IIMB Management Review (2023) 35, 215-228

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/iimb

# Using profits to re-estimate efficiency of internal capital markets

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Received 17 November 2021; revised form 5 June 2022; accepted 19 July 2023; Available online 22 July 2023

**KEYWORDS**
Intra-group financing;
Business groups;
Insider ownership;
Monitoring;
Emerging markets;
DEA

**Abstract** Internal capital markets (ICM) are fundamental to conglomerates and business groups across developed and developing economies. ICM can be opportunistic or benevolent, but its efficiency assessment remains a pressing question. We focus on measuring the profit efficiency of giver firms using a novel methodology based on data envelopment analysis (DEA). We also explore heterogeneity across group firms based on ownership and governance. Overall, ICM investments are efficiency-reducing, more so for firms with higher outsider ownership. Monitoring reduces inefficiency. These findings have strong methodological, policy, and financing implications and call for caution from lenders and investors of diversely held group firms.


## Introduction

Internal capital markets (ICM) are a popular way of reallocating capital for conglomerates and business-group-like structures. While the capital remains within the same entity in intra-firm ICM across departments within a conglomerate, the capital is reallocated across separate legal entities in intra-group ICM across group firms within a business group. An ICM transaction within a business group comprises firms of two types: the investing or *giver* firm and the firm receiving investment or the *taker* firm, both members of the same business group. This implies that the shareholders of the investing and investee firms differently share the benefits and costs of ICM. Moreover, ICM allow group-affiliated firms to reallocate capital among themselves without any additional external screening. This raises a key question: are all parties to this capital allocation decision better off? ICM allows the taker firm to raise capital, often at much cheaper rates and on easier terms. But are ICM efficient for the giver?

ICM help retain control over the allocated funds, provide flexibility, and are an important financing and investment decision affecting firm profitability and sustainability. However, the insiders have more information about the firms than external agents, and this information asymmetry can be used efficiently or opportunistically (Gonenc, 2009; Liebeskind, 2000). If insiders act benevolently, i.e., in the best interests of all capital providers, then all stakeholders benefit (Almeida, Kim, & Kim, 2015; Basu & Sen, 2015; Buchuk, Larrain, Prem, & Urzúa Infante, 2020; Khanna & Tice, 2001). However, if they act opportunistically, i.e., in their self-

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https://doi.org/10.1016/j.iimb.2023.07.003

interest, then the firm value is destroyed, and other stakeholders suffer (Kali & Sarkar, 2011; Lins & Servaes, 2002; Lu & Yao, 2006; Scharfstein & Stein, 2000).

Real-world examples support both kinds of behaviour. For instance, Aditya Birla Group's purchase of Pantaloons retail in India (2012)[1] and Tata Sons' recent infusion of cash into ailing Tata Motors[2] are examples of ICM support for survival. On the contrary, large-scale ICM-based scams like Satyam in India (2008),[3] Parmalat in Italy (2003),[4] Enron in the USA (2001)[5] and the DHFL in India (2019)[6] are all examples of opportunistic behaviour. Satyam Computer Services, one of the prominent tech giants, collapsed in 2009 due to an accounting fraud of over USD 1 billion. The fraud involved falsifying accounts and cash flows to siphon funds to the insiders' pockets and related firms controlled by the inside owner, such as Maytas – another example of inefficient ICM. Parmalat, once hailed as the jewel of Italian commerce, collapsed in 2003 with an USD 18.6 billion gap in its accounts after fraudulent transfers to subsidiary companies came to light.

Thus, whether ICM create or destroy value is critical to understanding a firm's financing and investment choices, explaining why certain organisational forms exist and why firms diversify. While a large body of literature continues to discuss how and why organisations use ICM, very little direct and conclusive evidence exists about the efficiency of such lending arrangements, more so within business groups and across different kinds of group-affiliated firms. The inconclusive results are primarily because of empirical limitations (Campa & Kedia, 2002; Graham, Lemmon, & Wolf, 2002). Most of the scholarly work borrows from the literature on ICMs within conglomerates, where the focus is departmental investment efficiency (Shin & Stulz, 1998; Rajan, Servaes, & Zingales, 2000). This is measured relative to the investment efficiency of other departments, i.e., whether firms allocate capital from low to high opportunity departments or segments. Here, growth is generally the average Tobin's Q of the industry the segment functions in, and segment investment is proxied by the segment's capital expenditure. The measurement is based on the expectation (of efficiency) that segments with low growth opportunities have a lesser need for capital and would reallocate it to the segments with higher growth opportunities and a higher need for capital (Scharfstein, 1998).

This construct of relative investment efficiency has been extended to the sparse business group literature and has led to other investment-based proxies like expected investment estimated as a function of sales growth to identify under or over-investment (Biddle, Hilary, & Verdi, 2009; Lin & Yeh, 2020). Investment cash flow sensitivity is another proxy often used in the business group literature examining ICM (Hoshi, Kashyap, & Scharfstein, 1991; Lee, Park, & Shin, 2009; Shin & Park, 1999). This is a measure of financial constraints, and its usefulness has been widely debated in the literature.

Thus, extant literature suffers from two major limitations. One, it does not differentiate between conglomerates and business groups when measuring ICM efficiency. Shin and Park (1999) find business groups treat high and low-growth firms similarly, and both types have similar levels of investment. This differs from the segment-based differential growth expectations fundamental in the literature on conglomerates. This results in empirical limitations based on relative growth and theoretical limitations since it ignores the boundaries of legal entities. Two, the literature remains focused on investment efficiency (based on capital expenditure and growth) and the taker firm, highlighting the benefits of ICM to high-growth firms. This curtails our understanding of ICM within business groups for multiple reasons. Other than funding financially constrained high-growth firms, ICM have been used to prop poorly performing firms (coinsurance) and tunnel resources (seek private benefits).[7] The lack of differentiation between conglomerates and business groups and the focus on taker firms and investment-based measures do not help capture these different motives and, thus, limit theoretical and empirical understanding.

Hence, this paper addresses the following research questions:

- *RQ 1:* How can the profit efficiency of ICM be measured?
- *RQ 2:* How will insider ownership and governance impact the efficiency of ICM?

The paper significantly contributes to the extant literature in multiple fields as follows. In the context of the Indian internal capital market, deviating from the existing approaches, this work focuses on devising an input-output-based profit efficiency analysis. For this purpose, a two-stage Variable Return to Scale-Semi-Oriented Radial Measure Data Envelopment Analysis (VRS-SORM-DEA) (Emrouznejad, Anouze, & Thanassoulis, 2010) and Regression-based methodology are incorporated to measure profit efficiency and examine the impact of insider ownership and governance on ICM efficiency. Existing literature highlights the extensive application of Data Envelopment Analysis (DEA) (Charnes, Cooper, & Rhodes, 1978; Banker, Charnes, & Cooper, 1984), a nonparametric mathematical technique, for performance evaluation. It facilitates the individual efficiency measurement of all the firms engaged in ICM transactions.

[1] Retrieved from: https://www.businesstoday.in/magazine/features/future-group-aditya-birla-nuvo-deal/story/24720.html. Accessed on 25th January 2021.

[2] Retrieved from: https://timesofindia.indiatimes.com/business/india-business/tata-sons-to-pump-rs-6500cr-into-flagship-tata-motors/articleshow/71768122.cms. Accessed on 25th January 2021.

[3] Retrieved from: https://www.hindustantimes.com/business/satyam-scam-all-you-need-to-know-about-india-s-biggest-accounting-fraud/story-YTfHTZy9K6NvsW8PxIEEYL.html. Accessed on 25th January 2021.

[4] Retrieved from: http://www.nbcnews.com/id/4030254/ns/world_news/t/parmas-god-falls-sky/#.XnRnJHtLipo. Accessed on 25th January 2021.

[5] Retrieved from: http://large.stanford.edu/courses/2018/ph240/smith1/. Accessed on 25th January 2021.

[6] Retrieved from: https://www.business-standard.com/article/companies/dhfl-scam-ed-probing-money-laundering-of-rs-4-122-crore-epf-corpus-119122700665_1.html. Accessed on 25th January 2021.

[7] See Basu and Sen (2015) for more details on the different motives for ICM.

First, the net and operating profit efficiency of the *giver* and *taker* firms of ICM are determined using the VRS-SORM DEA model. Incorporating the VRS-SORM DEA exhibits higher advantages than the conventional DEA model in dealing with the variables with negative data, prevalent in profitability evaluation. Also, the disaggregation of the net and operating profit efficiency facilitates more accurate measurement and eliminates the influence of operating profit on the net profit. Further, using multivariate regression analysis, the impact of insider ownership and governance on the net profit efficiency of the *giver* firms has been investigated with the operating profit efficiency as a control variable. Additionally, the investors' reaction to the efficiency of ICM has also been explored. This work brings several interesting insights related to the net profit and operating profit efficiencies of the *giver* and *taker* firms and the effect of insider ownership and governance on the net profit efficiency of the *giver* firms.

Thus, the paper adds substantially to the ICM-based business group literature through (a) an improved methodology that measures profit-based efficiency and (b) a focus on giver firms. It measures efficiency directly using profits instead of estimating it through less sophisticated investment-oriented variables. We measure net profit efficiency and examine the impact of ICM on it after controlling for a firm's inherent operating efficiency. This is a factor existing literature fails to capture and helps extend the stock returns-based results documented by Joh and Kim (2013). Next, we study the moderating effect of insider ownership on ICM. It throws light on the role insiders play in investment-based decision-making and highlights the need for minority shareholders to be more cautious when investing in firms with low insider ownership and engaging in intra-group transactions. This focus on insider ownership is an important research consideration in the context of ICM since there has been a decline in the conglomerate structure in developed markets, but the business group structure continues to flourish in developed and emerging markets. Insider owners dominate decision-making within these group structures, and our study helps us understand these dynamics better. Finally, our paper presents an innovative application of the modified VRS-SORM DEA model using accounting data in the realm of corporate finance.

The rest of the paper is organised as follows. The second section describes the literature review. The third section discusses the hypotheses development, and the fourth section demonstrates the data, efficiency estimation process and regression analysis. The fifth section presents the results and discusses the additional analyses undertaken. The sixth section discusses the managerial implications, and the final section highlights the contributions and future research avenues while concluding the paper.

## Literature review

The relevant literature can be classified into two categories; the field of ICM and business groups and another of applications of DEA in financial performance and evaluation.

### Internal capital market and business groups

The internal capital market (ICM) literature veered towards business groups in the last two decades but has remained sparse. Business groups are networks of loosely affiliated firms with common insider ownership. Masulis, Pham, and Zein (2011), through a forty-five-country study, highlight that ICM considerations drive the creation of networked organisations like business groups. ICM was identified as the reason business groups existed, i.e., as a solution to institutional voids, particularly in emerging markets (Gonenc, 2009; Khanna & Palepu, 1997).

ICM was initially examined within firms for capital reallocation across divisions but extended to exploring inter-firm networks (like within business groups), where ICM became a common tool for transferring resources. ICM has remained an area of interest for researchers over the years, with literature highlighting both advantages and disadvantages of ICM. The scholars focus on various issues such as the importance of different factors such as corporate headquarters, managers and group networks to maintain the performance of ICM (Stein, 1997), advantages of ICM to facilitate the capital allocation decisions of business groups (Buchuk, Larrain, Muñoz, & Urzúa, 2014), and so on.

Stein (1997) and Wulf (2009) examine the role of corporate headquarters on intra-firm capital allocation through ICM across projects and activities. Khanna and Tice (2001) extend this to inter-firm ICM networks and describe how ICM facilitates the capital expenditure decision of the firms under a business group. Gonenc (2009) explains how firms in Turkey take financial resource allocation decisions among affiliated firms of the business groups. Shin and Stulz (1998) investigate the role of cash flow in maintaining the efficiency of ICM in financial resource allocation. Shin and Park (1999) demonstrate how ICM can be useful in reducing the financing constraints of firms under the business groups of Korea. Similarly, Almeida et al. (2015) investigate the capital allocation of firms under Korean business groups. Buchuk et al. (2014) demonstrate the financing advantage of intra-group loans for the business groups of Chile. On the other hand, Scharfstein and Stein (2000) discuss how the rent-seeking behaviour of managers can bring down the efficacy of ICM. Lin and Yeh (2020) demonstrate the effect of ICM and ownership structure on the investment efficiency of business groups. Sautner and Villalonga (2010) examine the role of corporate governance in improving the efficiency of ICM.

### Application of DEA in financial performance

Existing literature indicates the substantial application of DEA for evaluating the financial performance of organisations. Ho and Wu (2006) apply a two-stage DEA model to facilitate the distinct evaluation of operational efficiency and operational effectiveness of Taiwanese banks. Mostafa (2007) applies the conventional output-oriented DEA model to evaluate the performance of 50 Gulf Cooperation Council (GCC) banks. Tsolas (2010) apply a two-stage DEA model to determine the efficiency of Greek banks. Similarly, Halkos and Tzeremes (2012) apply a bootstrapped DEA model to evaluate the financial performance of Greek manufacturing firms. Chaluvadi, Raut, and Gardas (2018) employ a two-stage network DEA model to measure the performance of Indian banks. Hu, Li, Zha, and Zhang (2020) apply a two-stage data DEA model to investigate the impact of monetary policy and ownership structure on the performance of

Chinese banks. Kamyab, Mozaffari, Gerami, and Wankei (2020) evaluate the efficiency of the incentive systems of commercial banks using a DEA model based on the ratio analysis (DEA-R) model. Lin and Li (2020) adopt a super-efficiency DEA-based approach to assess the efficiency of mutual funds. Xu and Zhou (2020) incorporate a two-stage assurance region-restricted DEA model (AR-DEA) for evaluating the performance of Chinese commercial banks.

Exploration of existing literature indicates that the application of DEA in the financial sector is mostly limited to the banking domain, whereas exciting and emerging applications such as the performance evaluation of ICM have not received enough attention. Also, existing research related to ICM highlights that researchers mostly incorporate output variables such as Tobin's Q and profitability within different regression models, thus indicating the absence of input-output-based analysis and the presence of endogeneity error. Additionally, these works do not consider the distinct measurement of net profit efficiency from the operating profit efficiency of the firms engaging in ICM transactions. This is important since ICM transactions do not affect operating performance but reflect non-operating performance through investment returns. Further, most research is restricted to intra-firm ICM, which is more common in developed economies. To the best of the authors' knowledge, this is the first work that presents a modified DEA and regression-based analysis to investigate the efficiency analysis of inter-firm ICM in an emerging economy like India. The contribution of this paper, along with a summarised description of the existing scholarly works related to ICM, is presented in Table 1.

## Hypotheses development

Our literature review indicates how ICM can be value-enhancing since the headquarters can allocate capital across divisions of a conglomerate more efficiently than external capital providers (Myers & Majluf, 1984; Stein, 1997). However, evidence also exists to the contrary, i.e., ICM can be value-reducing through misallocation of capital due to either over- or under-investment, biases and bureaucracy (Berger & Ofek, 1995; Scharfstein, 1998; Shin & Stulz, 1998).

ICM was seen as a solution to institutional voids in emerging economies. However, the persistence of business group-like structures and their growth in emerging economies despite institutional development (Colpan, Hikino, & Lincoln, 2010; Kim, Kim, & Hoskisson, 2010) and their presence in developed markets like many European and East Asian countries (Carney, Gedajlovic, Heugens, van Essen, & van Oosterhout, 2011) suggests the need to revisit why ICM continues to be a mechanism of choice.

The importance and complexities associated with ICM within business groups have also motivated a long academic debate about its costs and benefits. The benefits and costs of ICM are even more relevant within business group-like structures. In conglomerates, the cost of ICM decisions is borne by some divisions, so stakeholders remain largely internal. On the other hand, with business groups, all firms are separate legal entities, and any costs associated with intra-group ICM affect even external stakeholders not privy to such decisions. The Satyam scam, one of the largest accounting frauds in history, is a prime example of the use of ICM by insider owners to defraud minority investors and other stakeholders.

Satyam Computer Services, then a technology major in India and cross-listed in the United States, collapsed in 2009, embroiled in an accounting fraud of more than USD 1 billion. The fraud involved falsifying accounts and cash flows to siphon funds to the insiders' pockets and related firms controlled by the insiders, like Maytas through ICM. Many such large-scale accounting frauds have involved the use of ICM. For example, Parmalat collapsed in 2003—six years before Satyam, and became what remains Europe's largest bankruptcy. The fraud involved using subsidiaries, associate companies and shell companies to transfer and hide losses, receivables and debt.

**Table 1** Summary of the literature.

| Research paper | Methodology | Country studied | Objective |
|---|---|---|---|
| Shin and Stulz (1998) | OLS Regression | Cross-country | Role of cash flow in maintaining the efficiency of ICM in financial resource allocation. |
| Shin and Park (1999) | OLS Regression | Korea | Role of ICM in reducing the financing constraints of firms affiliated with business groups. |
| Khanna and Tice (2001) | Tobit Regression | USA | Role of ICM in the efficient allocation of the capital expenditure decision of business group affiliated firms. |
| Sautner and Villalonga (2010) | Logit Regression | Germany | Role of corporate governance in the efficiency of ICM. |
| Buchuk et al. (2014) | Probit Regression | Chile | Financing advantages of intra-group loans for business groups. |
| Almeida et al. (2015) | OLS Regression | Korea | Advantages of ICM for capital allocation among the firms of a business group. |
| Lin and Yeh (2020) | Tobit Regression | Taiwan | The effect of ICM and ownership structure on the investment efficiency of business group firms. |
| **Our work** | **VRS-SORM-DEA and Regression** | **India** | **Profit efficiency analysis of ICM (both giver and taker firms) and impact of insider ownership and governance on net profit efficiency of investing (giver) firms of ICMs.** |

Thus, the costs associated with ICM include expropriation, fund control and tunnelling for private benefits, while benefits include using proprietary information for more efficient resource allocation, providing cheaper resources and propping for firm survival. Tan, Yu and Ma (2018) examine ICM in China and find it reduces overinvestment. Buchuk et al. (2020) document an increase in intra-group loans during distress (2008–2009 financial crisis) in Chile and find high growth but financially constrained taker firms perform better. Similarly, Almeida et al. (2015) study Korean business groups during the Asian Financial crisis and find intra-group transfers from low to high-growth member firms helped the high-growth group firms mitigate capital constraints and the possible negative impact on investment and performance. However, in other studies on business groups in Korea, Shin and Park (1999) find ICM does not increase efficiency, and Lee et al. (2009) discuss how ICM among Korean chaebols allowed efficient capital allocation earlier but barely functioned post the Asian financial crisis. In another study on Korea, Joh and Kim (2013) document a negative stock market reaction to ICM. Many researchers have attributed this lack of consensus in literature to problems with research design (Campa & Kedia, 2002; Graham et al., 2002).[8]

Literature has documented many advantages to ICM transactions, like cheaper funding and propping during crises. The continuing existence of inter-firm networks that use ICM also implies that such transactions can be value-enhancing, particularly for taker firms. However, given the common knowledge that (a) most ICM lending happens at interest rates below market level with no effective repayment arrangements, (b) there is an increasing number of frauds using ICM and (c) the recent and expanding literature on ICM costs, we believe ICM investments are value-reducing, particularly for giver firms. Thus, it is inefficient for firms that invest in group firms (identified as 'givers') but efficient for group firms that receive cheaper ICM funding easily (identified as 'takers').[9]

**H1.** Giver firms have lower profit efficiency than taker firms.

The existing ICM literature also indicates that insider owners play a pivotal role in the functioning of ICM (Gonenc et al., 2007; Joh & Kim, 2013). The existence of concentrated shareholding can either provide financing advantages (Shin and Park, 1999) or enhance opportunities for expropriation (Johnson, La Porta, López-de-Silanes, & Shleifer, 2000). Samphantharak (2006) documents how ICM decisions are affected by corporate ownership and control rights. Tan et al. (2018) show that ICM in state-owned enterprises behave differently from private firms in China. For example, an insider, who has a stake in both the investing and receiving firms, may choose to make an investment that is efficient for the firm receiving the capital but inefficient for the firm investing the capital. While this decision may be value enhancing for the insider when considering their stake in both firms, it will be value destroying for the minority shareholders of the investing firm.

We expect ICM investments to have two dimensions for insider owners. Since ICM would benefit them overall, as stated above, we expect them to engage in ICM. If ICM investments are efficient, both firms and the insider owners benefit. There would, therefore, be no ownership restrictions on firms making efficient ICM investments. However, for inefficient ICM investments, we expect them to use low insider-owned firms (where personal stakes are lower and public attention lesser) to make these investments.

**H2.** More-insider-owned giver firms have higher profit efficiency than less-insider-owned giver firms.

Next, to validate our theory about insiders engaging in only efficient ICM when their stakes are higher, we examine whether governance plays a role. Governance plays a monitoring role in curbing inefficient investments (Sautner & Villalonga, 2010; Scharfstein & Stein, 2000). If insiders make efficient investments, better firm governance should not impact ICM investments. However, if better firm governance changes their behaviour, i.e., efficient ICM investments are made only when better monitored, it would indicate opportunistic behaviour that is curtailed by better monitoring. Such opportunistic investments would hurt the other stakeholders of the firm.

**H3.** More-insider-owned giver firms with stronger governance have higher profit efficiency than more-insider-owned giver firms with weaker governance.

## Data and methodology

### Sample

Our sample comprises all group firms listed on the Bombay Stock Exchange (BSE) 500 index as of 1st September 2016. The BSE 500 index represents 500 firms that account for nearly 93% of the total market capitalisation of the stock exchange and covers all 20 major industries in India. The sample period is seven years (to account for lead-lag indicators), from the financial year 2009-2010 to 2015-2016. The final tests are run on a 5-year window, from 2010-2011 to 2014-2015. Our data period starts after the Indian market stabilised post the financial crisis and the Satyam scam, both in 2008-2009. The sample ends in 2015-2016 since the new Companies Act, 2013 was enforced during this period. The financial and governance data post-enforcement is less comparable to the data before the Act, so we restrict our sample period. We use annual data extracted from Prowess, the largest and most comprehensive database of financial information about Indian companies. It has been used in previous studies like Khanna and Palepu (2000) and Gopalan et al. (2007). The principal data source for Prowess is the annual reports of individual companies. Our final sample comprises 1,242 firm-year observations[10] across 5 years, 151 business groups, 14 industries and 333 firms. All our variables are defined in Table 2.

[8] One of the main issues with empirical models used in literature is the existence of endogeneity.

[9] However, it is important to note that the ICM transaction may be efficient for the business group overall (benefits to taker greater than costs to giver), but this cannot be captured as business groups have many unlisted firms for which such ICM data is not publicly available. The overall efficiency may however, explain the persistence of the group form.

[10] We lose a lot of firm-year observations due to the sparse availability of data on internal capital market investments, the disclosure which was mandated fairly recently.

**Table 2** Definition of variables.

| Variable | Description |
|---|---|
| eff_ni | DEA-based measure of net profit efficiency |
| eff_oi | DEA-based measure of operating profit efficiency |
| d_netin | change in net group investment; ($netin_t$ - $netin_{t-1}$) where netin = total investment (debt and equity) made by firm k into all other group firms minus total investment from all other group firms into firm k, divided by firm k's lagged total assets |
| giver | indicator; 1 if d_netin $>$ 0, otherwise 0 |
| bus_grp | indicator; 1 if the firm belongs to a business group, otherwise 0 |
| own | percentage of shares held by promoters, i.e., insiders |
| h_own | indicator; 1 if own $>$ median(own), otherwise 0 |
| tobin | market-to-book ratio at t; (book value of debt + market value of equity)/(book value of debt + book value of equity) |
| lag_tobin | tobin at t $-$ 1 |
| age | number of years since incorporation; financial year less year of incorporation |
| size | log of total assets |
| log_empl | log of the total number of employees |
| lev | leverage; total debt divided by average total assets |
| roa | return on assets; net profit divided by average total assets |
| cfo_ta | cash flow from operations divided by average total assets |
| invs | total financial investments divided by average total assets |
| inst_pct | percentage of shares held by non-promoter institutions; institutions include financial institutions (mutual funds, banks, insurance companies, foreign institutional investors and venture capital funds) and governments |
| B4 | indicator; 1 if the firm is audited by a Big 4 auditor, otherwise 0 |
| ppe | tangible assets; property, plant and equipment |
| oth_asset | (total assets $-$ property, plant and equipment) |
| t_exp | selling, general and administrative expenses |
| t_debt | total short-term and long-term borrowings |
| div_yield | dividend paid divided by market price at the beginning of the period |
| kd | cost of debt; interest expense divided by average t_debt |
| log_audfee | log of total audit fee |
| inst_pct | percentage of shares held by non-promoter institutions; institutions include financial institutions (mutual funds, banks, insurance companies, foreign institutional investors and venture capital funds) and governments |
| annret | cumulative abnormal stock return for 12-month period ending 3 months after the fiscal year-end |
| interaction terms | interaction of the indicator variable *h_own* and *y*, any independent variable of the regression, is represented as *hown*y*; for example, *h_own* interacted with *roa* is represented as *hown*roa* |

## Methodology

As discussed in Section 1, the extant literature on ICM within business groups has focussed on investment efficiency and the taker firm. This substantially restricts our understanding of ICM and how it affects all stakeholders, particularly because ICM investments within business groups happen across different legal entities with different stakeholders. Our need to examine the impact on giver firms and all stakeholders can be enabled by focusing on profit efficiency instead of investment efficiency. Using profit efficiency also helps us distinguish between a firm's operating profit efficiency (unrelated to investment and financing decisions) and net profit efficiency (affected by investment and financing decisions).

For example, consider a business group GT with two firms, G and T. Firm G is profitable and has an investment capital of 100 available in the current period. Firm T is struggling and needs a fresh investment of 40 to tide over the issues temporarily. If G intends to fund T, it has two options. First, it can decide that the currently available capital of 100 will be used only for operational reasons, i.e., will be reinvested in the business. Then, G will have to raise additional capital of 40 and invest it in T. Second, it can decide that all investments, whether operational or financial, will be from the currently available capital of 100. Then, G will have to reallocate 40 of the existing capital to T and invest the remaining 60 in operations.

Now, to evaluate these two options, let us consider two outcome variables – operating profit (affected only by operating decisions) and net profit (also affected by financing and investment decisions). These are level variables. Let us also consider two rate variables – operating efficiency and profit efficiency. Efficiency is measured by the difference between the return from the investment (akin to output) and the cost of invested funds (akin to input). Given this, in the first case where G raises capital, firm G's operating efficiency and operating profit will remain as expected from the

base case since the operating rate of return remains the same with the entire capital of 100 invested in operations. Profit efficiency and net profit will increase (decrease) based on the efficiency (inefficiency) of the investment in T and the cost of borrowed funds. However, in the second case, operating efficiency will ideally remain the same, but operating profit (the level) will reduce proportionately. Profit efficiency and net profit will again increase (decrease) based on the efficiency (inefficiency) of the investment in T but will also depend on the operating profit generated.

Thus, inputs play a critical role in defining the profitability outputs. The lack of consistency in extant empirical results can be attributed to a specific focus on selecting outcome variables that exclude the role of these critical inputs. Thus, we do the following to measure efficiency.

## Efficiency estimation

DEA is an extensively used nonparametric mathematical technique applied to evaluate the relative efficiency of decision-making units (DMUs) that produces outputs using inputs (Cummins & Weiss, 2013; Das & Ghosh, 2009). Simply stated, the method identifies inefficient DMUs compared to the efficient ones that lie on the efficiency frontier, which is derived from all feasible input-output combinations. It assesses performance based on productivity and scale, compares with benchmarks among peers, and identifies target outputs and inputs. It, thus, provides useful slack information and guidelines for decision-makers to correct inefficient management choices. More importantly, as a nonparametric technique, DEA requires very few assumptions, no statistical distribution of deviations, no specification for the functional form of how inputs are transformed into outputs, and no sample constraints[11] (Botti, Boubaker, Hamrouni, & Solonandrasana, 2014). Banker, Cooper, Seiford, Thrall, and Zhu (2004) also show how DEA is more accurate than other econometric approaches in estimating efficiency when heteroscedasticity exists.

While widely used in many economics and banking areas over the last three decades (Eling & Jia, 2019; Lim, Oh, & Zhu, 2014; Premachandra, Bhabra, & Sueyoshi, 2009), DEA applications in corporate finance and accounting are only nascent (Botti et al., 2014; Cho, Choi, & Kim, 2018; Liu, Lu, Lu, & Lin, 2013; Su & He, 2012). This is primarily because of limitations associated with bidirectional variables. Conventional BCC-DEA (Banker et al., 1984) or CCR-DEA (Charnes et al., 1978) exhibit limitations in the presence of negative data due to the intrinsic assumption of positive input and output parameters. To overcome this limitation, scholars adopt different approaches, such as and Range Directional-based Model that handles the data without any transformation (Portela, Thanassoulis, & Simpson, 2004), modified slack-based measures (MSBM) model that eliminates the negative efficiencies (Sharp, Meng, & Liu, 2007; also see Adhikari, Basu, Biswas, Banerjee, & Sengupta, 2018). In this work, we apply the Variable Return to Scale-Semi-Oriented Radial Measure-based DEA model (VRS-SORM-DEA) proposed by Emrouznejad et al. (2010). VRS-SORM-DEA has several intrinsic advantages compared to other proposed solutions (including MSBM and Range Directional-based Model). First, unlike the other models, it does not require data transformation. Second, it also ensures non-negative efficiencies. Third, VRS-SORM-DEA is the most user-friendly method.

[11] However, it is preferable that the number of DMUs included in the sample exceed two times the sum of inputs and outputs. This ratio is greater than two in our paper.

## Stage 1: SORM-DEA model

We use the production approach in DEA to derive two efficiency levels – operating efficiency (*eff_oi*), where the output variable is operating profit (*oper_inc*), and profit efficiency (*eff_ni*), where the output variable is net profit (*net_inc*). Based on economic and financial theory, literature and the context of our paper, we use the following input variables:

a) Labour: measured as the number of employees (*n_emp*). For robustness, we also consider the log of this number.
b) Investment: measured as total assets (*t_assets*). Total assets is further divided into two variables; tangible assets measured by property, plant and equipment (*ppe*), and other assets (*oth_assets* = *t_assets less ppe*).
c) Expenses: measured as selling, general and administration (SGA) expenses (*t_exp*).
d) Leverage: measured as total debt to account for capital structure impact (*t_debt*).

Our model uses variable returns to scale and has an output orientation which is profit maximisation. We used the LINGO software to run industry-year-wise DEA models with the above inputs and outputs. To ensure construct validity, we dropped industry years where the number of DMUs was less than 16. Since the total number of inputs (*n_emp, ppe, oth_assets, t_exp, t_debt*) and outputs (either *oper_inc* or *net_inc*) is six, we should ideally have more than 2x, i.e., $\geq$12 DMUs in every industry-year. We chose a random number between 12 (2x) and 18 (3x). We also checked for the correlation between inputs and outputs, which were all statistically insignificant. This DEA process yielded an operating efficiency and a profit efficiency score (each ranging from zero to one) for every DMU at the industry-year level. A detailed description of the proposed methodology is as follows.

Let there be $n$ DMUs that transform $t$ inputs into $s$ outputs. Here, the $i_{th}$ input and $s_{th}$ output of the $j_{th}$ DMU can be represented as by $x_{ij}$ and $y_{sj}$ respectively, where $j = 1, 2.3, \cdots,$ n. $v_j$ describes the non-negative weight associated with input and output variables for the $j_{th}$ DMU. Let the DMU under examination be represented by $DMU_0$. The financial and operational efficiencies of $DMU_0$ are denoted by $(\theta_0)_{fin}$ and $(\theta_0)_{oper}$, respectively. As we consider an output-oriented model, the optimal value of efficiency for $DMU_0$ can be written as $\frac{1}{(\theta_0)_k}$ where $k\epsilon\{fin, oper\}$. The output parameter, i.e., net income and operating income in case of financial and operational efficiency respectively of the $j_{th}$ DMU can be expressed as $(y_j)_k$ where $k\epsilon\{fin, oper\}$. Now, the output of the $DMU_0$, i.e., DMU under evaluation can be represented as $(y_{j0})_k$, where $k\epsilon\{fin, oper\}$. Now, $(y_j)_k$ can be expressed in the following manner:

$$(y_{j0})_k^1 = \begin{cases} (y_{j0})_k \text{ if } (y_{j0})_k \geq 0 \\ 0 \text{ if } (y_{j0})_k < 0 \end{cases} \text{ and } (y_{j0})_k^2 = \begin{cases} 0 \text{ if } (y_{j0})_k \geq 0 \\ -(y_{j0})_k \text{ if } (y_{j0})_k < 0 \end{cases}$$

$(y_{j0})_k^1$ and $(y_{j0})_k^2$ capture positive and negative values, respectively. This separating variable helps overcome the disadvantages associated with treating negative data in conventional DEA models. Now, the output-oriented VRS-SORM model can be presented in the following manner:

$$\max(\theta_0)_k$$

Subject to

$$\sum_{j=1}^{n} v_j x_{ij} \leq x_{ij0} \quad \forall\, i \in \{1,2,3,4,5\}$$

$$\sum_{j=1}^{n} v_j (y_j)_k^1 \geq (\theta_0)_k (y_{j0})_k^1$$

$$\sum_{j=1}^{n} v_j (y_j)_k^2 \leq (\theta_0)_k (y_{j0})_k^2$$

$$\sum_{j=1}^{n} v_j = 1$$

$$v_j \geq 0, \forall\, j$$

### Stage 2: Multivariate regression framework

To test how making ICM investments (hypothesis 1), i.e., being a giver firm impacts profit efficiency, we use the following model:

$$eff\_ni_t = \alpha + \beta_1 * giver_t + controls \quad (1)$$

If ICM investments are efficient (inefficient), $\beta_1$ will be positive (negative). We specifically control for the operating efficiency of the investing firm (*eff_oi*) to ensure the results are not driven by operating performance. We also control for various other variables that might impact profit efficiency. These are current period growth (*lag_tobin*), age (*age*), size (log of *t_assets*), employee base (log of *n_emp*), leverage (*t_debt*/*t_asset*), return on asset (*roa*, measured as *net_inc*/*t_asset*), cash flows (*cfo_ta*, cash flows from operations deflated by *t_asset*), financial investments (*invs*) and monitoring (measured using institutional shareholding *inst* and Big 4 audit quality *B4*).

For hypothesis 2, we introduce insider ownership (*h_own*) into Eq. (1) and run the following model:

$$eff\_ni_t = \alpha + \beta_1 * giver_t + \beta_2 * h\_own_t + \beta_3 * h\_own * giver_t + controls + h\_own * controls \quad (2)$$

Here, *h_own* indicates high insider ownership and takes the value 1 when insider ownership is greater than the median, zero otherwise. The control variables remain the same as Eq. (1). However, we also interact all the control variables with *h_own* since the expectation is that these characteristics differ for high and low insider owner firms (Siregar & Utama, 2008). Our coefficient of interest is the interaction term $\beta_3$. If ICM investments by high insider-owned givers are efficient (inefficient), $\beta_3$ will be positive (negative).

In estimating hypothesis 3, we split the sample into two subsamples based on a high or low governance level. We create two indicator variables: (a) *h_inst*, which takes the value one if the institutional shareholding is greater than the median, zero otherwise and (b) *h_aud*, which takes the value one if *B4*=1, zero otherwise. We also use the log of audit fees (*ln_audfee*) for audit quality and create *h_aud1*, which takes the value one if *ln_audfee* is greater than the median, and zero otherwise. We then run Eq. (2) for each of the subsamples. If better governance results in more efficient ICM investments, $\beta_3$ will be positive (negative) only for the high (low) governance subsamples.

We use the Newey and West (1987) correction for standard errors for all our tests and aggregate the year-wise cross-sectional estimates using the Fama and MacBeth (1973) methodology. We also control for industry-fixed effects. All our continuous variables are winsorized at the top and bottom 1 percent.

## Results

### Descriptive statistics and univariate tests

Table 3 presents the descriptive statistics for all our variables. Panel A presents the statistics for the whole sample, while Panel B displays it by firm type (giver or taker). In Panel A, we find that 44% of our sample are *giver* firms, i.e., invest in ICM. Profit efficiency varies from 0.01 (least efficient) to 1 (most efficient). While insider ownership ranges from zero to 90%, the average is 50.32%. In our sample, 63% of firm years belong to business groups.

Panel B, Table 3 shows that the mean and median profit efficiency is lower for givers. On average, insiders do not have a majority stake (~49%) in givers but have a majority stake in takers (~51%). Givers are larger but younger. They also have a more tangible asset base and enjoy a lower cost of debt capital (7.7% vs. 9.8%). These differences are significant, as found in unreported univariate tests.

Table 4 presents the correlation coefficients for some of our key variables. While operating and profit efficiency are positively correlated, the correlation is 0.65 indicating the significance of non-operating activities like financing and investing in overall profit efficiency. Givers have significantly more property, plant and equipment and significantly lesser cost of debt, as was also indicated by the descriptive statistics.

### Multivariate tests

Table 5 (Columns 1 and 2) presents the results for hypothesis 1. We first run a base model without controlling for operating efficiency and find that investing firms (*giver*) have significantly lower profit efficiency. The coefficient for *giver* is -0.044, significant at 1% level. When we add operating efficiency (*eff_oi*) as a control variable, givers still have significantly lower profit efficiency with a coefficient of −0.022 (significant at 5% level). The adjusted $R^2$ is 62.4%.

**Table 3** Descriptive statistics.

| Variable | Panel A | | | | Panel B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Giver | | | | Taker | | | |
| | N | Mean | Median | Std Dev | N | Mean | Median | Std Dev | N | Mean | Median | Std Dev |
| eff_ni | 1242 | 0.80 | 0.93 | 0.25 | 546 | 0.79 | 0.92 | 0.26 | 696 | 0.81 | 0.94 | 0.25 |
| eff_oi | 1241 | 0.80 | 0.95 | 0.25 | 545 | 0.80 | 0.93 | 0.25 | 696 | 0.81 | 0.97 | 0.25 |
| d_netin | 1242 | 0.01 | 0.00 | 0.06 | 546 | 0.03 | 0.01 | 0.08 | 696 | -0.01 | 0.00 | 0.04 |
| giver | 1242 | 0.44 | 0.00 | 0.50 | 546 | 1.00 | 1.00 | 0.00 | 696 | 0.00 | 0.00 | 0.00 |
| own | 1208 | 0.50 | 0.50 | 0.18 | 538 | 0.50 | 0.50 | 0.19 | 670 | 0.51 | 0.51 | 0.18 |
| h_own | 1208 | 0.47 | 0.00 | 0.50 | 538 | 0.47 | 0.00 | 0.50 | 670 | 0.47 | 0.00 | 0.50 |
| bus_grp | 1242 | 0.62 | 1.00 | 0.49 | 546 | 0.66 | 1.00 | 0.48 | 696 | 0.59 | 1.00 | 0.49 |
| lag_tobin | 1193 | 1.39 | 1.06 | 0.94 | 525 | 1.51 | 1.15 | 1.01 | 668 | 1.29 | 1.00 | 0.87 |
| age | 1242 | 45.95 | 41.00 | 21.65 | 546 | 44.72 | 37.00 | 22.05 | 696 | 46.91 | 42.00 | 21.29 |
| size | 1242 | 8.54 | 8.57 | 1.71 | 546 | 8.93 | 8.99 | 1.73 | 696 | 8.23 | 8.11 | 1.63 |
| log_empl | 1242 | 7.04 | 6.99 | 1.46 | 546 | 7.35 | 7.38 | 1.42 | 696 | 6.80 | 6.80 | 1.45 |
| lev | 1242 | 0.32 | 0.30 | 0.19 | 546 | 0.32 | 0.30 | 0.19 | 696 | 0.32 | 0.31 | 0.19 |
| roa | 1242 | 0.06 | 0.05 | 0.08 | 546 | 0.07 | 0.06 | 0.07 | 696 | 0.05 | 0.05 | 0.08 |
| cfo_ta | 1235 | 0.08 | 0.08 | 0.11 | 545 | 0.08 | 0.08 | 0.11 | 690 | 0.08 | 0.08 | 0.11 |
| invs | 1202 | 0.13 | 0.06 | 0.17 | 537 | 0.16 | 0.10 | 0.17 | 665 | 0.11 | 0.04 | 0.15 |
| inst_pct | 1208 | 14.10 | 9.93 | 14.44 | 538 | 16.32 | 12.74 | 15.39 | 670 | 12.32 | 7.50 | 13.38 |
| B4 | 1242 | 0.31 | 0.00 | 0.46 | 546 | 0.33 | 0.00 | 0.47 | 696 | 0.30 | 0.00 | 0.46 |
| ppe | 1242 | 8,706.86 | 2,008.40 | 19,295.53 | 546 | 11,859.90 | 3,154.50 | 23,871.70 | 696 | 6,233.35 | 1,586.30 | 14,283.20 |
| oth_asset | 1238 | 10,509.48 | 1,934.70 | 25,590.27 | 542 | 14,369.26 | 3,588.55 | 29,936.12 | 696 | 7,503.74 | 1,352.10 | 21,149.44 |
| t_exp | 1242 | 16,769.92 | 3,000.77 | 37,521.31 | 546 | 23,724.03 | 6,073.71 | 46,083.14 | 696 | 11,314.54 | 1,966.38 | 27,942.11 |
| t_debt | 1242 | 9,432.93 | 1,204.80 | 48,782.33 | 546 | 16,205.85 | 1,969.50 | 71,875.39 | 696 | 4,119.68 | 837.55 | 11,569.18 |
| div_yield | 914 | 0.03 | 0.02 | 0.03 | 437 | 0.03 | 0.02 | 0.03 | 477 | 0.03 | 0.02 | 0.03 |
| kd | 1236 | 0.10 | 0.09 | 0.07 | 544 | 0.09 | 0.08 | 0.07 | 692 | 0.10 | 0.09 | 0.07 |
| log_audfee | 908 | −0.48 | −0.36 | 1.26 | 419 | −0.29 | −0.22 | 1.27 | 489 | −0.64 | −0.69 | 1.24 |

*Note*: Panel A is for the full sample, while Panel B is split by subsamples based on whether funds are invested (giver) or received (taker).

**Table 4** Correlation coefficients.

| | *eff_ni* | *eff_oi* | *giver* | *own* | *inst* | *B4* | *ppe* | *kd* |
|---|---|---|---|---|---|---|---|---|
| *eff_ni* | 1 | 0.65*** | −0.05 | −0.05* | 0.09*** | −0.03 | 0.11*** | 0.06** |
| *eff_oi* | 0.65*** | 1 | −0.02 | −0.04 | 0.12*** | −0.03 | 0.14*** | 0.07** |
| *giver* | −0.05 | −0.02 | 1 | −0.04 | 0.14*** | 0.04 | 0.14*** | −0.07** |
| *own* | −0.05* | −0.04 | −0.04 | 1 | −0.48*** | −0.06** | −0.23*** | −0.07** |
| *inst* | 0.09*** | 0.12*** | 0.14*** | −0.48*** | 1 | 0.39*** | 0.43*** | −0.07** |
| *B4* | −0.03 | −0.03 | 0.04 | −0.06** | 0.39*** | 1 | 0.14*** | −0.03 |
| *ppe* | 0.11*** | 0.14*** | 0.14*** | −0.23*** | 0.43*** | 0.14*** | 1 | −0.07** |
| *kd* | 0.06** | 0.07** | −0.07** | −0.07** | −0.07** | −0.03 | −0.07** | 1 |

*Note*: ***, ** and * indicate that the coefficient is significant at the 1%, 5%, and 10% levels, respectively.

In Column 3 of Table 5, we test hypothesis 2 using Eq. (2) with ownership included. Our key variable of interest is the interaction term between ownership and giver. We find that, as hypothesised, givers have lower profit efficiency ($\beta_1$), but this reverses when givers are insider controlled, i.e., high insider owner givers have higher profit efficiency ($\beta_3$). The interaction term (*h_own*giver*) displays a coefficient of 0.050, significant at 1%, while *giver* displays a coefficient of −0.033, significant at 1% as well. This implies that high insider owner firms contributing to ICM make more efficient investments. The adjusted $R^2$ improves to 63.5% when we include ownership variables.

Next, we refine our efficiency tests using monitoring variables. The results for this (hypothesis 3) are presented in Table 6. As stated in Section 3.2.2, we create subsamples based on median splits of two monitoring variables: institutional shareholding (*inst*) and audit quality (*aud*). For both variables, we find that only when monitoring is high do insider-owned firms make more efficient investments. The coefficient for the interaction term $\beta_3$ is positive in columns 1 (*h_inst*; 0.078, significant at 1% level) and 3 (*h_aud*; 0.163, significant at 5% level). The same coefficient is negative or insignificant when monitoring is low. The adjusted $R^2$ further improves when we consider the effect of monitoring.

## Additional tests

We also run the above tests using different proxies of the key independent variables, and our results remain qualitatively similar. In additional analysis, we examine how investors react to internal capital market investments. For this, we run Eq. (2) with annual stock returns (*annret*) as the dependent variable instead of *eff_ni*. We find that while investors do not penalise *giver* firms ($\beta_1$), they react negatively to high insider-owned *giver* firms ($\beta_3$). This is despite investments by such firms being positively associated with profit efficiency (refer to hypothesis 2 results in Table 4). Moreover, this negative reaction exceeds the penalty applied to high insider-owned firms ($\beta_2$). We provide an extract of these results in Table 7.

## Discussion

The analysis yields several interesting insights for various business stakeholders. First, *giver* firms have significantly higher property, plant and equipment and lower cost of debt. This implies that business groups use firms with more tangible assets and are, therefore, able to raise cheaper debt as *giver* firms. This is important for lenders to understand when doling out loans to group firms since funds may be invested in other group firms and not necessarily in their own operations. This is also important for investors, particularly minority investors (shareholders) when taking investment decisions since *giver* firms may be prone to making inefficient group investments. The fact that the *giver* firms have lower average profit efficiencies than taker firms is also a significant input for lenders and investors. Second, the internal capital market investments reduce the net profit efficiency of the *giver* firms of a business group, indicating inefficiency. However, investments made by the *giver* firms are more efficient when the firm has a higher proportion of insider ownership. It signifies that the insiders are more cautious about their wealth, particularly where insiders have a higher stake. Therefore, higher insider-owned group firms may be making more efficient inter-firm investments. Finally, better governance and a strong monitoring system raise the efficiency of the insider-owned *giver* firms of a business group. This is an important input for lenders, investors, and policymakers.

In summary, internal capital market investments are efficiency-reducing, particularly for firms where insiders have lesser stakes, i.e., outsiders have higher stakes. This has implications for policymakers who should demand more transparency for such investments, lenders of diversely-held group firms, and investors who should be wary of the impact such investments have on their returns (both dividend and capital gains).

## Conclusion

In this work, using a novel two-stage empirical approach, we evaluate the profit efficiency of ICM—a fundamental aspect of multi-firm group-like organisation structures. This is a significant area of study, specifically because the business group-based ICM literature borrows heavily from conglomerate literature. However, capital reallocation within groups happens across separate legal entities with different external stakeholders, unlike in conglomerates, where all decisions are internal to the firm. So the external stakeholders are the same.

We add significantly to the existing knowledge on ICM within business groups by focusing on (a) profit (operating and overall) efficiency instead of the oft-used investment efficiency and (b) the investing or the giver firm instead of

**Table 5** Efficiency of ICM investments and the effect of insider ownership (Hypotheses 1 and 2).

| Variable | (1) *eff_ni* | (2) *eff_ni* | (3) *eff_ni* | (4) *eff_ni* |
|---|---|---|---|---|
| Intercept | 0.930*** | 0.569*** | 0.564*** | 0.516*** |
| | [14.47] | [7.09] | [6.73] | [6.18] |
| ***giver*** | ***−0.044**** | ***−0.022**** | ***−0.032**** | ***−0.033**** |
| | ***[−6.98]*** | ***[−2.92]*** | ***[−3.62]*** | ***[−4.43]*** |
| h_own | | | −0.008 | 0.110* |
| | | | [−1.24] | [1.91] |
| ***hown_giver*** | | | ***0.019**** | ***0.050**** |
| | | | ***[2.69]*** | ***[3.44]*** |
| eff_oi | | 0.623*** | 0.621*** | 0.657*** |
| | | [29.34] | [30.86] | [26.65] |
| lag_tobin | 0.006 | 0.014** | 0.014** | 0.058*** |
| | [0.81] | [2.56] | [2.59] | [3.33] |
| age | −0.001*** | −0.001** | −0.001** | −0.001* |
| | [−4.58] | [−2.82] | [−2.69] | [−2.20] |
| size | −0.003 | −0.032** | −0.031** | −0.048*** |
| | [−0.33] | [−2.90] | [−2.62] | [−3.34] |
| log_empl | −0.026*** | −0.002 | −0.002 | 0.004 |
| | [−3.55] | [−0.25] | [−0.32] | [0.97] |
| lev | −0.204*** | −0.147*** | −0.147*** | 0.014 |
| | [−7.88] | [−5.41] | [−5.69] | [0.35] |
| roa | 1.408*** | 0.369*** | 0.385*** | 0.18 |
| | [14.24] | [3.28] | [3.34] | [1.17] |
| cfo_ta | 0.178** | 0.104* | 0.090* | 0.286 |
| | [3.23] | [2.14] | [1.88] | [1.76] |
| invs | 0.126*** | 0.109*** | 0.110*** | 0.212*** |
| | [8.45] | [3.53] | [3.70] | [7.91] |
| inst_pct | 0.002*** | 0.002** | 0.002** | 0.001 |
| | [5.64] | [3.25] | [2.48] | [1.74] |
| B4 | −0.050** | −0.014 | −0.013 | −0.031** |
| | [−2.84] | [−1.67] | [−1.62] | [−2.98] |
| hown*effoi | | | | −0.151 |
| | | | | [−1.64] |
| hown*lag_tobin | | | | −0.100** |
| | | | | [−2.63] |
| hown*age | | | | 0 |
| | | | | [−0.92] |
| hown*size | | | | 0.022*** |
| | | | | [8.80] |
| hown*log_empl | | | | −0.004 |
| | | | | [−0.35] |
| hown*lev | | | | −0.256*** |
| | | | | [−3.83] |
| hown*roa | | | | 0.904 |
| | | | | [1.52] |
| hown*cfo_ta | | | | −0.247 |
| | | | | [−1.63] |
| hown*invs | | | | −0.150*** |
| | | | | [−4.61] |
| hown*inst_pct | | | | 0.002 |
| | | | | [1.68] |
| hown_b4 | | | | 0.003 |
| | | | | [0.15] |
| Adj. Rsq | 0.372 | 0.624 | 0.623 | 0.635 |
| Obs | 1135 | 1135 | 1135 | 1135 |

*Note*: Column 1 is the base model to examine the association between being a giver and profit efficiency. Column 2 also includes operating efficiency as an additional control variable. Columns 3 and 4 include the moderating effect of insider ownership, with the latter also including all control variables interacted with ownership (Basu & Sen, 2015). Newey-West t-statistics are presented below the coefficients; ***, ** and * indicate that the coefficient is significant at the 1%, 5%, and 10% levels, respectively. The slopes and adjusted R-squares reported above are the averages of the annual cross-sectional regressions (Fama-MacBeth); the total observations are also reported.

**Table 6** Impact of monitoring/governance on ICM efficiency (Hypothesis 3).

| Dependent: *eff_ni* Sub-sample | (1) *H_inst* | (2) *L_inst* | (3) *H_aud* | (4) *L_aud* |
|---|---|---|---|---|
| Intercept | 0.368*** | 1.592*** | 0.166** | 0.585*** |
| | [4.33] | [3.90] | [2.87] | [4.99] |
| giver | −0.054*** | 0.162*** | −0.086*** | −0.019* |
| | [−4.08] | [4.64] | [−4.09] | [−1.88] |
| h_own | −0.537* | −0.697** | −0.58 | 0.240** |
| | [−1.96] | [−2.28] | [−0.97] | [2.46] |
| ***hown_giver*** | ***0.078**** | ***−0.153**** | ***0.163**** | ***0.069*** |
| | ***[3.56]*** | ***[−2.85]*** | ***[2.86]*** | ***[1.16]*** |
| eff_oi | 0.692*** | 0.108 | 0.693*** | 0.599*** |
| | [31.06] | [0.58] | [8.87] | [13.58] |
| lag_tobin | 0.042 | −0.187 | 0.038 | 0.054** |
| | [1.83] | [−0.94] | [1.58] | [2.75] |
| age | −0.001** | −0.005* | −0.001*** | −0.001 |
| | [−2.94] | [−1.90] | [−3.57] | [−1.04] |
| size | −0.044 | −0.072* | −0.029* | −0.046* |
| | [−1.57] | [−2.16] | [−1.97] | [−1.92] |
| log_empl | 0.005 | −0.021 | 0.03 | −0.007 |
| | [0.36] | [−0.24] | [1.78] | [−0.37] |
| lev | 0.154 | 0.197* | 0.047 | 0.098* |
| | [1.27] | [1.89] | [0.60] | [2.05] |
| roa | 0.880*** | 0.016 | 0.834*** | −0.204 |
| | [3.60] | [0.02] | [4.90] | [−1.32] |
| cfo_ta | 0.343 | 1.187** | −0.004 | 0.482** |
| | [1.20] | [3.04] | [−0.02] | [2.26] |
| invs | 0.254*** | 0.767 | 0.212*** | 0.274* |
| | [3.54] | [1.67] | [8.18] | [1.96] |
| B4 | −0.032 | −0.123 | −0.001 | 0.002* |
| | [−1.48] | [−1.44] | [−0.64] | [1.88] |
| hown*effoi | 0.132 | 0.236 | −0.365 | 0.088 |
| | [1.02] | [1.30] | [−0.83] | [0.79] |
| hown*lag_tobin | 0.06 | 0.059 | −0.023** | −0.118*** |
| | [1.36] | [0.40] | [−2.49] | [−4.96] |
| hown*age | 0 | 0.004 | 0.005 | −0.001 |
| | [0.14] | [1.32] | [1.22] | [−0.39] |
| hown*size | −0.154 | 0.031 | 0.228 | −0.029 |
| | [−0.78] | [1.21] | [1.28] | [−1.71] |
| hown*log_empl | 0.215 | 0.045 | −0.137 | 0.019 |
| | [0.95] | [0.78] | [−1.58] | [1.10] |
| hown*lev | −0.094 | −0.495** | −0.504 | −0.330** |
| | [−0.43] | [−3.06] | [−1.65] | [−2.37] |
| hown*roa | −0.097 | 0.906 | 0.203 | −0.364 |
| | [−0.41] | [1.51] | [0.40] | [−0.72] |
| hown*cfo_ta | 0.002 | −0.999** | −1.823 | −0.442* |
| | [0.01] | [−3.01] | [−1.21] | [−2.03] |
| hown*invs | −0.200*** | −0.784* | 0.008 | −0.406 |
| | [−4.28] | [−1.91] | [0.04] | [−1.20] |
| hown*b4 | −0.011 | 0.045 | −0.008 | 0.004 |
| | [−0.17] | [1.01] | [−1.78] | [0.97] |
| Adj. Rsq | 0.639 | 0.653 | 0.634 | 0.658 |
| Obs | 686 | 449 | 560 | 575 |

*Note*: The model in Column 4 of Table 4 is repeated based on high or low monitoring levels, with columns 1 and 2 displaying results for institutional shareholding and columns 3 and 4 for auditing. Newey-West t-statistics are presented below the coefficients; ***, ** and * indicate that the coefficient is significant at the 1%, 5%, and 10% levels, respectively. The slopes and adjusted R-squares reported above are the averages of the annual cross-sectional regressions (Fama-MacBeth); the total observations are also reported.

the investee or taker firm. We also add more nuances to this understanding by examining how insider ownership and governance alter ICM investments and the profit efficiency of firms. We also make a methodological contribution by

**Table 7** Impact of ICM on stock returns.

| Dependent Variable | annret | annret | annret |
|---|---|---|---|
| Intercept | 0.923*** | 0.940*** | 0.878*** |
| | [3.29] | [3.59] | [3.81] |
| giver | 0.065 | 0.07 | 0.082* |
| | [1.33] | [1.54] | [1.87] |
| h_own | −0.921*** | −1.030*** | −0.996*** |
| | [−3.53] | [−3.74] | [−3.99] |
| ***hown_giver*** | ***−0.297**** | ***−0.297**** | ***−0.299**** |
| | ***[−5.24]*** | ***[−5.28]*** | ***[−5.13]*** |
| eff_ni | | 0.015 | 0.16 |
| | | [0.21] | [1.60] |
| Controls | Yes | Yes | Yes |
| hown*Controls | Yes | Yes | Yes |
| Adj. Rsq | 0.25 | 0.255 | 0.252 |
| Obs | 1135 | 1135 | 1135 |

*Note*: Newey-West t-statistics are presented below the coefficients; ***, ** and * indicate that the coefficient is significant at the 1%, 5%, and 10% levels, respectively. The slopes and adjusted R-squares reported above are the averages of the annual cross-sectional regressions (Fama-MacBeth); the total observations are also reported.

providing an accounting and finance application of a modified VRS-SORM-DEA in determining our profit efficiency scores. We then use this profit efficiency estimate within a multivariate regression framework to examine whether ICM investments are profit efficient and impacted by insider ownership and monitoring.

Our analysis reveals the profit inefficiency of ICM investments and heterogeneity in efficiency across firms. When high insider-owned firms make ICM investments, they are efficiency-enhancing, especially when monitoring is strong. This indicates that insiders are more cautious about their wealth since profit efficiency is higher where insider stakes are higher. However, inefficient ICM investments are made by group firms where insider stakes are lower. This hurts outsider shareholders – institutional and minority. This is also reflected in the a) change in such expropriating behaviour when monitoring is stronger and b) negative returns experienced by high insider-owned firms.

This work opens several interesting avenues. First, applying other DEA models such as MSBM and RDM, or aggregating different DEA models to determine a single efficiency score of the firms in a business group may be an interesting exploration. Second, this work can be extended to other developed and developing economies to obtain context-specific insights, more from markets that are not bank-dependent for funds and where insider ownership behaves differently. Third, the study can be extended to explore the effect of factors such as family ownership, top management role, and institutional investors on the profit efficiency of the investing and receiving firms. Finally, future researchers can investigate the gaps between operating and net profit efficiency.

## Funding

Not applicable.

## Availability of data and material

Proprietary data available from paid sources (Prowess, CMIE).

## Code availability

Can be made available on request.

## Declaration of Competing Interest

Not applicable.

## Acknowledgement

We thank the Associate Editor and anonymous reviewers for their helpful comments. All remaining errors are our own.

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