'Economique*, 9(2), 331-341.

Reid, G. C. (1996). Mature Micro-Firms and Their Experience of Funding Shortages. *Small Business Economics*, 8(1), 27-37.

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring Organizational Performance: Towards Methodological Best Practice. *Journal of Management*, 35(3), 718-804.
Roessl, D. (2005). Family Businesses and Interfirm Cooperation. *Family Business Review*, 18(3), 203-214.
Rogoff, E. G., & Heck, R. K. Z. (2003). Evolving research in entrepreneurship and family business: recognizing family as the oxygen that feeds the fire of entrepreneurship. *Journal of Business Venturing*, 18(5), 559-566.
Romano, C. A., Tanewski, G. A., & Smyrnios, K. X. (2001). Capital structure decision making: A model for family business. *Journal of Business Venturing*, 16(3), 285-310.
Sacristán-Navarro, M., Gómez-Ansón, S., & Cabeza-García, L. (2011). Family Ownership and Control, the Presence of Other Large Shareholders, and Firm Performance: Further Evidence. *Family Business Review*, 24(1), 71-93.
Salvato, C., & Melin, L. (2008). Creating Value Across Generations in Family-Controlled Businesses: The Role of Family Social Capital. *Family Business Review*, 21(3), 259-276.
Sánchez-Vidal, J., & Martín-Ugedo, J. (2005). Financing Preferences of Spanish Firms: Evidence on the Pecking Order Theory. *Review of Quantitative Finance and Accounting*, 25(4), 341-355.
Sato, K. (1976). The Meaning and Measurement of the Real Value Added Index. *The Review of Economics and Statistics*, 58(4), 434-442.
Saving, T. R. (1961). Estimation of Optimum Size of Plant by the Survivor Technique. *The Quarterly Journal of Economics*, 75(4), 569-607.
Scherer, F. M. (1991). *Changing Perspectives on the Firm Size Problem* University of Michigan Press.
Schulze, W. S., Lubatkin, M. H., & Dino, R. N. (2003). Exploring the Agency Consequences of Ownership Dispersion among the Directors of Private Family Firms. *The Academy of Management Journal*, 46(2), 179-194.
Schulze, W. S., Lubatkin, M. H., Dino, R. N., & Buchholtz, A. K. (2001). Agency Relationships in Family Firms: Theory and Evidence. *Organization Science*, 12(2), 99-116.
Sciascia, S., & Mazzola, P. (2008). Family Involvement in Ownership and Management: Exploring Nonlinear Effects on Performance. *Family Business Review*, 21(4), 331-345.
Seiford, L. M. (1996). Data envelopment analysis: The evolution of the state of the art (1978–1995). *Journal of Productivity Analysis*, 7(2), 99-137.
Seiford, L. M., & Thrall, R. M. (1990). Recent developments in DEA : The mathematical programming approach to frontier analysis. *Journal of Econometrics*, 46(1-2), 7-38.
Shalit, S. S., & Sankar, U. (1977). The Measurement of Firm Size. *The Review of Economics and Statistics*, 59(3), 290-298.
Sharma, P., Chrisman, J. J., & Chua, J. H. (1996). *A Review and Annotated Bibliography of Family Business Studies*. Boston: Kluwer.
Sharma, P., Chrisman, J. J., & Chua, J. H. (1997). Strategic Management of the Family Business: Past Research and Future Challenges. *Family Business Review*, 10(1), 1-35.

Shleifer, A., & Vishny, R. W. (1986). Large Shareholders and Corporate Control. *Journal of Political Economy*, 94(3), 461-488.
Simon, H. A. (1955). A behavioral model of rational choice. *The Quarterly Journal of Economics*, 69(1), 99-118.
Sirmon, D. G., & Hitt, M. A. (2003). Managing Resources: Linking Unique Resources, Management and Wealth Creation in Family Firms. *Entrepreneurship Theory and Practice*, 27(4), 339-358.
Smyth, D. J., Boyes, W. J., & Peseau, D. E. (1975). The Measurement of Firm Size: Theory and Evidence for the United States and the United Kingdom. *The Review of Economics and Statistics*, 57(1), 111-114.
Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*, 39(3), 312-320.
Steijvers, T., Voordeckers, W., & Vanhoof, K. (2010). Collateral, relationship lending and family firms. *Small Business Economics*, 34(3), 243-259.
Stewart, A., & Hitt, M. A. (2012). Why Can't a Family Business Be More Like a Nonfamily Business?: Modes of Professionalization in Family Firms. *Family Business Review*, 25(1), 58-86.
Stigler, G. J. (1958). The Economies of Scale. *Journal of Law and Economics*, 1, 54-71.
Stiglitz, J. E., & Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. *The American Economic Review*, 71(3), 393-410.
Stockmans, A., Lybaert, N., & Voordeckers, W. (2010). Socioemotional Wealth and Earnings Management in Private Family Firms. *Family Business Review*, 23(3), 280-294.
Storey, D. J., & Thompson, J. (1995). The Financing of New and Small Enterprises in OECD Countries. *OECD, Paris*.
Stulz, R. (1988). Managerial control of voting rights: Financing policies and the market for corporate control. *Journal of Financial Economics*, 20(0), 25-54.
Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice. *The Journal of Finance*, 43(1), 1-19.
Villalonga, B., & Amit, R. (2006). How do family ownership, control and management affect firm value? *Journal of Financial Economics*, 80(2), 385-417.
Wall, R. A. (1998). An empirical investigation of the production function of the family firm. *Journal of Small Business Management*, 36(2), 24-32.
Ward, J. L. (1987). *Keeping the Family Business Healthy*. San Francisco, CA: Jossey-Bass.
Ward, J. L. (1988). The Special Role of Strategic Planning for Family Businesses. *Family Business Review*, 1(2), 105-117.
Watson, J. (2002). Comparing the Performance of Male- and Female-Controlled Businesses: Relating Outputs to Inputs. *Entrepreneurship: Theory & Practice*, 26(3), 91-100.
Watson, J. (2007). Modeling the relationship between networking and firm performance. *Journal of Business Venturing*, 22(6), 852-874.
Watson, J., & Robinson, S. (2003). Adjusting for risk in comparing the performances of male- and female-controlled SMEs. *Journal of Business Venturing*, 18(6), 773-788.
Watson, R., & Wilson, N. (2002). Small and Medium Size Enterprise Financing: A Note on Some of the Empirical Implications of a Pecking Order. *Journal of Business Finance & Accounting*, 29(3-4), 557-578.

Weiss, L. W. (1979). The Structure-Conduct-Performance Paradigm and Antitrust. *University of Pennsylvania Law Review*, 127(4), 1104-1140.
Weiss, L. W. (1964). The Survival Technique and the Extent of Suboptimal Capacity. *Journal of Political Economy*, 72(3), 246-261.
Williamson, O. E. (1967). Hierarchical Control and Optimum Firm Size. *Journal of Political Economy*, 75(2), 123-138.
Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
Zahra, S. A. (2005). Entrepreneurial Risk Taking in Family Firms. *Family Business Review*, 18(1), 23-40.
Zahra, S. A., Hayton, J. C., Neubaum, D. O., Dibrell, C., & Craig, J. (2008). Culture of Family Commitment and Strategic Flexibility: The Moderating Effect of Stewardship. *Entrepreneurship Theory and Practice*, 32(6), 1035-1054.
Zellweger, T. (2007). Time Horizon, Costs of Equity Capital, and Generic Investment Strategies of Firms. *Family Business Review*, 20(1), 1-15.
Zellweger, T. M., & Dehlen, T. (2011). Value Is in the Eye of the Owner: Affect Infusion and Socioemotional Wealth Among Family Firm Owners. *Family Business Review*.