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Blood and Water: Information Technology Investment and Control in Family-owned Businesses

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ABSTRACT

Family-owned businesses differ in their strategic intent and behavior as they serve as a reservoir of wealth and social status for their family owners. Family-owned businesses demonstrate relatively conservative strategic decision making that aspires long-term wealth preservation and enhancement. For family owners, investments in information technology (IT) raise a predicament as they are risky, yet a long-term imperative. We propose three hypotheses that build upon the thesis that family owners combine a deep understanding of the business with a strong influence on stakeholders within and beyond the firm's boundaries to exert strategic control in the extended enterprise. First, family ownership negatively influences IT investment, because family owners are likely to avoid investments in IT that are frivolous, reduce information asymmetry, or leave auditable digital trails. Second, the negative influence of family ownership on IT investment is weakened when a career professional is appointed in the senior-most executive position of a family-owned business. This is because professional executives strive to utilize IT for control and performance benefits, and family owners desire to use IT to monitor and control the non-family professional executive. Third, family ownership weakens the negative influence of environmental hostility on the relationship between IT investment and firm performance, as family-owned businesses incur less dynamic adjustment costs and maintain better alignment between IT and business strategy. Empirical analysis, consisting of panel regression estimations, on archival data of publicly listed Indian firms in the years 2006 to 2018 provides support for our theory that highlights how IT for control acts as a noneconomic motivation for the strategic IT behavior of firms. In doing so, we bring family ownership into the theoretical foreground for future IS scholarship. We contribute to theory and practice by advancing the nature of ownership and executive management as sources of heterogeneity in IT investment and its business value.

KEYWORDS

IT business value; digital transformation; IT strategy; IT investment; control; family ownership; professional executives; environmental hostility; emerging markets; family-owned business

Introduction

Family-owned businesses constitute a significant majority of firms in many economies. For example, in 2011-2012, 35 to 66 percent of listed companies in Southeast Asian countries

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had family owners [11], while in the United States, nearly one-half of the largest 2,000 industrial firms were family-owned businesses, some even decades after going public [5]. The three largest economies, the United States, China, and India, account for the largest number of family-owned businesses. Not only are firms with family ownership large in numbers, but empirical research also documents that family-owned businesses perform better than non-family businesses [3, 7, 99], have lower cost of debt [6], and generate greater shareholder value [86]. A comprehensive multi-year global study by *Credit Suisse* [11] has also found that family-owned businesses outperform non-family businesses across multiple sectors and regions.

Family-owned businesses differ in their strategic intent and behavior from other firms [20, 42, 43]. Family owners have an emotional attachment to the firm as it is the reservoir of the family's multi-generational wealth and social status [95]. Strategic decisions are resultantly framed in terms of loss aversion of noneconomic endowments and long-term wealth preservation and enhancement [3, 43]. Growth is welcome, but not at the expense of sustainable cash flows and profitability [6, 7]. Thus, family-owned businesses demonstrate relatively conservative strategic decision making, avoiding strategies such as aggressive internationalization [84] and R&D-intensive innovation [5, 34]. Similarly, family-owned businesses tend to accumulate wealth by reinvesting earnings in the firm and its assets, instead of pursing short-term gains via dividends and stock buybacks [5, 79].

The beneficial impact of information technology (IT) for firm performance is widely recognized and reflected in the impetus for digital transformation in firms. Hence, IT investment decisions are significant in size and strategic in nature, which necessitates the involvement of executive management, firm owners, and/or board members [28, 72]. For family owners, IT investments raise a predicament as while they are an imperative for long term growth and survival, they are also risky. Thus, due to their emphasis on long-term wealth-preservation and conservative strategic posture, anecdotal evidence suggests that family-owned businesses may systemically differ from non-family businesses in their level of investment in IT such that, while they invest in IT, they do so *prudently*. For example, in a large-scale industry survey conducted in 2018, 80 percent family-owned businesses stated that IT is of strategic importance, yet a majority claimed that they were not prepared to make the investments at present [81]. This motivates the first research question of this study:

Research Question 1 (RQ1): How does Family Ownership influence IT Investment?

Family owners seek to safeguard their wealth accumulated within the family-owned business by exercising tight control over the firm [7]. It is through control that employee activities and performance are consistently and continuously aligned with the goals and aspirations of the firm [32], and thereby its owners. Family owners can combine a deep understanding of the business [3] with a strong influence on stakeholders both within and beyond the firm's boundaries [7], and thus exert strategic control in the extended enterprise [63]. Two established methods to exercise control are particularly salient for family-owned businesses: concentration of family ownership [64] and active participation in executive management [19]. Increased or concentrated family ownership, which empowers and incentivizes family owners to monitor executive behaviors and firm strategies [3, 7, 45], is a widely adopted stratagem. For example, family owners are the largest shareholders in 19 percent of the *S&P 500* firms [111]. Participation in executive

management, either directly by the family owners, or through the appointment of surrogates, also empowers family owners to shape and implement strategies of family-owned businesses [8, 79]. This control mechanism is also popular with family owners. In the United States, family members serve as the top executive in 63 percent of family-owned businesses [3]; whereas, globally, approximately one-third of public firms are managed by their owner families [64]. In other words, family owners safeguard family wealth by exerting tight control through these two mechanisms that involve their own kin, as *blood is thicker than water*.

Over the years, family owners have also sought to professionalize their firms as means to ensure longevity and sustainability of the business [99]. Professionalization includes appointing career professionals (who are not members or surrogates of the owner family) in executive management positions. Hiring such professional executives enables family-owned businesses to acquire capabilities and expertise that are beneficial to the firm and aids in improving efficiencies and effectiveness of the business [99]. Furthermore, career executives tend to imbibe professional traits of non-family businesses, which have different time horizons and objectives and thus seek valuation for the market and are systems-ready for organic and inorganic growth. Hence, non-family businesses are more fluid and ever able to move in response to fleeting opportunities. In other words, family owners strive to enhance sustainability of family wealth by appointing career executives who imbibe the fluidity of non-family businesses, as they seek to *be like water*.

However, the appointment of an outsider in an executive position diminishes the control that family owners can exert over their firm [3, 23]. Given the importance of control in safeguarding family wealth accumulated within the family-owned business, anecdotal evidence suggests that family owners seek compensatory mechanisms to indirectly exert control through selective digital means. For example, India's *Muthoot family business*, which traces its genesis to a timber business of 5,000 people and 17 elephants from 800 years ago, is managed by the 20th generation of the family. The group has invested in IT-based control systems that allow live monitoring of its more than 5,300 branches to ensure adherence to standards and processes, and alignment to the enduring values of trust and commitment of the family [82]. This motivates the second research question of this study:

> *Research Question 2 (RQ2): How does professionalization impact the relationship between Family Ownership and IT Investment?*

The above notions regarding family owners' ability to exert control, in conjunction with the prudent IT investments of their firms (regardless the nature of executive management), give rise to an intriguing implication. Even in an unfavorable business environment, family-owned businesses should plausibly be able to extract more business value from their selective IT investments due to the family owners deeper understanding of, and stronger influence over, the extended enterprise. This brief builds upon prior research which finds that payoffs for underinvestment in IT become positive for firms with family ownership [49], and motivates the third and final research question of this study:

> *Research Question 3 (RQ3): How does Family Ownership impact the relationship between IT Investment and Firm Performance in a hostile environment?*

We draw upon prior literature on family businesses, and IT and control, to propose three hypotheses. First, we offer our primary thesis that firms with family owners invest less in IT. The rationale underlying this hypothesis is that since family owners seek to preserve their wealth accumulated within the family business, they avoid investments in IT that are frivolous, reduce information asymmetry, or leave auditable digital trails. Second, we argue that the negative influence of family ownership on IT investment is weakened when a career professional is appointed in the senior-most executive position of a family-owned business. This builds upon the premise that both family owners and professional executives have aligned preferences for increased investment in IT; the former desire to use IT to exert control over the latter, whereas the latter aspire to utilize IT for its control and performance benefits. Finally, we argue that family-owned businesses incur lesser dynamic adjustment costs and better maintain alignment between IT and business strategy. Hence, family ownership weakens the negative influence of environmental hostility on the relationship between IT investment and firm performance.

Our research model is presented in Figure 1. We test our hypotheses using archival panel data of publicly listed Indian firms in the years 2006 to 2018. Our empirical analysis, consisting of panel regression estimations and multiple supplementary procedures, provides broad support for our hypotheses. Our findings make critical contributions to research by offering the nature of ownership and executive management as two sources of heterogeneity among firms that explain differences arising in IT investment across *Red Queen* cohorts (groups of peers/rivals relative to whom an organization is judged), and ultimately, the payoffs associated with IT. Our findings also highlight how IT for control acts as a noneconomic motivation for the strategic behavior of firms and provide a nuanced conceptualization of how control can enable better leverage of IT investments.

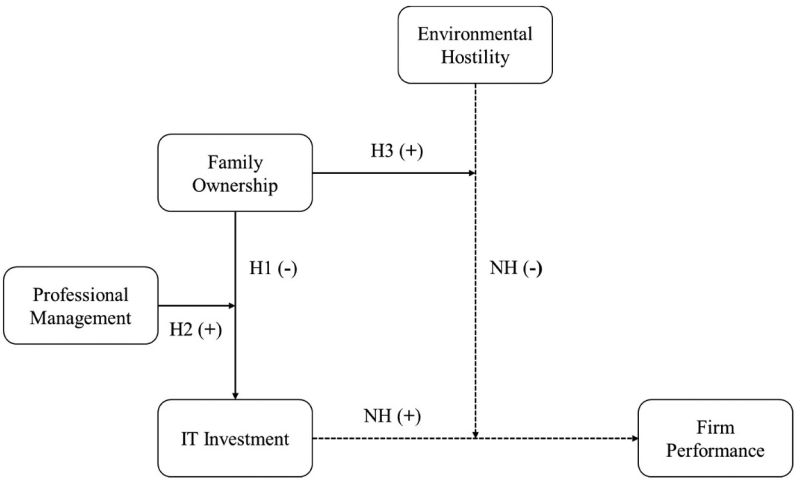

Figure 1. Research Model: Family Ownership and IT Investment.
Notes: NH signifies not hypothesized.

Background Literature and Theory Development

Key Thematic Issues in Family-owned Business Literature

Although various definitions persist in the literature, we adapt Anderson and Reeb [7], and define family-owned businesses as *those firms in which the promoter or members of his or her family by either blood or marriage (agnates or cognates*[1]*), own equity, either individually or as a group* [111]. Hence, we use kin-based ownership as a defining criterion for family-owned businesses [99].

The dichotomy between family-owned businesses and non-family businesses has been examined vigorously in management research for several decades (for example, see [19] for an early exposition). The basic premise underlying much of this research is that due to the highly prevalent and persistent nature of family ownership, family-owned businesses behave differently from non-family businesses [7]. For example, family owners often maintain a long-term presence in their firms. A case in point is the *DuPont* family, which for over 200 years, has maintained a substantial presence of a minimum 15 percent equity stake in the firm bearing the family name. Hence, family owners potentially have longer time horizons than other shareholders, and family-owned businesses are thus more willing to invest in long - term projects as compared to non-family businesses that have relatively shorter horizons [3, 7]. Family owners also acquire more firm-specific and domain knowledge [3, 18] due to their participation in the family-owned business since its inception [99]. This also results in family owners moving further along the firm's learning curve and being able to exert superior oversight and influence over the firm [6, 7]. Another consequence of long-term ownership in the firm is that not only is a substantive amount of family owners' economic wealth accumulated within the firm, but the firm is also a source of nonpecuniary benefits for family owners [7, 99]. For example, the *Agnellis* family of Italy have benefitted from their ownership of *Fiat* by securing proximity to the government (and sometimes even within the government through family members as cabinet ministers), which has facilitated public transfers to *Fiat* [23]. Another example is the *Jindal* group of India, whose first- and second-generation chairmen have been elected members of the federal legislature.

Resultantly, the Socioemotional Wealth perspective has been offered as an explanation for why the strategic behavior of firms with family ownership differs from nonfamily businesses [20, 42, 43]. This perspective suggests that the firm is a source of personal pride, self-identification, and satisfaction for family owners [95]. Due to a resultant emotional attachment to the firm, family members usually frame strategic decisions in terms of loss aversion of noneconomic endowments [43]. Thus, the Socioemotional Wealth perspective offers preservation and enhancement of noneconomic or affective endowments of family owners as a fundamental motivation for the strategic behavior of family-owned businesses [20]. This motivation manifests in a risk-averse and conservative strategic decision-making behavior in family-owned businesses [5]. Due to the overarching desire to preserve socioemotional wealth, the strategic alternative selected by family-owned businesses may not necessarily be entirely justifiable based on purely economic considerations [42]. For example, family-owned businesses avoid risky strategies such as internationalization [84] and R&D-intensive innovation [5]. These behaviors intensify as family ownership becomes more concentrated or persists in a firm [98]. The few studies of family owners' decisions related to IT also reflect such behavior by suggesting that family owners closely monitor IT decision making.

Key Thematic Issues in Control Literature

Control is a fundamental concept that originates from the earliest works in management science [19]. Control is exerted through mechanisms that align the actions of employees with the organization's desired goals and aspirations and thereby improve the probability of attaining them [32, 48]. The rich literature on organizational control has defined different types of control and the tasks to which they can be applied (e.g., [37, 76]). The different control mechanisms employed by organizations can be broadly categorized into output control, process control, and input control. Output control measures output indicators and is appropriate to use when outputs are easy to measure, but processes are difficult to measure. Process control assesses adherence to processes and is appropriate to use when there is shared understanding of the process by which inputs transform into outputs [108]. Input control assesses the fit of individuals to the organization, their intrinsic dedication, and inputs to their tasks. IT can be used as any of these three control mechanisms: to measure output, process adherence, or inputs. Resultantly, the concept of control has been incorporated in various topics in information systems research, such as software development [104], outsourcing [65, 108], alliances [107], governance [102], auctions [92, 93], and platforms [106].

IT transforms the manner in which businesses are governed [109] as it enables firms to exert strategic control over its extended enterprise [63]. As a verb, control relates to the exercise of restraint, and as a noun, control relates to the ability to use tools and techniques of control. IT enables control in both forms; first as a verb because it facilitates restraint of business practices within and beyond the enterprise, and second as a noun because it constitutes the capability through which firms can assert this restraint [63]. The control implications of IT stem from its influence on organizational planning as knowledge-based planning systems improve the development of plans and facilitate their implementation [9]. The implications of IT on control have moved beyond the impact of mere tools, as IT has now evolved to such a strategic extent that it is beginning to have a significant impact on improving management governance and practice [62]. IT makes the organizational boundary porous [17] and enables information sharing across the extended enterprise. Supported by such boundary-spanning systems, effective information sharing enables firms to gain stronger control over their extended enterprise.

The control implications of IT manifest in two significant ways. First, IT enables an understanding of what is taking place in the enterprise and in the extended environment. Understanding implies *awareness* and *appreciation* of what has occurred, is occurring, and could occur [63]. IT systems can facilitate automatic and effective planning through sensing and forecasting of the environment, and in doing so, enable efficient running of business practices, resulting in performance gains for firms [67]. Second, IT enables an influence over the actions of various stakeholders, both inside and outside the enterprise. Influence refers to communicating, commanding, persuading, or inducing specific behavior [63]. IT systems empower executives to induce appropriate responses by stakeholders by reducing information asymmetry through the intelligent detection of opportunities in the environment, and thereby improve firm performance outcomes [38]. Interestingly, the control implications of IT previously outlined are two-sided. Just as executives can leverage IT as an instrument of control, concurrently, the same IT also enables firm owners to monitor the actions and induce desirable behaviors of executives appointed to run the firms.

Family Ownership and IT Investment

The nature of ownership is a key source of heterogeneity in firm strategies [29, 30]. Family owners have a long-term focus [3] and are motivated by the preservation of the family's wealth and reputation [20, 43, 99]. Family owners seek sustainable revenues and profitability from the firm as the firm is the main source of present and future income and socioemotional wealth for the family and its bloodlines [42, 43]. Hence, while growth is welcome, it is not desirable at the expense or risk of sustainable cash flows and profits [6, 7]. Thus, family-owned businesses, with their long-term time horizons [7], are akin to a lifestyle choice [99], with no desire or action towards attaining aggressive growth through organic or inorganic means such as Mergers & Acquisitions (M&A) [98].

Control, within and beyond the boundaries of the firm, is imperative to achieve sustainable cash flows and profits [63]. Family owners are able to exert effective control because of their deep understanding (of the business and its domain) [3] and strong influence (over employees, long-term suppliers, and perhaps even loyal customers) [7]. Control manifests in the avoidance of bad and unnecessary expenditures [3] such as those IT capital investments which are "fashionable" or are pursued by the herd [101, 112]. Also, since family owners bear the burden of frivolous investments that may adversely impact the long-term economic well-being and societal reputation of their businesses [42, 43, 114], family owners hesitate to make IT investments of such a nature. Instead, family owners are prone to make a few credible investments that maximize value for money.

There are two additional reasons that underlie the reluctance of family owners towards investments in IT, beyond the level necessary for enhancing business operations. First, family owners prefer to intentionally maintain information asymmetry within the firm by various means, such as compartmentalizing information inside organizational silos. This enables owners to exert control over the firm and its day-to-day operations. For example, *JewelCo* (pseudonym used for anonymity), a 150-year-old family-owned manufacturer and retailer of jewelry in India, deliberately hides cost information from sales personnel and store managers across its numerous retail stores. This ensures that family owners or their surrogates must be consulted before discounts are offered to customers. This modus operandi minimizes the risk of proprietary information from falling into the hands of employees or competitors, and thus harming the ability of the family to maintain control and firm's long-term well-being, respectively. Investments in IT, such as enterprise social systems like social networks, wikis, and blogs, endow benefits through the horizontal and vertical sharing and integration of information across the firm [90]. Such information flows are at odds with the information asymmetry preferences of family owners, thus contributing towards family owners' reluctance towards IT investments. Second, family owners realize control beyond the boundaries of the firm by "managing" the institutional and competitive environments. This is achieved by developing relational capital with key environmental actors through the leverage of the firm's resources and influence to confer favors and preferential treatment [99]. For example, family owners may provide "complementary" travel on corporate aircraft to players who bestow benefits to the family or its business. Automated business processes that leave digital trails are not amenable to appropriation by family owners for asserting control beyond the enterprise, thus further dissuading family owners from investing in IT.

On the contrary and in comparison, non-family businesses are short-term focused and motivated by stock market considerations that reward executives and shareholders for quarterly performance. Since shareholders' personal wealth is distributed across different firms with varying prospects [68], they are risk-neutral and reward firms that provide higher returns. Hence, non-family businesses seek a valuation for the market through aggressive growth which may be pursued at the risk of future sustainability. Aligned with this outlook, non-family businesses exhibit a state of preparedness for inorganic growth through M&A [25, 98]. Hence, non-family businesses maintain digital readiness through information sharing, codification, and digital audit trails to support fluidity of this M&A ready strategic posture. Furthermore, empirical evidence supports the notion that career professionals tend to overinvest in IT; managers do so due to the "empire-building" syndrome [36], while executives are gullible to invest unnecessarily in IT for personal motives, for example, to increase their benefits from stock options [21, 116]. Non-family businesses are also vulnerable to memetic pressures that may result in unnecessary investments in IT [91]. Hence, compared to family-owned businesses, non-family businesses are prone to invest in risky, non-viable, or fashionable IT.

In summary, family owners prioritize the preservation or enhancement of socioemotional and economic wealth [20, 43, 99] and avoid frivolous investments in IT that may reduce information asymmetry or leave auditable digital trails, and instead make lesser *IT Investment* that maximizes value for money. This reluctance towards *IT Investment* increases as family owners' ownership stake in the family-owned business increases [40, 98]. Hence, we propose:

Hypothesis 1 (H1): Family Ownership negatively influences IT Investment.

Professional Executives and IT Investment in Family Businesses

The nature of executive management is another source of heterogeneity in firm strategies [15, 30]. Usually, family owners directly exert control over their firm by appointing either a family member, or surrogate as the senior most executive of the firm [3, 8, 79]. This is because a large proportion of family wealth is invested in the family firm. Family executives derive substantial control and decision-making authority from this wealth [45]. In turn, family executives use this power and authority to make strategic decisions that preserve and grow their wealth through sustainable cashflows and profitability and hence advance the family's long-term goals [6, 79]. Further, the confluence of ownership and management control provides the family with greater prestige and socioemotional wealth from the firm [84].

However, due to increasing complexity of the business environment, many family businesses are seeking to professionalize by appointing a professional to manage and run the firm [99]. Professional executives, who are not members or surrogates of the family, are hired because they are likely to possess knowledge and experience about successfully running similar businesses [23]. They also bring valuable business contacts, and managerial skills and capabilities necessary for the firm to compete effectively [99]. Finally, professional executives are often hired because potential investors or foreign collaborators may exhibit a preference to deal with such individuals [16] and believe that the collective talent of family owners and outsiders may drive long-term growth.

The presence of a professional executive weakens family owners' overall influence on the family business [8, 23, 95]. Family owners are no longer able to exercise unrestrained authority, influence, and power over all aspects of the business [3, 99]. Hence, by hiring professional executives, family owners cede control over the firm and its decision-making processes [3, 98]. However, since preservation of family wealth is the overarching motivation of family owners, family owners seek an alternative to monitor and control the actions of professional executives [7]. In other words, family owners aspire to *police the policeman* (appointed to manage their firm). For example, as part of its professionalization efforts, *Cipla*, an Indian pharmacetical firm established in 1935, hired a professional Chief Executive Officer in 2013, overseen by a management council headed by the family owners [83]. We maintain that family owners use IT as an instrument to exert control over professional executives as IT-based control systems make it difficult to conceal information and actions due to availability of reports and digital trails. Hence, in the presence of professional executives, family owners are more likely to invest in IT that exceeds the basic level necessary for facilitating business operations. Additional theoretical intuition for this claim is as follows. Family executives and employees related to family owners represent an ingroup within the organization. However, a professional executive is a member of an outgroup [26]. Family-owned businesses with professional executives are blended organizations, where employees who are not part of the ingroup suffer from reduced loyalty and a lesser sense of belongingness. These issues can be addressed when employees not in the ingroup are monitored through control systems [33].

However, family owners may delegate IT investment decisions to professional executives. Nonetheless, investments in IT are likely to increase as professional executives may also prefer to reinforce deployment of IT due to the following reasons. The performance of career professionals in executive positions is assessed by family owners through the performance of the family business. IT investments enhance firm performance outcomes [28, 116] and can neutralize the stifling and stunting effect of family owners' authority to unleash creativity [73, 94] and productivity [85], which in turn can enhance innovation outcomes. Correspondingly, professional executives will prefer to increase such expenditures. Also, professional executives prefer to use IT to monitor their subordinates and exert control across the firm. Professional executives also prefer IT-based information sharing across the firm as this may result in efficiancy gains and better control and coordination [17, 66]. They also discourage the use of informal processes that are less efficient and suffer from governance issues as compared to formal, digitally-enabled business processes. Thus, professional executives are likely to encourage investments in IT that remove information asymmetry and codify processes with digital trails and traces. Thereby, professional executives are likely to encourage increased digitization through IT investment that maximizes economic returns, improves control and coordination, and enhances formalization and governance within the firm.

In summary, we propose that presence of a career professional (who is not a member of the family that owns the firm) in the senior-most executive position of the firm is likely to weaken the negative influence of *Family Ownership* on *IT Investment* because both family owners and professional executives prefer greater investments in IT for control and performance benefits.

Hypothesis 2 (H2): The negative influence of Family Ownership on IT Investment is weakened in the presence of a Professional Executive.

IT Investment and Firm Performance in Hostile Environments

Environmental Hostility refers to the existence of unfavorable external forces in a firm's business environment [118]. Hostility results from perceived competitive-, market-, and regulatory-related factors and reflects the extent to which a firm's environment can prevent a sustained rate of growth [35]. Factors which can cause *Environmental Hostility* include fierce rivalry among competitors, rapidly evolving demand conditions, multitude of inconsistently applied laws, and more generally, economic recessions [31, 118]. In contrast, placid (less hostile) environments provide abundant market opportunities due to their munificent settings.

Performing effectively in the presence of *Environmental Hostility* requires managers to identify, evaluate, and seize fleeting opportunities. Hence, a firm needs to invest heavily in three broad areas: understanding its business while monitoring the environment [38], aligning the business with its environment [110], and implementing planned strategies to manage the hostility in its environment. Since hostile environments suffer from stiff competition [69], growth is achieved primarily at the expense of rivals, implying a near zero-sum game [80]. Thus, as hostility intensifies, firms incur prohibitively high costs for making adjustments [103] owing to disruptions in supplier networks, and need for innovation, marketing, and advertising to develop brands and customer loyalty [10, 117, 118].

Given the high costs of adjusting to a hostile environment [103], firms may lack scarce resources to mobilize investments in IT in the form of IT capabilities and make complementary investments [47, 89, 115]. Performance benefits from *IT Investment* occur only when organizations leverage IT capabilities, in consort with other complementary organizational resources and capabilities [28, 47, 89]. However, even if a firm devotes scarce resources to create such capabilities, it may fail to receive fair returns on its *IT Investment* in a hostile environment [100, 115] as it is difficult to ensure dynamic alignment between IT and business strategy [88]. Ensuring strategic alignment between business and IT strategy requires directing valuable resources towards building shared understanding, which exacerbates dynamic adjustment costs [50]. Hence, *IT Investment* has lesser influence on *Firm Performance* in the presence of *Environmental Hostility*. This theory is consistent with other studies that find negative moderating effects of environmental variables on the relationship between *IT Investment* and *Firm Performance* [27].

We maintain that *Family Ownership* weakens the negative influence of *Environmental Hostility* on the relationship between *IT Investment* and *Firm Performance*. This is due to two fundamental mechanisms: family-owned businesses incur lesser dynamic adjustment costs and maintain better alignment between IT and business strategy. The logic which underlies these mechanisms is provided hereafter and arises from the adage that *a smooth sea never made a skilled sailor*.

First, family owners have a deep *understanding* of the business [3] and *influence* over its business partners [7], which enables them to exert strategic control in the extended enterprise [63]. (Note that though a professional executive may gain rich *understanding* of the organization and its challenges, family owners' *understanding*, and *influence* are more vividly in-depth due to the inter-generational and relationship-based nature of their shared business experiences with the extended enterprise [96].) The wealth preservation objective of the family also extends beyond the enterprise as financially secure suppliers ensure sustainable revenues and profitability for the family-owned business. This encourages richer collaborations in the extended enterprise to filter noise and information to make necessary readjustments [50], while avoiding information overload especially prevalent in

hostile environments [51]. Furthermore, in service of their long-term orientation, family-owned businesses take extraordinary steps to develop and preserve their reputation [7]. As a result, they are perceived as credible and trustworthy, and rewarded with customer loyalty, even in hostile environments [12, 75]. Hence, family-owned businesses require less investments to develop customer loyalty. Overall, since family owners have shared values and aligned interests with suppliers and customers, family-owned businesses incur lesser costs when operating in environments with intense hostility. This in turn frees up scarce resources that can be used to generate IT capabilities and make complementary investments. For example, *BPW Bergische Achsen KG* (BPW), a 120-year-old German family-owned business, digitalized its core product of chassis systems for truck trailers, using sensors and telematic systems. *BPW* collaborated deeply with its extended enterprise to achieve transparency and digitization of sub-processes across the entire supply chain, deriving benefits from its IT investments in a relatively hostile (competitive) environment [22].

Second, prior research finds that the two key drivers for achieving alignment between IT and business strategy include (1) an ability to formally integrate a business with a technology plan and (2) an in-depth awareness of the challenges faced by the business [54]. Since family owners have a better *understanding* of the business domain and its challenges [3], they can anticipate specific decisions and areas that can benefit from the prudent IT investments made by the firm [39]. Furthermore, family owners can *influence* business and IT managers towards difficult decisions regarding where to target IT investments and how to appropriately leverage them in the business [88], thereby achieving integration of business and technology. Hence, family-owned businesses have a greater level of shared understanding between business and IT, which also eases dynamic alignment between IT and business strategy [88]. Thus, family-owned businesses are able to achieve and maintain better alignment between IT and business strategy, and receive relatively higher returns on IT investment in hostile environments. For example, *BPW* offers a key new digital service — a *mobile spare-part storeroom*, to its channel partners and large customers. This service offers automatic, contactless, and real-time identification, invoicing, reordering, and restocking of thousands of spare parts for an entire fleet. This highly successful digital solution is possible due to the optimal alignment between IT and business strategy achieved by *BPW* [22].

In line with the aforementioned theorization, we propose:

Hypothesis 3 (H3): Family Ownership assuages the negative influence of Environmental Hostility on the relationship between IT Investment and Firm Performance.

Methods

Research Context and Data

To test our research model, we use archival panel data from the entire population of publicly listed Indian firms. India, a large emerging economy, is an appropriate context for our research for at least three reasons. First, India has the world's second-largest number of family-owned firms and family firms constitute a large percentage of publicly listed firms in India [11, 84]. Second, Indian family owners have been increasing their reliance on

professional managers to cope with the rising complexity of the business environment since India liberalized its economy in 1992 [57, 60, 61]. Third, India has a hostile business environment due to intense competition and dynamic institutional policies [24, 55]. As a result, a sample of Indian firms offers a good understanding of the dynamics underlying *IT Investment* in family-owned businesses.

We use *Prowess*$_{dx}$, a database offered by the *Center for Monitoring the Indian Economy* to collate data for all companies listed on the *Bombay Stock Exchange* and *National Stock Exchange* of India. This database has been widely used by many researchers in studies that investigate phenomena in Indian firms [59, 61]. After excluding observations with missing data or with data for only a single year, we construct a longitudinal dataset consisting of 10,437 firm-year observations of 3,277 firms over the time period 2006 to 2018. We run means comparisons tests between our sample and the population and find no significant differences across critical sample characteristics. Note that we also test multiple imputation methods for missing values and subsequently find consistent results.

Our dataset offers rich insights into the ownership landscape of publicly listed firms in India. During the period between 2006 and 2018, promoters hold an average of approximately 50 percent of the common stock of publicly listed firms in India. Indian families are the largest and dominant category of promoters, with their average shareholding during this period steadily increasing from 43 to 47 percent. Indian family owners hold shares both directly (yearly average ranging between 22 and 26 percent), and through associated individuals and firms. These figures correspond favorably with analyst reports [11, 74], which also find that in over half of the top 100 companies by market capitalization listed on the *Bombay Stock Exchange*, family owners have a direct shareholding of more than 20 percent. We also find that in our sample, though average IT Investment per firm year is approximately 2.5 percent of sales revenue, it varies widely, is lower for family-owned businesses, and higher for IT intensive industries in recent years.

Variables

As subsequently discussed, we perform panel data analyses to test our hypotheses. In the first specification, *IT Investment* is the dependent variable, whereas *Firm Performance* is the dependent variable in the second specification. Variables of both specifications of this study are measured as follows (Table 1 lists definitions and operationalizations of all variables).

IT Investment is measured as the total capital expenditure on IT infrastructure, hardware, software, and IT related research & development as a percentage of sales revenue in the focal year [88]. Hence, this measure excludes operational IT expenses incurred to maintain current IT assets. *Family Ownership* is measured as the sum of shareholdings of the promoter and family members, as a percentage of total common stock of the firm [4, 6, 84, 111]. *Professional Executive* is operationalized as a dummy variable, coded as 1 if an individual, who is not a member of the promoter family, occupies the senior-most executive position (Executive Chairperson, Chief Executive Office, or Managing Director) in the firm [64]. Alternatively, a value of 0 is assigned to the measure [97]. *Firm Performance* is measured as net income divided by total assets or Return on Assets (ROA). ROA is a widely used firm performance measure in prior IS studies that reflects how efficient a firm is in using assets to generate earnings, which is aligned with the credo of family owners to maximize value for money. Furthermore, ROA is relatively resistant to financial

Table 1. Description of variables.

Variable	Definition and Operationalization
IT Investment	*A firm's total capital expenditure on Information Technology.* Total capital expenditure on IT infrastructure, hardware, software, and IT related research & development as a percentage of annual sales revenue. Operational IT expenditures incurred to maintain current IT assets are excluded.
Family Ownership	*Promoter family's aggregate ownership of equity in a firm.* Sum of shareholdings of the promoter and family members, as a percentage of total common stock of the firm.
Professional Executive	*Presence of a career professional, who is not a member or surrogate of the promoter family, in the senior-most executive position of a firm.* Dummy variable, coded as 1 if an individual, who is not a member of the promoter family occupies the senior-most executive position (Executive Chairperson, Chief Executive Office, or Managing Director) in the firm. Alternatively, coded as 0.
Environmental Hostility	*The existence of unfavorable external forces in a firm's business environment.* Reciprocal of antilog of regression coefficient of natural log of total sales revenue of the firm's primary industry against an index variable of five years [t, t-4].
Firm Performance	*A firm's aggregate financial performance.* ROA, calculated as ratio of net income to total assets.
Controls	
Firm Age	*Number of years since the firm's incorporation.* Focal year minus incorporation year of the firm.
Firm Size	*The scale of business operations of a firm.* Total annual sales revenue.
Liquidity	*A firm's ability to meet its short-term obligations.* Ratio of current assets to current liabilities.
Performance Deviation	*A firm's aggregate financial performance relative to its competitors.* Three-year moving average of deviation of the firm's ROA from the median industry ROA.
Cash Flow	*The net amount of cash generated (or consumed) by a firm's business operations.* Earnings before interest, taxes, depreciation, and amortization.
Leverage	*A firm's ability to borrow capital.* Ratio of total debt and shareholder's equity
R&D Investment	*A firm's total expenditure on research & development activities.* Total expenditure on Research & Development as a percentage of annual sales revenue.
Marketing Investment	*A firm's total expenditure on marketing activities.* Total expenditure on marketing as a percentage of annual sales revenue.
Industry Growth	*Extent of growth in aggregate revenue in the industry.* Three-year percentage change in aggregate annual sales revenue for all firms in an industry.
Industry Capital Intensity	*Extent of assets required to generate revenue in the industry.* Median value of ratio of total assets to annual sales revenue for all firms in an industry.
Industry Concentration Ratio	*Extent of market control of the largest firms in the industry.* Four-firm concentration ratio, defined as the sum of market shares of the top four market share leaders of the firm's industry (computed as a percentage).

manipulations of owners and management [41, 44]. *Environmental Hostility* is measured as the reciprocal of environmental munificence calculated using growth in industry sales [58, 77, 88]. To do so, for each firm, we regress the natural log of total sales of its primary industry (based on the India's National Industry Code) against an index variable of five years [t, t-4]. We then use the reciprocal of the antilog of the regression coefficient to measure *Environmental Hostility*.

We also include several control variables that may influence *IT Investment* or *Firm Performance*, which enhances the credibility of our empirical tests by ruling out alternative explanations. We include several firm-level controls. Older firms may systemically differ from newer firms in *IT Investment* and/or *Firm Performance* due to learning effects. Accordingly, we control for *Firm Age*, measured as the number of years the firm has been in operation since incorporation, in both the specifications [56, 61]. Since large firms have more resources that may influence *IT Investment* or *Firm Performance*, we control for *Firm*

Size, which is measured as annual sales revenue [89]. We also control for three possible sources of funding for IT investments — reserves, surpluses, and debt. Accordingly, we control for *Liquidity*, measured as the ratio of current assets to current liabilities [88]; *Performance Deviation*, measured as the three-year moving average of the deviation of the firm's ROA from the median industry ROA [28]; *Cash Flow*, measured as earnings before interest, taxes, depreciation, and amortization [89]; and, *Leverage*, measured as the ratio between total debt and shareholder's equity [61]. We control for investments in marketing and Research and Development (R&D), which are two key investments other than IT that may influence *Firm Performance*. *Marketing Investment* and *R&D Investment* are measured as the total expenditure on marketing and R&D as a percentage of sales revenue in the focal year, respectively [61]. Finally, we also control for the effect of *Past Performance* [89].

We also include several control variables at the industry level. We control for *Industry Growth* in both stages as growing industries may entice investments in IT or systemically influence the performance of firms [71]. We control for *Industry Capital Intensity*, measured as the median of the capital intensities of the firms in that industry, as it may influence the dependent variables in both the stages [61, 88]. To account for the effect of competition on *IT Investment* [115], we control for *Industry Concentration Ratio*, measured as the percentage sum of market shares of the top four market share leaders of the industry [28]. Finally, we include industry dummy variables that represent the firm's primary sector, to account for industry-specific idiosyncrasies beyond those accounted for by the other industry-level controls [88, 89]. We also include year dummy variables to account for time-specific heterogeneity [28].

The independent variables and control variables were lagged one year prior to the dependent variable, as appropriate, to ensure temporal precedence and strengthen causal inference. For example, payoffs from IT investments accrue after a time lag and hence incorporating a one-year lag in examining the effect of *IT Investment* on *Firm Performance* is appropriate. Table 2 depicts the means, standard deviations, and correlations among the main variables.

Estimation Models

We estimate the following regression specification to test hypotheses 1 and 2:

$$ITInvestment_{it} = \mathcal{F}[FamOwnership_{it}, ProfExecutive_{it}, FamOwnership_{it} * ProfExecutive_{it}, X_{it}^{Firm}, X_{it}^{Industry}, Z_i^{Firm}, Z_i^{Industry}, Z_t^{Year}] \quad (1)$$

where X_{it}^{Firm} is the vector of time-variant firm-level control variables, $X_{it}^{Industry}$ is the vector of time-variant industry-level variables, Z_i^{Firm} and $Z_i^{Industry}$ are the vectors of time-invariant firm-level and industry-level control variables, respectively, and Z_t^{Year} is the vector that controls for year-fixed effects.

Since our data is longitudinal in nature, we estimated both fixed-effects and random-effects panel regression models. Based on *Hausman tests* [46], we are unable to reject the null ($p > 0.05$), suggesting that random-effects models are consistent. We also conducted the *Breusch-Pagan Lagrange Multiplier test* ($p < 0.01$) which indicates the presence of a random panel effect. Furthermore, random effects estimations retain all time-invariant variables. Due to the cross-sectional time-series nature of our data, there is potential for

Table 2. Descriptive statistics and correlations.

	Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1	*IT Investment*	2.47	9.91	1.00												
2	*Family Ownership*	23.97	23.14	**-0.02**	1.00											
3	*Prof. Executive*	0.69	0.46	**-0.02**	-0.01	1.00										
4	*Env. Hostility*	1.27	2.78	0.01	0.02	0.00	1.00									
5	*Firm Performance*	2.01	13.91	**-0.05**	**0.07**	**0.04**	**-0.03**	1.00								
6	*Firm Age*	30.65	18.55	**-0.03**	**-0.13**	**0.22**	0.00	**0.04**	1.00							
7	*Firm Size*	332.04	198.94	**-0.23**	**-0.20**	**0.06**	**-0.02**	**0.24**	**0.16**	1.00						
8	*Liquidity*	3.89	29.70	**0.05**	0.00	**-0.03**	0.00	0.00	**-0.02**	**-0.11**	1.00					
9	*Performance Deviation*	-1.90	78.75	0.00	0.00	-0.01	0.00	**0.06**	0.00	**0.03**	0.00	1.00				
10	*Cash Flow*	43.75	263.58	**0.04**	**-0.12**	**0.05**	**0.02**	**0.09**	**0.06**	**0.31**	-0.01	0.01	1.00			
11	*Leverage*	1.62	12.80	0.00	-0.02	**-0.02**	0.00	**-0.09**	0.01	0.02	-0.01	0.00	0.00	1.00		
12	*R&D Investment*	0.24	2.01	-0.01	**-0.02**	-0.01	-0.01	- 0.01	0.00	**0.06**	-0.01	0.01	0.01	-0.01	1.00	
13	*Marketing Inv.*	1.31	3.15	**-0.03**	**0.05**	0.01	-0.01	**0.05**	**0.03**	**0.08**	**-0.03**	0.01	**-0.02**	-0.02	**0.03**	1.00

Notes: Correlations are boldfaced if significant at the 5 percent level.

panel-specific heteroskedasticity, as the variance of the error term ε may change over time and across industries. Hence, we conduct the *likelihood ratio test* ($p < 0.05$), which indicates the presence of panel-specific heteroskedasticity. Hence, we report random-effects models with robust standard errors which account for the lack of homoskedasticity by using *Sandwich* estimators.

To test H3, we estimate the following regression specifications using the methodological approach previously described.

$$\begin{aligned} FirmPerformance_{it} = F[&ITInvestment_{it}, EnvHostility_{it}, FamOwnership_{it}, \\ &ITInvestment_{it} * EnvHostility_{i_t}, ITInvestment_{it} * FamOwnership_{i_t}, EnvHostility_{i_t} \\ &* FamOwnership_{i_t}, ITInvestment_{it} * EnvHostility_{i_t} \\ &* FamOwnership_{i_t}, X_{it}^{Firm}, X_{i_t}^{Industry}, Z_{it}^{Firm}, Z_{i_t}^{Industry}, Z_t^{year}] \end{aligned} \quad (2)$$

We reduce the potential of artificial multicollinearity by creating the interaction terms after standardizing all the variables in the specifications [2]. We use a *hierarchical regression approach*, wherein in Equation 1, we first enter only the control variables (Table 3, Model 1), then add the main effects of *Family Ownership* and *Professional Executive* (Table 3, Model 2), and finally add interaction term of *Family Ownership* and *Professional Executive* (Table 3, Model 3). In Equation 2, we first enter only the control variables (Table 4, Model 1), then add the direct effects of *IT Investment* and *Environmental Hostility* (Table 4, Model 2), and then add the two-way interaction of *IT Investment* with *Environmental Hostility* (Table 4, Model 3). We finally add the *Family Ownership* variable to the regression by including its direct, two-way, and three 3-way interaction effects (Table 4, Model 4).

Results

The results of the main analysis are reported in Table 3 and Table 4. Results of the first specification, reported in Table 3, show that *Family Ownership* (Model 2, $\beta = -0.016$, $p < 0.01$) has a negative and significant coefficient, supporting H1. We also find support for

Table 3. Influence of family ownership and professional executive on IT investment.

	IT Investment		
Variable	(1) Controls	(2) Direct Effects	(3) Complete Model
Family Ownership	**––**	**-0.016*** (0.006)**	**-0.031*** (0.009)**
Professional Executive	––	-0.102 (0.322)	-0.721* (0.494)
Family Ownership × Professional Executive	**––**	**––**	**0.023** (0.011)**
Firm Age	0.001 (0.007)	-0.003 (0.007)	-0.003 (0.007)
Firm Size	-0.011*** (0.001)	-0.011*** (0.001)	-0.011*** (0.001)
Liquidity	0.006* (0.005)	0.006 (0.005)	0.006 (0.005)
Performance Deviation	0.001** (0.0002)	0.001** (0.0002)	0.001** (0.0002)
Cash Flow	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
Leverage	0.0002 (0.003)	-0.0002 (0.003)	-0.0002 (0.003)
Industry Growth	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Industry Capital Intensity	-0.003* (0.002)	-0.003* (0.002)	-0.003* (0.002)
Industry Concentration	0.020*** (0.006)	0.020*** (0.006)	0.020*** (0.006)
Prob > χ^2	0.000	0.000	0.000

Notes: (1) Robust standard errors in parentheses. (2) Significant at * 10 percent, ** 5 percent, and *** 1 percent level. (3) Random effects panel regression models used for estimation. (4) Industry dummies, year dummies, and intercept included in all models. (5) Firm-year observations = 9,805 and number of firms = 3,096. (6) χ^2-test for significance of interaction = 4.02 ($p < 0.05$). (7) Variables related to the hypotheses boldfaced.

Table 4. Influence of family ownership and IT investment on firm performance.

	Firm Performance			
Variable	(1) Controls	(2) Direct Effects	(3) Moderating Effect	(4) Complete Model
IT Investment	––	0.025** (0.013)	0.035** (0.021)	0.067** (0.034)
Environmental Hostility	––	-0.063* (0.044)	-0.050 (0.048)	-0.376*** (0.121)
Family Ownership	––	––	––	0.084*** (0.010)
IT Investment × Environmental Hostility	**––**	**––**	**-0.008** (0.003)**	**-0.016** (0.008)**
IT Investment × Family Ownership	––	––	––	-0.002** (0.001)
Environmental Hostility × Family Ownership	––	––	––	0.009*** (0.003)
IT Investment × Environmental Hostility × Family Ownership	**––**	**––**	**––**	**0.001*** (0.000)**
Firm Age	-0.027*** (0.011)	-0.027** (0.012)	-0.027*** (0.011)	-0.005 (0.011)
Firm Size	0.021*** (0.002)	0.021*** (0.001)	0.021*** (0.002)	0.024*** (0.002)
Liquidity	0.011*** (0.004)	0.011** (0.005)	0.011*** (0.004)	0.012*** (0.004)
Past Performance	-0.0003 (0.001)	-0.0003 (0.001)	-0.0003 (0.001)	-0.0003 (0.001)
R&D Investment	-0.156 (0.233)	-0.157* (0.973)	-0.157 (0.233)	-0.143 (0.232)
Marketing Investment	-0.099 (0.265)	-0.100** (0.505)	-0.100 (0.265)	-0.125 (0.264)
Industry Growth	0.001* (0.001)	0.001** (0.001)	0.001* (0.001)	0.001* (0.001)
Industry Capital Intensity	0.029*** (0.005)	0.029*** (0.005)	0.029*** (0.005)	0.030*** (0.005)
Prob > χ^2	0.000	0.000	0.000	0.000

Notes: (1) Robust standard errors in parentheses. (2) Significant at * 10 percent, ** 5 percent, and *** 1 percent level. (3) Random effects panel regression models used for estimation. (4) Industry dummies, year dummies, and intercept included in all models. (5) Firm-year observations = 10,437 and number of firms = 3,277. (6) χ^2-test for significance of interactions in Model 3 = 5.43 ($p < 0.05$) and Model 4 = 5.59 ($p < 0.05$). (7) Variables related to the hypotheses boldfaced.

H2 as the two-way interaction term (*Family Ownership* × *Professional Executive*) is positive and significant (Model 3, $\beta = 0.023$, $p < 0.05$). The results of the second specification are reported in Table 4. We find support for H3 as the coefficient of *IT Investment* × *Environmental Hostility* × *Family Ownership* is positive and significant ($\beta = 0.001$, $p < 0.05$), while the term (*IT Investment* × *Environmental Hostility*) is negative and significant ($\beta = -0.008$, $p < 0.05$). We also tested these models by introducing the two-way interaction terms and three-way interaction hierarchically and found similar results (omitted for brevity).

The coefficients of the control variables are largely consistent with expectations. For example, the coefficient of *Cash Flow* is positive and significant in the first specification. Hence, firms with greater surpluses invest more in IT. In the second specification, the coefficient of *Firm Size* is positive, and hence firms with a larger resource base have superior performance. Coefficients of *Liquidity* is also positive and significant in Table 4. Thus, as expected, firms with greater reserves and slack perform better.

Supplementary Analyses

We conduct a series of supplementary analyses. First, there is potential reverse causality between *Family Ownership* and *IT Investment* such that it is remotely plausible that firms with low *IT Investment* in a year may witness an increase in *Family Ownership* in the subsequent year. We address this potential endogeneity in a manner similar to prior research and identify two-year lagged *Family Ownership* as an instrumental variable. Thus, we run two-stage least square estimates as a supplementary analysis for Equation 1. Results, presented in Table 5, are consistent with the results of our main analysis.

Second, to assess the presence of autocorrelation, we conduct the *Wooldridge test* [113] for serial correlation in panel data, which indicates marginal presence of AR (1) autocorrelation in our dataset ($p < 0.10$). This assesses idiosyncratic errors of a linear panel data model and thus is a *Wald test* of the null hypothesis of no autocorrelation [90, 113]. Hence,

Table 5. Supplementary analysis for IT investment.

	IT Investment	
Variable	Direct Effects	Complete Model
Family Ownership	**-0.036** (0.020)**	**-0.009* (0.007)**
Professional Executive	-0.120 (0.314)	-0.660* (0.470)
Family Ownership × Professional Executive	**––**	**0.019** (0.011)**
Firm Age	-0.007 (0.008)	-0.003 (0.007)
Firm Size	-0.011*** (0.001)	-0.011*** (0.001)
Liquidity	0.005 (0.005)	0.006 (0.005)
Performance Deviation	0.001** (0.0002)	0.001*** (0.0002)
Cash Flow	0.003** (0.001)	0.003*** (0.001)
Leverage	-0.0002 (0.002)	-0.0001 (0.002)
Industry Growth	0.001 (0.001)	0.001 (0.001)
Industry Capital Intensity	-0.004* (0.003)	-0.004* (0.003)
Industry Concentration	0.020*** (0.006)	0.020*** (0.006)
Prob > χ^2	0.000	0.000

Notes: (1) Robust standard errors in parentheses. (2) Significant at * 10 percent, ** 5 percent, and *** 1 percent level. (3) Random effects panel regression models with two-year lagged *Family Ownership* as instrumental variable used for estimation. (4) Industry dummies, year dummies, and intercept included in all models. (5) Firm-year observations = 9,805 and number of firms = 3,096. (6) χ^2-test for significance of interactions = 3.27 ($p < 0.1$). (7) Variables related to the hypotheses boldfaced.

Table 6. Supplementary analysis for firm performance.

Variable	Firm Performance Complete Model
IT Investment	**0.198*** (0.073)**
Environmental Hostility	-0.879*** (0.228)
Family Ownership	0.075*** (0.010)
IT Investment × Environmental Hostility	**-0.174*** (0.066)**
IT Investment × Family Ownership	-0.005*** (0.002)
Environmental Hostility × Family Ownership	0.011* (0.007)
IT Investment × Environmental Hostility × Family Ownership	**0.003*** (0.001)**
Firm Age	0.018*** (0.007)
Firm Size	0.019*** (0.001)
Liquidity	0.015*** (0.004)
Past Performance	9.084** (4.167)
R&D Investment	-0.163*** (0.065)
Marketing Investment	0.091** (0.041)
Industry Growth	0.011*** (0.005)
Industry Capital Intensity	0.031*** (0.001)
Prob > χ^2	0.000

Notes: (1) Standard errors in parentheses. (2) Significant at * 10 percent, ** 5 percent, and *** 1 percent level. (3) Feasible GLS panel regression models used for estimation. (4) Industry dummies, year dummies, and intercept included in all models. (5) Firm-year observations = 10,437 and number of firms = 3,277. (6) χ^2-test for significance of interactions in = 6.57 ($p < 0.05$). (7) Variables related to the hypotheses boldfaced.

we conduct robustness tests by repeating the estimations using feasible *Generalized Least Squares* (GLS) with appropriate corrections for the first specification and find consistent results (omitted for brevity). The second specification of our model, which has *Firm Performance* as the dependent variable, is more likely to be plagued by panel specific autocorrelation (PSAR1) and panel-specific heteroskedasticity as both may differ in magnitude across firms for this stage. Hence, we estimate this specification using feasible GLS with such corrections. These results, reported in Table 6, are consistent with the main analysis.

Third, it is plausible that our independent variables are endogenously related to the dependent variable. We addressed this potential endogeneity by employing the *Hausman–Taylor* estimation procedure for the endogenous covariates — *Family Ownership* in the first regression specification, and *IT Investment* and *Family Ownership* in the second specification. The Hausman–Taylor estimation uses time-varying exogenous variables as instruments, once as cross section averages and the second time as deviations from these averages, and time-varying exogeneous variables as the third set of instruments. Results shown in Table 7, are consistent with our main analysis.

Fourth, cross-sectional dependence leading to contemporaneous correlations may be a problem in macro panels with long time series [13, 14]. Even though our data does not fit the definition of a long time series (greater than 30 years), we conducted *Pesaran's CD test* [78] as cross-sectional dependence can lead to biased results. We are unable to reject the null ($p > 0.05$) that residuals across entities are not correlated. Hence, there is no contemporaneous correlation in our models. Fifth, we also estimate random effects panel regressions including quadratic effects of the focal variables in both specifications as prior research has argued that there may be optimal levels of *Family Ownership* [99] or *IT Investment* [50]. No quadratic term is significant in these regressions. Results are excluded due to space considerations.

Table 7. Robustness analysis for potential endogenous covariates.

Panel (a): IT Investment			
Family Ownership	-0.005** (0.002)	-0.005** (0.002)	-0.010*** (0.004)
Professional Executive		0.004 (0.004)	-0.006 (0.008)
Family Ownership × Professional Executive			**0.008** (0.005)**
Panel (b): Firm Performance			
IT Investment	0.106*** (0.032)	0.118** (0.054)	0.138** (0.062)
Environmental Hostility	-0.033*** (0.013)	-0.033** (0.016)	-0.031*** (0.012)
Family Ownership	––	––	0.045*** (0.012)
IT Investment × Environmental Hostility	––	**-0.014* (0.010)**	**-0.030*** (0.011)**
IT Investment × Family Ownership	––	––	-0.008 (0.008)
Environmental Hostility × Family Ownership	––	––	0.003 (0.004)
IT Investment × Environmental Hostility × Family Ownership	––	––	**0.087** (0.042)**

Notes: (1) Dependent variable is IT Investment for Panel (a) and Firm Performance for Panel (b). (2) Robust standard errors in parentheses. (3) Significant at * 10 percent, ** 5 percent, and *** 1 percent level. (4) Hausman-Taylor panel regression models used for estimation. (5) Firm controls, industry controls, industry dummies, year dummies, and intercept included in all models. (6) Firm-year observations = 10,078 and number of firms = 3,139 for Panel (a) and firm-year observations = 10,768 and number of firms = 3,344 for Panel (b). (7) Variables related to the hypotheses boldfaced.

Sixth, additional regressions indicate that *Family Ownership* does not influence *Professional Executive*, consistent with the conceptualized moderation model, rather than a mediation model. Seventh, as our original analysis uses an *absolute* measure *IT Investment*, which is a threshold measure, we repeated our analysis using an alternative *relative* measure of *IT Investment* appropriate for Red Queen competition, by calculating the percentage deviation of the firm's *IT Investment* from the industry average *IT Investment*. Eighth, we utilized asset efficiency (revenues divided by assets) an alternative measure of *Firm Performance*. Nineth, we used total income, rather than total sales to calculate an alternative measure of *Environmental Hostility*. Qualitatively similar results were obtained for all these alternative measures, lending credence to our main results.

Finally, we conduct additional tests to address any remaining concerns of reverse causality by exploiting the time dimension of the data. For the first specification, we regress *Family Ownership* on the lagged values of *IT Investment* and *Professional Executive*, while controlling for other variables. For the second specification, we regress *IT Investment* on the lagged values of *Firm Performance* and *Environmental Hostility*, along with control variables. All coefficients are statistically nonsignificant across both specifications, suggesting that past values of *IT Investment* and *Professional Executive* do not predict current level of *Family Ownership*, and past values of *Firm Performance* and *Environmental Hostility* do not predict current value of *IT Investment*. We also regressed *Professional Executive* separately on the lagged values of *Family Ownership* and *IT Investment*, controlling for other variables. The coefficients are not significant, suggesting that past values of these variables do not predict current *Professional Executive*. These robustness tests further mitigate concerns of reverse causality. Together, our supplementary analyses, which are summarized in Table 8, address critical potential issues, and hence increase confidence in our main results.

Discussion

This study yields three main findings that are consistent across a variety of estimation approaches. First, we find that *Family Ownership* has a negative influence on *IT Investment*.

Table 8. Summary of supplemental analysis.

Potential Issue	Supplemental Analysis
Results contingent upon missing values.	Estimated random effects panel regressions with missing values replaced by imputed values and found similar results.
Potential reverse causality between *Family Ownership* and *information technology* (*IT*) *Investment*.	Estimated two-stage least square (2SLS) regression using Instrumental Variables.
Results influenced by autocorrelation or heteroskedasticity.	Estimated feasible Generalized Least Squares (GLS) regressions using panel specific autocorrelation (PSAR1) and panel-specific heteroskedasticity.
IT Investment and *Family Ownership* endogenously related to dependent variables.	Estimated Hausman–Taylor regression that creates sets of instruments for the endogenous covariates.
Cross-sectional dependence leading to contemporaneous correlations.	Performed Pesaran's CD test and found no correlation of residuals across entities and hence no contemporaneous correlations.
Presence of quadratic effects.	Estimated random effects panel regressions with quadratic effects of focal variables and found no significant quadratic terms.
Presence of a mediation rather than the conceptualized moderation model.	Estimated random effects panel regressions that found no effect of *Family Ownership* on *Professional Executive*.
Results contingent on absolute measure of *IT Investment*.	Estimated random effects panel regressions with *IT Investment* calculated as deviation from industry average IT Investment.
Generalizability of results to alternate measure of *Firm Performance*.	Estimated random effects panel regressions with *Firm Performance* calculated as asset efficiency.
Results contingent on measure of *Environmental Hostility*.	Estimated random effects panel regressions with *Environmental Hostility* calculated from total income.
Potential reverse causality between past values of *IT Investment* and *Professional Executive* and current value of *Family Ownership*.	Estimated random effects panel regressions with lagged values and found no effect of *IT Investment* and *Professional Executive* on *Family Ownership*.
Potential reverse causality between past values of *IT Investment* and *Family Ownership* and current value of *Professional Executive*.	Estimated random effects panel regressions with lagged values and found no effect of *IT Investment* and *Family Ownership* on *Professional Executive*.
Potential reverse causality between past values of *Firm Performance* and *Environmental Hostility* on *IT Investment*.	Estimated random effects panel regressions with lagged values and found no effect of *Firm Performance* and *Environmental Hostility* on *IT Investment*.
Results contingent on the estimation method due to unobserved heterogeneity.	Estimated both random effects panel regressions and feasible Generalized Least Squares (GLS) regressions.

This supports our theorizing that family owners avoid investments in IT that may be frivolous, reduce information asymmetry, or leave verifiable digital trails, and instead make conservative IT investments that maximize value for money. Second, we find that *Professional Executive* weakens the negative influence of *Family Ownership* on *IT Investment*. This suggests that when an outsider, career professional occupies the senior-most executive position of the firm, family owners prefer greater investments in IT for control, aligning with the career professional's preference for more investments in IT due to control and performance benefits. Together, these two findings shed light how otherwise comparative firms such as *Hertz* (non-family business) and *Enterprise Rent-a-Car* (family-owned business) in the US, and *Pantaloons* (family owned, professionally managed business) and *Raymond* (family owned and family managed till early 2010's) follow different digital trajectories. Third, we find that *Family Ownership* weakens the negative influence of *Environmental Hostility* on the *IT Investment* to *Firm Performance* relationship. This supports our theorizing that family-owned businesses incur lesser dynamic adjustment costs and maintain better alignment between IT and business strategy. Furthermore, this finding concurs with our logic that family-owned businesses make prudent IT investments —cautious in attitude and careful in actions.

Theoretical Contributions

This study makes two key contributions to research. Our first contribution is to the enduring thematic area of research that examines antecedents to firm investments in IT [28, 52, 71, 91, 115, 116]. We offer the nature of ownership and the nature of executive management as two sources of heterogeneity among firms that underlie differences in IT investment. Though prior studies have explored the role of the top management as a driver of IT investments [71], either directly or through supportive actions [28, 116], we identify the confluence of ownership and executive management as a critical consideration. Given that family ownership is prevalent and substantial [7], the systematic difference in the IT investment of family-owned businesses compared to non-family businesses as uncovered by this study, is a significant addition to our collective understanding. The extent of *Family Ownership* and the presence of a *Professional Executive* can serve as theoretical edifices that can not only spur future research on antecedents to artifacts of IT strategy, but also enable scholars to revisit prior research that finds firm-level heterogeneity in IT strategy. For example, our study informs research that applies the lens of Red Queen competition [1, 106] to IT investment decisions and their repercussions [49, 71]. This phenomenon implies that an organization must be judged relative to a cohort of rival organizations [1], and an organization must invest progressively higher amounts in IT to merely keep up with its cohort of rivals [105]. Our findings suggest that family-owned businesses and non-family businesses within the same industry be considered as two disparate cohorts for the purposes of conceptualizing Red Queen effects or calculating deviation from rivals regarding IT investment decisions and implications. We also affirm the notion that underinvestment in IT indeed has positive performance implications [49] by conceptualizing that family-owned businesses make prudent IT investments.

Our second contribution is to the IT and control literature. On the one hand, we develop nuanced theory regarding the use of IT for control within family-owned businesses in the presence of professional executives. On the other hand, we conceptualize the positive performance implications of leveraging IT for control in family-owned businesses in the presence of a hostile environment. Thus, this study builds and contributes to a rich thematic area in the literature (e.g., [92, 93, 109]) by (1) asserting how IT for control acts as a noneconomic motivation for the strategic behavior of firms, and (2) providing a nuanced conceptualization of how control can enable better value extraction from IT investments. These findings extend prior research that identified ownership concentration as a control mechanism that enables firms which underinvest in IT to gain performance benefits [49] by elaborating upon this relationship in a nuanced manner that incorporates environmental contingencies. More generally, this perspective provides a new approach for researchers to understand the noneconomic motivations for the strategic behavior of firms related to IT and digital strategies and adds to the growing literature in this arena (e.g., [71, 116]).

Implications for Practice

Our study has two implications for practice. First, IT is an imperative in the modern information age as the positive relationship between IT investment and beneficial firm outcomes is well established (e.g., [28, 47, 51, 71, 88, 116]). Hence, it is critical for firms to

invest in IT to secure and maintain a competitive advantage. Our findings related to the negative influence of *Family Ownership* on *IT Investment* provide a note of caution to family owners. While judiciously investing in IT may support the aspirations of family owners to maintain control over family-owned businesses, they need to be cognizant of this relative weakness compared to other firms. Conscious efforts must be made to ensure that the family business does not loose competitive parity due to lack of investments in IT. Family owners must also bear in mind the path-dependency and time-compression diseconomies which govern the development of advanced IT capabilities. Hence, they should consider judicious investments in foundational technologies such as cloud computing, which may serve as the basis for future next-generation IT applications but require a hierarchical approach to build related capabilities [56].

Second, our findings related to the *Family Ownership - Environmental Hostility - IT Investment - Firm Performance* relationship offers rich guidance to practitioners. Our results suggest that managers need to consider the implications of the hostility of the business environment on the firm's ability to appropriate value from investments in IT. The findings reveal that family-owned businesses are better able to leverage IT for performance in such conditions. Hence, we suggest that managers of non-family businesses should consider additional means to extract value from IT investments. Perhaps, it may be prudent for managers whose firms operate in a hostile environment to eschew frivolous investments in IT and instead, follow a more prudent investment approach, similar to family-owned businesses. Alternatively, other methods by which dynamic adjustment costs can be reduced [50], or alignment of IT and business strategies ensured [88], may be pursued.

Limitations

Our study suffers from three limitations which must be considered when assessing our results. First, the nature of family is different across individualistic and collectivistic societies [96]. Though India is a good empirical context for this study due to the reasons affirmed earlier, its collectivistic culture and tight knit family units may plausibly have bearing on the generalizability of some aspects of our theory to individualistic cultures. Furthermore, since many Indian family businesses have long histories, many family owners derive significant social status and reputation from the long historical nature of their firms. Hence, there are high societal pressures to avoid risk as there is severe perceived shame in failure. Hence, it is plausible that parts of our conceptual logic may not readily apply to family-owned businesses in other contexts.

Second, we have considered each of our variables of interest as a black box. Yet, there are nuances within family ownership; for example, founder family owners versus descendent family owners, and agnates versus cognates. Perhaps these nuances have implications for and can enrich our theory further—an interesting line of enquiry that our data precludes us from pursuing. On similar lines, we consider all types of professional executives as equal for the purposes of our study. Even though this approach provides adequate insights on how this form of professionalization affects the relationship between family ownership and IT investment, measures that capture characteristics (e.g., experience, qualifications, and gender) of the individuals may provide additional insights — an interesting possibility for future research.

Third, control serves as an overarching theoretical mechanism in our research model. We neither measure nor empirically assess its presence—a task future researchers may find of interest. Finally, though it is a statutory requirement in India for major promoters to declare all direct and indirect ownership of shares in firms, it is possible that family owners might own a stake in the firm via shell or offshore companies. Unsurprisingly, such detail is not publicly available and triangulation for family ownership with such data can be pursued in future research that might help in further derivation of richer insights.

Future Research

We highlight two broad avenues of future research that result from our study, beyond those that originate from its limitations. First, there are several sources of heterogeneity that may act in consort with family ownership to influence strategic decisions and outcomes related to IT. For example, the effect of firm size or firm age on IT investment decisions, IT portfolios, or IT outcomes may differ for family-owned businesses and non-family businesses. Similarly, environmental attributes may underlie differences in IT variables for family-owned businesses in *GREAT* countries [53] in contrast to the rest of the world. Hence, future theory that incorporates family ownership and other sources of heterogeneity may reveal nuanced answers to abiding questions in IT business value literature. Second, prior research has advanced several economic motivations for firms to invest in information technologies. However, our study indicates that non-economic, yet strategic rationales may underlie many IT related decisions. Control, and the aspiration to yield it, underlie IT investment decisions of family-owned businesses. Future research can theorize other strategic and behavioral motivations, such as the well-being of family owners [70], and their resultant impact on the smorgasbord of strategic IT decisions and outcomes.

In addition to the aforementioned specific opportunities for research, this study also paves the way for future scholarship that bridges the literatures of information systems and family business. Research on family-owned businesses has a rich, interdisciplinary history spanning several decades, which has been synthesized succinctly by Rovelli and her co-authors [87]. Given the imperative of digital transformation, it is essential to integrate IS research into this evolving conversation. We adapt the guidelines presented in Rovelli et al. [87] and elaborate upon them to present a roadmap for future research at the frontiers of IS and family business research. First, a key consideration is that not all family-owned businesses are equal. Examining drivers and consequences of heterogeneity across family-owned businesses, especially in terms of digital resources, capabilities, and digital strategies is of vital importance in the 2020s and beyond. Second, exploring *how* and *why* questions, instead of merely *what* questions, is likely to yield deeper insights as future researchers explore the underlying motivations, processes, and repercussions of digital transformations in family-owned businesses. Third, IS research is inherently cross-disciplinary, with multiple research streams and traditions. The reimagination and reapplication of each of these varied lenses to firms with family ownership offers synergistic potential. Finally, introducing methodologies—such as induction-abduction for theory building [55], and perspectives—such as family businesses as complex adaptive systems, offer potentialities for advancing both IS and family business research.

Conclusion

In conclusion, we corroborate the concept that though family owners have a conservative approach towards IT investment, which manifests in the form of a negative relationship, their firms derive greater value from this investment, especially in hostile conditions. The involvement of a professional executive incentivizes family owners to increase IT spend. The key takeaway for researchers is the notion that given the vital importance of family businesses to the global economy, and the primacy of IT as a strategic investment for firms, it is incumbent upon us to pursue systematic investigations of IT strategies for family-owned businesses. The introduction of the *Family Ownership* and *Professional Management* constructs into the research lexicon of information systems offers the potential to bridge theory and practice. Family businesses are distinctive, yet diverse, and hence proffer fertile, challenging, and exciting opportunities for the growth of the information systems research family.

Note

1. Agnates are family members descended from the same male ancestor, especially through the male line. Cognates are family members descended from a common female ancestor, especially related through marriage.

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