Pakistan Journal of Commerce and Social Sciences
2020, Vol. 14 (4), 913-961
Pak J Commer Soc Sci

Ownership Concentration, Owner Identity and Technological Innovation Propensity: Moderating Role of Corporate Diversification

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Article History

Received: 04 Aug 2020 Revised: 21 Nov 2020 Accepted: 11 Dec 2020 Published: 31 Dec 2020

Abstract

This paper examines, from the perspectives of the agency-theoretic approach, how ownership concentration impacts technological innovation. We conduct this analysis by allowing the effect to vary according to the identity of the main shareholder and test several hypotheses by employing survey data for 21 developing countries. Initial evidence suggests that concentrated corporate ownership is negatively related to technological innovation propensity, a result contrary to the "agency cost minimization effect" of ownership concentration. Disentangling this negative correlation, we show that, where the largest shareholder is a family, firms are likely to have lower technological innovation propensity than firms with a foreign or a domestically-owned corporate group as the main shareholder. Further uncovering the negative effect for family-owned businesses, we show that risk aversion, induced by the lack of corporate diversification, negatively affects technological innovation propensity. Finally, the impact of family firms on innovation propensity appears to be negative only for radical innovation, and family and non-family firms have no differential innovation propensity for incremental innovation. In sum, this paper provides new evidence on innovation processes in family firms by investigating the moderating role of corporate diversification on the technological innovation propensity. We find that corporate diversification moderates the relationship between family involvement in ownership and technological innovation propensity.

Keywords: technological innovation, concentrated ownership, radical and incremental innovation, product and process innovation, corporate diversification.

1. Introduction

How concentrated ownership, in particular controlling shareholders, influence corporate innovation has gained increasing traction in the past decades (Choi et al., 2011; Corsi &

Prencipe, 2018; Hussinger, Dick, & Czarnitzki, 2018; Iturriaga & López-Millán 2016; Kim & Koo, 2018; Migliori et al., 2020; Munari et al., 2010). Several theoretical views explain the underlying mechanisms central to the concentrated ownership-innovation relationships. According to the agency perspective (Jensen & Meckling, 1976), concentrated ownership minimizes agency costs, and promotes long-termism. That may positively influence value-enhancing technological innovation (Hosono et al., 2004; Wahal & McConnell, 2000). The *stakeholder theory*, based on the incomplete contracting framework, by contrast, conjectures that concentrated shareholdings induce principal-principal conflicts. That may, consequently, reduce the incentives of other firm stakeholders to exert efforts in innovation activities *ex-ante*, anticipating ex-post potential expropriation by controlling shareholders. This, in consequence, may limit the firm's ability to access external funding for R&D investments (Grossman & Hart, 1986). *Stakeholder theory*, therefore, predicts ownership concentration to be negatively related to technological innovation (Morck et al., 2005).

While important theoretical issues are still open, empirical analysis has so far not led to unambiguous conclusions. Moreover, it is less clear whether previous empirical contributions from studies on the U.S. corporate sector are relevant in the context of developing economies (Munari et al., 2010; Xu & Zhang, 2008). In addition to the differing regulatory standards (Khan & Hijazi, 2009), inadequate institutional development, the weak market for corporate control, and poor investor protection (Shah, Abdullah, Khan, & Khan, 2011), all affecting the quality of corporate governance mechanisms in developing economies. High levels of concentrated corporate ownership – a distinct feature in these markets (Claessens et al., 2002) – can induce an *entrenchment effect* and exacerbate conflicts between controlling and minority shareholders. These agency conflicts can be detrimental to the complicated and risky innovation investment decisions. Corporate innovation in such an environment becomes even more challenging given the varied nature of competing interests of various types of shareholders (Grinstein, 2008). Concentrated ownership might also be crucial from a monitoring perspective, as long as controlling shareholders exercise monitoring and provide "patient capital" for R&D investments (Chatterjee & Bhattacharjee, 2020; Choi et al., 2011; Lacetera, 2001). Furthermore, many developing markets have made strides and transitions from imitation to innovation (Song Wei & Wang, 2015; Tang et al., 2020; Zhang, 2018). Hence developing-market context and the unique features may enrich innovation literature by adding new insights from a non-western context.

We empirically investigate whether concentrated share ownership affects technological innovation propensity in developing markets and argue that this effect varies between different types of owners. Empirical evidence suggests that firms may fare differently in their technological innovation propensity depending on whether the largest shareholder is a private investor (a family), a foreign parent company, or a domestically-owned corporate group. Consequently, we mainly focus on whether technological innovation propensity differs across distinct types of firm owners. We also aim to explore the family firm-innovation relationships by examining an under-explored intervening mechanism, namely the corporate diversification on the technological innovation propensity of family firms. We also examine whether innovation behavior, particularly innovation heterogeneity, of a family firm differs from that of non-family firms.

We obtain the following results. Ownership concentration, on average, negatively affects technological innovation propensity. This result is suggestive of the theoretical predictions that controlling shareholder agency conflicts or risk aversion, induced by large shareholding, may hinder innovation propensity in developing economies. Our analysis corroborates the limited generalizability of the “agency cost minimization effect” of concentrated ownership (Francis & Smith, 1995; Hosono et al., 2004). Hence, empirical results support the idea that traditional managerial agency conflicts affecting U.S. large public corporations differ substantially from the agency conflicts affecting firms in other markets (Munari et al., 2010; Minetti et al., 2015). Also, the results support the presence of a non-linear effect of concentrated ownership: negative effects kick in at relatively higher levels (for instance, at an equity share of 30% or more). We also obtain that family firms have a lower propensity to introduce radical innovations than those firms with a foreign or a domestically-owned corporate group as the main shareholder.

This paper is related to the literature on corporate ownership and technological innovation in two important aspects. First, in developing markets, characterized by privately-held, owner-managed firms with pronounced concentrated ownership, firms are often plagued by agency conflicts between large and minority shareholders (Claessens et al., 2000). Agency theory predicts that these horizontal agency costs are severe when ownership is separate from control. Our empirical analysis corroborates this view that, where the main shareholder retains less control, firms are less likely to undertake technological innovation. To sum up, our empirical estimations support the “stakeholder theory” that the disincentive effect of concentrated ownership towards other corporate stakeholders due to the potential expropriation risks ex-post could be a contributing factor for the negative effect of the ownership concentration on technological innovation propensity.

Second, most studies have highlighted a negative relationship between family involvement in firm ownership and R&D investments (Nieto et al., 2013; Chen & Hsu, 2009). We contribute to this line of research as our empirical estimates suggest that risk aversion, induced by the lack of corporate diversification, may also contribute to the negative effect of family ownership on technological innovation propensity. Furthermore, we find that this negative effect is found only for radical innovation propensity and that both family and non-family firms have no differential impact on incremental innovation propensity. These results further lend support to the risk aversion hypothesis in the family firm behavior concerning radical innovation propensity. This study offers useful insights into the discussions on the role of technological innovation propensity in family firms (Martínez-Alonso et al., 2020). We show that risk aversion by family involvement in ownership has important implications for technological innovation propensity in family firms. Furthermore, our empirical results also lend support to the prevalence of agency problems in family firms that could negatively contribute to the technological innovation propensity in family firms. Finally, we provide new evidence on innovation processes in family firms and find that corporate diversification moderates the relationship between family involvement in ownership and technological innovation propensity.

The rest of the article proceeds as follows. Section 2 briefly reviews the theoretical background and develops testable hypotheses. Section 3 outlines the estimation strategy, data description, and discussion of the main results, followed by the concluding remarks in section 4.

2. Literature Review and Hypotheses

2.1 Agency Costs and Innovation

Ownership concentration - a particular dimension of corporate governance - is recognized to be central to the link between corporate ownership and innovation. Two main approaches have developed in the literature that attempts to untangle how concentrated share ownership affects innovation. The *shareholder primacy* approach, rooted in the seminal contributions of agency theory, asserts that dispersed ownership leads to sub-optimal levels of monitoring as small atomistic shareholders lack incentives to invest in monitoring the management due to the free-rider problems (Grossman & Hart, 1980). Concentrated ownership facilitates the alignment of ownership and control rights (Shleifer & Vishny, 1997). This may indeed be useful concerning innovation investments since high-risk R&D investments are prone to induce divergence between manager and shareholder interests and exacerbate agency problems (Zhang & Zheng, 2020). Hence, concentrated ownership may positively affect innovation as it minimizes agency costs by curtailing the free-rider problem, and reduces the ownership-control wedge. Hence, we formulate the following hypothesis based on the *agency cost minimization* proposition.

- **H_1a:** Concentrated ownership positively affects innovation as share concentration minimizes managerial agency costs, all else equal.

The corporate governance literature emphasizes the aforementioned benefits of large shareholding in mitigating agency costs arising from dispersed ownership. On the other side, a broad body of literature argues that additional agency problems arise under the concentrated ownership structure (La Porta et al., 1999; Melis, 2000). According to the *stakeholder approach*, a concentrated ownership structure affects the incentives of other stakeholders (minority investors, creditors, and managers) concerning their participation in innovation activities. Because innovation activities are multifaceted and accumulative endeavors requiring human capital and firm-specific investments, the disincentive effect of concentrated ownership towards other corporate stakeholders negatively affects corporate innovation. The *stakeholder theory*, therefore, predicts a negative effect for ownership concentration on a firm’s propensity to innovate (Grossman & Hart, 1986). We formulate the following hypothesis in line with the *stakeholder approach*.

- **H_1b:** Concentrated ownership negatively affects technological innovation propensity.

2.2 Risk Aversion and Innovation

As innovation projects are complex, risky, and have a high probability of failures, exposing shareholders to additional risks. This has implications, in particular, for large shareholders if their wealth is mainly concentrated in the firm they own. Faccio et al. (2011) provide robust evidence that firms, controlled by poorly diversified shareholders, adopt conservative corporate policies than firms controlled by well-diversified shareholders. Ortega-Argilés et al. (2005) argue that concentrated ownership deters firms from investments in R&D activities. Furthermore, the risk aversion hypothesis predicts that shareholders get more risk-averse as their level of share concentration grows to higher levels (Beatty & Zajac, 1994). Consequently, large shareholders have an incentive to manage firms in ways to achieve risk diversification (Bolton & Von Thadden, 1998). This may adversely affect corporate innovation. Hence, the expected effect on the firm's innovation activities may be negative, as stated in the following hypothesis.

- **H_2:** Concentrated ownership negatively affects technological innovation propensity due to the risk aversion induced by large shareholdings

2.3 Corporate Groups and Innovation

Large, well-diversified corporate groups - an overriding phenomenon in most Asian and developing economies (Khanna & Yafeh, 2007) - can foster innovation by providing institutional infrastructure since BGs are viewed as substituting for market failures and weak market institutions (Khanna & Palepu, 1997; Khan et al., 2020). Business Group's (BG) deep pockets (Belenzon & Berkovitz, 2010), within-group coordination and access to resources (technology, human talent, financial), and group's internal capital markets (Teece, 1996) can be crucial for funding and nurturing innovation in the group-affiliates. Foreign firms may be hesitant to forge contracts with other lesser-known independent firms from developing markets due to the fear of expropriation of intellectual property rights (Kock & Guillén, 2001). Hence, BGs can leverage its reputation in forging technological linkages with foreign firms. Moreover, BGs can exploit internal labor talent in facilitating intra-group spillovers of technological knowledge and capabilities (Filatotchev, Piga, & Dyomina, 2003).

Business groups in developing economies are plagued with principal-principal conflicts. Divergence of control and ownership rights in group-affiliates exacerbates the risks of expropriation of minority shareholders through various means, such as tunneling of resources (Bertrand et al., 2002), self-dealing, and sub-optimal risk-taking (Varma, 1997). The expropriation risks are particularly high in markets characterized by poor regulatory environment and weak external control mechanisms (Young et al., 2008). These agency problems can substantially limit the firm's ability to finance R&D investments (Tajoli& Battaggion, 2001), consequently reducing the firm's technological innovation propensity. Based on these arguments, our third hypothesis is as follows:

- **H_3:** Firms whose main shareholder is a corporate group have higher technological innovation propensity than firms whose main shareholder is not affiliated to a corporate group, all else equal.

2.4 Technological Innovation Heterogeneity in Family Firms

Family characteristics may influence the firm's innovation decisions and strategies (De Massis et al., 2013; Migliori et al., 2020). Based on agency theory, the alignment of ownership and control (as is the case in FFs) reduces agency costs and encourage the firm to take risky decisions, such as R&D investments, that could enhance firm value in the long run. Counter arguments do exist that have shown that FFs are traditionally risk-averse, path-dependent (De Massis et al., 2014) and adopt conservative posture. Most studies are consistent in documenting the negative effect of FFs on technological innovation (e.g., Chen & Hsu, 2009). Two main theoretical arguments are presented in the literature for this negative relationship. First, FFs are risk-averse and conservative in their financial policies, with a predilection for internal financial resources with an overall objective of maintaining family control over the firm (Alim & Khan, 2016; Le Breton-Miller & Miller, 2006). These preferences limit the firm's access to external capital that could impede investments in innovation. Concentrated shareholdings in a family firm may also exacerbate problems in maintaining effective relations with outside investors that may lead to significant costs in accessing external capital for firm growth and investments. Firm opacity and information asymmetries may prevent family firm owners from building relations with external providers of capital, resulting from the notion that family firms lack transparency due to the absence of developed monitoring systems (Kotey & Folter, 2007). These inefficiencies contribute to the difficulties of monitoring family firms and reduce the incentives for external parties to cooperate with the firm. Thus family firms are constrained by access to external capital. That may have negative consequences for technological innovation propensity since R&D investments require substantial external funding.

Secondly, the family firm's investment and financial policies are distinctively driven by economic and non-economic goals (commonly referred to as Socioemotional Wealth – SEW). To protect family business and the related socioemotional wealth for future generations, FFs tend to pursue conservative policies and prefer investments that could preserve the firm's future cash flows (Faccio et al., 2011). The pursuit of these economic and non-economic goals could hamper investments in technological innovation in family firms.

In sum, although some features of FFs ownership and governance mechanism could favor innovation, such as long-term orientation of FFs owners in their investment horizon (Chrisman & Patel, 2012), lower principal-principal conflicts (Kloeckner, 2009), superior knowledge and information about the firm's future prospects (Hansen & Hill, 1991), and high exit costs (Lee & O'Neil, 2003); there are strong arguments (e.g., risk-aversion, conservatism, path-dependency, and resource constraints) suggesting that FFs are less likely than non-family firms to innovate. Hence, we propose the following hypothesis:

- **H_4:** Th degree of family involvement in ownership negatively affects technological innovation propensity

Another important question to answer is the nature and type of technological innovation FFs are most likely to undertake given the distinctive features and characteristics of family firms (Calabrò et al., 2019). Technological innovation is either radical or incremental innovation based on the degree of innovation novelty (Anderson & Tushman, 1990). Radical technological innovation requires a completely different skillset and capabilities than are required for incremental innovations (March, 1991). As a high-risk-high-return strategy, radical innovation requires the firm to drastically change the way it operates and by introducing new technologies new to the firm. Because FFs are conservative, slow to change, have a strong preference for the conservation of family power and control over the firm, these can hinder the exploitation of new markets, technologies and products thus preventing the introduction of radical innovations. Moreover, family managers could show reluctance for radical changes in the firm operations that could threaten their power base in the firm (Dyer and Whetten, 2006). In short, FFs are likely to achieve incremental innovation because the latter is associated with lower risk. FFs managers want to exploit their deep understanding of their markets and client base. Hence, we propose the following two interrelated hypotheses:

- **H_5:** Family involvement in ownership is negatively correlated with radical innovation propensity.
- **H_6:** Family and non-family firms have no differential incremental innovation propensity.

3. Methodology and Data Description

The decision to innovate, conditional on the difference between expected returns from innovation and the existing technologies, denoted by INV*, can be modeled as:

$$\mathrm{INV_j} = \begin{cases} \mathrm{INV_j^*} & \text{if } \mathrm{INV_{j,}^*} > 0 \\ 0 & \text{if } \mathrm{INV_j^*} \leq 0 \end{cases} \qquad (1)$$

$$\mathrm{INV_j^*} = \omega_1 \mathrm{K_j} + \beta_{11} \mathrm{X_j} + \varepsilon_j \qquad (2)$$

Where *INV* denotes a binary variable that equals 1 for product (or process) innovation, K_j denotes a measure of share ownership concentration, X_j is a set of controls, and finally, ε_j is the error term.

Consistent with previous research (Pindado & Torre, 2004; Demsetz & Villalonga, 2001; Khan et al., 2019), it is imperative to control for unobserved factors that may simultaneously affect ownership and technological innovation propensity. For instance, information asymmetry influences a firm's ability to access external financing which, in turn, has implications for corporate ownership structure (Barath & Pasquariello, 2009). Likewise, efficiency in productivity entails that firms will generate better returns from new technology adoptions. This may, in turn, attract new investors ultimately affecting firm ownership composition. In addition, endogeneity may also arise from reverse causality. We address the endogeneity of ownership variables by implementing an instrumental variable approach in the estimation strategy. We must acknowledge that developing appropriate instruments for ownership variables that are not correlated with technological innovation propensity has always been a challenge, a concern shared by many studies (e. g., Chen, Li, Shapiro, & Zhang, 2014; Iona, Leonida, & Navarra, 2013). Moreover, the nature of our cross-sectional data, drawn from enterprise surveys, further adds to the challenge of designing a commendable strategy to construct suitable instruments. Nevertheless, we follow Gonzalez et al. (2017) and Harada and Nguyen (2011) by employing average industry-country ownership concentration (Herfindahl Concentration Index) as an instrument for the two proxies of ownership concentration. This instrument is assumed to capture unobservable industry-level information correlated with corporate ownership but is less likely to be systematically related to the error terms in the innovation model. Our second instrument captures banking relationships measured as the number of outstanding loans and/or lines of credit held by a firm. A proxy for the local credit market conditions, this variable affects the firm's ability and incentive to attract new equity which may, in turn, affect a firm's ownership composition (Minneti et al., 2015).

To address the endogeneity issue, we use Newey's (1987) Amemya's Generalized Least Squares (AGLS) for censored dependent variables (see e.g., Newey (1987), and Panagiotis, Tarko, & Mannering (2008) for more details for Tobit estimations). AGLS is computationally-robust and produces consistent estimates, when the dependent variable and the endogenous regressor are dichotomous and continuous, respectively. We also use two-stage least squares (2SLS) estimation procedure employing the same set of instruments.

3.1 Data Description

We source data from the *enterprise surveys* which are conducted by the World Bank Group's partners, and overseen by the bank's *Enterprise Analysis Unit*. These firm-level surveys are administered to a sample of a country's private sector covering small, medium-sized, and large businesses. A uniform methodology is implemented across all countries and geographic regions using a standardized global methodology employing a core questionnaire. The qualitative and quantitative indicators collected through the surveys are consistent and comparable across countries and survey years. The surveys collect firm-level information such as basic financial statements, exports, legal status and ownership structure, R&D activities and innovation outcomes. In addition, these surveys provide information on the country's business-related infrastructure and services, sectoral and industrial competition, taxation and regulations, and business environment. Information is collected from firms while keeping their identity strictly confidential. Confidentiality of the survey respondents helps ensure integrity and confidence in the quality of data collected through the surveys. Our sample covers major economic regions using a cross-sectional data set from 21 developing countries. We employ the most recent survey for each country of the sample conducted between 2013 and 2015. The 21 countries in our sample were randomly selected from a sample of countries where World Bank Enterprise Surveys were conducted in 2013 and 2015. These 21 countries represent various geographic regions, namely Europe and Central Asia (4,156 firms, 15.54% of the sample), East Asia and Pacific (5,651 firms, 21% of the sample), Sub-Sahara Africa (4,397 firms, 16.44%), and South Asia (11,970 firms, 44.75% of the sample). We apply two filters to the data. First, to improve the reliability and accuracy of the data, as in Leon (2015), we use survey question *a16* that reports the interviewer's perception about the truthfulness of the interviewee's in answering the survey questions. We drop firms from the sample where the interviewers consider that the firm representatives' responses are not truthful or where there is a missing value for *a16*. Second, we drop observations with missing values on technological innovation, ownership concentration, and other key explanatory variables. The final dataset consists of 24,857 firms in 21 countries.

3.2 Measuring Innovation Constructs

Beginning with Schumpeter's (1934) concepts of innovation that entailed the novelty aspect in products, services, processes, and exploitation of new markets, subsequent developments in the literature have led to more wide-ranging definitions, classifications, and typologies such as radical and incremental innovation (Dewar & Dutton, 1986), administrative innovation (Cooper, 1998). Furthermore, innovation classifications also differ across economic sectors. Manufacturing and services industries, for instance, may use different technical, technological and non-technical innovation typologies. These varied classifications abound, highlighting different aspects of innovation. The innovation indicators in the WBES dataset are developed in line with the conceptual framework of the Oslo Manual (OECD, 2005). This allows our innovation outcomes to be comparable with prior studies using similar constructs based on survey data, such as the Community Innovation Survey (CIS) Eurostat by EU member states. As in Khan, Shah, and Rizwan (2019), *Product Innovation* is constructed as a binary variable equals 1 if the firm has, over the past three years, introduced (a) "*new or significantly improved product or service",* which is also *(b) new to the firm's main market". Product Innovation* equals 0 otherwise. Thus, this measure differentiates radical innovation from incremental ones (i.e., an establishment responded 'yes' for item (a) and 'No' for item (b)). The latter innovation is imitative (*only-new-to-firm*) and adopted from elsewhere (Freel, 2006; Khan, Shah, & Rizwan, 2019). *Process Innovation* is a binary variable equals 1 if the firm introduced process and process-related innovation. The WBES considers Process innovation as consisting of three components: "a) *new or significantly improved methods of manufacturing goods or offering services; b) logistics, delivery, or distribution methods for inputs, products, or services; and c) supporting activities such as maintenance systems or operations for purchasing, accounting, or computing*".

Our constructs of technological innovation are equally appropriate for more mundane innovations in services sectors as well as radical technological innovations in the high-technology sectors. Although patents and their citations are a widely used measure of innovation outputs (Aghion et al., 2013; Bianchini, Krafft, Quatraro, & Ravix, 2017), Cohen, Nelson, and Walsh (2000) show that several industries do not exclusively rely on patents. Furthermore, few innovation activities result in new patent filings, particularly in developing economies. Moreover, patenting is highly skewed, sector-specific, and unevenly spread across small and large firms (Hall, Helmers, Rogers, & Sena, 2013). Hence, our constructs are relatively direct measures of firm-level technological innovation.

3.2.1 Measuring Ownership Concentration Variables

We construct two variables to measure ownership concentration. First, *MSHR* is the percentage of equity share held by the largest shareholder, a widely-used measure of ownership concentration (Hautz, Mayer & Stadler, 2011; Minetti et al., 2015). Descriptive statistics show that in our sample, on average, 77.6% of equity is held by the main shareholder, suggesting that this measure is most suited to the data in our sample.

It may be appropriate to consider the percentage of ownership held by the largest shareholder in the context of developing markets (Kirchmaier & Grant, 2005; Minetti et al. 2015). It may bias our estimations if there are other owners with substantial equity stakes whose presence has an impact on corporate policies. To account for this possibility, as in Kastl, Matimort, and Piccolo (2013), we calculate a Herfindahl Concentration Index, denoted by *HCI3*, by taking the sum of the squared ownership proportion held by the three largest stockholders. Because of data limitation, we acknowledge that our estimate of the Herfindahl Concentration index may not be an ideal measure as the dataset does not specifically report the exact percentage of ownership held by shareholders other than the one held by the main shareholder. The data, however, do contain ownership stake held by various categories of stockholders. We assume each category of the shareholder as a distinct type of shareholder and construct *HCI3* accordingly.

Moreover, to allow for the effect of concentrated share ownership to vary between different types of the largest shareholder, we generate three binary variables. Each variable each takes a value of 1 if the respective main shareholder is identified as a family, foreign corporate group, or a domestically-owned corporate group. While we generate three dummies capturing a particular identity of the main shareholder, we treat family firms as the reference group, and which assumes a value of 0 when constructing the other two binary variables. For instance, a dummy that identifies the domestic corporate group as the main shareholder takes a value of 1 while family firms (reference group) and the foreign corporate group assumes a value of 0. This dummy coding system generates directly interpretable comparisons with the reference group (Hautz et al., 2011). A set of interaction variables is then constructed between *MSHR* and each of the three binary variables. For instance, *LARG_DOMINDV* is constructed as a product of *MSHR* and a binary variable identifying domestic private investors or a family as the main shareholder. This variable captures the degree of share ownership by a family when the family is the largest shareholder in the firm. Likewise, *LARG_FORCG* is interacted with *MSHR* and a dummy that identifies the foreign corporate groups as the main shareholder. This interaction variable separates the effect of foreign corporate groups on technological innovation. Likewise, the third interaction term, *LARG_DOMCG*, accounts for whether a firm has a parent company identified as a domestically-owned corporate group.

3.2.2 Other Control Variables

We include several explanatory variables advocated in the literature as potential determinants of corporate innovation. Firm size signifies the scale of resources available for innovation investments (Hoffman et al., 1998). The level of organizational complexity of large firms, by contrast, may hinder innovation management (Acs & Audretsch, 1998). We control for size (natural logarithm of the number of employees) and its squared term. Age represents experience and knowledge intensity that can drive the firm's capacity to take risks (Rizwan & Khan, 2007), and was measured as the number of years since incorporation, using three dummy variables: 1-6 years, 6-20 years, and above 20 years. Product market structure may affect a firm's propensity to innovate (Beyer et al., 2012), which we capture by including three dummy variables (Gilbert, 2006). *CMP2* equals 1 if a firm has between 4 and 6 competitors; *CMP3* equals 1 if a firm has 7 to 15 competitors, and *CMP4* equals 1 if a firm has more than 15 competitors; *CMP1* (firms having up to 3 competitors) - a proxy for monopoly or tight oligopoly - is the reference category. *EXPT*, the proportion of direct exports out of total sales, accounts for export intensity and controls for the geographical information of the market (Ortega-Argilés et al., 2005). Next, a binary variable, *EMP_TR*, that equals 1 if an establishment has implemented formal employee training programs. This variable accounts for the level of the employee's ability to use and develop technologies (Un & Cuervo-Cazurra, 2008). Second, *SKEMP* is the proportion of skilled workers out of total employees (Autor et al., 2002). Third, *UNIV_DEGREE* is the proportion of the labor force with a university degree. This variable accounts for the firm's absorptive capacity (Li et al., 2019). Next, *CERTIF* is a dummy variable that equals 1 if a firm has obtained international quality certification. This variable accounts for the firm's internal efficiency. *MULTI* (natural logarithm of the number of establishments) controls for the multi-plant operations (Love & Ashcroft, 1999). Finally, four industry dummies based on the taxonomy proposed by Pavitt et al. (1989), country dummies, and year dummies (accounting for the year of the survey) capture variations in innovation intensity across industries, countries, and years, respectively.

Descriptive statistics for key variables are reported in Table 1 and Table 2 (whole sample). Country-specific sample size varies considerably since enterprise surveys utilize stratified random sampling techniques based on the overall size of the business sectors and the different geographic regions within a country. There are considerable cross-country variations in the percentage of innovative firms. The highest proportion of innovative firms are from Uganda (48.6%) and Kenya (42.6%) for product innovation (new-to-industry) and similarly higher percentages for process innovation. In contrast, the lowest percentage of innovative firms are from Malaysia (6.8%) and Georgia (8.6%) for product innovation, while the lowest proportion of innovative firms concerning process innovation are from Georgia (9.8%) and Turkey (12%). Most concentrated ownership is observed for Senegal and Pakistan where the largest owner, on average, holds 95.3% and 90.6% of the equity stake in the firms. In contrast, Zambia (24.6%) and the Philippines (17.5%) have the highest proportion of foreign ownership. On the other side, the main shareholder holds the lowest proportion of equity in Thailand (56.34%) and Malaysia (65.8%). Overall, there is not much variation in the largest shareholder's ownership concentration across countries.

Table 1: Summary Statistics

Country	Sample Size	Radical Innovation (%)	Incremental Innovation (%)	Process Innovation (%)	Largest Shareholder's Ownership (%)	Foreign Ownership (%)	Year of Survey
Bangladesh	1,442	0.1931	0.3410	0.3983	0.7796	0.0191	2013
Georgia	360	0.0861	0.1000	0.0978	0.7337	0.0372	2013
Ghana	720	0.2622	0.5146	0.6083	0.8648	0.1449	2013
Hungary	310	0.1586	0.2136	0.2020	0.6889	0.0629	2013
India	9,281	0.3065	0.4491	0.4796	0.7632	0.0050	2014
Indonesia	1,320	0.0938	0.1227	0.1276	0.8720	0.0463	2015
Jordan	573	0.1752	0.2389	0.2061	0.6871	0.0841	2013
Kazakhstan	600	0.1433	0.1933	0.1305	0.8652	0.0293	2013
Kenya	781	0.4258	0.6787	0.5956	0.6933	0.0715	2013
Malaysia	1,000	0.0682	0.1017	0.2667	0.6586	0.0648	2015
Pakistan	1,247	0.2046	0.2979	0.2563	0.9059	0.0132	2013
Philippines	1,335	0.2102	0.3564	0.3677	0.7444	0.1752	2015

Country	Sample Size	Radical Innovation (%)	Incremental Innovation (%)	Process Innovation (%)	Largest Shareholder's Ownership (%)	Foreign Ownership (%)	Year of Survey
Romania	540	0.2278	0.4056	0.3667	0.7780	0.1112	2013
Senegal	601	0.3166	0.4757	0.3967	0.9531	0.0866	2014
Tanzania	813	0.3849	0.5198	0.5510	0.8831	0.0339	2013
Thailand	1,000	0.0929	0.1123	0.1305	0.5634	0.0402	2015
Turkey	1,344	0.1084	0.1281	0.1205	0.7050	0.0230	2013
Uganda	762	0.4855	0.6447	0.7286	0.8516	0.1244	2013
Ukraine	1,002	0.1152	0.2004	0.1255	0.8114	0.0267	2013
Vietnam	996	0.1943	0.3077	0.3225	0.7883	0.0710	2015
Zambia	720	0.3538	0.5343	0.5875	0.7740	0.2465	2013

This table contains country-wise descriptive statistics for product innovation, process innovation, and the share ownership of the largest shareholder and foreign ownership. Incremental innovation is a dummy variable equals 1 for product or service innovation that was *new-to-firm*, and, otherwise 0 for non-innovating firms. Radical innovation is a dummy variable for whether product or service innovation is new to the firm's main product market and 0 otherwise. Process innovation is a dummy variable for whether a firm has introduced the process and related innovation. Foreign ownership is the proportion of equity stake held by foreign private individuals, institutions, or a foreign corporate group.

Descriptive statistics in Table 2 shows that, on average, almost 36 percent of firms are product or service innovators while almost a similar proportion (37.76%) have introduced the process and related innovation. In contrast, firms introducing *new-to-market* product innovation, on average, is 24.13%, almost 33 percent less than the proportion of firms introducing incremental innovation. Further, the mean (median) number of 112 (25) employees suggests that small-to-medium-sized firms constitute a big portion of the sample. As a comparison, the "Banking Group of Capitalia" survey data, used by Minetti et al (2015) for ownership and innovation, the firm's mean (median) number of employeehas were 105 (30). In this respect, businesses in our dataset have considerable similarity to those of Minetti et al's (2015) sample in terms of frim size. Further, 2.46% of the sample are publically traded firms, almost one-quarter of the sample are privately-held firms, and about three-fourths (72%) are private businesses organized as either sole proprietorship, partnerships, or other forms, suggesting that private businesses dominate the sample.

Table 2: Whole Sample: Summary Statistics

Variable	Mean	SD	Min	Max
Incremental Innovation: (new-to-firm only) (%)	0.3608	0.4802		
Radical Innovation: (new-to-market) (%)	0.2413	0.4279		
Process Innovation (%)	0.3776	0.4848		
Largest shareholder's ownership (%)	0.7764	0.2646	0.01	1
Largest owner: Family (%)	0.8067	0.2588	0.01	1
Largest owner: Domestic Corporate Group (%)	0.7005	0.2696	0.01	1
Largest owner: Foreign Corporate Group (%)	0.7211	0.2649	0.01	1
Firm Age (years)	18.4882	12.979	1	118
Size (number of employees)	112	435.729	5	20,000
Legal status of the firm:				
Public company with shares traded (%)	0.0246			
Private company with non-traded shares (%)	0.2550			
Other (sole proprietorship, partnership) (%)	0.7204			

This table contains descriptive statistics for firm-specific variables, technological innovation, and different ownership measures. Mean values in column 1 for technological innovation represent percentage of innovative firms in the sample.

Table 3 contains the ownership concentration breakdown for different types of the largest shareholder. The distribution of shareholdings is quite skewed to the right. In addition, firms with individual investors (family firms) constitute the largest share (77.35% of ownership in the firm), followed by a domestic corporate group as the main shareholder. The main shareholder's average ownership stake is 77.60%. That is a significantly concentrated shareholding. For 18,612 firms (71.94%) this equity stake is 51% or more.

Table 3: Ownership Structure and Identity of the Largest Shareholder: Descriptive Statistics

Ownership concentration	Individual investors (Family)	Domestic Corporate Group	Foreign Corporate Group	Foreign individuals and entities	Other	total
0 - 20%	309	117	49	19	7	501 (1.94%)
20 - 30%	704	187	29	38	31	989 (3.82%)
30 - 50%	4,188	1180	149	194	58	5,769 (22.30%)
50 - 75%	2,199	730	163	104	57	3,253 (12.57%)
above 75%	12,610	1744	407	408	190	15,359 (59.37%)
Total	20,010 (77.35%)	3958 (15.30%)	797 (3.08%)	763 (2.95%)	343 (1.33%)	25,871

This table contains a breakdown of ownership proportions held by the largest shareholder. The four main types of the largest owner are the individual investors or a family, domestic corporate group, foreign corporate group, and foreign private individuals or entities. “Other” includes various types of main shareholders not defined by each of the previously mentioned categories of the main shareholder. The first column contains blocks of ownership concentration of the main shareholder. Column 2 -6 contains the total number of each type of the main shareholder for each block of ownership proportion while the last column contains the total number (percentage in parenthesis) of shareholders for each block of ownership concentration.

3.3 Estimation Results

We begin with the results for the AGLS model for analyzing the impact of ownership concentration on technological innovation propensity, without differentiating between the types of main shareholders. This approach implicitly assumes that the effect is homogenous across different types of the largest shareholder. The negative and statistically significant coefficient estimate for *MSHR* in estimations for product innovation (columns 1 – 2, Table 4) and process innovation (columns 5 - 6) suggests that ownership concentration negatively affects technological innovation propensity. Thus we find statistical significance for H_1b suggesting that a high concentration of equity stake in the hands of the largest shareholder supports a lower propensity for technological innovation. This negative and statistically significant coefficient estimates for technological innovation propensity (both product innovation and process innovation) statistically confirm H_1b. Technological innovation propensity is likely to be lower in firms where shareholding is largely concentrated in the hands of the main shareholder. That result is consistent with the findings of Minetti et al (2015) for Italian firms. Italian firms are characterized by highly pronounced ownership concentration, and the conflicts between majority and minority shareholders (i. e., principal-principal conflicts). Our results are also in line with those reported by Rapp and Udoieva (2016) for 24 emerging markets. Drawing on a sample of listed firms from 24 emerging economies, the authors show that firm-level R&D intensity is negatively correlated with large block ownership. They argue that the entrenchment effect of concentrated ownership negatively affects R&D intensity in emerging market firms. Exploring a large dataset of Chines SMEs, Deng, Hofman, and Newman (2013) find that single-owner firms with a dominant control of one family are more efficient in converting R&D input into innovation outputs in contrast to the multi-owner SMEs where principal-principal agency conflicts are more likely to be severe. Thus, our results corroborate the *stakeholder approach* in explaining the negative effect of ownership concentration on the technological innovation propensity. The expropriation issues associated with large shareholdings may hinder corporate innovation investments in developing markets (Young et al., 2008). Hence the *entrenchment costs* associated with concentrated ownership may provide a disincentive effect for other stakeholders (e. g., minority shareholders) stemming from the principal-principal conflicts. These results are in line with many previous studies that have examined the impact of corporate governance, in particular the ownership concentration, on technological innovation in developing markets (e. g., Block et al., 2013; Xiang, Chen, Tripe, & Zhang, 2019).

However, this result is contrary to the findings of a positive effect of ownership concentration on technological innovation in studies on the U.S. data where firms are characterized mainly by the dispersed ownership structures (Hill & Snell, 1988; Holmstrom, 1989). Since managerial agency costs are most prevalent when shareholdings are dispersed, allowing the manager-shareholder conflicts to be severe. Concentrated ownership reduces these agency costs and disciplines the manager's behavior (Holmstrom, 1989). Small, atomistic shareholders have little incentives to monitor the managers because of the free-rider problems (Jensen & Meckling, 1976). The agency costs approach thus predicts that a diffused ownership structure negatively affects technological innovation activities because the dispursed ownership structure allows the managers to pursue their objectives that may not necessarily be aligned with the shareholder's interests. Concentrated ownership, by contrast, entails more effective monitoring of the managers' strategic decisions, and in turn, reducing the high agency costs linked to the investment decisions, in particular, the R&D and technological innovation investments. Dispersed shareholders with a little equity stake in the firm can quickly sell out their equity stake and exit the firm if the firm's innovation investments start to show low returns or lower probability of success. Undertaking R&D activities and innovation investments are also unattractive to managers, since the managers mostly bear the costs of failures, either in the form of job loss or a significant decrease in other monetary and non-monetary benefits. Thus, firms, where shareholders have a control by way of large equity stakes, will undertake high-risk R&D activities and innovation investments that could lead to creating value in the long-run. Firms in which managers dominate because of the dispersed ownership, by contrast, will have a preference for low-risk, imitative investment strategies. Some previous studies on the U. S. market find a positive effect of equity concentration on technological innovation (e. g., Baysinger et al., 1991; Hill and Snell, 1988), supporting the "cost minimization effect" of equity concentration on corporate innovation.

In contrast, our results suggest that, in developing markets, either agency problems associated with expropriation of minority shareholders (hypothesis H_1b) (i. e., principal-principal conflicts) or the risk aversion induced by the large shareholding (hypothesis H_2) may hinder innovation in firms with concentrated ownership structures. Concentrated shareholders might perceive R&D investments as excessively risky, especially given other alternative investment opportunities. Consequently, large shareholders might deploy firm resources in ways that can diversify their risks associated with large block-holding or maintain stability and capital preservation (Morck & Yeung, 2003). We will further explore these assumptions in section 4.4.

3.3.1 Non- Linearity of Ownership Concentration

According to agency theory, dispersed ownership creates "free-rider problems" making it costly for small atomistic shareholders to monitor managers. Concentrated ownership can potentially reduce agency problems as it provides large shareholders greater incentives, and powers, to monitor managers if their equity stake exceeds some threshold since they can partially internalize the benefits of their efficient monitoring (Grossman & Hart, 1986). Still, at excessively higher levels of concentrated ownership, risk aversion might dissuade managers to undertake risky R&D investments. Several studies have incorporated quadratic terms in the estimations to capture this potential non-linearity in ownership structure. However, growing empirical evidence suggests that simply incorporating a quadratic term in the econometric specifications may not be enough to capture the complex non-linearity of ownership concentration. Consequently, as in Morck et al. (1988), we use three thresholds of ownership stakes of the main shareholder, after we account for the relatively higher ownership concentration in our data of the developing markets. The three ownership threshold levels we use are 1-15%, 16 – 30%, and above 30%, respectively. The three threshold levels are measured as follows: (1) MAIN_15 equals MSHR if equity ownership of the main shareholder is less than or equal to 15%. It equals 15% when MSHR exceeds 15%. (2). MAIN15_30 equals 0 if MSHR is less than or equal to 15%. It equals MSHR minus 0.15 when 15%<MSHR≤30%. This variable equals 30% if the main shareholder equity stake exceeds 30%. (3). MAIN_OVER30 equals zero if MSHR≤30%, it equals MSHR minus 0.30 when MSHR > 30%. A similar approach was also adopted by Minneti et al. (2015) to account for the relatively higher ownership concentration in the Italian firms as compared to the ones in the U.S. market. The results, as reported in Table 5, show that concentrated ownership manifests its negative effect on innovation propensity at relatively higher levels (30% and above). For robustness, we ran piecewise regressions, as in Mock et al. (1988), using the same three thresholds levels. The results, not tabulated in the paper, are similar to the one obtained using AGLS estimations. This non-linearity of ownership concentration suggests that moderate levels of ownership concentration are beneficial for firm innovation investments as moderate levels of concentrated ownership promotes *interest alignment effects* of ownership concentration. Such a condition allows the shareholders to promote value enhancing-R&D investments. However, excessively higher levels of concentrated equity induce *risk aversion* that may induce a conservative approach in the firm's financing and investment decisions. That may lead to lower technological innovation propensity for firms with high ownership concentration.

Table 4: Ownership Concentration and Firm Innovation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product Innovation				Process Innovation			
	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS
MSHR	-2.671**	-0.853***			-4.125***	-1.835***		
	(1.040)	(0.284)			(0.861)	(0.372)		
HC13			-1.017**	-0.337***			-1.811***	-0.798***
			(0.499)	(0.130)			(0.364)	(0.151)
Size	0.196**	0.0310	0.290***	0.0608***	-0.154**	-0.0840**	-0.0275	-0.0280
	(0.0979)	(0.0257)	(0.0783)	(0.0192)	(0.0781)	(0.0337)	(0.0538)	(0.0222)
SizeSQD	-0.0229***	-0.00445**	-0.0280***	-0.00622***	0.0101	0.00591**	0.00318	0.00276
	(0.00848)	(0.00216)	(0.00767)	(0.00184)	(0.00651)	(0.00283)	(0.00506)	(0.00213)
Age	0.0808***	0.0183**	0.101***	0.0227***	-0.0162	-0.00871	-0.00429	-0.00417
	(0.0279)	(0.00753)	(0.0295)	(0.00756)	(0.0229)	(0.00984)	(0.0213)	(0.00874)
UNIV_Degree	0.0285	0.0215	-0.00308	0.0141	-0.377	-0.110	-0.472*	-0.144
	(0.378)	(0.0913)	(0.365)	(0.0833)	(0.306)	(0.118)	(0.269)	(0.0951)
MULTI	-0.114**	-0.0380***	-0.0350	-0.0135	-0.0502	-0.0198	0.0309	0.0168
	(0.0495)	(0.0137)	(0.0413)	(0.0111)	(0.0409)	(0.0179)	(0.0301)	(0.0129)
EMP_TR	0.0879	0.0187	0.213***	0.0558***	0.0684	0.0327	0.240***	0.107***
	(0.0817)	(0.0224)	(0.0572)	(0.0151)	(0.0675)	(0.0293)	(0.0416)	(0.0175)
SKEMP	0.203***	0.0648***	0.143*	0.0491**	0.277***	0.123***	0.230***	0.0988***
	(0.0732)	(0.0198)	(0.0740)	(0.0192)	(0.0611)	(0.0261)	(0.0546)	(0.0223)
CMP2	0.0890	0.0234	0.0763	0.0178	0.0284	0.0159	0.0217	0.0120
	(0.0674)	(0.0186)	(0.0689)	(0.0182)	(0.0566)	(0.0244)	(0.0510)	(0.0211)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product Innovation				Process Innovation			
	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS
CMP3	-0.277***	-0.0792***	-0.257***	-0.0727***	0.0306	0.00201	0.107***	0.0335**
	(0.0558)	(0.0149)	(0.0539)	(0.0137)	(0.0456)	(0.0196)	(0.0384)	(0.0158)
CMP4	-0.182***	-0.0503***	-0.193***	-0.0540***	0.0155	0.00174	0.0585	0.0203
	(0.0625)	(0.0169)	(0.0638)	(0.0165)	(0.0512)	(0.0222)	(0.0459)	(0.0191)
EXPT	0.209**	0.0513**	0.178**	0.0412*	-0.0221	-0.00222	-0.0188	-0.00110
	(0.0855)	(0.0236)	(0.0828)	(0.0218)	(0.0714)	(0.0312)	(0.0602)	(0.0253)
CERTF	0.254***	0.0690***	0.291***	0.0796***	0.0581	0.0215	0.0793***	0.0293**
	(0.0425)	(0.0117)	(0.0413)	(0.0110)	(0.0356)	(0.0154)	(0.0307)	(0.0127)
Wald Test (P-Value)	8.52(0.003)		5.08(0.024		36.12(0.00)		23.41(0.000)	
Sargan Over-Identification Test (P-Values)		(0.472)		(0.061)		(0.732)		(0.091)
Observations	10,540	10,540	9,196	9,196	10,539	10,539	9,197	9,197
Country, Industry and Year Dummies	YES	YES	YES	YES	YES	YES	YES	YES

Table 5: Non-Linearity of Ownership Concentration: 2-Stage Least Squares (2SLS) Model

Panel A: Product Innovation	(1)	(2)	(3)	(4)	(5)	(6)
	(MAIN_15)	(15%-30%)	(above 30%)	(15% - 45%)	(45% - 80%)	(above 80%)
MAIN_15	-193.4					
	(135.5)					
MAIN15_30		-7.959*				
		(4.326)				
MAIN_OVER30			-0.783***			
			(0.237)			
MAIN_15_45				-2.264**		
				(1.067)		
MAIN_45_80					-0.365**	
					(0.175)	
MAIN_OVER80						-0.484***
						(0.143)
Panel B: Process Innovation						
MAIN_15	-35.7					
	-29.4					
MAIN_15_30		-16.39***				
		(5.769)				
MAIN_OVER30			-1.466***			
			(0.294)			
MAIN_15_45				-2.264**		
				(1.067)		
MAIN_45_80					-0.736***	

	(1)	(2)	(3)	(4)	(5)	(6)
	(MAIN_15)	(15%-30%)	(above 30%)	(15% - 45%)	(45% - 80%)	(above 80%)
					(0.197)	
MAIN_OVER80						-0.897***
						(0.178)
	(0.0856)	(0.0274)	(0.0280)	(0.0192)	(0.0212)	(0.0294)
Control variables	YES	YES	YES	YES	YES	YES
Observations	11,414	11,414	10,962	11,411	11,414	10,962
Country, industry and year Dummies	YES	YES	YES	YES	YES	YES

The table 4 provides empirical estimatsions (standard errors in parenthesis) for the instrumental variables AGLS and 2SLS models. Columns 1 – 4 has production innovation (0/1) as dependent variable, while for columns 5 – 6, it is the process innovation (0/1) as the dependent variable while the estimation procedure is mentioned on top of each column. The two instruments are the industry-country mean ownership stake held by the top 3 shareholders (Herfindahl Concentration Index) and the natural logarithm of 1 plus the number of outstanding loans and/or lines of credit. *MSHR* is the proportion of ownership held by the main shareholder. HCI3 is the Herfindahl concentration index of the three largest shareholders. The description of other controls is as follows. AGE is the number of years since firm was formally registered. SIZE is the number of full-time employees and SIZESQD is the square of SIZE. UNIV_DEGREE is the percent of employees with a university degree as the highest education. MULTI is the natural logarithm of the number of establishments by a firm. SKEM is the proportion of the skilled labor force. EXP is the export intensity (% of exports out of total sales). CERTIF (0/1): firm has obtained international quality certification. CMP2 – 4 are dummy variables representing how many competitors are there in the firm's main product market. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

The table 5 contains estimates for the 2SLS model for product innovation (Panel A) and process innovation (Panel B). The threshold levels of ownership stake for the main shareholder are reported on top of each column: (1) MAIN_15 equals *MSHR* if equity ownership of the main shareholder is less than or equal to 15%. It equals 15% when *MSHR* exceeds 15%. (2). MAIN15_30 equals 0 if *MSHR* is less than or equal to 15%. It equals *MSHR* minus 0.15 when $15\% < MSHR \leq 30\%$. This variable equals 30% if the main shareholder equity stake exceeds 30%. (3). MAIN_OVER30 equals zero if $MSHR \leq 30\%$, it equals MSHR minus 0.30 when *MSHR* > 30%. Threshold levels for columns 5–6, used as robustness checks for columns 1-4, are constructed similarly. Coefficient estimates for control variables are not reported in the table for brevity. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

3.3.2 Robustness checks

We apply two robustness tests to see if the results still carry through using sub-sample analyses based on size and economic sectors (Shah, Shah, & Khan, 2017). First, we conduct an empirical analysis by splitting the sample into two subgroups. The cutoff point is the median number of employees where we distinguish between small (less than 25 employees in our sample) and large firms (25+ employees). Panel A and B of Table 6 reports sub-samples analyses. The main results of the negative effect of concentrated ownership hold for medium-sized and large firms only. These results support the idea that agency problems of principal-principal conflicts may not be severe in small firms since the distinction between controlling and minority shareholders may be insignificant, such as part of an extended family or network. These conflicts in small firms may hold less importance for the firm's financial, investments, and innovation propensity. Moreover, to ascertain that results are not excessively prejudiced by extremely small or extremely large firms, we drop the smallest and largest 5% of firms based on the number of employees. Again, results reported in Panel C and D, Table 6, remain unchanged.

Second, we repeat econometric analysis on sub-samples based on the type of sector a firm operates in. All industries are not equally innovation-intensive and the patterns of innovative activities differ substantially across industries (Greenhalgh & Rogers, 2006; Zhu, 2019). Prior research demonstrates that high-technology sectors need to show greater innovation propensity to maintain their competitive advantage and growth (Hamel & Prahalad, 1996). To examine whether the effect of ownership concentration is robust across different sectors, we split the sample into high-technology and medium-to-low technology sectors, based on the taxonomy put forth by Beneito (2003). This analysis was performed to explore if ownership concentration has different incentives for innovation activities across different sectors. Empirical analysis (Table 7) shows that the negative effect of ownership concentration seems to be distinct for firms operating in the more traditional sectors (Panel B, Table 7). The coefficient for our two proxies of ownership concentration, namely MSHR and HCI3 are both negative and statistically different than zero for both 2SLS and AGLS models. The coefficient estimates for other control variables were not reported in the table for brevity. Panel A presents coefficient estimates for a subsample of firms from the high-technology sectors. The coefficient estimates for both proxies of the ownership concentration is negative and statistically significant at the 0.10 level. This result is significant only for the AGLS model while 2SLS yield statistically insignificant results. Thus we find weak support for H_1b suggesting that this effect is less pronounced for the innovation-intensive high-tech sector firms, where concentrated ownership has a limited depressing effect on the firm’s technological innovation propensity. These results, unreported in the paper, still hold if we repeat estimations by following the high-tech sector classification of Benfratello et al. (2008).

The following table 6 contains coefficient estimates for two-stage least squares (2SLS) and two-stage conditional maximum likelihood (AGLS, Newey's minimum chi-squared estimator). The dependent variable and estimation procedure are mentioned in the second and third rows of each column (standard errors in parenthesis). In Panel C, we drop the top and bottom 5% of firms in terms of size (number of employees). In Panel D the data were trimmed by excluding the bottom 5% of firms (based on size: number of employees). Coefficient estimates for control variables are not reported in the table for brevity. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

Table 6: Robustness Checks: Size Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Small Firms (<26 employees)	Product/service Innovation		Process Innovation		Product/service Innovation		Process Innovation	
	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS
	-1.634	-0.385	-4.081***	-1.572***				
Main Shareholder ownership (MSHR)	(1.411)	(0.301)	(1.127)	(0.423)				
					-0.917	-0.216	-2.026***	-0.764***
Herfindahl Concentration Index (HCI3)					(0.881)	(0.184)	(0.620)	(0.226)
Country, industry and year dummies + control variables	YES	YES	YES	YES	YES	YES	YES	YES
observations								
Panel B: Large Firms (>25 employees)								
	-3.701**	-1.288***	-3.907***	-1.865***				
Main Shareholder ownership (MSHR)	(1.481)	(0.472)	(1.141)	(0.537)				
					-1.238**	-0.443**	-1.750***	-0.825***
Herfindahl Concentration Index (HCI3)					(0.581)	(0.177)	(0.429)	(0.195)
Country, industry and year dummies + controls	YES	YES	YES	YES	YES	YES	YES	YES
Panel C: top 5% and bottom 5% dropped								
	-2.820***	-0.877***	-4.233***	-1.827***				
Main Shareholder ownership (MSHR)	(1.077)	(0.292)	(0.900)	(0.380)				
Herfindahl Concentration Index (HCI3)					-1.120**	-0.351***	-1.880***	-0.794***
					(0.509)	(0.132)	(0.378)	(0.153)
Country, industry and year dummies + controls	YES	YES	YES	YES	YES	YES	YES	YES
observations	9,559	9,559	9,555	9,555	8,284	8,284	8,279	8,279

Panel D: only bottom 5% dropped	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product/service Innovation		Process Innovation		Product/service Innovation		Process Innovation	
	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS	AGLS	2SLS
Main Shareholder ownership (MSHR)	-2.583**	-0.837***	-3.966***	-1.762***				
	(1.045)	(0.289)	(0.859)	(0.373)				
Herfindahl Concentration Index (HCI3)					-0.924*	-0.313**	-1.711***	-0.751***
					(0.488)	(0.129)	(0.355)	(0.148)
Observations	10,106	10,106	10,104	10,104	8,778	8,778	8,778	8,778
Country, industry and year dummies + controls	YES	YES	YES	YES	YES	YES	YES	YES

Table 7: Robustness Checks: Traditional and High-Tech Sectors

	Product/Service Innovation		Process/Service Innovation		Product/Service Innovation		Process Innovation	
	AGLS	2-SLS	AGLS	2-SLS	AGLS	2-SLS	AGLS	2-SLS
Panel A: High tech sector:								
MSHR	-3.634*	-1.313*	-1.829	-0.932				
	(2.161)	(0.705)	(1.316)	(0.630)				
HCI3					-2.070*	-0.757**	-0.867	-0.437
					(1.057)	(0.338)	(0.669)	(0.308)
Observations	2,424	2,424	2,426	2,426	1,984	1,984	1,986	1,986
R-squared		-0.451		0.008		-0.172		0.150
+ Control variables								
Country, industry, and year Dummies	YES	YES	YES	YES	YES	YES	YES	YES
PANEL B: Medium-to-Low tech sector								
MSHR	-3.122**	-0.939***	-4.592***	-1.992***				
	(1.233)	(0.321)	(1.040)	(0.438)				
HCI3					-1.305**	-0.396***	-2.054***	-0.872***
					(0.593)	(0.147)	(0.435)	(0.175)
+ Control variables								
Observations	8,543	8,543	8,536	8,536	7,609	7,609	7,605	7,605
Country, industry, and year Dummies	YES	YES	YES	YES	YES	YES	YES	YES

The table 7 reports coefficient estimates for the AGLS and 2-SLS models for sub-samples of high-technology sector firms (Panel A) and medium-to-low tech sectors (Panel B). Standard errors are in parenthesis. Coefficient estimates for control variables are not reported in the table for brevity. The first and second row of each column states the dependent variable and the estimation procedure for each regression estimation. MNSHR is the percentage of equity held by the largest shareholder. HCI1 is the cumulative percentage of the equity ownership held by the three largest shareholders. Product Innovation (0/1): firm introduced new-to-market product or service innovation. Process Innovation (0/1): firm introduced a process and related innovation. ***, **, and * indicates statistical significance at 1%, 5%, and 10% levels, respectively.

3.3.3 Types of the main shareholder and technological innovation propensity

Next, we begin to explore if the identity of the main shareholder matters for technological innovation propensity. Different types of investors have heterogeneous attitudes towards risky corporate investment decisions (Hoskisson et al., 2002). We construct three interaction terms between a variable that measures ownership concentration (*MSHR*) and three dummy variables that each represents a particular identity of the main shareholder. These interaction terms are of particular interest since each separates the effect of concentrated ownership, concerning the main shareholder's identity, on the technological innovation propensity. Family firms serve as the reference category. The coefficient estimates for *MSHR* represent the effects of the reference category (family firm) when other owner identity dichotomous variables are zero. The results are presented in Table 8 for both product innovation and process innovation propensity. Two different types of econometric specifications were employed to test the hypotheses. The negative coefficient of the ownership concentration variable (i. e., MSHR) in all six models in columns 1 – 6 suggests that concentrated ownership is negatively related to technological innovation propensity for family-firms, consistent with hypothesis H_1b.

To assess whether the effect of concentrated ownership on innovation propensity varies substantially between different types of the main shareholder, we start with the interaction terms that identify a foreign and domestically-owned corporate group as the main shareholder. Thus the two interaction terms separate the "corporate ownership effect" relative to the family firms (reference category) when the analysis is considered from the perspectives of concentrated ownership. In columns 1 – 4 (Table 8), the positive coefficients of both interaction terms (i.e., *LARG_DOMCG* and *LARG_FORCG*) in all estimations suggest that firms, with a foreign and a domestic corporate group as the main shareholder, are likely to have higher technological innovation propensity than the family-owned firms. The joint F-test confirms the overall statistical significance of interaction terms in all estimation models. The results still carry through for both product and process innovation propensity if we replace the interaction term with a dummy variable (i. e., *LARGEOWN_GROUP*) for whether the main shareholder is the corporate group (columns 5 – 6). Finally, in columns 7 – 8, results still carry through if we exclude *MSHR* from the model. These results support hypothesis H_3. Hence we find statistical significance for confirming H_3. These results are consistent with the Resource-based View (RBV) that business groups can foster innovation by providing institutional infrastructure since corporate groups are viewed as substituting for market failures and weak market institutions (Khanna & Palepu, 1997). Business Group's (BG) deep pockets (Belenzon & Berkovitz, 2010), and access to resources (technology, human talent, financial), and group's internal capital markets (Teece, 1996) can be crucial for funding and nurturing innovation in the group-affiliates. As shown by Table 8 that other control variables are closely linked to technological innovation propensity. Firm age, international quality certification, a higher percentage of skilled employees, export intensity, and having formal employee training in place, all positively influencing innovation propensity.

The following table 8 reports empirical estimations for AGLS and 2SLS regressions (Standard errors in parenthesis). The dependent variable and the estimation procedure for each model are mentioned on top of each column. *MSHR*: the proportion of ownership by the largest shareholder. An interaction, LARG_DOMCG, is a product of the *MSHR* and a dummy variable that identifies a domestic corporate group as the main shareholder. In columns 5-6, we replace LARG_DOMCG with a dummy variable, LARGEOWN_GROUP, for whether the main shareholder is the domestic corporate group. Process innovation (0/1): An establishment introduced process or related innovation. In columns 7-8, as we exclude MSHR – a proxy for the main shareholder ownership stake. AGE is the years since firm was formally registered. SIZE is the number of full-time employees and SIZESQD is the square of SIZE. UNIV_DEGREE is the percent of employees with a university degree as the highest education. MULTI is the natural logarithm of the number of establishments by a firm. SKEM is the proportion of the skilled labor force. EXP is the export intensity (% of exports out of total sales). CERTIF is a dummy variable for whether a firm has obtained international quality certification. CMP2 – 4 are dummy variables representing how many competitors are there in the firm's product market. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

Table 8: Family firms versus Domestic and Foreign Corporate Group as the Main Shareholder

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product Innovation		Process_Innovation		Product Innovation		Product Innovation	
	AGLS	2SLS	2SLS	AGLS	AGLS	2SLS	AGLS	2SLS
MSHR	-2.430**	-0.768***	-1.698***	-3.835***	-2.473**	-0.804***		
	(0.959)	(0.260)	(0.333)	(0.774)	(1.025)	(0.289)		
LARG_DOMCG	0.678***	0.214***	0.366***	0.816***			4.943**	1.587**
	(0.182)	(0.0496)	(0.0638)	(0.148)			(2.306)	(0.651)
LARG_FORCG	0.472*	0.131*	0.387***	0.922***			1.953**	0.609**
	(0.280)	(0.0756)	(0.0971)	(0.223)			(0.988)	(0.279)
LARGEOWN_GROUP					0.133*	0.0425*		
					(0.0752)	(0.0219)		
SIZE	0.196**	0.0319	-0.0826***	-0.153**	0.201**	0.0331	0.265***	0.0531**
	(0.0957)	(0.0249)	(0.0319)	(0.0744)	(0.0963)	(0.0254)	(0.0886)	(0.0238)
SIZESQD	-0.0229***	-0.00449**	0.00573**	0.00991	-0.0233***	-0.00459**	-0.0265***	-0.00556**
	(0.00830)	(0.00209)	(0.00268)	(0.00619)	(0.00841)	(0.00213)	(0.00858)	(0.00226)
AGE	0.0899***	0.0212***	-0.00410	-0.00594	0.0860***	0.0195***	0.153***	0.0414***
	(0.0266)	(0.00711)	(0.00911)	(0.0213)	(0.0277)	(0.00754)	(0.0336)	(0.00942)
UNIV_DEGREE	0.00352	0.00881	-0.133	-0.422	0.0408	0.0221	-0.359	-0.107
	(0.376)	(0.0899)	(0.114)	(0.299)	(0.378)	(0.0915)	(0.437)	(0.113)
MULTI	-0.299***	-0.0956***	-0.124***	-0.284***	-0.159***	-0.0537***	-1.366**	-0.440**
	(0.0919)	(0.0250)	(0.0320)	(0.0739)	(0.0437)	(0.0123)	(0.629)	(0.178)
EMP_TR	0.0934	0.0212	0.0375	0.0790	0.0935	0.0204	0.216***	0.0599***
	(0.0783)	(0.0213)	(0.0273)	(0.0630)	(0.0808)	(0.0225)	(0.0488)	(0.0139)
SKEMP	0.168**	0.0541***	0.104***	0.237***	0.187**	0.0613***	-0.0760	-0.0237
	(0.0690)	(0.0185)	(0.0239)	(0.0562)	(0.0735)	(0.0201)	(0.116)	(0.0327)
CMP2	0.0918	0.0248	0.0187	0.0345	0.0931	0.0241	0.111	0.0312
	(0.0663)	(0.0181)	(0.0233)	(0.0543)	(0.0666)	(0.0183)	(0.0740)	(0.0210)
CMP3	-0.285***	-0.0810***	-0.000704	0.0248	-0.280***	-0.0797***	-0.280***	-0.0796***
	(0.0557)	(0.0147)	(0.0190)	(0.0443)	(0.0553)	(0.0148)	(0.0621)	(0.0172)
CMP4	-0.184***	-0.0502***	0.00374	0.0198	-0.188***	-0.0512***	-0.162**	-0.0428**
	(0.0617)	(0.0165)	(0.0212)	(0.0493)	(0.0618)	(0.0167)	(0.0714)	(0.0199)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product Innovation		Process_Innovation		Product Innovation		Product Innovation	
	AGLS	2SLS	2SLS	AGLS	AGLS	2SLS	AGLS	2SLS
EXPT	0.226***	0.0577**	0.00489	-0.00859	0.215**	0.0543**	0.374***	0.105***
	(0.0830)	(0.0228)	(0.0294)	(0.0675)	(0.0852)	(0.0235)	(0.0929)	(0.0264)
CERTF	0.250***	0.0677***	0.0177	0.0486	0.257***	0.0690***	0.253***	0.0686***
	(0.0425)	(0.0116)	(0.0149)	(0.0347)	(0.0419)	(0.0116)	(0.0475)	(0.0135)
Over-identification test (p-values)		0.589	0.906					
Chi-sq F		20.70***						
Observations	10,526	10,526	10,525	10,525	10,529	10,529	10,526	10,526
Country, industry, and year dummies	YES	YES	YES	YES	YES	YES		YES

Finally, we also examine innovation heterogeneity in the family firm behavior using both 2SLS and AGLS models (columns 8 – 10, Table 9). In columns 8 – 10, the main explanatory variable, LARG_DOMINDV, is an interaction term between a dummy variable that identifies the family as the main shareholder and MSHR. The reported negative coefficient for radical innovation in the table (column 8) suggests that, compared to non-family firms, family firms have a lower technological innovation propensity for radical innovations. This result supports hypothesis 4 that family involvement in ownership and control is negatively correlated with technological innovation propensity. The negative coefficient estimation for radical innovation for the Heckman 2-stage selection model in column (10) of Table 9 further finds statistical evidence for hypotheses 4 and 5. These results suggest that family involvement in ownership would support lower levels of technological innovation propensity, in particular, radical innovation propensity. Our empirical estimations, therefore, statistically confirm that the propensity of family firms to engage in radical technological innovation is lower compared to non-family firms. These results are in line with some previous studies that conjecture that family firms are not as innovative, in particular, as non-family firms (e. g., Block et al., 2013; Classen et al., 2014; Schmid et al., 2014). The key reasons advanced in the literature are related to the distinct nature of the family firms (e. g., Sanchez-Bueno & Usero, 2014). The principal-agent conflicts (agency conflict 1) are minimal in family firms. That promotes long-term orientation as family members view their businesses as not just a financial investment but intending to pass on the family business to their future generations (Chen, Tsao & Chen, 2013). Thus family shareholders are viewed as providing "patient capital" to the family business (Lumpkin & Brigham, 2011). Such a long-term perspective tends to provide conducive conditions for promoting innovation activities since returns from R&D investments are long-term. However, the agency conflict between majority and minority shareholders (agency conflict II) may also hinder R&D investments in FFs. Our results are also consistent with Chin et al. (2009) for Taiwanese firms. The authors find that the greater the family members' involvement in ownership and control, the lower is the number of patents and patent citations generated by the firm. They argue that a family exerts control over the firm through their involvement in management and governance as proxied by the CEO and Chairmen being family members, and exploits minority shareholders' interests, slowing the innovation activities and investments. The second reason often advanced in the literature is that FFs are often risk-averse and reluctant to undertake risky R&D investments (e. g., Miller et al., 2011). The founding family is often exposed to the idiosyncratic risk since most of their financial wealth is tied to the firm. Consequently, they could manage the firm in ways to reduce risk at the firm level (Anderson & Reeb, 2003), avoid entrepreneurial activities, and risk-taking in their strategic decision-making process (Acosta-Prado et al., 2017; Naldi et al., 2007). Thus shareholders in the FFs might be tempted to avoid investments in risky R&D projects. Anderson et al. (2012) documented that FFs prefer investing in physical assets compared to investments in risky R&D activities. Our empirical results concur with the risk aversion hypothesis (Matzler et al., 2015; Naldi et al., 2007) that innovation propensity is lower in FFs compared to non-family firms.

Next, we consider whether FFs and non-family firms have different innovation propensity for incremental and radical technological innovation. The results of the 2-stage Least Squares regression, where the dependent variable is the incremental innovation, are reported in column (9) of Table 9. The coefficient estimate is positive and statistically significant at 1 percent level. This suggests there is no differential innovation propensity for incremental innovation between FFs and non-family firms. That further supports our earlier results in the table where we find a differential impact of technological innovation propensity between FFs and non-family businesses. Incremental innovations are mainly imitative, routine type of product and process innovations.

Technological innovation propensity may also be influenced by the unobservable firm-specific or environmental factors not captured by our control variables. As in Mazzelli, Kotlar, and De Massis (2018), we use the Heckman 2-stage selection model to account for the endogeneity of family involvement in ownership. The inverse Mills ratio estimated from the first-stage regression, where family firm ownership is employed as an endogenous variable, is used in regression estimations on the family firm's propensity to introduce technological innovation. We follow the approach in Mazzelli et al. (2018) and use three variables that can affect the attractiveness of continued family involvement in ownership and governance but may not have an impact on the technological innovation propensity. The first two are dummy variables (firm is privately held, and group-affiliation) and the third variable is the proportion of foreign ownership. Empirical results, reported in column (10) of Table 9, qualitatively remain unchanged for radical innovation propensity.

3.3.4 Agency Conflicts, Risk Aversion, and Technological Innovation Propensity

As discussed in the previous sections, we identify two channels through which ownership concentration may potentially influence innovation propensity. These are the agency conflicts between controlling and minority shareholders, and the large shareholder's risk aversion. In the following paragraphs, we attempt to untangle the contribution of the two channels.

Claessens et al. (2002) argue that expropriation risks are high when there is a divergence between control and cash flow rights. Controlling shareholders with a high control-ownership wedge has greater incentives to make sub-optimal investment decisions to extract private benefits of control (Abdullah, Shah, & Khan, 2012; Masulis, Wang, & Xie, 2009). We construct two measures as proxies for the main shareholder's control over the firm. First, *MAINCONT* is a binary variable that takes a value of 1 if (i) a firm is majority-owned by the main shareholder (main shareholder's equity stake exceeds 50%), and (ii) financial statements are prepared separately from those of the headquarters' or other firms (if any). *MAINCONT* equals 0 if any of the two conditions are not met. This variable effectively captures the control-ownership wedge, which we assume to be lower. As an alternative, we construct another dummy variable, denoted by MAINCONT2. It equals 1 if the establishment happens to be a headquarter (with or without production and sales), in addition to being majority-owned by the main shareholder. This variable equals 0 if any of the two conditions are not met. Table 9 displays the results of AGLS and 2SLS estimates. The coefficient estimates for *MAINCONT* and MAINCONT2 (columns

1 – 4) are positive and statistically significant in estimations for both the product and process innovation, suggesting that the alignment of cash flow and control rights mitigates expropriation risks and, consequently, promotes technological innovation propensity. The coefficient still retains its positive sign and statistical significance when we control for ownership concentration by including a proxy for ownership concentration, *MSHR*.

3.3.5 Moderating Role of Corporate Diversification on Family Firm Technological Innovation Propensity

As discussed in section 3.3.4, we identify two potential channels that the ownership concentration may affect technological innovation propensity; one of these channels is corporate diversification. In this section, we examine if corporate diversification moderates the link between family involvement in ownership and technological innovation propensity. Some recent studies have stressed the important distinctive nature of the FFs in diversification strategies and choices (e. g., Casprini, Dabic, Kotlar, & Pucci, 2020; Fernandez & Nieto, 2006; Sanchez-Bueno & Usero, 2014). This increased interest in family firm diversification and internationalization is motivated by the arguments that diversification may present FFs with distinctive opportunities (e. g., Casprini et al., 2020). Family firms also pursue non-financial goals such as long-term survival (e. g., Casson, 1999), reputation, and preserving socio-emotional wealth (e. g., Cennamo et al., 2012). Although FFs are viewed as more reluctant to adopt diversification strategies (e. g., Cesinger et al., 2016; Goranova et al., 2007; Gomez-Mejia et al., 2010), when FFs do venture into new businesses, industries, and markets, they tend to achieve financial goals without compromising the non-economic goals such as socio-emotional wealth. Anderson and Reeb (2003) show that FFs have higher incentives to involve in diversification strategies with an objective to reduce idiosyncratic risk due to concentrated ownership. Orland, Renzi, Sancetta, and Cucari (2017) show that diversification indirectly affects R&D investments. R&D activities provide the FFs an opportunity to transform R&D resources, accumulated from national and international diversification, into new products, services, and processes (Del Giudice et al., 2010). The diversification is thus expected to have a positive impact on the family firm's investments, such as R&D activities and technological innovation propensity (Gómez-Mejía et al., 2011). Hence we formulate the following hypothesis.

- **H_7:** corporate diversification has a positive moderating effect on the family firm's technological innovation propensity.

Considerable empirical work has documented a positive relationship between corporate diversification and R&D investments (Miller, 2006; Alonso-Borrego & Forcadell, 2010), consistent with the idea that a diversified firm has the resources to invest in innovation activities (Orlando et al., 2017). In contrast, several studies emphasize the negative effect of corporate diversification on innovation since the former may exacerbate managerial agency problems (Hoskisson et al. 1993). Entropy index - the firm's percentage of revenues in each related and unrelated industries - has been one of the commonly used measures of corporate diversification (Kim et al., 2013). Due to the data limitation, we are unable to use this measure of corporate diversification. As in Un and Cuervo-Cazurra

(2008), we construct a measure for product-market diversification based on the firm’s core business activities. This dichotomous variable equals 1 if the revenues from the main product market (based on ISIC (Rev. 3.1) Code) is less than 70%, 0 else. We construct this variable based on the survey item that traces the proportion of revenues attributable to the firm’s single largest business in an industry (classification of the industry according to the ISIC Rev 3.1 code). A higher percentage of revenues indicates that the firm is highly concentrated in a single industry. An interaction term, that separates the effect of (lack of) diversification on innovation propensity, is then constructed as a product of this dummy and *MSHR*. In columns 5 – 6 of Table 9, the positive and significant coefficient of the interaction term in estimations for both product and process innovation suggests that the negative effect of ownership concentration may also depend on the extent of corporate diversification. In other words, the lower the corporate diversification, the lower is the firm’s propensity to innovate, supporting the risk aversion hypothesis (H_2, section 2.2). Similar to the interaction term between ownership concentration (MSHR) and a proxy of corporate diversification, we construct an interaction term between a variable that measures the degree of family involvement in ownership and a proxy of the corporate diversification. The results of the 2-stage Least squares (2SLS) are reported in column 7, Table 9. The coefficient of the interaction is positive and statistically significant at the 0.05 level. This confirms H7, as we find statistical evidence in support of H7 that technological innovation propensity is higher in those family firms that have undertaken corporate diversification. In other words, corporate diversification positively moderates the relationship between the degree of family involvement in ownership and the firm’s technological innovation propensity. Those family-owned firms that have adopted a certain degree of corporate diversification have a higher preference for technological innovation propensity compared to those family-owned businesses that have a lower degree of corporate diversification.

We acknowledge that we conduct our analysis on data derived from countries with different financial and corporate governance systems. Although our econometric specifications account for country-effects, we split the sample into various geographic regions. We then re-calculate our key econometric specifications separately for each subsample constructed based on geographic segmentation. For this purpose, we split the sample into four subsamples, namely South Asia, Sub-Sahara Africa, East-Asia and Pacific, and Europe and Central Asia. The results are not reported in the paper for brevity and are available upon request. For the subsample of East-Asia and the pacific (Indonesia, Malaysia, Vietnam, Philipines, Thailand), the moderating role of diversification on technological innovation propensity is positive and statistically significant at 0.05 level. These results generally support those of Chou and Shih (2020) for Taiwan that FFs achieve higher firm value from their diversification strategies than the non-family firms. Likewise, the coefficient estimate for a sample of countries from Sub-sahara Africa (Ghana, Kenya, Tanzania, Uganda, Zambia, Senegal) has a positive sign and statistically different than zero at 0.05 level. For a subsample from Europe and central Asia, the coefficient estimate of the interaction term is insignificant because the data points are very few (only 145 observations in individual ownership categories). Therefore, the coefficient estimates are not statistically significant for the interaction term between diversification and family involvement in ownership and control. For a sample of countries from South Asia (Pakistan, India, Bangladesh), we do not find statistical evidence of the moderating effect of diversification on technological innovation propensity for family firms. Overall, the results are similar in substance as reported for the global sample. Whereas the results may not lead us to suggest substantive structural differences across different geographic regions and governance systems, we do not find conclusive evidence on the potential differences between various financial and corporate governance systems. Further research may shed light on this area.

The following table 9 contains estimations for 2SLS models (standard errors in parenthesis). The second row of each column specifies the dependent variable for each regression specification. MAINCONT is a dummy variable that equals 1 if an establishment is (a) majority-owned by the main shareholder (main shareholder's equity stake greater than 50%) and (b) the financial statements are prepared separately from those of the headquarters' or other firms (if any), otherwise it equals 0 if any of the two conditions are not met. MAINCONT2 is also a binary variable that assumes a value of 1 if (a) an establishment happens to be a headquarter (with or without production and sales), in addition to being majority-owned by the main shareholder. This variable equals 0 if any of the two conditions are not met. Finally, an interaction term of a proxy for product-market competition and *MSHR* separates out the effect of (lack of) diversification on innovation concerning ownership concentration. In columns 7 – 10, the dependent variable is either incremental innovation (*new-to-firm*) and radical innovation (0/1): *new-to-market* innovation). The estimation procedure for columns 8 – 9 is the 2SLS while it is the Heckman 2-stage selection model for column 10 (as a robustness check). Coefficient estimates for controls are not reported in the table for brevity. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

Table 9: Corporate Diversification, Ownership Concentration, and Innovation

Variables	(1) Product Innovation	(2) Process Innovation	(3) Product Innovation	(4) Process Innovation	(5) Product Innovation	(6) Process Innovation	(7) Interaction Of Diversification and Ffs	(8) Radical Innovation	(9) Incremental Innovation	(10) Radical Innovation
	0.950**	1.797***								
MAINCONT	(0.375)	(0.526)								
			0.824***	1.285***						
MAINCONT2			(0.274)	(0.319)						
					0.0499***	0.0594***				
MSHR*Diversification					(0.0160)	(0.0212)				
							0.0512***			
Family-firm*Diversification							(0.0177)			
	-0.595**	-1.367***	-0.156***	-0.408***	-0.849***	-1.832***	-0.858***			
MSHR	(0.253)	(0.354)	(0.0584)	(0.0680)	(0.282)	(0.370)	(0.282)			
LARG_DOMINDV								-2.627**	1.335*	-.059*
+ Control variables								(1.378)	(0.81722)	(.03380)
Sargan statistic (over-identification test):p-values	0.453	0.118	0.150	0.319	0.583	0.430	0.331	0.519	0.199	
Observations	5,675	5,673	8,254	8,253	10,455	10,452	10,455	11,412	11,115	
Country, industry, and year Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

4. Conclusion, Limitations, and Future Research Agenda

This study has examined the role of concentrated ownership on technological innovation propensity in developing markets. Emerging markets are generally characterized by concentrated ownership and conflicts between controlling and minority shareholder often constitutes main agency problems. We document that ownership concentration negatively affects technological innovation propensity. This effect is generally more pronounced for firms operating in more traditional sectors while this negative effect is less distinct in high-technology intensive sectors. Our empirical analysis suggests the limited generalizability of the "agency cost-minimization effect" of concentrated ownership for developing markets. Rather we find the concentrated ownership is significantly negatively related to the technological innovation propensity. Our results, thus, lends support to the expropriation risk hypothesis of the concentrated ownership arising from the principal-principal conflicts, which may limit the firm's ability to innovate, in particular, technological innovation propensity. Furthermore, risk aversion, induced by the lack of corporate diversification, may also exacerbate the negative effect of share concentration on technological innovation propensity. Our results also lend support to the notion of the curvilinear effect of ownership concentration on the technological innovation propensity (Li, Guo, Yi, & Liu, 2010). Moderate levels of ownership concentration are beneficial for firm investment and R&D decisions. However, higher levels of ownership concentration may create principal-principal agency costs or induce risk-aversion. That may have detrimental effects for value-enhancing but risky R&D activities and innovation investments. Further analysis reveals that family firms are more likely to have lower radical innovation propensity in contrast to the non-family firms, in particular those firms where the main block-holder is either a foreign or domestically-owned corporate group.

Finally, we also examined the moderating effect of corporate diversification on the degree of family involvement in ownership and the technological innovation propensity. We find a positive moderating effect of diversification on family ownership and technological innovation propensity. We find that family-owned businesses that have considerably diversified into other products, businesses, and markets, have a higher propensity for technological innovation as compared to family firms that have lower levels of corporate diversification.

4.1 Practical and Theoretical Implications

The impact of family involvement in ownership and control on the technological innovation propensity of family-owned businesses has become a promising area that has gained traction of researchers in the past decade (e. g., Xiang, Chen, Tripe, & Zhang, 2019; Sageder et al., 2018; Xi et al., 2015). Innovation investments are quite risky, complex, and resource-consuming (Hall and Lerner 2010). Given that family firms are quite heterogeneous and may have competing goals, such as long-termism, economic efficiency, and preserving of the family social interests (e. g., Chua et al., 2003). These competing economic and non-economic goals could hamper technological innovation propensity in family-owned businesses. Further, our results concur with some previous studies that large diversified shareholders, such as family, are likely to avoid high-risk

R&D investments and are thus likely to have lower technological innovation propensity (e. g., Matzler et al., 2015; Naldi et al., 2007).

However, some authors argue that family involvement in ownership and control impacts positively on the firm's innovation propensity since long-term survival and growth of FFs and passing on the business to the future generations is one of the overriding socio-economic objectives of the FFs. Technological innovation is one of the driving forces of firm growth, productivity, and long-term survival (e. g., Tsai & Wang, 2004). Our results generally support the agency conflicts, the application of agency theory, and risk aversion that has plagued family firms in the developing markets.

From a managerial perspective, we need to acknowledge that innovation is an "… aggregate effect resulting from both positive and negative mediating effects" (Rosenbusch et al., 2011, p. 444). Our results suggest that family members need to be more active in firm management and governance; mere large family shareholdings may not achieve the desired results of long-term survival (Casson, 1999) and having higher technological innovation propensity to achieve these objectives. Lastly, corporate diversification could be one potential channel to achieve long-term family objectives and remain competitive in the long run by enhancing the technological innovation propensity.

4.2 Limitations and Future Research

This study has a few limitations that may be taken into account in future studies. First, we have used survey data that has a limitation that we could not use more variables for ownership concentration, in particular, the ownership concentration of the second-largest shareholder, as we relied on the nature of the main shareholder's ownership concentration. Other shareholders holding a significant equity stake in the firm also play relevant roles regarding corporate investment policies, and R&D activities. That could have provided a more nuanced analysis of ownership concentration on technological innovation propensity. Thus, it may be interesting to analyze the ownership structure of family firms (FFs) in more detail, controlling for the presence of other different types of shareholders (e. g., Sacristán et al., 2011).

A second limitation of our study also stems from the data limitation. We have employed a generic proxy of corporate diversification. Future studies may adopt more detailed measurements of corporate diversification that would entail various sectors and sub-sectors in which family firms operate and generate business revenues. One avenue for future research may be to adopt alternative proxies of corporate diversification to study if the positive moderating effects of corporate diversification on the technological innovation propensity in family firms can be validated.

Third, further research can explore the role of corporate diversification on the relation between family ownership and innovation efficiency (that is, innovation input-output formula). Innovation activities are highly knowledge-intensive processes that generate knowledge-based resources (Nonaka & Takeuchi, 1995). R&D activities and technological innovation is not only a means to diversify the FFs into new markets but also provide the FFs an opportunity to transform R&D resources accumulated from national and international diversification into new products, services, and processes (Del Giudice et al., 2010). Some previous studies show that firms are better able to derive value from their innovation when operative in several markets (Kafouros et al., 2008). Future research may look into the implications of FFs diversification strategies on technological innovation from the perspectives of the family-firm heterogeneity. Finally, we have employed cross-sectional survey data to examine our hypotheses. A longitudinal survey data may also be employed to account for the evolution of family firms, institutional settings, and how the technological innovation propensity is affected over time concerning the evolving nature of family involvement in ownership, management, and governance of family firms.

Grant Support Details / Funding

This research work received no research grant.

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