# Allocative Efficiency of Internal Capital Markets: Evidence from Equity Carve-outs by Diversified Firms

Valeriya Vitkova[a], Siyang Tian[b], and Sudi Sudarsanam[a, c]

[a]*Bayes Business School (formerly Cass)*
[b]*Southwestern University of Finance and Economics*
[c]*Cranfield University*

## Abstract

We examine whether equity carve-outs (ECOs) lead to improvements in the functioning of the internal capital markets (ICM) of diversified firms. Divestitures, including spin-offs, sell-offs, and equity carve-outs, can be employed by firms to improve allocative efficiency. Equity carve-outs, unlike other forms of divestiture, leave the parent's ICM largely intact but provide the opportunity to enhance internal and external corporate governance mechanisms that can improve the parent's ICM. Using a US sample of 354 equity carve-outs completed between 1980 and 2013, we find that the allocative efficiency of parents is augmented significantly following transaction completion. This increase in allocative efficiency is driven by improvements in both the external and internal governance characteristics of parent companies, consistent with the expectation that motivates equity carve-outs.

**JEL classification:** G32; G34

**Keywords: Internal Capital Markets, Equity Carve-outs, Corporate Governance, Investment Efficiency, Diversified Firms, Refocusing, Divestment, Propensity Score Matching, Endogeneity, Heckman Bias Correction**

Sudi Sudarsanam, Emeritus Professor of Finance & Corporate Control, Cranfield School of Management, UK and Senior Research Adviser, Mergers & Acquisitions Research Centre, Cass Business School, 106 Bunhill Row, London EC1Y 8TZ, United Kingdom. Telephone: +44 (0) 20 7040 5126. Email: p.s.sudarsanam@cranfield.ac.uk (Sudarsanam); Siyang Tian, Assistant Professor, Southwestern University of Finance and Economics, 555 Liutai Road, Chengdu, China, 610000. Email: sytian@swufe.edu.cn (Tian); Valeriya Vitkova, Faculty of Finance and Mergers & Acquisitions Research Centre, Cass Business School, 106 Bunhill Row, London EC1Y 8TZ, United Kingdom. Telephone: +44 (0) 20 7040 5126. Facsimile: +44 (0) 20 7040 5168. Email: Valeriya.Vitkova.2@city.ac.uk (Vitkova). We gratefully acknowledge the helpful comments from Pat Akey, Giacinta Cestone, Claudia Custodio, Viet Dang, Andrey Golubov, William Megginson, Anh Tran, Armen Hovakimian (Discussant), Thomas Moeller (Discussant), Helen Spiropoulos (Discussant) and conference and seminar participants in EFMA 2016, FMA 2016, PFMC 2018, University of Nottingham (Ningbo) and Bayes Business School (formerly Cass). Any shortcomings are our responsibility.

## 1. Introduction

Whether a conglomerate is an efficient organizational structure for a business has been a question debated by investors and scholars for many years. Many prior studies have demonstrated that the market valuation of conglomerates is at a discount to the aggregated individual values of their component businesses (Lang and Stulz, 1994; Lamont, 1997; Shin and Stulz, 1998; Rajan, Servaes, and Zingales, 2000; Ozbas and Scharfstein, 2010; Glaser, Lopez-de-silanes, Sautner, 2013). This undervaluation is generally attributed to the failure of the capital allocation function of the conglomerate, i.e., the failure of the Internal Capital Market (ICM). Theoretical models (Milgrom and Roberts, 1990; Scharfstein and Stein, 2000; Rajan et al., 2000; Stein, 2003) predict that, because of the rent-seeking behaviour on the part of divisional managers and their bargaining power, there is corporate socialism that provides life support to the weak divisions and starves the strong ones of investment funds, as well as the managerial preference to allocate capital according to organisational politics, rather than by any objective value-maximising criteria. Stein (1997) and Matsusaka and Nanda (2002) make the opposite theoretical prediction that conglomerates could allocate resources efficiently. Some of these authors also argue that the dysfunctionality of the ICM is due to factors such as the complexity and opacity of the parent's portfolio and asymmetry of information between the divisional managers and the top management as well as between top managers and shareholders. A stream of empirical papers document that poor corporate governance could be the possible explanation for the investment inefficiency (Lins and Servaes, 2002; Fauver, Houston, and Naranjo, 2003; Sautner and Villalonga, 2010; Hoechle, Schmid, Walter, and Yermack, 2012).

To address the putative causes of inefficiency in the parent's ICM, diversified firms have the option to undertake divestitures of segments of their business in the form of spin-off, sell-off, tracking stock, or equity carve-out (ECO). A sell-off is a sale of a business segment to another company, a spin-off is the floatation of the divested part on a stock exchange, with the distribution of the shares in that newly listed company to the shareholders of the parent, a tracking stock is a separate class of the parent stock that tracks the performance of a subsidiary of interest, and an ECO is the floatation of the divested part on a stock exchange, with the parent selling a minority of share ownership to outside investors. A

few studies have examined the direct impact of spin-offs and sell-offs on the allocative efficiency of the parent's ICM and reported significant impact (Gertner, Powers and Scharfstein, 2002; Dittmar and Shivdasani, 2003; Burch and Nanda, 2003; Ahn and Denis, 2004; and McNeil and Moore, 2005). Some of these studies have attributed the ICM improvement to various factors, including, in particular, improved governance at the parent level. Çolak and Whited (2007), unlike other prior studies, conclude that there is no significant improvement in the allocative efficiency of the parent's ICM following spin-offs and sell-offs, and attribute the observed improvement in prior studies to model misspecification that did not account for self-selection or endogeneity bias. The impact of ECOs on the ICM efficiency of parents and governance improvement caused by them have however received scant attention.

In this paper, we examine the efficiency of the ICM in a new and arguably more appropriate context, i.e., the ECO. Prior studies report the impact of ECOs only on the parent's shareholder value and the improvement in the parent's operating performance, drawing indirect inferences about the functioning of the parent's ICM. However, we believe that this approach is consistent with, but not necessarily corroborative of, an improvement in the parent's ICM (Vijh, 2002). Our investigation is, therefore, the first study to focus on the direct impact of ECOs on the allocative efficiency of the parent's ICM, a major financial rationale for diversification. In contrast to other forms of divestiture, the advantage of using the ECO event for assessing the ICM efficiency of the diversified parent is that ECOs directly address some of the putative causes of ICM inefficiency. Independent monitoring of the carved-out segment by analysts and investors can mitigate the agency conflict between different managerial levels and between the top management and the parent's shareholders.

An ECO also allows the parent to augment its corporate focus and provide the offspring with greater autonomy, while the two business entities continue to maintain a strategic relation if, in the product markets served by them, such a relationship may yield continued competitive advantage (Jain, Kini, and Shenoy, 2011). Maintaining such a relation may be accomplished by the parent through its continued equity investment and this opportunity makes ECOs a more attractive divestiture mechanism than spin-offs (Fee, Hadlock, and Thomas, 2006; Jain et al., 2011). The external capital market also provides valuable information to the parent regarding the prospects of the two businesses as separate

units (Nanda, 1991; Slovin, Sushka, and Ferraro, 1995). As a result, and unlike in spin-offs, sell-offs, and tracking stocks, monitoring of the offspring by the equity capital markets also has a healthy feedback effect on the governance and efficiency of the parent's ICM. The ECO generally provides a mechanism to align the interests of top management in the newly formed company and the shareholders by facilitating managerial incentives based on stock market performance (Holmstrom and Tirole, 1993). Upon announcement of ECOs, the market reacts positively, and there is a positive abnormal return to the parent firm (Dasilas and Leventis, 2018). For these reasons, we hypothesise that ECOs can lead to a significant increase in the parent's ICM efficiency and that improvements in the internal and external governance of the parent contribute significantly to such an increase.

To test these predictions, we use a US sample of ECOs completed between 1980 and 2013. We compare the allocative efficiency of the parent firms before and after the completion of the ECO and assess the statistical significance of any improvement. We employ three different metrics of ICM efficiency that were pioneered by Rajan et al. (2000). Two are direct measures of capital allocation (relative investment ratio, *RINV*, and relative value added, *RVA*) and one is an indirect measure reflecting the change in the parent company's valuation (excess value, *EXVAL*). We also consider the endogeneity that can be associated with restructuring events. Any observed improvement in allocative efficiency following restructuring can potentially be linked to the idiosyncratic characteristics of the conglomerate parent rather than the restructuring *per se*. This calls into question studies that point to inefficient ICMs prior to restructuring based on the evidence of post-restructuring increases in allocative efficiency. To address the issue of endogeneity, our primary methodology employs the propensity score matching (PSM) estimator (Dehejia and Wahba, 2002). As an additional test of the robustness of our results, we analyse the change in allocative efficiency by using the Heckman (1979) model. Our results based on the PSM estimator demonstrate that ECOs lead to a significant improvement in the allocative efficiency of parent firms, consistent with ICM inefficiency in these firms prior to ECOs. We observe similar results using the Heckman methodology.

To test whether the improvements in the functioning of the parent's ICM are driven by enhanced quality of corporate governance in the parent firms, we examine the changes in the internal

and external corporate governance characteristics of these firms. Specifically, we analyse internal corporate governance characteristics such as board duality i.e., non-separation of the board chairman and CEO roles, board size, board independence, CEO compensation mix, and CEO tenure. The external governance characteristics that we investigate include the degree of analyst coverage, the accuracy of the analysts' forecasts, the number of institutional investors on the share register of the parent firm, the percentage of shares held by institutional investors, and the concentration of their ownership. We show that the analyst coverage and institutional shareholding, in terms of the number of investors and percentage of shares held of both parent and offspring firms, increases significantly following the ECO, which suggests that both the parent and carved-out unit are exposed to greater stock market scrutiny and greater transparency in the functioning of the ICM. We also find improvements in many internal governance characteristics of the parent firms, such as greater board independence.

More importantly, we find evidence that the improvement in the parent's allocative efficiency is significantly higher in the firms which experience such positive changes in their internal and external governance characteristics. Over the two years following ECO relative to two years before, we find that higher analyst coverage leads to more extensive improvements in the parent's *RINV* and *RVA*. Increased board independence enhances RVA. Increased shareholding by institutional investors improves RINV. In terms of internal governance changes, increased board independence (RVA), smaller board size (RINV, RVA, and EXVAL), lower cash compensation (RVA and EXVAL), higher stock-based compensation (RINV and EXVAL) significantly improve the allocative efficiency metrics indicated in parentheses. Board duality improves RINV. Longer CEO tenure improves both RINV and RVA, suggesting that such extension, far from implying deeper entrenchment, is beneficial to the parents under the more rigorous governance regime heralded by the ECO. Over the longer 3-year period following ECO, wider analyst coverage, higher institutional shareholding, smaller board size, longer CEO tenure, and higher stock compensation improve efficiency. Thus, the efficiency improvements achieved through governance improvements over the 2-year window are not eroded but sustained over a longer period. These results have important implications for corporate managers who seek to improve

the allocative efficiency of their firms by demonstrating that ECO could be a very effective restructuring mechanism.

Our paper contributes evidence bearing on the issue of whether corporate restructuring, and which type of restructuring, improve the allocative efficiency of parent firms. Since earlier studies addressing these questions in the context of spin-offs and sell-offs have yielded inconclusive evidence (see e.g. Ahn and Denis, 2004; Çolak and Whited, 2007), our study uses equity carve-out which is arguably a more appropriate corporate restructuring event to investigate the implications of divestiture and provide new evidence on the efficiency improvement following such an event. Earlier studies that investigated ECOs provided at best only indirect evidence on the ICM efficiency improvement, but we provide direct evidence (see e.g., Vijh, 2002). Most of these earlier studies did not address the issue of the endogeneity of the restructuring decision but our study accounts for endogeneity and yields significant direct evidence of ICM improvement which is triggered by the ECO. Our evidence of allocative efficiency enhancement from ECOs is more conclusive than the ambiguous evidence from spin-offs and sell-offs in prior studies. We thus demonstrate that extrapolating the conclusions from such studies to ECOs may be unwarranted and unwise. We also provide strong evidence that improvements in parent ICM are driven by improvements in internal and external governance structures of parent firms, consistent with a major motivation behind ECOs.

This paper is organised as follows: Section 2 provides a review of the literature on restructuring and allocative efficiency as well as the different implications for the ICM following carve-outs and other types of restructuring; Section 3 discusses the data sources, describes the methodology and provides a full list of explanatory variables; Section 4 presents the empirical tests of the hypotheses; and the conclusions are presented in Section 5.

## 2. Literature Review and Hypotheses

### 2.1 ICM

One of the important rationales for the conglomerate or diversified business portfolio held by companies is that it allows them to allocate their scarce capital more efficiently among the businesses

in their portfolio than if these businesses depended on the external capital market for debt or equity. The conglomerate head office is expected to function as a capital market playing an allocative role and, as a result, this market is referred to as the internal capital market (ICM). Such a market is said to have an information advantage over investors in the conventional external capital market, which allows the conglomerate head office to select potential winners and allocate capital to the highest valued investment opportunities (Stein, 1997; Khanna and Tice, 2001; Guedj and Scharfstein, 2004; Anjos and Fracassi, 2011).

This benign view of the ICM efficiency has been challenged by several scholars. Some studies have provided evidence that conglomerates in the stock market trade at a discount to the value of a portfolio composed of the individual segments assuming such segments were traded as stand-alone (or pure-play) entities (Berger and Ofek, 1995). The difference in value between the conglomerate and the portfolio of businesses as stand-alone entities is referred to as the conglomerate or diversification discount. Several explanations have been offered for the existence of the diversification discount. Among them is a dysfunctionality of the ICM arising from both the complexity and diversity of the firm's organization, internal organizational politics and the agency conflicts between the top managers and divisional managers (Milgrom and Roberts, 1990; Scharfstein, 1998; Rajan et al., 2000; Scharfstein and Stein, 2000). Previous empirical papers document that poor corporate governance could explain, at least partly, the inefficiency of internal capital markets in Germany (Sautner and Villalonga, 2010), the U.S. (Hechle, Schimid, Walter, and Yermack, 2012), and cross-country studies (Lins and Servaes, 1999; Fauver, Houston, and Naranjo, 2003). A corollary to this argument is that any restructuring of the conglomerate's portfolio that results in greater focus or reduced complexity should improve the efficiency of the ICM. One should therefore observe a significant improvement in the allocative efficiency of the parent following such restructuring. Similarly, where the ICM inefficiency is caused by the failure of internal governance to prevent capital misallocation due to rent seeking, misaligned incentives, corporate socialism etc., one should observe a significant improvement in allocative efficiency when governance is improved following a restructuring.

## 2.2 Equity Carve-out and ICM

Diversified firms undertake divestments of segments of their business to cure one or more of the putative causes of the dysfunctionality of the parent's ICM and the diversification discount referred to above. The parent firm's shareholders experience significant positive returns when divestments in the form of spin-offs, sell-off, tracking stock and ECO are announced, indicating that they are perceived by investors as value-creating decisions (Comment and Jarrell, 1995; Seward and Walsh, 1996, Mulherin and Boone, 2000; Chemmanur and Paelis, 2001; Billet and Vijh, 2004; Lee and Madhavan, 2010; Desai, Klock, and Mansi, 2011; Dereeper and Mashwani, 2013; Dasilas and Leventis, 2018). Other studies have reported improved operating performance of the parents following divestments (John and Ofek, 1995; Maksimovic and Phillips, 2001; Denis and Shome, 2005; Klein and Rosenfeld, 2010). These results are consistent with an improvement in the underlying parent's ICM efficiency and a reduction in the diversification discount. They also imply a pre-divestment allocative inefficiency of the parent. Chemmanur and Paeglis (2001), however, report that over the two-year period following spin-offs, ECOs and tracking stock, the parent shareholders experience negative returns of 2.7%, 57.8% and 28.6% respectively. In the case of tracking stock, the offspring experiences -43.9%.

Other studies on divestments have empirically tested the inefficiency of the conglomerate's ICM prior to restructuring by examining the post-restructuring data of the parent and offspring (Ahn and Denis, 2004). This approach has been held to be methodologically superior to the prior approach of using a stand-alone single segment investment opportunity as a proxy for the unobservable investment opportunity of the segments of the diversified firm (Lang and Stulz, 1994). Critics of this proxy-based approach to measuring the segment's investment opportunity set have argued that it suffers from endogeneity bias since the conglomerate's acquisition of a segment is self-selected and based on its strategic considerations (Campa and Kedia, 2002). This approach is, however, affected by an endogeneity problem. Çolak and Whited (2007) assess whether the allocative efficiency of diversified firms improves significantly following a spin-off or a sell-off by controlling for the problems associated with endogeneity. In the former event, a business segment becomes a listed entity subject to independent scrutiny, but there are no direct implications for the efficiency of the parent's residual portfolio. In the

latter event, the business segment becomes part of the buyer's portfolio and is shielded from any independent monitoring. Any observed improvement in allocative efficiency following restructuring can potentially be linked to the idiosyncratic characteristics of the conglomerate rather than the restructuring *per se*. This calls into question studies that point to inefficient ICMs prior to restructuring based on the evidence of post-restructuring allocative efficiency improvement. In this paper, we also account for the endogenous nature of the ECO decision following the methodologies described in Dahejia and Wahba (2002) and Heckman (1979).

We noted that tracking stock was another form of restructuring, where the parent formed a separate subsidiary out of the businesses which, it considers, could benefit from a separate profile and greater transparency. Instead of floating off this subsidiary on the stock market, the parent issues a new class of its own stock to track the performance of the newly created subsidiary and gets this tracking stock listed on a stock market. However, ECO is a superior form of restructuring to tracking stock since the latter does not facilitate the same scale and type of internal and external corporate governance changes (Sudarsanam, 2010). Assessing how such changes impact on the ICM efficiency in the parent is a key objective of our study. None of the prior studies reviewed by Sudarsanam (2010) addresses the impact of tracking stock issue on the parent's ICM. We also note that tracking stocks are very rare and that firms have effectively ceased using this form of restructuring with the last new issue of tracking stock in 2001 (Davidson and Harper, 2014). These authors conclude that most corporations have realized that the costs associated with this type of restructuring outweigh the benefits. Given that corporates no longer use tracking stock and it is far less effective in achieving the parent's governance objectives, we do not consider tracking stock in our analysis.

The above empirical studies focusing on spin-offs and sell-offs cannot be extrapolated to assess the effectiveness of ECO in improving the parent ICM since the early studies are methodologically deficient. When such deficiency is remedied as in Çolak and Whited (2007), the results do not testify to any improvement. Such extrapolation is also inappropriate (1) when the implications of ECO for internal and external governance of parents and the offspring, and (2) the ability and scope for

maintaining important strategic relations between these firms, are substantially different from those that attend upon either spin-off or sell-off.

In this sense, the issue of whether diversified parents have dysfunctional ICMs and whether restructuring contributes to improvements in the allocative efficiency of the parent remains unresolved. This is particularly the case in the context of ECOs as a form of divestment. The ECO setting has superior conceptual and methodological properties over other forms of divestiture for such investigation. An ECO enables the parent to establish the offspring's value in a more transparent manner. In particular, the ECO reduces the information gap that exists between company insiders and the capital market participants (i.e. the company outsiders) thanks to the release of information about the offspring in the form of regulatory filings and annual financial statements (Desai et al., 2011). Nanda (1991), drawing upon Myers and Majluf (1984), however, models the ECO decision as opportunistic, designed and timed by the parent to exploit its information advantage as the insider over the investors in the ECM and sell stock in the overvalued offspring. Slovin et al. (1995), Slovin and Shushka (1998) and Powers (2003) report empirical evidence supportive of the Nanda model. Other studies challenging this information asymmetry model provide evidence that the observed shareholder value gains are supported by improvement in the operating performance of both the parent and the offspring (Vijh, 2002). Hulbert et al. (2002) argue that such operational improvement is inconsistent with the Nanda model of the parent exploiting overvaluation by external capital markets. In our study we focus on the operating performance of the parent as manifested in the improvement of the parent ICM functioning.

Cline, Garner, and Yore (2014) argue that diversified firms operating inefficient ICMs tend to avoid issuing new equity or debt since the external capital market generally discounts such issues. Such external capital market monitoring improves the ICM by means of a feedback loop from investors. Habib, Johnson, and Naik (1997) support the feedback argument in the context of spin-offs which, like ECOs, are subject to external capital market monitoring. In the ECO setting, however, the feedback is about both the offspring and the residual parent. Further, the need for a more transparent capital allocation between the two and the greater bargaining power of the offspring against the parent can improve allocative efficiency (Klein, Rosenfeld, and Beranek, 1991; Slovin and Shushka, 1998;

Hulbert, Miles and Woolridge, 2002; Boone, 2003; Triantis, 2002). The greater bargaining power of the offspring emanates from its new access to the external capital market and the constraint on any rent-seeking behaviour by the offspring's managers (Rajan et al., 2000; Scharfstein and Stein, 2000). To finance the capital investment needs of the offspring, the parent can choose from the options of either raising equity directly or through the offspring. This increased financing flexibility can also augment the efficiency of the ICM (Nanda, 1991; Slovin and Shushka, 1998).

At the same time, the carved-out entity can still enjoy most of the synergistic benefits arising from joint operations with the parent company. The extent of these synergistic benefits depends on the degree of control that the parent continues to maintain over the offspring. Given that the offspring is now a separately listed entity, it is not free to enter contracts or other arrangements that are structured in favour of the parent to the detriment of the shareholders in the offspring. However, the parent firm can employ a range of control levers such as majority ownership, control of the executive composition and control of the board of directors to receive favourable treatment. Thus, the parent can still reap the potential benefits of preserving the ICM, thereby enhancing its own value (Desai et al., 2011).

An additional benefit associated with ECOs is that they allow the different business segments comprising the residual portfolio of the parent as well as the offspring to be independently valued by analysts who have developed expertise in their respective industries. This is consistent with the literature, which shows that the number of covering analysts increases and their specialisation improves following ECOs (Schipper and Smith, 1986; Slovin et al., 1995; Gilson, Healy, Noe and Palepu, 2001). Moreover, the management of the offspring can be rewarded with its own stock following ECO, thereby enhancing the alignment of the interest of managers and shareholders (Holmstrom and Tirole, 1993; Schipper and Smith, 1986). There is also evidence that the adoption of segment-based incentive plans could exert a positive influence on the quality of employees that either the offspring or the parent can hire (Kumar and Sopariwala, 1992). Such incentive alignment enhances both the offspring's and parent's valuations. This channel of efficiency enhancement of the parent is not available in spin-offs and sell-offs since the divested segment has no bearing on the performance of the parent. Hulbert et al. (2002) argue that the incentive alignment of the managers of carved-out units through stock-based

compensation will incentivise both the carved-out and parent firms to improve their operating performance. Stock-based compensation is also likely to reward the parent's managers if their ECO decision is value-enhancing and results in higher market valuation of the parent, which should be the rationale behind such a decision. Such changes imposed by ECO could help to mitigate the poor corporate governance, which is considered as an important explanation for investment inefficiency (Hechle et al., 2012).

Given the above arguments, in the ECO setting, the financing and investment cash flows between the two entities are more transparent and more rigorously monitored by analysts and investors. As a result, investment decision processes are improved (Vijh, 2002; Hulbert et al., 2002). While this enhances the transparency and monitoring of the ICM, the parent's business scope is essentially unaffected, and this differentiates an ECO from a spin-off or a sell-off. The internal and external governance structures of both the parent and the offspring (such as board size and independence, institutional ownership, and level of analyst following), are expected to change because of the ECO. The potential decrease in information asymmetry and improvement in management incentive plans can enhance the quality of corporate governance of both the parent and offspring, thereby driving the observed improvement in the efficiency of the parent's ICM. Such improvement in corporate governance mechanisms is evidence that the expected divestment gains are likely to be the true motive for the ECO. The discussion presented in this section motivates the following hypotheses that we test in this study:

***H1: The allocative efficiency of the parent's ICM improves significantly following an ECO.***

***H2: The improvement in allocative efficiency of the parent's ICM is driven by improvements in the internal and external corporate governance mechanisms of the parent following the ECO.***

While we have argued above that improvement in the corporate governance of the offspring contributes to increasing the parent's ICM efficiency, this contribution is indirect, and this paper focuses on the direct impact of improvement in the parent's governance on its own ICM efficiency.

## 3. Sample and Methodology

### 3.1. Sample

To investigate the impact of ECOs on allocative efficiency and firm valuation we construct two different samples of companies based on US data: a sample of companies that carve out divisions (the *treatment* firms) and a sample of companies that do not perform any divestment activity (the *control* firms) over the entire sample period from 1980 to 2013. We match each ECO parent with a closely comparable control firm and the new regulation will affect all firms simultaneously and consistently. In this case, we assume the impact on investment efficiency of treatment firms and control firms would be μ. We then have the treatment effect of $\Delta\ RINV_{ECO\ Parent} + \mu - \Delta\ RINV_{Control\ Company} - \mu = \Delta\ RINV_{ECO\ Parent} - \Delta\ RINV_{Control\ Company}$.[1]

We obtain the sample of ECOs from the SDC Global New Issues Database and our initial sample consists of 1,328 parent firms that complete ECOs during the sample period. We exclude companies that operate in financial services industries with Standard Industry Classification (SIC) codes between 6000 and 6999, which reduces the sample of ECOs to 889. This is consistent with sample construction in previous papers (see e.g., Çolak and Whited, 2007) as the segment reporting in the financial industry is different from that of other industries. We exclude parent companies for which company- and segment-level data are not available following Çolak and Whited (2007). As a result, small operating units with no relevant financial data have been excluded from the analysis. Specifically, since we track each ECO over a 7-year period (i.e., from three years before to three years after the transaction year), we exclude companies that do not have relevant financial information over this period surrounding each ECO. Our final sample consists of 354 ECOs.

We obtain our sample of control companies from the most recent Compustat business information file. We exclude the firm-year observations that lack any of the financial information necessary to perform the matching procedures. We also remove from the control group companies with a changing number of segments during the sample period as this suggests some restructuring. Finally, we require that each control firm has more than one business segment, i.e., it is a diversified firm. These criteria result in a final sample of 3,695 control firms. From this control sample, we identify a matching

firm that did not perform an ECO but has characteristics similar to its ECO performing counterpart. To this end, we use the Dahejia and Wahba (2002) PSM matching procedure and a probit model of the likelihood of performing an ECO. Table 1 provides detailed definitions of the explanatory variables used in this study.

[Please Insert Table 1 about Here]

### 3.2. Measuring Allocative Efficiency of ICM Before and After ECO

We adopt two direct measures of allocative efficiency, namely, the relative investment ratio (*RINV*) and relative value added (*RVA*) (Rajan et al., 2000). We also employ an indirect measure of allocative efficiency, namely, *EXVAL* (Ahn and Denis, 2004). These correlation-based measures aim to capture the association between the level of investment and the investment opportunities across segments. The parent's investment programme is considered the more efficient, the greater the investment in the segments with the highest growth potential and investment opportunities. *RINV* measures the relative investment intensity in high growth versus low growth segments. *RVA* captures the sensitivity of industry-adjusted investment of a parent's segment to the industry median q ratio that is measured using the pure-play companies which operate in the given segment's industry. The numerator of q is calculated as the book value of assets minus book value of equity plus equity market capitalisation minus deferred taxes. The denominator of q equals the book value of assets. *EXVAL* captures the value of a conglomerate relative to a collection of single-segment companies in the industries corresponding to the conglomerate's segments. Appendix A1 describes the formulae used for calculating *RINV*, *RVA*, and *EXVAL*.

### 3.3. Treatment Effects Estimator

Our methodology accounts for the possible endogeneity that may arise when analysing the change in allocative efficiency of firms that decide to perform an ECO. In an observational sample such as ours, the assignment of firms to the ECO group (the *treatment* group) and to the non-ECO group (the *non-treatment* or *control* group) is not random and could be self-selected. This means that the treatment effect, i.e., the improvement in allocative efficiency of the parent's ICM, could be due to the

characteristics of the self-selecting firms rather than to the treatment *per se.* If the decision to carve out business operations is thus endogenous, companies that opt for it would have systematically different characteristics from those that decide not to. If the allocative efficiency of companies does improve following ECOs, and this improvement is attributable to the ECO event, then this treatment effect must be observable after controlling for such systematic differences. The average treatment effect is statistically estimated by building a control sample of companies displaying the same characteristics and thus the same propensity as the treated sample and then averaging the difference in allocative efficiency metrics between the treatment and matched control samples.

We use the matching estimator developed by Dehejia and Wahba (1999, 2002). All matching results are based on one nearest neighbour, i.e., the one with the closest propensity to a treated observation, selected from the control group. Hence this approach is called propensity score matching (PSM). In unreported results, we also perform matching based on alternative numbers of nearest neighbour control firms such as five and ten matched control peers, and our conclusions remain unchanged. We apply the methodology developed in Rosenbaum (2002) to test the sensitivity of our results to unobservable factors, not included in the probit model used to estimate the propensities, that could lead to biased PSM estimates.

Next, we estimate the treatment effects on each of our performance variables, i.e., the control sample-adjusted results. We calculate the average values of *RINV*, *RVA*, and *EXVAL* before and after each ECO for parent firms and their matched control firms. The *Difference in Difference (DinD)* treatment effect captures the average change in the performance variables relative to the average change in the control sample. Using *RINV* as an example, the variable *DinD* is defined as:

$$\Delta \text{ RINV}_{\text{ECO Parent}} - \Delta \text{ RINV}_{\text{Control Company}} \quad (1)$$

$\Delta$ RINV$_{\text{ECO Parent}}$ is the result of average after value subtracting the average before value for the parent firm while $\Delta$ RINV$_{\text{Control Company}}$ is for the matched control firm. The *DinD* estimator accounts for time-invariant unobservable heterogeneity between the treatment and control groups and it is similar to the first difference method in panel data. For the treatment effects, we also estimate level treatment effects

as the average post-ECO level of each of the three variables relative to the level in the control sample. We calculate the average values of RINV, RVA and EXVAL before and after each ECO, respectively. Specifically, we define the variable *Before* as the average for each conglomerate company over a period t-2 to t-1 (t-3 to t-1) years relative to the ECO year. For *Before*, it is invalid to adopt the level of RINV, RVA and EXVAL as controls. This is because there is no counterfactual group before the event in the level treatment effect estimation and these variables would be self-explained. The variable *After* is the average for each conglomerate company over a period t+1 to t+2 (t+1 to t+3) years around the ECO year, relative to the average of a matched sample of diversified firms using the PSM method. We define the variable *Change* as the difference between the variable values *After* and *Before*. To interpret the level treatment effect estimates, we look at the *change* which takes the pre-treatment level of variable of interest as the reference point. If the level treatment effects are not closer to the pre-treatment levels, namely, *Change* is significantly from zero and the sign of coefficient is positive, we could then document evidence of investment efficiency improvement. However, the level treatment effect estimator does not account for the time-invariant difference between the treatment and the control group and the interpretation should be cautious. It is less robust than the *DinD estimator*. When the variables *DinD* are significantly greater than zero, we interpret this result as an indication that the given improvement in allocative efficiency and valuation is driven by the ECO *per se* and not by the inherent characteristics of the ECO parents.

The PSM matching procedure requires the development of a probability model that estimates the likelihood of embarking on an ECO. The probit regression that we estimate is of the form:

$$\text{Probit (ECO)} = \alpha + \beta_n \text{Controls} + \varepsilon_n \qquad (2)$$

where the control variables are as defined in Table 1. To estimate the regression, we use two sub-samples of firms: the *treatment* sample of companies that perform ECOs and the control sample of companies that did not engage in any restructuring activity. The dependent variable assumes a value of one if the firm has carried out an ECO and zero otherwise.

As an alternative robustness test, we employ the Heckman (1979) procedure to correct for self-

selection. Villalonga (2004) applies the PSM methodology to the study of conglomerate discount. In this model, we estimate the average allocative efficiency before and after an ECO by running the following (Heckman) regression:

$$\Delta S_n(T_n) = \alpha + \beta_1 T_n + \beta_2 \text{InvMills} + \varepsilon_n \quad (3)$$

where α represents the average change in allocative efficiency in the sample of non-restructuring companies and the sum of $(\alpha+\beta_1)$ captures the average change in allocative efficiency in the ECO sample. ΔS is defined as the change in allocative efficiency and conglomerate valuation and $T_n$ is a dummy variable that is equal to one if the company performs a carve-out and zero otherwise. $\beta_2$ is defined as the coefficient of the variable used to adjust for self-selection bias in the Heckman regression. If the firm has self-selected to perform the restructuring and the decision thus is endogenous, $\varepsilon_i$ is correlated with ΔS and the estimate of $\beta_1$ will be biased. According to Heckman (1979), the issue of having a biased estimate is analogous to an omitted variable problem where the omitted variable is the inverse Mills Ratio (*InvMills*) that corresponds to the likelihood of performing ECO. To obtain a consistent estimate of $\beta_1$, we first need to estimate the *InvMills* with a probit model. We then include the estimated *InvMills* in Eq. (3). To present the results from the analysis based on the Heckman bias correction procedure, we define the variable *Heckman Treated* as the sum of $(\alpha+\beta_1)$ in Eq. (3). We also define the variable *Heckman Controls* as the coefficient corresponding to α in Eq. (3). Finally, we note that all tests in this study are performed with winzorised variables at the 1st and 99th percentile of the sample.

### 3.4. Modelling the Impact of Governance Changes on Allocative Efficiency

To examine whether ECO leads to enhanced corporate governance of the parent and offspring, we match the offspring and its parent firm with the BoardEx, Execucomp, and Factset databases. We replace any missing information from BoardEx and Execucomp by searching the Proxy Statements, 10K and Prospectuses filed by the parent and offspring firms. Internal corporate governance characteristics are measured by board duality i.e., non-separation of the board chairman and CEO roles, board size, board independence i.e., proportion of independent directors, CEO compensation mix, and

CEO tenure. External governance characteristics are measured by analyst coverage, analyst's forecast accuracy, the number of institutional investors on the share register of the given company, the percentage of shares held by them, and the concentration of their ownership. Detailed definitions of the corporate governance characteristics examined in this study are provided in Table 1. We follow the methodologies in Brickley, Coles, and Terry (1994); and Coles, McWilliams, and Sen (2001) when constructing the internal and external governance characteristics. Data on analyst coverage and analyst forecast dispersion are obtained from the Institutional Brokers' Estimate System (IBES) database. Data on institutional investors are obtained from the Factset and proxy statements (for beneficial owners and block holders). We regress the changes in our allocative efficiency measures on the changes in corporate governance characteristics of the parents to assess the impact of governance changes on allocative efficiency.

## 4. Empirical Results

### 4.1. Sample Descriptive Statistics

Table 2 Panel A presents the distribution of our ECO sample over time. The smallest proportion of ECOs in our sample was announced in the 1980s. The proportions of ECOs announced in the 1990s and 2000s are very similar, with 42% of our ECO sample announced in the former and 39% announced in the latter period.

[Please Insert Table 2 about Here]

Table 2 Panel B shows some of the key financial characteristics of companies that embark on ECOs and the control sample of multi-segment companies that do not perform any restructuring activity (non-ECO). The table demonstrates several interesting differences between the two sub-samples. First, ECO parents appear to have significantly better investment opportunities than the control firms (median *MTBV* of 1.65 vs. 1.38, respectively). Second, ECO parents have significantly higher *EBITDA/Sales* margins (median values of 0.14 vs. 0.10 for the control sample). Third, ECO parents are considerably and significantly more leveraged (with a median *Debt/Assets* of 0.27 vs. 0.18 for control firms), and therefore, under greater financial constraints. In addition, the ECO firms comprise significantly more

segments (degree of diversification) than the control sample (median *Number of segments* of 4.00 vs. 2.00 for the non-ECO firms). The significant difference in *Relative entropy* further confirms that ECO parents are more diversified. ECO parents face a significantly greater *Financing gap* than non-ECO firms. The other significant differences are in firm size (*Log sales*), *Industry sales growth*, *IPO Activity*, *Market share*, and *Largest segment profit*. As regards the efficiency metrics, the ECO parents are less efficient (median RVA (RINV) of-0.0003 (-0.0002) vs. -0.0002 (0.0003)). They are also less valued than the control firms (median *EXVAL* of -0.119 vs. 0.0648).

Based on this initial univariate analysis, it is apparent that the ECO parents are more diverse and complex and, as a result, more vulnerable to dysfunctional ICMs. Additionally, these findings show that ECO parents differ systematically from the control sample. This suggests that any estimate of the improvement in allocative efficiency of the ECO parents' ICMs could be subject to a potential endogeneity bias, i.e., these systematic differences between ECO and non-ECO firms could be the true cause of the increase in allocative efficiency and not the ECO event *per se.* Such improvement is reported in previous studies that examine the effect of refocusing through spin-offs (Gertner et al., 2002; Burch and Nanda, 2003; Ahn and Denis, 2004) but they ignore the endogeneity.

Table 2 Panel C provides more transactional data on the ECO parents and their offspring units. The median offspring is about one-twentieth of the median parent and the ECO raises nearly $97m (median *Proceeds*). The parent retains a median 72% of the equity in the newly listed segment. The median of *Proceeds* is around 30% ($97m over $311m) of the median ECO offspring market value, which is consistent with the *Equity retained* statistic. Of the 354 ECOs, 155 are in the same SIC3 industry as the parent, while 84 are in the same 2-digit (SIC2) industry but in different 3-digit SIC (SIC3) industries. Thus, 68% of the offspring retain very strong/strong product market, technology, input, or marketing links with their parents.

### 4.2. Probit Model of the ECO Decision

To perform the PSM matching procedure, we first estimate a probit regression of the likelihood of performing an ECO by including covariates that have been identified as relevant by previous studies

(see Table 1) and included in Table 2. The results of this analysis are presented in Table 3 and discussed here in detail. Our analysis demonstrates, consistent with the univariate results in Table 2, that companies that perform ECOs have systematically different characteristics from companies that do not embark on restructuring. These differences, potentially accounting for some of the observed treatment effects, highlight the need to address the problem of endogeneity when assessing the change in allocative efficiency.

[Please Insert Table 3 about Here]

We find that ECO parents are significantly larger and more diversified. Specifically, for a one-unit increase in the *Relative entropy* of the parent firm, the likelihood of performing an ECO increases by 0.1%. They also have higher valuation or growth opportunities, carry more debt, and perform ECOs in favourable market conditions with high IPO activity. Of these, the IPO market environment has the strongest marginal impact, suggesting that parent firms exploit the market opportunity to time their ECOs. In particular, for 1% increase in *IPO activity*, the likelihood of ECO increases by 5.9%. We note that the *IPO activity* and *M&A activity* are exogenous to the change in parent's allocative efficiency and valuation following ECO. While being associated with the ECO decision, they are unlikely to be significantly related to any subsequent change in the parent's allocative efficiency.

In terms of the economic significance of other factors, we find that for 1% increase in the *Debt/Asset* ratio, the likelihood ECO increases by 0.3%; for 1% increase in the *Log sales* of the parent firm, the likelihood of ECO increases by 0.1%; and for 1% increase in the *Largest segment profit*, the likelihood of ECO decreases by 0.3%. Additionally, parent firms that enjoy relatively higher *Industry sales growth*, higher *Market share* and more favourable profit performance of their largest segments (*Largest segment profit)* are associated with a significantly lower likelihood of undertaking an ECO. Under these favourable conditions, parents have less incentive to restructure through an ECO. For example, for 1% increase in *Industry sales growth*, the likelihood of ECO decreases by 0.7%.

Based on the above probit model, we employ the PSM matching procedure to identify an appropriate control (non-ECO) firm for each ECO parent in our sample. To evaluate the accuracy of

our matching procedure, we compare our ECO sample to the 354 control firms identified by the PSM method on a one-for-one nearest neighbour criterion. The mean and median comparison tests between the two groups in terms of the significant firm-specific predictor variables in the probit model (*Log sales, MTBV, Debt/Assets, Relative entropy, Market share,* and *Largest segment profit*) show no statistically significant differences between our ECO parent sample and the matched control firms. These unreported findings suggest that the selected control firms are very similar to the ECO parents in all important aspects, including their propensity to undertake ECO, but only the ECO parents carry out the restructuring. Two other variables significant in the probit model, *IPO activity* and *Industry sales growth*, are stock market- and industry- related rather than firm-specific and hence excluded from this comparison.

Based on the probit model of ECO we employ the Dahejia and Wahba PSM technique to identify a 'most appropriate' control (non-ECO) firm for each ECO parent in our sample. To evaluate the accuracy of our matching procedure, we compare our ECO sample to the 354 control firms identified by the PSM method. Table 4 presents the mean and median comparison tests between the two groups. Matching is done on the probit of the propensity score using calipers of width equal to 0.2 of the standard deviation of the probit of the propensity score. Non-matching treated observations are excluded. Note that for the purposes of this analysis we consider only the significant predictor variables from the analysis of the likelihood of performing an ECO. The results show that there are no statistically significant differences between our ECO sample and the matched control firms in terms of key financial characteristics as of one year prior to the ECO event. These findings suggest that the selected control firms are very similar to the ECO parents in all important aspects but the ECO event itself.

[Please Insert Table 4 about Here]

### 4.3. Treatment Effects Results

To gain an understanding of whether investment inefficiency existed before the ECOs, we need to examine whether the allocative efficiency improves following the ECO, after addressing any possible endogeneity bias. The analysis presented in Table 5, Panel A, demonstrates that the allocative efficiency of the parent is improved significantly during the first three years following an ECO. In particular, the

*DinD (*difference-in-difference*) Treatment Effects* coefficients for *RINV* (+0.119) and *RVA* (+0.009) measured over the window (-2, +2) years are statistically significant. Furthermore, the *RINV and RVA DinD* coefficients are also positive (+0.114) and (+0.010) over the longer (-3, +3) years event window and statistically significant (at the 10% and 5% levels significance respectively).

[Please Insert Table 5 about Here]

Table 5, Panel A indicates that there is also significant improvement in the parent's *EXVAL*. Specifically, this finding is supported by the positive and significant *DinD* coefficients (+0.021) and (0.241) over the (-2, +2) and ((-3, +3) years event windows, respectively. These results, stronger with direct measures of allocative efficiency (RINV and RVA), provide support to our hypothesis H1 of a significant increase in the allocative efficiency of parent firms following ECOs. The fact that parents are better able to allocate capital across different business segments following ECO suggests that these pre-restructuring parents were suffering from inefficiency of their ICMs.

A concern that may arise with our results is that they might be driven by a hidden sample selection bias. Although our PSM procedure is one way to account for this, there may be unobservable factors that affect the propensity to perform an ECO which may lead to a hidden bias in our results. While we cannot fully eliminate the possibility that our findings are driven by unobservable selection bias, we can evaluate the extent to which the findings are sensitive to potential selection bias (if it exists), by estimating the Rosenbaum bounds (Rosenbaum, 2002). DiPrete and Gangl (2004) suggest the Rosenbaum bound represents a "worst-case scenario" and argue that this approach provides reasonable confidence in a causal relationship between treatment and outcome in the presence of potentially confounding hidden covariates. It does not indicate whether or not unobservable bias exists but shows how large the impact of unobservable factors on both the probability of a firm undertaking an ECO and the efficiency effects of that ECO has to be in order to render the treatment effects obtained from matching on observables insignificant. We evaluate the reliability of our PSM estimates using the Rosenbaum bounds technique A recent paper that employs the PSM and Rosenbaum bounds methodologies to examine the impact of relationship banking on loan pricing is Bharath et al (2011). In their paper, the level at which their observed causal effect turns insignificant is 1.5. They also note this

is a worst-case scenario. They conclude that "it is unlikely such powerful unobserved covariates (over and above the long vector of observed covariates that we have controlled for) can be at work to challenge our estimates of the causal effect of relationships on spreads" (see Appendix A2 for further discussion).

Our analysis suggests that our PSM estimates start becoming insignificant at exp(γ) values higher than two. In general, the larger the value of exp(γ), the less-sensitive the PSM estimates to unobservable bias. For example, exp(γ) values which are higher than two suggest that the matched control companies have to be more than twice as likely to receive treatment (i.e. perform an ECO) because of unobservable variables to render our results insignificant. Based on this sensitivity analysis we conclude that the likelihood that our results are driven by sample selection bias or unobservable variables influencing the ECO decision is relatively low.

As a further robustness test, we repeat the analysis of the impact of ECO on conglomerate allocative efficiency and valuation with the use of the Heckman (1979) bias adjustment procedure in Table 5, Panel B. We note that for the first stage of the Heckman procedure we have used the probit model reported in Table 3. We show that all coefficients associated with the variable *InvMills* presented in Table 5, Panel B are positive and significant. This finding highlights the importance of correcting for the self-selection bias. In other words, firms that expect to improve their efficiency through ECO choose to adopt that restructuring method. This could be explained by the parents having some private information that drives the ECO (see Li and Prabhala, 2006 on how unobservable private information may drive self-selection). Crucially, we also find that most of the Heckman treatment estimates (i.e. the coefficients corresponding to the variable Heckman_Treated) are positive and statistically significant in Table 5, Panel B. These results show that in addition to the improvement due to self-selection, the ECO itself contributes to further significant improvement in allocative efficiency. The Heckman model thus provides incremental insight into the sources of such improvement, compared to the PSM model. In unreported results we repeat the analysis using the Abadie and Imbens (2006) matching procedure which corrects for the asymptotic bias that can be present in simple matching estimators, such as the PSM. Our conclusions about significant improvements in the allocative efficiency of the ICM of the parent remain largely unchanged. Importantly, the Abadie and Imbens (2006) procedure shows that our analysis is unlikely to suffer from any asymptotic bias as the values of the *DinD Treatment Effects*

coefficients with the bias adjustment that we obtain are almost identical to the *DinD Treatment Effects* coefficients without the bias adjustment. This result suggests that our analysis based on the PSM is unlikely to be tainted by issues relating to the presence of asymptotic bias. Hence the Abadie and Imbens analysis is redundant and not reported.

## 4.4. Analysis of Corporate Governance Characteristics

Our hypothesis H2 is that the functioning of the parent company's ICM is improved following an ECO owing to better corporate governance in the parent companies triggered by that event. To test the validity of this proposition, we examine the change in key internal governance characteristics such as board duality, board size, board independence, and CEO compensation mix. We also investigate the change in key external governance characteristics such as analyst coverage, analyst forecast accuracy and stock ownership of institutional investors in our sample of ECOs. For the parent firm, we perform the univariate difference-in-differences analysis, and we believe the governance changes would be more evident in the ECO parent firm. As for the ECO, the variable *Before* is the average of the given governance variable for each conglomerate company over a period t-2 to t-1 (t-3 to t-1) relative to the ECO year. Similarly, *After* is the average of the given governance variable for each conglomerate company over a period t+1 to t+2 (t+1 to t+3) relative to the ECO year. The variable *Change* is defined as the difference between *Before* and *After*.

Table 6 reports the dynamics. Following the ECO, there are more institutional investors, both in terms of the percentage of shares held and the number of institutional investors. We also find that the *Analyst Coverage* (DinD) increases significantly by 5.2 and 6.0, during the (-2, +2) and (-3, +3) years event windows, respectively (representing about 50% more analysts) following the ECO. These results indicate that the parent management is subject to increased internal independent monitoring and more rigorous capital market scrutiny following the ECO. These improvements in governance are likely to lead to reduced levels of asymmetric information between company insiders and company outsiders. In the (-2, +2) years window, we also observe an increase in the average analyst's forecast standard error perhaps due to more analysts following, but the significance and magnitude of the coefficient decrease

in the (-3, 3) years window, suggesting a decline in the information asymmetry of parent firms as observed by analysts over time.

In addition, our results show that the ratio of non-executive to executive board members increases after the ECO over the (-3, 3) years windows that we consider. Specifically, we observe a positive and statistically significant change in the variable *Board independence.* amounting to +0.66 during the (-3, +3) years event window. We find that *Board size* decreases significantly for treatment firms during the (-2, +2) and (-3, +3) years event windows following the ECO. But such an effect is insignificant relative to the control firms. These results suggest an improvement in the governance structure of the parent, as a smaller board size could imply better coordination among directors (Yermack, 1996), and more independent directors can lead to improved control, monitoring, and strategic leadership of the board (Gilson et al., 2001).

[Please Insert Table 6 about Here]

We observe a significant increase in the CEO's non-cash based compensation during the (-2, +2) and (-3, +3) year windows for the treatment firms. The DinD coefficients on non-cash compensation are insignificant but remain positive. Such performance-based compensation also accounts for the largest proportion of the increase in the total average CEO compensation in the parent firm, whereas the proportion of cash compensation has fallen. We expect that the CEO's financing and investment decisions are more likely to have a direct impact on the parent company's share price, and these actions will have a more direct impact on the CEO's non-cash-based compensation. It appears that the increase in non-cash-based compensation associated with the ECO leads to a better alignment between the interests of managers and the interests of shareholders. This better alignment of interests could arguably improve the allocative efficiency of the parent firm, thereby satisfying one of the key objectives of the ECO, which is to align better managerial and shareholder interests than in the diversified parent. This link is investigated further below.

Comparison of the changes in the External governance characteristics and the Internal governance characteristics of the ECO parents relative to control firms (see the $\Delta T - \Delta C$ column in Table

6, Panels A and B) shows that the changes in the former are wider, much stronger and more significant than changes in the latter. The latter seems to be part of an industry/ economy-wide phenomenon, whereas the changes in the External governance characteristics seem clearly attributable to the ECO event. This is as expected since that event is designed to trigger governance changes beyond those the ECO parent could have adopted without ECO.

In sum, the analyses presented in this section provide supporting evidence that there are some considerable improvements in the internal and, more so, in the external governance characteristics of parent firms following ECOs.

Similar governance enhancements in the offspring, which are among the motivations for the ECO, are likely to have an indirect effect on the parent performance. To gain some insight into the governance changes in the offspring, Table 7 presents the univariate analysis of the change in corporate governance characteristics in the offspring firm in the first two- and three-year periods following ECO completion, respectively, bearing in mind that it was only possible for us to obtain observations for offspring firms after the ECO event. In this case, the variable *Before* is the value of the given governance characteristic for each offspring at t = 0. *After* is value of the governance variable for each offspring as of t+2 (t+3) relative to the ECO year. The variable *Change* is defined as the difference between *Before* and *After*. We note that the data availability for different governance characteristics varies considerably. Each governance characteristic is tested on the basis of the number of observations for which we have available data. The sampling variation needs to be kept in mind in assessing the significance of the offspring-related improvements.

[Please Insert Table 7 about Here]

Our analysis shows that there is an increase in the institutional investment and the degree of analyst coverage over the (0, +2) and (0, +3) years windows following the ECO. Specifically, we observe a positive and statistically significant increase in the number of institutional investors and the percentage of shares held. Also, the institutional investor's share concentration decreases. Moreover, the number of institutional investors (block) also increase significantly, amounting to 0.56 and 0.45 in

over the (0, +2) and (0, +3) years windows following the ECO at t = 0, respectively. The *Analyst coverage* of the offspring also increases by 2.5 and 2.8 analysts over the (0, +2) and (0, +3) years windows after the ECO, respectively. These results demonstrate that the offspring companies are subject to strong capital market scrutiny that increases over time, thereby enhancing the external governance of the offspring.

Our results also show that, in the offspring, *Board size* as well as the ratio of non-executive directors to executive directors (*Board independence*) tend to increase following ECO. Specifically, we observe a statistically significant increase of 0.65 and 0.22 in *Board size* and *Board independence* respectively over the (0, +2) year period following ECO. *Board size* also increases significantly over the period of (0, +3) years. These results suggest that as the carved-out units being newly-established entities, tend to expand their sales and market share, they are also likely to recruit more directorial talent and increase their board size. The contemporaneous decrease in the board size of parents and increase in that of offspring may be because of the reduced complexity of the parent and the transfer of directors to the infant offspring. Additionally, the increase in the proportion of independent directors suggests that the offspring companies tend to adopt a more independent board structure that is likely to lead to greater governance effectiveness by strengthening oversight and reducing conflicts of interest between managers and shareholders.

While the average CEO's compensation falls together with its equity component over the (0, +2) and (0, +3) years windows after the ECO, this decrease is not significant. The CEO's tenure increases significantly by about 1.7 and 2.2 years on average over the (0, +2) and (0, +3) years windows following the ECO, perhaps to provide a stable leadership to the infant firms. This argument receives some support from the significant increase in the cases of overlap of the CEO and chairperson roles in these firms over the (0, +3) event window after the ECO. As a result, there appears to be a trade-off between the leadership demands of the newly incorporated offspring and rigorous governance. The internal and external governance improvements in the offspring firms, in conjunction with similar improvements in the parents, are consistent with such anticipated improvements acting as major motivators for the ECO decision. We next model the impact of the changes in governance characteristics

of parents on their allocative efficiency metrics in a multivariate framework. We do not model the impact of improvements in the offspring on the allocative efficiency of their parents measured over windows starting before the ECO event as they may be indirect with an unclear channel and model only the impact of improvements in the parents.

### 4.5 Effect of Corporate Governance Changes on the Functioning of the Parent's ICM

We perform a regression analysis of the determinants of the change in allocative efficiency and valuation of the parents following the ECO. The results are presented in Table 8, Panels A and B over the windows (-2, +2) and (-3, +3) years respectively centred on the year of ECO completion, t = 0. For each parent company the change in allocative efficiency or valuation is adjusted for the corresponding change in the matched control firms, where each control firm is identified using the PSM matching estimator. We note that this analysis excludes any additional control variables such as parent company firm and industry characteristics since these variables are already accounted for in the PSM matching procedure that is based on the set of significant predictor variables in our probit model (see Table 3). As argued by Dittmar and Shivadasani (2003), proceeds from divestiture could help the conglomerate to finance segments that have positive NPV projects and thus improve the investment policy. On the other hand, such proceeds might provide a cash windfall for segments beyond the cash level needed and this might lead to poor investment decision. To control for changes in financial resources, we include the total proceeds from the equity carve-out in our analysis. For the purposes of the regression analysis we measure the change in governance characteristics over a (-1, +1) years window. All regressions include year and industry fixed effects.

[Please Insert Table 8 about Here]

Overall, the results presented in Table 8 support our hypothesis H2 that the observed increase in allocative efficiency following ECOs is driven by improvements in the governance characteristics of parent firms. Specifically, over the event window (-2, +2) years our analysis suggests that one of the factors that contribute to enhanced allocative efficiency following the ECO is the increased capital market scrutiny to which the parent firm is subjected. This conjecture is supported by the positive and

statistically significant relationship between the increase in the stock ownership of institutional investors (Δ *Shares of inst. investors*) and improvements in Δ *RINV*, Δ *RVA*, and Δ *EXVAL* following ECOs. An increase in the number of analysts also significantly improves *RVA.*

In addition, we find that improvements in the internal governance characteristics of parent firms, such as the increase in the ratio of non-executive to executive directors (Δ *Board independence*) and the decrease in the number of board members (Δ *Board size*) are positively and significantly related to changes in investment measurement. Smaller boards and boards with reduced duality also strongly improve parent valuation *EXVAL*. Reduced duality also strongly enhances Δ *RINV*. Our results also demonstrate that cash-based CEO compensation, rather than stock-based compensation, is likely to lead to a worsening of the alignment between the interests of managers and the interests of shareholders, thus leading to a decrease in the allocative efficiency of the parent firm. Specifically, we find that the variable Δ *CEO cash compensation* is negatively, strongly and significantly related to Δ *RVA* and Δ *RINV*. ECOs appear to bring about significant changes in internal and external corporate governance structures as well as in the CEO incentive structure, resulting in stronger monitoring of the investment decisions of the parents and enhanced allocative efficiency.

In additional unreported robustness tests we replicate the regression analysis presented in Section 4.5 with the inclusion of the control variables which relate to the financial and industry-level characteristics of the parent firms before the carve-out and find that our results remain unchanged. We also test the robustness of our results to the use of alternative measures of the presence of institutional investors in the parent firm's shareholder base. Specifically, we repeat the analysis presented in Table 8 using the variable *Number of inst. investors* instead of *Share of inst. investors* and confirm that our results remain qualitatively unchanged.

These findings are robust when we consider the longer (-3, +3) years window around the ECO completion year. We find that higher values of Δ *CEO cash compensation* are negatively related to changes in *RINV*. While larger boards (Δ *Board size*) are significantly associated with declines in *XVAL, and RVA* institutional ownership (Δ *Shares of inst. investors*) enhances both Δ *RINV* and Δ *RVA*.

We also find evidence that institutional ownership concentration which implies closer institutional monitoring is positively associated with Δ *RINV*. Longer CEO tenure improves both *RINV* and *RVA* suggesting that CEOs who undertake ECO and remain in place longer to see the restructuring through accomplish greater efficiency. Increase in CEO cash compensation significantly lowers RINV, as in Panel A, again affirming the importance of shareholder-aligned CEO compensation structure. The initial governance-induced improvements following ECO are sustained over (-3, +3) years although the impact of the later changes is less comprehensive. In unreported results we repeat the analysis presented in Table 8 Panels A and B above using the change in governance characteristics over longer windows of (-2, +2) and (-3, +3) years window respectively and our results remain qualitatively similar.

In the univariate analysis of governance changes in parents in Table 6 above, we found that external governance changes were far more important than internal governance changes. In Table 8, however, we find that the impact of internal governance changes on allocative efficiency is much stronger and wider than external governance changes. This suggests that, while ECOs trigger stronger external governance changes, it is the internal governance changes that have a more significant impact on whether or not allocative efficiency improves following ECOs. This is logical since the internal governance characteristics that affect the monetary incentives e.g. remuneration, and executive authority e.g. duality have a more immediate and direct influence on managerial decisions and hence on performance outcomes. It seems that the external governance changes triggered by ECO set in motion internal governance changes that together induce greater allocative efficiency of the parent ICM.

To confirm that our results are not driven by the specific pre-event financial characteristics of ECO parents but by the ECO event itself, we perform additional regression analyses of the relation between the change in allocative efficiency and the change in corporate governance characteristics of the parent firms. The aim of this analysis is to determine whether the improvement in allocative efficiency is driven by increases in the internal and external corporate governance quality of the parent sample that is higher than any potential increases that could have materialised in the matched control sample over the same time period. In other words, we seek to establish whether the difference in difference change in allocative efficiency is driven by the difference in difference (*DinD* changes in

corporate governance characteristics. The difference in difference values are calculated as the change in the parent company minus the change in the matched control firm over identical time periods. For this purpose, we use the parent and matched control firm samples selected using the PSM matching procedure and estimate the following regression model:

$$DinD\_treatment\ effects\ (\Delta\ RINV,\ RVA\ or\ EXVAL) = \alpha + \beta_i\ DinD\_treatment\ (\Delta\ corporate\ governance\ characteristics) + \varepsilon_i \quad (4)$$

Table 9 shows the results from this analysis. Overall, the results presented in Table 9 confirm the robustness of our findings in the earlier analysis and show that the improvements in corporate governance characteristics are significantly related to increased allocative efficiency and enhanced valuation following the ECO. In particular, our analysis shows that greater analyst coverage (*DinD_*Δ *Analyst coverage.*), increase in institutional shareholding, smaller board size (*DinD_Board size*) as well as higher non-cash CEO compensation (*DinD_*Δ *CEO non-cash compensation)* all significantly improve *DinD* Δ *RINV* measured over the window of (-2, +2) years. In addition, higher analyst coverage (*DinD_*Δ *Analyst coverage*), greater board independence (*DinD_*Δ *Board independence*) and lower cash CEO compensation (*DinD_*Δ *CEO cash compensation*) significantly improve *DinD* Δ *RVA* over the same event window. Similarly, higher non-cash CEO compensation (*DinD_*Δ *CEO non-cash compensation*) enhance *DinD* Δ *EXVAL*. Further, longer CEO tenure significantly improves both RINV and RVA.

[Please Insert Table 9 about Here]

Over the longer event window, (-3, +3) years , we find in Panel B that greater analyst coverage (*DinD_*Δ *Analyst coverage*), smaller board size (*DinD_*Δ *Board size*), higher portion of ownership by institutional investors (*DinD_*Δ *Shares of inst. investors*) are all significantly enhance Δ *RINV*. Additionally, increased non-cash CEO compensation (*DinD_* Δ *CEO non-cash compensation*) significantly improves *EXVAL*. Smaller board size (*DinD_*Δ *Board size*), higher portion of ownership by institutional investors (*DinD_*Δ *Shares of inst. investors*) also significantly improve *RVA*. Longer CEO tenure significantly improves both RINV and RVA. As noted in the context of a similar impact of

CEO tenure in Table 8, given the disruption caused by the ECO and, under the improved governance structure post-ECO, the CEO is being allowed to continue running the parent, to improve its allocative efficiency. Table 9 reinforces the conclusion from our previous analysis in Table 8 that the governance-induced improvements in allocative efficiency over (-2, +2) years following ECO are sustained by the further governance changes over (-3, +3) years although the impact of the later changes is less comprehensive. Our hypothesis H2 of a positive impact of governance changes following ECOs on the allocative efficiency and valuation of the parent firms is thus strongly supported.

## 5. Summary and Conclusions

Prior studies such as Gertner et al. (2002), Ahn and Denis (2004), Dittmar and Shivdasani (2003), Burch and Nanda (2003), and Çolak and Whited (2007) investigate the impact of spin-offs and sell-offs on the functioning of the internal capital market (ICM) of the parent company. Our study contributes to the literature by considering an alternative mechanism of restructuring, namely equity carve-out (ECO). We adopt the propensity score matching (PSM) methodology to account for the endogeneity of the ECO decision by evaluating the change in the allocative efficiency of the internal capital market relative to the change in such efficiency which occurs in a group of control companies with similar characteristics and propensity to undertake an ECO. Specifically, we account, *inter alia*, for the degree of diversification (*Relative entropy*), size (*Log sales*), liquidity (*Financing gap*), leverage (*Debt/Assets*), industry M&A and IPO activity as well as *Industry sales growth*. Importantly, our analysis shows that ECOs have a significant positive impact on the allocative efficiency of parent companies that undertake them.

By accounting for the problem of endogeneity we demonstrate that the relative value added (RVA) and relative investment ratio (RINV) are significantly enhanced following ECOs and that these results are not driven by any inherent characteristics associated with companies that choose to perform ECOs, but by the ECO event itself. Importantly, we also demonstrate that the improvement in allocative efficiency of parent firms is linked to increased capital market scrutiny and board independence as well as reduced board size in these companies following ECOs. Our analysis shows that the enhanced allocative efficiency is further related to the fact that the CEOs of the parent firms have stronger

incentives to act in the best interest of shareholders since their remuneration contracts are geared more towards stock/ non-cash based compensation following ECOs. Interestingly, longer CEO tenure which may in general be interpreted as a signal of entrenchment is not so, no doubt due to the stronger governance regime that emerges from the ECO and it contributes significantly to improved allocative efficiency of the parents. These findings contribute to the extant literature on restructuring by showing that the functioning of the ICM can be enhanced by augmenting the level of monitoring from company outsiders as well as the internal governance mechanisms of the business rather than by merely reducing its size or industry diversity to improve business focus as in the case of spin-offs or sell-offs.

Our results contrast with the lack of impact of spin-offs and sell-offs in improving the allocative efficiency of conglomerate parents, reported by Çolak and Whited (2007) and confirmed by our own unreported results.[2] Our analysis carries important implications for the corporate managers who seek to improve the allocative efficiency of their companies by demonstrating that carve-out could be a more effective mechanism to restructure company operations than spin-off and sell-off. The reasons for this differential impact on allocative efficiency of alternative re-focusing strategies merit future research. Since equity carve-out can be considered an interim corporate stage that tends to be followed by secondary events including full spin-off, sell-off and re-acquisition (Klein et al., 1991; Perotti and Rosetto, 2007), a potential avenue for future research is to investigate the relation between the allocative efficiency and such secondary events.

Footnotes

[1] The Financial Accounting Standard (FAS) 131 which came to force in 1997 requires the company to adopt the management approach rather than the risk and reward approach when defining a given business unit as a segment. This could have potentially resulted in the disclosure of more segments following the introduction of this accounting standard (see Bugeja, et al, 2015). We note that to the extent that the adoption of new rules is not correlated with treatment effects, these issues are unlikely to affect our results.

[2] In unreported results we examine the change in allocative efficiency surrounding spin-offs and sell-offs using the same performance metrics as in our current paper using the Abadie and Imbens (2006) methodology. We find evidence that the ICM efficiency of the parent does not change over the two-year period following spin-offs and sell-offs. We find some evidence of deterioration in the allocative efficiency of parents during the three-year period following sell-offs but not following spin-offs. We also repeat this analysis using the PSM matching procedure and the Heckman bias adjustment procedure and find no evidence of significant change in allocative efficiency once endogeneity and sample selection biases are allowed for. This lack of impact is consistent with the evidence reported by Çolak and Whited (2007). These results are available from the authors.

**Appendices**

**Appendix A1.** Definitions of RINV, RVA and EXVAL

We compute RINV as follows. We first calculate the median q (the numerator of q is calculated as the book value of assets minus book value of equity plus market capitalisation minus deferred taxes. The denominator of q equals the book value of assets) of the pure play (i.e. single-segment) companies operating in the same three-digit SIC industry as a segment of the parent portfolio and then rank the segments by size of these q's. Suppose the first k segments have industry median q's greater than the sales-weighted average of all the segments' industry median q's. Let $S_j$ be the sales of segment j, $w_j$ be the proportion of company sales made by segment j, $I_j$ be the capital expenditure of segment j, and $\left(\frac{I}{S}\right)_j^{SS}$ be the capital expenditure to sales ratio of the median pure play company operating in the same three-digit SIC industry as segment j. Then, *RINV* is calculated as:

$$RINV_S \equiv \sum_{j=1}^{k} w_j \left\{\frac{I_j}{S_j} - \left(\frac{I}{S}\right)_j^{SS} - \sum_{i=1}^{n} w_i \left[\frac{I_i}{S_i} - \left(\frac{I}{S}\right)_i^{SS}\right]\right\} - \sum_{j=n-k+i}^{n} w_j \left\{\frac{I_j}{S_j} - \left(\frac{I}{S}\right)_j^{SS} - \sum_{i=1}^{n} w_i \left[\frac{I_i}{S_i} - \left(\frac{I}{S}\right)_i^{SS}\right]\right\} \quad (1)$$

where

$$\left[\frac{I_j}{S_j} - \left(\frac{I}{S}\right)_j^{SS}\right] \quad (2)$$

represents investment to sales ratio of segment j adjusted by its industry median and

$$\frac{I_j}{S_j} - \left(\frac{I}{S}\right)_j^{SS} - \sum_{i=1}^{n} w_i \left[\frac{I_i}{S_i} - \left(\frac{I}{S}\right)_i^{SS}\right] \quad (3)$$

represents the industry- and firm-adjusted investment to sales ratio. Eq. (1) implies that, after adjusting for industry- and firm-investment levels, $RINV_S$ will be higher when companies invest more in their high-q segments, i.e. when they are more efficient.

If $q_j$ is the industry median q of segment j, the relative value-added measure that uses sales as the denominator of each ratio, *RVA* is:

$$\text{RVA} = \sum_{j=1}^{n} w_j (q_j - \bar{q}) \left\{\frac{I_j}{S_j} - \left(\frac{I}{S}\right)_j^{SS} - \sum_{i=1}^{n} w_i \left[\frac{I_i}{S_i} - \left(\frac{I}{S}\right)_i^{SS}\right]\right\} \quad (4)$$

where $\bar{q}$ is the sales-weighted average of all of the segment industry median $q$'s. To help understand the interpretation of *RVA* let us assume that we have a conglomerate firm where the sales of the different segments are all the same. In this case *RVA* represents the covariance between industry-adjusted segment investment and industry median $q$. Since the different conglomerate segments have typically different segment levels *RVA* can be thought of as the sales-weighted covariance between investment and $q$. Higher values of *RVA* indicate higher levels of allocative efficiency.

This variable is defined as:

$$\text{Excess Value} = \left(\frac{V}{S}\right)_i - \sum_{j=1}^{n} w_j \left(\frac{V}{S}\right)_j^{SS} \quad (5)$$

where $w_j$ is the proportion of company sales made by segment j, $\left(\frac{V}{S}\right)_j^{SS}$ is the median market value of equity to sales ratio for the three digit SIC-industry in which segment j operates, and $\left(\frac{V}{S}\right)_i$ is the market value to sales ratio for the entire conglomerate. Higher values of *EXVAL* demonstrate improvements in company valuation. *EXVAL* is, however, an indirect measure of allocative efficiency and could be influenced by other value-relevant factors affecting the firm and not just change in allocative efficiency.

**Appendix A2.** Analysis of the hypothetical hidden bias required to trigger an increase in odds ratio by a factor of 2

| | Beta coefficient $\beta_j$ | Standard deviation $\sigma_j$ | Implied N |
|---|---|---|---|
| Log sales | 0.218 | 1.038 | 3.065 |
| MTBV | 0.029 | 0.814 | 29.376 |
| Debt/Assets | 0.228 | 1.467 | 2.073 |
| Relative entropy | 0.321 | 3.678 | 0.587 |
| Market share | -0.416 | 11.951 | -0.139 |
| Largest segment profit | -0.326 | 9.110 | -0.233 |

The critical level of exp(γ) that would cause us to question our findings of a positive effect of ECO on investment efficiency is 2. An exp(γ) of 2 is obtained if an unobserved factor results in a difference between the odds ratio of assignment treatment and control cases by a factor of about 2. It is important to note that these numbers represent worst-case theoretical outcomes. A value for exp(γ) of 2 does not suggest that there is no true positive effect of ECOs on investment efficiency. This result shows that the confidence interval for the improvement in investment efficiency would include zero if:

1. If there is an unobserved factor that causes the odds ratio assignment to the treatment and control groups to differ by a factor of 2

2. The unobserved factor's impact on investment efficiency would have to be sufficiently strong in order to almost certainly determine that investment efficiency would be higher for the treatment case (performance of ECO) in each pair of matched firms in the sample, in order to negate our interpretation and include zero in the confidence interval for the estimated effect.

Note that in the case where a confounding variable had an equally strong effect on group assignment (treatment versus control) but only a weak effect on the outcome variable, the confidence interval for spreads would not contain zero.

To demonstrate the extent of unobserved (hidden) bias that would require the revision of our conclusions of causal relationship between the ECO decision and investment efficiency, we use the extent of unobserved bias given by $\exp(\gamma) = 2$ to determine the equivalent effect that would be required from our observed predictor variables. Specifically, we want to determine the magnitude by which the significant predictor variables in our likelihood model would have to change in order to increase the odds ratio by a factor of 2. We can use the predictor variables for this purpose since we have already estimated the impact on assignment ($\beta_j$ coefficient) to treatment from our probit model. From the probit regression model (with a variable $x_j$ with coefficient $\beta_j$ and standard deviation $\sigma_j$), for an n standard deviation in variable $x_j$, we know that the odds ratio is expected to change by a factor of $\exp(\beta_j * \sigma_j * n)$, keeping all other variables unchanged. By setting this equal to a factor of 2 (the change in odds ratio from $\exp(\gamma) = 2$ from $\exp(\gamma) = 1$), we can assess n for each significant variable in our probit model. This analysis is presented in Table A2. The numbers suggest that implausibly high changes in the observed variables would be required to increase the odds ratio by a factor of 2. For example, the log of sales would require an increase of at least 300% (i.e., 3.065 standard deviations) in order to increase the odds ratio of assignment by a factor of 2, which would cause us to question our results. Based on the analysis for observed variables that affect the likelihood of performing ECO, we conclude that it is highly unlikely that such strong unobserved factors (in addition to the observed variables that we have included in the propensity score matching) can exist and question our findings of the causal impact of ECO on investment efficiency.

## REFERENCES


Abadie, A. and Imbens, G.W., 2006. Large sample properties of matching estimators for average treatment effects. *Econometrica*, 74 (1), 235–267.

Abadie, A., Drukker, D., Herr, J.L., and Imbens, G.W., 2004. Implementing matching estimators for average treatment effects in Stata. *The Stata Journal*, 4 (3), 290–311.

Ahn, S. and Denis, D.J., 2004. Internal capital markets and investment policy: Evidence from corporate spin-offs. *Journal of Financial Economics*, 71 (3), 489–516.

Almeida, H., Kim, C.S., and Kim, H.B. 2015. Internal capital markets in business groups: Evidence from the Asian financial crisis. *Journal of Finance*, 70 (6), 2539–2586.

Anjos, F. and Fracassi, C., 2011. Shopping for information? Diversification and the network of industries. SSRN working paper.

Berger, P.G. and Ofek, E., 1995. Diversification's effect on firm value. *Journal of Financial Economics*, 37 (1), 39–65.

Bharath, S T, Dahiya, S, Saunders A and Srinivasan A, 2011. Lending relationships and loan contract terms. *Review of Financial Studies*, 24 (4), 1141–1203.

Billet, M and Vijh, A., 2004. The wealth effects of tracking stock restructurings. *Journal of Financial Research*, 27 (4), 559–583

Boone, A., 2003. The interaction of ownership, governance, and product markets: evidence from equity carve-outs. Working paper, College of William and Mary.

Brickley, J.A., Coles, J.L., and Terry, R.L., 1994. Outside directors and the adoption of poison pills. *Journal of Financial Economics*, 35 (3), 371–390.

Bugeja, M., Czernkowski R., and Moran, D., 2015, Impact of the management approach on segmental reporting, *Journal of Business Finance & Accounting*, 42(3) & (4), 310–366.

Burch, T.R. and Nanda, V., 2003. Divisional diversity and the conglomerate discount: Evidence from Spin-offs. *Journal of Financial Economics*, 70 (1), 69–98.

Campa, J.M. and Kedia, S., 2002. Explaining the diversification discount. *Journal of Finance*, 58 (4), 654–697.

Chemmanur, T and Paeglis, J., 2001. Why issue tracking stock? Insights from comparisons with spin-offs and carve-outs. *Journal of Applied Corporate Finance*, 14 (2), 102–114

Çolak, G. and Whited, T.M. 2007. Spin-offs, divestitures, and conglomerate investment. *The Review of Financial Studies*, 20 (3), 557–595.

Cline, B.N., Garner, J.L., and Yore, A.S., 2014. Exploitation of the internal capital market and the avoidance of outside monitoring. *Journal of Corporate Finance*, 25, 234–250.

Coles, J.W., McWilliams, V.B., and Sen, N., 2001. An examination of the relationship of governance mechanisms to performance. *Journal of Management*, 27 (1), 23–50.

Comment, R. and Jarrell, G., 1995. Corporate focus and stock returns. *Journal of Financial Economics*, 37 (1), 67-87.

Davidson and Harper, 2014. Off track: The disappearance of tracking stocks. Journal of Applied Corporate Finance, 26 (4), 98–105.

Daley, L., Mehrotra, V., and Sivakumar, R., 1997. Corporate focus and value creation: Evidence from spin-offs. *Journal of Financial Economics*, 45 (2), 257–281.

Dasilas, A. and Leventis, S. 2018. The performance of European equity carve-outs. *Journal of Financial Stability*, 34, 121-135.

Denis, D.K. and Shome, D.K., 2005. An empirical investigation of corporate asset downsizing. *Journal of Corporate Finance*, 11 (3), 427–448.

Dehejia, R.H. and Wahba, S., 1999. Causal effects in non-experimental studies: Re-evaluating the evaluation of training programs. *Journal of the American Statistical Association*, 94(448), 1053–1062.

Dehejia, R.H. and Wahba, S., 2002. Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics*, 84 (1), 151–161.

Dereeper, S. and Mashwani, A. 2013. Equity carve-outs and revelation of information about wealth effects. SSRN Working Paper.

Desai, C.A., Klock, M.S., and Mansi, S.A., 2011. On the acquisition of equity carve-outs. *Journal of Banking and Finance*, 35 (12), 3232–3449.

Desai, H., and Jain, P.C., 1999. Firm performance and focus: Long-run stock market performance following spin-offs. *Journal of Financial Economics*, 54 (1), 75–101.

DiPrete, T. A., and Gangl, M. 2004. Assessing Bias in the Estimation of Causal Effects: Rosenbaum Bounds on Matching Estimators and Instrumental Variables Estimation with Imperfect Instruments. *Sociological methodology*, 34 (1), 271-310.

Dittmar, A.K. and Shivdasani, A., 2003. Divestitures and divisional investment policies. *Journal of Finance*, 58 (6), 2711–2744.

Duchin, R. and Sosyura, D. 2013. Divisional managers and internal capital markets. *Journal of Finance*, 68 (2), 387–429.

Duggal, R. and Millar, J. 1999. Institutional ownership and firm performance: The case of bidder returns. *Journal of Corporate Finance*, 5, 103–117.

Fauver, L., Houston, J., Naranjo, A., 2003. Capital market development, international integration, legal systems, and the value of corporate diversification: a cross-country analysis. *Journal of Financial and Quantitative Analysis*, 38, 135–157.

Fee, C.E., Hadlock, C.J., and Thomas, S., 2006. Corporate equity ownership and the governance of product market relationships. *Journal of Finance*, 61, 1217–1251.

Feldman, E.R. 2016. Managerial compensation and corporate spinoffs. *Strategic Management Journal*, 37 (2), 2011–2030.

Gertner, R., Powers, E.A., and Scharfstein, D.S., 2002. Learning about internal capital markets from corporate Spin-offs. *Journal of Finance*, 57 (6), 2479–2506.

Gilson, S.C., Healy, P.M., Noe, C.F., and Palepu, K., 2001. Analyst specialization and conglomerate stock breakups. *Journal of Accounting Research*, 39 (3), 565–582.

Glaser, M., Lopez-De-Silanes, F., and Sautner, Z. (2013). Opening the black box: Internal capital markets and managerial power. *Journal of Finance*, 68 (4), 1577-1631.

Guedj, I. and Scharfstein, D.S., 2004. Organizational scope and investment: evidence from the drug development strategies and performance of biopharmaceutical firms. NBER working paper.

Habib, M.A., Johnson, D.B., Naik, N.Y., 1997. Spin-offs and information. *Journal of Financial Intermediation*, 6, 153–176.

Haynes M., Thompson, S., and Wright, M., 2003. The determinants of corporate divestment: Evidence from a panel of UK firms. *Journal of Economic Behavior and Organization*, 52 (1), 147–166.

Heckman, J., 1979. Sample selection bias as specification error. *Econometrica*, 47 (1), 153–161.

Hoechle, D., Schmid, M., Walter, I., and Yermack, D. 2012. How much of the diversification discount can be explained by poor corporate governance?. *Journal of Financial Economics*, 103 (1), 41–60.

Holmstrom, B. and Tirole, J., 1993. Market liquidity and performance monitoring. *Journal of Political Economy*, 101 (4), 678–709.

Hulbert, H.M., Miles, J.A., and Woolridge, J.A., 2002. Value creation from equity carve-outs. *Financial Management*, 31 (1), 83–100.

John, K. and Ofek, E., 1995. Asset sales and increase in focus. *Journal of Financial Economics*, 37 (1), 105–126.

Khanna, N. and Tice, S., 2001. The bright side of internal capital markets. *Journal of Finance*, 56 (4), 1489-1528.

Klein, A., Rosenfeld, J., and Beranek, W., 1991. The two stages of an equity carve-out and the price response of parent and subsidiary stock. *Managerial and Decision Economics*, 12 (6), 449–460.

Klein, A. and Rosenfeld, J., 2010. The long-run performance of sponsored and conventional spin-offs. *Financial Management*, 39 (1), 227–247.

Krishnaswami, S., and Subramaniam, V., 1999. Information asymmetry, valuation, and the corporate spin-off decision. *Journal of Financial Economics*, 53 (1), 73–112,

Kumar, R. and Sopariwala, P.R., 1992. The effect of adoption of long-term performance plans on stock prices and accounting numbers. *Journal of Financial and Quantitative Analysis*, 27 (4), 561–573.

Lang, L. and Stulz, R.M., 1994. Tobin's *q*, corporate diversification and firm performance. *Journal of Political Economy*, 102 (6), 1248–1280.

Lang, L., Poulsen, A., and Stulz, R.M., 1995. Asset sales, firm performance, and the agency costs of managerial discretion. *Journal of Financial Economics*, 37 (1), 73–112.

Lamont, O.A., 1997. Cash flow and investment: Evidence from internal capital markets. *Journal of Finance*, 52 (1), 83–109.

Lee, D. and Madhavan, R., 2010. Divestiture and firm performance: A meta-analysis. *Journal of Management*, 36 (6), 1345–1371.

Li, K. and Prabhala, N.R., 2006. Self-selection models in corporate finance. *Centre for Corporate Governance Working Paper*, Tuck School of Business at Dartmouth.

Lins, K. and Servaes, H., 2002. Is corporate diversification beneficial in emerging markets? *Financial Management*, 31, 5–31.

Nanda, V., 1991. On the good news in equity carve-outs. *Journal of Finance*, 46 (5), 1717–1737.

Maksimovic, V. and Phillips, G., 2001. The market for corporate assets: Who engages in merges and asset sales and are there efficiency gains? *Journal of Finance*, 56 (6), 2019–2065.

Maksimovic, V. and Phillips, G., 2002. Do conglomerate firms allocate resources inefficiently across industries? Theory and evidence. *Journal of Finance*, 57 (2), 721–767.

Matsusaka, J. and Nanda, V., 2002. Internal capital markets and corporate refocusing. *Journal of Financial Intermediation*, 11, 176–211.

McNeil, C.R. and Moore, W., 2005. Dismantling internal capital markets via spin-offs: Effects on capital allocation efficiency and firm valuation. *Journal of Corporate Finance*, 11 (1), 253–275.

Milgrom, P. and Roberts, J. 1990. Bargaining costs, influence costs and the organizations of economic activity', in Alt, J. and Shepsle, K. (eds). *Perspectives on Positive Political Economy*. Cambridge: Cambridge University Press.

Mulherin, J.H. and Boone, A., 2000. Comparing acquisitions and divestitures. *Journal of Corporate Finance*, 6 (2), 117–139.

Myers, S.C. and Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investor do not have. *Journal of Financial Economics*, 13 (2), 197-221.

Otsubo, M., 2009. Gains from equity carve-outs and subsequent events. *Journal of Business Research*, 62, 1207–1213.
Ozbas, O., and Scharfstein, D., 2010. Evidence on the dark side of internal capital markets. *Review of Financial Studies*, 23, 581–599.

Palepu, K., 1985. Diversification strategy, profit performance and the entropy measure. *Strategic Management Journal*, 6 (3), 239–255.

Parrino, R., 1997. Spin-offs and wealth transfers: The Marriott case. *Journal of Financial Economics*, 43 (2), 241–274.

Perotti, E. and Rossetto, S., 2007. Unlocking value: Equity carve-outs as strategic real options. *Journal of Corporate Finance*, 13 (5), 771–792.

Powers, E.A., 2003. Deciphering the motives for equity carve-outs. *Journal of Financial Research*, 26 (1), 31–50.

Rajan, R., Servaes, H., and Zingales, L., 2000. The cost of diversity: The diversification discount and inefficient investment. *Journal of Finance*, 65 (1), 35–80.

Rosenbaum, P. R. 2002. *Observational studies*. New York: Springer.

Sautner, Z., and Villalonga, B. 2010. Corporate governance and internal capital markets. Harvard Business School Finance Working Paper.

Scharfstein, D.S., 1998. The dark side of internal capital markets II: Evidence from diversified conglomerates. NBER working paper.

Scharfstein, D.S. and Stein, J.C., 2000. The dark side of internal capital markets: Divisional rent-seeking and inefficient investment. *Journal of Finance*, 55 (6), 2537–2564.

Schipper, K. and Smith, A., 1986. A comparison of equity carve-outs and seasoned equity offerings: Share price effects and corporate restructuring. *Journal of Financial Economics*, 15 (1), 153–186.

Schlingemann, F.P., Stulz, R.M., and Walkling, R.A., 2002. Divestitures and the liquidity of the market for corporate assets. *Journal of Financial Economics*, 64 (1), 117–144.

Seward, J.K. and Walsh, J.P., 1996. The governance and control of voluntary corporate spin-offs. *Strategic Management Journal*, 17 (1), 25–39.

Shleifer, A. and Vishny, R.W., 1991. Takeovers in the '60s and the '80s: Evidence and implications. *Strategic Management Journal*, 12 (S2), 51–59.

Shin, H. and Stulz, R.M., 1998. Are internal capital markets efficient? *Quarterly Journal of Economics*, 113 (2), 531–552.

Slovin, M.B., Sushka, M.E., and Ferraro, S.R. 1995. A comparison of the information conveyed by equity carve-outs, spin-offs and assets sell-offs. *Journal of Financial Economics*, 37 (1), 89–104.

Slovin, M.B. and Sushka, M.E., 1998. The economics of parent-subsidiary mergers: an empirical analysis. *Journal of Financial Economics*, 49, 255–279.

Stein, J.C., 1997. Internal capital markets and the competition for corporate resources. *Journal of Finance*, 52 (1), 111-133.

Stein, J.C., 2003. *Agency, Information and Corporate Investment in Constantinides, G., Harris, M. and Stulz, R.M.* (eds). Handbook of the Economics of Finance. Amsterdam: Elsevier.

Sudarsanam, S. 2010. *Creating value from mergers and acquisitions*. Financial Times.

Triantis, G.G., 2002. Organizations as Internal Capital Markets: The legal boundaries of firms, collateral and trusts in commercial and charitable enterprises. *Harvard Law Review*, 117, 1102–1162.

Vijh, A.M., 2002. The positive announcement-period returns of equity carve-outs: Asymmetric information or divestiture gains? *Journal of Business*, 75 (1), 153–190.

Villalonga, B., 2004. Does diversification cause the “Diversification Discount”? *Financial Management*, 33 (2), 5–27.

Whited, T.M., 2001. Is it inefficient investment that causes the diversification discount?. *Journal of Finance*, 56 (5), 1667–1691.

Yermack, D., 1996. Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, 49 (2), 185–211.

Zajac, E.J. and Westphal, J.D. 1994. The costs and benefits of managerial incentives and monitoring in large U.S. corporations: when is more not better? *Strategic Management Journal*, 15 (S1), 121–142.

**Table 1.** Variable definitions

| Variable name | Description, prior relevant studies and source of data |
|---|---|
| | *Main Dependent Variables* |
| Equity carve-out (ECO) | Dummy variable that is equal to one if the company performs a carve-out and zero otherwise. (Source: SDC) |
| RINV | Measure of whether the parent allocates capital to relatively high-growth i.e. high q segments. Low allocative efficiency could motivate an ECO. (Çolak and Whited, 2007). See Appendix A1 for description and formulae used to calculate this variable. The numerator of q is calculated as the book value of assets minus book value of equity plus market capitalisation minus deferred taxes.* The denominator of q equals the book value of assets.* |
| RVA | Measure of whether the parent's capital allocation to a segment is correlated with the industry median q. Low allocative efficiency could motivate an ECO (Çolak and Whited, 2007). See Appendix A1 for description and formulae used to calculate this variable.* |
| Excess value (EXVAL) | Indirect proxy for allocative efficiency measured as the parent's market value of equity to sales ratio relative 3-digit Standard Industrial Classification (SIC) industry median adjusted market to sales ratio of segments in which parent operates. Low allocative efficiency could motivate ECO. (Çolak and Whited, 2007) See Appendix A1 for description and formulae used to calculate this variable.* |
| | *External Governance Variables* |
| Analyst coverage | Analyst coverage for a given year calculated as average of the monthly number of analysts who cover the given stock. For the conglomerate, we combine the analyst coverage of the offspring in the post-ECO period and the analyst coverage of the parent (Gilson et al., 2001).* (Source: IBES) |
| Analyst forecast dispersion | Analyst forecast dispersion for a given year calculated as the average of the monthly standard deviation regarding the given stock.* (Source: IBES) |
| Shareholder concentration | The average of quarterly institutional investor ownership concentration index (Duggal and Millar, 1999). (Source: Factset). |
| No. of inst. investor | The average of quarterly number of institutional investors. (Source: Factset) |
| %Shares of inst. investor | The average of quarterly percentage of shares held by institutional investors. (Source: Factset) |
| No. of inst. investor (Block) | Number of institutional investors with a minimum of 5% ownership present on the company's share register (The institutional investor information is obtained by researching proxy statements).* (Source: Edgar) |
| %Shares of inst. investor (Block) | Proportion of shares owned by institutional investors.* (Source: Edgar) |
| | *Internal Governance Variables* |
| Board duality | Dummy variable equal to one if the CEO of firm is also chairman of the board of directors and zero otherwise.* (Source: BoardEx, Edgar) |
| Board size | Number of board directors.* (Source: BoardEx, Edgar) |
| Board independence | Number of non-executive directors/number of executive directors (Non-executive directors is used in BoardEx).* (Source: BoardEx, Edgar) |
| CEO cash compensation | Sum of salary and bonus (Zajac and Westphal, 1994; Feldman, 2016).* (Source: BoardEx, Execucomp, Edgar) |
| CEO non-cash compensation | CEO's total compensation *minus* his/her cash compensation (Zajac and Westphal, 1994; Feldman, 2016).* (Source: BoardEx, Execucomp, Edgar) |

| | |
|---|---|
| CEO tenure | Number of years since the CEO was appointed to that position.* (Source: BoardEx, Execucomp, Edgar) |
| | *Control Variables* |
| Assets | Total assets of the conglomerate company.* |
| Investment | Measures the capital expenditures of the conglomerate divided by the total sales in the year prior to carve-out completion.* |
| Number of segments | Number of segments of the conglomerate company.* |
| Tobin's Q | The numerator of Q is calculated as the book value of assets minus book value of equity plus market capitalisation minus deferred taxes.* The denominator of q equals the book value of assets.* |
| Relative entropy | For a firm operating in n industry segments, this takes into consideration (i) number of segments in which it operates, and (ii) relative importance of each segment in total sales. If $P_i$ is the share of the ith segment in total sales, then DT = $\sum_{i=1}^{N}\left[P_i * \ln\left(\frac{1}{P_i}\right)\right]$ (Palepu, 1985; Daley, Mehrotra and Sivakumar, 1997; Desai and Jain, 1999; Krishnaswami and Subramaniam, 1999).* |
| Debt/Assets | A positive proxy for scope and incentive to expropriate debt holders and benefit stock holders. (Shleifer and Vishny, 1991; Parrino, 1997). Debt = long-term debt/ net assets.* |
| Log sales (Size) | Parent size proxy and measure of likelihood of ECO (Haynes, Thompson, and Wright, 2003). Measured as natural logarithm of Net Sales.* |
| Market share | Parent sales/ 3-digit (primary SIC-code) industry sales. Parent primary SIC code defined by Compustat.* |
| Financing gap | Proxy for parent's need for cash to finance future investment activities (Lang, Poulsen, and Stulz, 1995). (Cash flow plus net debt issued minus net capital expenditure)/ Net sales.* |
| EBITDA/Sales | Proxy for parent's need for cash to finance future investment activities (Lang, Poulsen, and Stulz, 1995). (Cash flow plus net debt issued minus net capital expenditure)/ Net sales.* |
| Largest segment profit | Proxy for positive demand shock (Maksimovic and Phillips, 2002) operating profits of firm's largest segment/ its net sales.* |
| Industry sales growth | Two-year industry sales growth measured as of year of carve-out completion, at parent's primary two-digit industry SIC code level and a proxy for unanticipated shifts in industry prospects (Çolak and Whited, 2007). |
| M&A activity | Positive proxy for liquidity of market for corporate assets (Schlingemann, Stulz, and Walkling, 2002). Value of all mergers, acquisitions, and acquisitions of majority interest (as defined by the SDC Platinum Database) in parent firm's two-digit industry and normalized by that industry's market capitalization.** (Source: SDC) |
| IPO activity | Positive proxy for liquidity of market for new equity issues (Schlingeman et al., 2002). Market value of IPOs in parent firm's primary two-digit SIC code industry and normalized by that industry's market capitalization.** (Source: SDC) |
| MTBV | Market value of parent equity/ book value of equity as of one year before ECO completion.* |
| Proceeds | Total proceeds amount for the entire transaction. (Source: SDC) |

Note: * means as of the company's fiscal year end taken from its annual financial statements; ** means as of the end of the calendar year preceding the ECO. Otherwise indicated, all variables are constructed with Compustat inputs.

**Table 2. Sample Characteristics**

**Panel A.** Sample distribution over time.

| Year | Frequency by year | Percent |
|---|---|---|
| 1980s | 68 | 19.2 |
| 1990s | 149 | 42.08 |
| After 2000 | 137 | 38.69 |
| Total | 354 | 100 |

**Panel B.** Financial characteristics of ECO parents and non-restructuring firms

| Variable name | ECO Mean (A) | Controls Mean (B) | Difference A-B (t-stat) | ECO Median | Controls Median | Difference A-B (Pearson $chi^2$) |
|---|---|---|---|---|---|---|
| Assets | 34,662 | 33,077 | **1,585*****<br>(11.821) | 3,786 | 5,613 | -1,827<br>(1.232) |
| Investment | 0.078 | 0.057 | **0.021*****<br>(3.730) | 0.057 | 0.045 | 0.012<br>(1.491) |
| Number of segments | 4.09 | 2.63 | **1.46*****<br>(2.833) | 4.00 | 2.00 | **2.00****<br>(2.362) |
| Log sales | 8.077 | 5.056 | **3.021***<br>(21.672) | 7.275 | 5.084 | **2.191***<br>(149.300) |
| MTBV | 2.113 | 2.074 | **0.039****<br>(2.023) | 1.646 | 1.380 | **0.266***<br>(18.609) |
| Debt/Assets | 0.287 | 0.205 | **0.082***<br>(10.058) | 0.271 | 0.182 | **0.089***<br>(94.210) |
| EBITDA/Sales | 0.156 | 0.092 | **0.064***<br>(6.473) | 0.142 | 0.101 | **0.041***<br>(21.840) |
| Relative entropy | 0.930 | 0.598 | **0.332***<br>(11.305) | 0.970 | 0.622 | **0.348***<br>(49.984) |
| RVA | -0.001 | -0.022 | **0.021****<br>(1.650) | -0.0003 | -0.0002 | **-0.0001***<br>(18.724) |
| RINV | -0.0004 | -0.006 | **0.006****<br>(2.228) | -0.0002 | 0.0003 | **-0.0005***<br>(17.580) |
| EXVAL | -0.330 | 0.180 | **-0.510***<br>(-2.737) | -0.119 | 0.0648 | **-0.184***<br>(10.467) |
| Financing gap | -0.089 | -0.020 | **-0.069***<br>(-5.384) | -0.064 | -0.049 | **-0.015***<br>(8.270) |
| IPO activity | 0.003 | 0.004 | -0.0002<br>(-0.550) | 0.0008 | 0.0003 | **0.0005*****<br>(2.703) |
| M & A activity | 0.076 | 0.150 | -0.074<br>(-1.078) | 0.041 | 0.039 | 0.002<br>(0.020) |
| Industry sales growth | -0.030 | 0.024 | **-0.055***<br>(-7.359) | 0.025 | 0.031 | **-0.006****<br>(2.613) |
| Market share | 0.095 | 0.048 | **0.047***<br>(7.701) | 0.056 | 0.005 | **0.051***<br>(126.877) |
| Largest segment profit | 0.073 | 0.099 | **-0.026****<br>(-2.178) | 0.100 | 0.081 | **0.019****<br>(4.655) |
| Sample size | 354 | 3,695 | | 354 | 3,695 | |

**Panel C.** Additional ECO characteristics

| Statistics | Equity retained | Market value of ECO (Million USD) | Market value of parent (Million USD) | Proceeds (Million USD) | Same SIC3 ECO | Different SIC2 ECO | Same SIC2 but different SIC3 ECO |
|---|---|---|---|---|---|---|---|
| Mean | 66% | 2,519.159 | 21,178.497 | 584.925 | - | - | - |
| Median | 72% | 311.400 | 5,649.530 | 96.855 | - | - | - |
| Number of ECOs | 184 | 259 | 244 | 354 | 155 (44%) | 115 (32%) | 84 (24%) |

**Notes:** The data is extracted from SDC and the sample covers ECOs completed during the period 1980 - 2013. In Panel B, Assets are measured in millions of US dollars (USD). t-stats or Pearson $chi^2$ statistics are reported in parentheses. In Panel C, SIC3 (SIC2) = 3 (2) digit standard industrial classification. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

**Table 3.** Probit model of likelihood of equity carve-out (Dependent variable: ECO dummy)

| Parent variables | Coefficients | Marginal Effects |
|---|---|---|
| Log sales | **0.218*** ** | **0.001*** ** |
| | (13.37) | (9.788) |
| MTBV | **0.029** ** | **0.007** ** |
| | (2.268) | (2.284) |
| EBITDA/Sales | 0.103 | 0.002 |
| | (0.940) | (0.692) |
| Debt/Assets | **0.228*** ** | **0.003*** ** |
| | (9.891) | (7.331) |
| Relative entropy | **0.321*** ** | **0.001*** ** |
| | (5.554) | (4.147) |
| RVA | 0.281 | 0.001 |
| | (0.907) | (0.443) |
| RINV | -0.012 | -0.004 |
| | (-0.137) | (-1.228) |
| EXVAL | 0.004 | 0.0008 |
| | (0.656) | (0.079) |
| Financing gap | -0.089 | -0.002 |
| | (-1.035) | (-0.258) |
| IPO activity | **5.029** ** | **0.059*** ** |
| | (2.577) | (3.291) |
| M&A activity | -0.231 | -0.002 |
| | (-1.325) | (-1.481) |
| Industry sales growth | **-0.355*** | **-0.007*** |
| | (-1.837) | (-1.939) |
| Market share | **-0.416** ** | **-0.001** ** |
| | (-2.215) | (-2.482) |
| Largest segment profit | **-0.326** ** | **-0.003** ** |
| | (-2.277) | (-2.397) |
| Industry FE | Yes | |
| Year FE | Yes | |
| Number of ECOs | 354 | |
| Control sample | 3,695 | |
| Pseudo $R^2$ | 0.329 | |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. *RINV*, *RVA* and *EXVAL* are defined according to Eqs. (1), (4) and (5) in Appendix A1. For the definitions of the other variables see Table 1. t-stats are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively. This model includes year and industry fixed effects.

**Table 4.** Comparison of significant predictor variables of ECO between treated sample and control firms identified using the Dehejia and Wahba PSM procedure.

| Variable name | Carve-outs Mean (A) | Controls Mean (B) | Difference A-B (t-stat) | Carve-outs Median | Controls Median | Difference A-B (Pearson chi2) |
|---|---|---|---|---|---|---|
| Log Sales | 8.077 | 7.468 | 0.609 | 7.275 | 5.735 | 1.540 |
| | | | (0.741) | | | (2.372) |
| Market to book | 2.113 | 2.006 | 0.107 | 1.646 | 1.467 | 0.179 |
| | | | (0.816) | | | (1.582) |
| Debt | 0.287 | 0.237 | 0.050 | 0.271 | 0.281 | -0.010 |
| | | | (1.258) | | | (1.283) |
| Relative entropy | 0.930 | 0.933 | -0.003 | 0.970 | 0.940 | 0.030 |
| | | | (-0.660) | | | (1.431) |
| Market share | 0.095 | 0.097 | -0.002 | 0.056 | 0.061 | -0.005 |
| | | | (-1.149) | | | (1.390) |
| Largest segment profit | 0.073 | 0.080 | -0.007 | 0.100 | 0.108 | -0.008 |
| | | | (-1.180) | | | (0.188) |
| Sample size | 354 | 354 | | 354 | 354 | |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. T-stats are provided for the mean comparison tests and Pearson chi2 statistics are provided for the median comparison tests in parentheses. The matched sample is obtained following the Dehejia and Wahba PSM procedure. The identification of variables is presented in Appendix A1. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

**Table 5.** ECO effects on allocative efficiency and firm value based on propensity score matching (PSM) and Heckman methodologies

**Panel A.** Treatment effects Adjusted for matched control firm efficiency using the Dehejia and Wahba PSM procedure

| Variable | **RINV** | **RVA** | **EXVAL** |
|---|---|---|---|
| ***Treatment Effects over (-2, +2) years window*** | | | |
| DinD | **0.119**** | **0.009*** | **0.021*** |
| | (2.057) | (1.825) | (1.762) |
| ***Treatment Effects over (-3, +3) years window*** | | | |
| DinD | **0.114*** | **0.010**** | **0.241*** |
| | (1.821) | (2.463) | (1.808) |
| Number of ECOs | 354 | 354 | 354 |

Notes: Panel A present the results of analysis of the effects of carve-outs on allocative efficiency and firm value of parents. *RINV*, *RVA* and *EXVAL* are defined in Appendix A1. Sample size is 354 ECO parents and 354 control firms. The control sample is selected using the Dahejia and Wahba PSM procedure as shown in the text. *DinD treatment effects* are the difference between change for treated observations and change for corresponding control observations. t-stats are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

**Panel B.** Heckman bias-adjusted change in allocative efficiency and firm value

| Variable | RINV | RVA | EXVAL |
|---|---|---|---|
| ***Heckman Method over (-2, +2) years window*** | | | |
| Heckman_Treated | **0.027*** | 0.001 | **0.135***** |
| | (1.929) | (0.228) | (5.625) |
| Heckman_Controls | **-0.038***** | **-0.010***** | **-0.727***** |
| | (-3.167) | (-2.503) | (-2.077) |
| InvMills | **0.011***** | **0.002**** | **0.224**** |
| | (3.667) | (2.205) | (2.113) |
| ***Heckman Method over (-3, +3) years window*** | | | |
| Heckman_Treated | **0.008**** | **0.003***** | **0.113***** |
| | (2.112) | (3.166) | (5.136) |
| Heckman_Controls | **-0.014***** | **-0.004***** | **-0.668***** |
| | (-6.968) | (-6.667) | (-7.506) |
| InvMills | **0.003***** | **0.004**** | **0.206***** |
| | (4.286) | (2.175) | (7.103) |
| Number of ECOs | 354 | 354 | 354 |

Notes: *RINV*, *RVA* and *EXVAL* are defined in Appendix A1. The variables labelled '*Heckman_Treated'* correspond to the sum of $(\alpha+\beta_1)$ in the regression, $\Delta S_n(T_n)= \alpha + \beta_1 T_n + \beta_2 \text{InvMills} + \varepsilon_n$ (see equation 3 in text) where $\alpha$ represents the average change in allocative efficiency in the sample of non-restructuring companies and the sum of $(\alpha+\beta_1)$ captures the average change in allocative efficiency in the carve-out sample. $\Delta S$ is defined as the change in allocative efficiency and conglomerate valuation and $T_n$ is a dummy variable that is equal to one if the company performs a carve-out and 0 otherwise. In addition, $\beta_2$ is defined as the coefficient on the variable used to adjust for self-selection bias in the Heckman regression. '*Heckman_Controls'* captures the value of $\alpha$ in the Heckman regression. t-stats are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

**Table 6.** Governance characteristics of ECO parents
**Panel A.** Event window (-2, +2) years

| Variables | Treatment | | | Control | | | ΔT- ΔC |
|---|---|---|---|---|---|---|---|
| | Before | After | Change | Before | After | Change | DinD |
| *External Governance Characteristics* | | | | | | | |
| %Shares of inst. investor | 0.448 | 0.495 | **0.046*** ** | 0.452 | 0.461 | 0.009 | **0.038** ** |
| Shareholder concentration | 0.126 | 0.120 | -0.006 | 0.166 | 0.180 | 0.014 | -0.020 |
| No. of inst. investor | 225.181 | 272.807 | **47.626*** ** | 120.271 | 136.131 | **15.860*** ** | **31.766*** ** |
| %Shares of inst. investor (Block) | 0.190 | 0.180 | -0.010 | 0.233 | 0.231 | -0.002 | -0.008 |
| No. of inst. investor (Block) | 1.976 | 2.107 | 0.127 | 2.847 | 3.043 | 0.196 | -0.068 |
| Analysts | 11.020 | 16.441 | **5.420*** ** | 6.876 | 7.087 | 0.211 | **5.208*** ** |
| Forecast dispersion | 0.165 | 0.199 | **0.033** ** | 0.211 | 0.154 | **-0.057** ** | **0.091*** ** |
| *Internal Governance Characteristics* | | | | | | | |
| Duality | 0.553 | 0.541 | -0.012 | 0.710 | 0.677 | -0.032 | 0.020 |
| Board independence | 4.947 | 5.533 | **0.586*** ** | 5.603 | 6.062 | **0.459** * | 0.126 |
| Board size | 11.528 | 11.131 | **-0.397*** ** | 14.104 | 12.980 | **-1.119*** ** | **0.721** ** |
| Total compensation | 4.899 | 6.244 | **1.345*** ** | 4.681 | 5.885 | **1.203** ** | 0.142 |
| Non-cash compensation | 3.153 | 4.372 | **1.218*** ** | 3.128 | 4.161 | **1.033** ** | 0.185 |
| Cash compensation | 1.822 | 1.856 | 0.034 | 1.553 | 1.723 | **0.169** * | -0.135 |
| CEO tenure | 5.9203 | 5.561 | -0.359 | 5.915 | 5.475 | -0.440 | 0.080 |

**Panel B.** Event window (-3, +3) years

| Variables | Treatment | | | Control | | | ΔT- ΔC |
|---|---|---|---|---|---|---|---|
| | Before | After | Change | Before | After | Change | DinD |
| *External Governance Characteristics* | | | | | | | |
| %Shares of inst. investor | 0.451 | 0.517 | **0.066*** ** | 0.451 | 0.465 | 0.014 | **0.0523*** ** |
| Shareholder concentration | 0.123 | 0.116 | -0.008 | 0.174 | 0.193 | 0.019 | -0.026 |
| No. of inst. investor | 187.866 | 240.591 | **52.724*** ** | 116.111 | 134.367 | **18.255*** ** | **34.468*** ** |
| %Shares of inst. investor (Block) | 2.016 | 2.078 | 0.061 | 2.861 | 3.222 | 0.361 | -0.299 |
| No. of inst. investor (Block) | 0.191 | 0.178 | -0.013 | 0.278 | 0.292 | 0.013 | -0.027 |
| Analyst | 11.017 | 17.108 | **6.090*** ** | 9.155 | 9.225 | 0.070 | **6.020*** ** |
| Forecast dispersion | 0.159 | 0.189 | 0.029* | 0.139 | 0.137 | -0.002 | 0.031 |
| *Internal Governance Characteristics* | | | | | | | |
| Duality | 0.585 | 0.599 | 0.014 | 0.730 | 0.704 | -0.025 | 0.039 |
| Board independence | 4.961 | 5.678 | **0.716*** ** | 6.124 | 6.178 | 0.054 | **0.655** ** |
| Board size | 11.851 | 11.386 | **-0.464*** ** | 14.960 | 13.846 | **-1.113*** ** | 0.648 |
| Total compensation | 3.786 | 5.394 | **1.607*** ** | 4.712 | 5.757 | **1.044** ** | 0.563 |
| Non-cash compensation | 2.172 | 3.560 | **1.387*** ** | 3.155 | 4.024 | **0.868*** | 0.519 |
| Cash compensation | 1.642 | 1.850 | **0.208*** | 1.556 | 1.732 | **0.175*** | 0.033 |
| CEO tenure | 6.2703 | 5.932 | -0.338 | 6.477 | 6.539 | 0.062 | -0.399 |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. *Before* is the average for each conglomerate company over the window (t = -2 to t = -1 years) in Panel A and (t = -3 to t = -1 years) in Panel B relative to the ECO year t = 0. The variable *After* is the average over the window (t = +1 to t = +2 years) in Panel A and (t = +1 to t = +3 years) in Panel B relative to the ECO year t = 0. The variable *Change* is defined as the difference between *Before* and *After*. The raw difference-in-differences is equal to ΔT- ΔC. T-stats are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively

**Table 7.** Governance characteristics of ECO offspring

| Variables | Event window (0, +2) years | | | Event window (0, +3) years | | |
|---|---|---|---|---|---|---|
| | Before | After | Change | Before | After | Change |
| *External Governance Characteristics* | | | | | | |
| %Shares of inst. investor | 0.248 | 0.337 | **0.088*** ** | 0.256 | 0.378 | **0.122*** ** |
| Shareholder concentration | 0.234 | 0.200 | **-0.035** ** | 0.222 | 0.167 | **-0.055*** ** |
| No. of inst. investor | 34.155 | 68.386 | **34.230*** ** | 35.396 | 76.549 | **41.153*** ** |
| %Shares of inst. investor (Block) | 0.203 | 0.233 | 0.030 | 0.189 | 0.228 | 0.039 |
| No. of inst. investor (Block) | 1.839 | 2.395 | **0.555*** ** | 1.855 | 2.304 | **0.449** ** |
| Analyst | 3.493 | 6.015 | **2.521*** ** | 3.467 | 6.259 | **2.792*** ** |
| Forecast dispersion | 0.173 | 0.808 | 0.634 | 0.181 | 0.830 | 0.648 |
| *Internal Governance Characteristics* | | | | | | |
| Duality | 0.574 | 0.576 | 0.007 | 0.587 | 0.860 | **0.273*** ** |
| Board independence | 3.807 | 4.019 | **0.216** ** | 3.923 | 3.968 | 0.045 |
| Board size | 7.515 | 8.169 | **0.654*** ** | 7.611 | 8.397 | **0.785*** ** |
| Total compensation | 2.589 | 2.136 | -0.453 | 2.665 | 2.105 | -0.560 |
| Non-cash compensation | 1.678 | 1.235 | -0.442 | 1.710 | 1.143 | -0.478 |
| Cash compensation | 0.947 | 0.910 | -0.036 | 0.996 | 0.971 | -0.024 |
| CEO tenure | 1.669 | 3.397 | **1.728*** ** | 2.616 | 4.849 | **2.232*** ** |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. *Before* is the governance characteristic for each offspring at t=0. *After* is the governance variable for each offspring in two (or three) years after the completion of the ECO. The variable *Change* is defined as the difference between *Before* and *After* t-stats are reported in parentheses. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

**Table 8.** Impact of changes in governance following ECO on allocative efficiency and valuation of parents

**Panel A.** Dependent variable: Change in allocative efficiency and valuation over the event window (-2, +2) years

| | Model 1: Δ RINV | Model 2: Δ RVA | Model 3: Δ EXVAL |
|---|---|---|---|
| *External Governance Characteristics* | | | |
| Δ Analyst coverage | 0.021 | **0.085*** | 0.011 |
| | (1.252) | (1.752) | (1.607) |
| Δ Shares of inst. investors | **0.036**** | **0.012**** | **0.036**** |
| | (2.423) | (2.113) | (2.243) |
| Δ Analyst forecast dispersion | -0.017 | -0.094 | -0.055 |
| | (-0.391) | (-1.096) | (-1.218) |
| Δ Shareholder concentration | 0.438 | 1.091 | 1.844 |
| | (0.348) | (0.998) | (0.268) |
| *Internal Governance Characteristics* | | | |
| Δ Board independence | 0.235 | **0.098*** | 0.255 |
| | (0.597) | (0.768) | (0.906) |
| Δ Board size | **-0.0677**** | -0.0492 | **-1.669**** |
| | (-2.489) | (-0.807) | (-1.963) |
| Δ CEO tenure | **0.0682*** | **0.0497**** | **0.819*** |
| | (1.898) | (2.634) | (1.859) |
| Board duality | **-0.087***** | -0.023 | **-0.436**** |
| | (-3.387) | (-0.690) | (-2.243) |
| Δ CEO cash compensation | **-0.0367**** | **-0.0128***** | -0.1105 |
| | (-2.261) | (-2.972) | (-0.771) |
| Δ CEO non-cash compensation | 0.204 | 0.0730 | 1.983 |
| | (0.680) | (0.864) | (0.864) |
| *Other Controls* | | | |
| Proceeds | 0.057 | 0.061 | 0.017 |
| | (0.653) | (0.924) | (0.185) |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Number of ECOs | 93 | 93 | 93 |
| Adjusted $R^2$ | 0.282 | 0.299 | 0.284 |

**Panel B.** Dependent variable: Change in allocative efficiency and valuation over the event window (-3, +3) years

| | Model 1: Δ RINV | Model 2: Δ RVA | Model 3: Δ EXVAL |
|---|---|---|---|
| *External Governance Characteristics* | | | |
| Δ Analyst coverage | 0.014 | 0.077 | 0.057 |
| | (1.543) | (0.181) | (0.923) |
| Δ Shares of inst. investors | **0.024**** | **0.074**** | 0.023 |
| | (2.283) | (2.292) | (0.873) |
| Δ Analyst forecast dispersion | -0.027 | -0.047 | -0.015 |
| | (-0.593) | (-0.307) | (-1.199) |
| Δ Shareholder concentration | **0.198**** | 0.046 | 0.018 |
| | (2.119) | (0.717) | (0.661) |
| *Internal Governance Characteristics* | | | |
| Δ Board independence | 0.0348 | 0.0193 | 0.0132 |
| | (0.671) | (0.785) | (0.406) |
| Δ Board size | -0.0623 | **-0.0143*** | **-0.278***** |
| | (-0.452) | (-1.915) | (-3.050) |
| Δ CEO tenure | **0.014**** | **0.035**** | 0.028 |
| | (2.301) | (2.171) | (1.164) |
| Board duality | -0.055 | -0.029 | -0.033 |
| | (-0.909) | (-0.00138) | (-0.539) |
| Δ CEO cash compensation | **-0.059**** | -0.023 | -0.033 |
| | (-2.213) | (-0.420) | (-0.399) |
| Δ CEO non-cash compensation | 0.013 | 0.063 | 0.010 |
| | (0.775) | (0.318) | (0.443) |
| *Other Controls* | | | |
| Proceeds | 0.066 | 0.027 | 0.026 |
| | (0.515) | (0.636) | (0.629) |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Number of ECOs | 93 | 93 | 93 |
| Adjusted $R^2$ | 0.323 | 0.294 | 0.280 |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. The dependent variable in each model is the change in allocative efficiency (RINV in Model 1 and RVA in Model 2) or valuation (EXVAL in Model 3) adjusted by the change in the matched control firm where each control firm is identified using the PSM matching estimator. Change in the governance variables is measured over a period starting one year before and ending one year after the ECO completion. Please refer to Table 1, the Sample and Methodology Section 3 and Appendix A1 for detailed definitions of the dependent and independent variables. t-stats are reported in parentheses. ***, **, and * indicate statistical significance at a 1%, 5%, and 10% level, respectively. All Models include year and industry fixed effects.

**Table 9.** Difference-in-difference (DinD) analysis of effect of changes in governance following carve-out on parent allocative efficiency and valuation.

**Panel A.** Dependent variable: Change in allocative efficiency and valuation over the event window (-2, +2) years

| | Model 1: Δ RINV | Model 2: Δ RVA | Model 3: Δ EXVAL |
|---|---|---|---|
| *External Governance Characteristics* | | | |
| DinD_Δ Analyst coverage | **0.041*** | **0.013*** | 0.051 |
| | (1.864) | (1.820) | (0.550) |
| DinD_Δ Shares of inst. investors | **0.096*** | 0.015 | 0.044 |
| | (1.779) | (1.280) | (0.418) |
| DinD_Δ Analyst forecast dispersion | -0.083 | -0.018 | -0.033 |
| | (-0.676) | (-0.494) | (-1.200) |
| DinD_Δ Shareholder concentration | 0.229 | 0.107 | 0.0467 |
| | (0.588) | (1.160) | (0.409) |
| *Internal Governance Characteristics* | | | |
| DinD_Δ Board independence | 0.0612 | **0.098*** | 0.659 |
| | (1.268) | (1.794) | (0.786) |
| DinD_Δ Board size | **-0.0417***** | **-0.0125***** | **-0.052*** |
| | (-2.968) | (-2.997) | (-1.793) |
| DinD_Δ CEO tenure | **0.0451**** | **0.0722***** | 0.921 |
| | (1.995) | (3.395) | (1.361) |
| DinD_Board duality | **-0.020*** | -0.050 | -0.012 |
| | (-1.855) | (-0.184) | (-0.323) |
| DinD_Δ CEO cash compensation | -0.038 | **-0.047***** | **-0.016*** |
| | (-0.670) | (-3.366) | (-1.850) |
| DinD_Δ CEO non-cash compensation | **0.0173*** | 0.0571 | **0.0859**** |
| | (1.888) | (1.272) | (2.212) |
| *Other Controls* | | | |
| Proceeds | 0.045 | 0.015 | 0.0415 |
| | (1.274) | (1.120) | (0.774) |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Number of ECOs | 93 | 93 | 93 |
| Adjusted $R^2$ | 0.258 | 0.232 | 0.271 |

**Panel** B**.** Dependent variable: Change in allocative efficiency and valuation over the event window (-3, +3) years

| | Model 1: Δ RINV | Model 2: Δ RVA | Model 3: Δ EXVAL |
|---|---|---|---|
| *External Governance Characteristics* | | | |
| DinD_Δ Analyst coverage | **0.0157*** | 0.0463 | 0.015 |
| | (1.740) | (1.270) | (1.735) |
| DinD_Δ Shares of inst. investors | **0.0153*** | **0.580**** | 0.099 |
| | (1.799) | (2.045) | (0.132) |
| DinD_Δ Analyst forecast dispersion | -0.017 | -0.027 | -0.026 |
| | (-1.104) | (-1.257) | (-1.813) |
| DinD_Δ Shareholder concentration | 0.111 | 0.354 | 0.035 |
| | (0.357) | (0.882) | (0.762) |
| *Internal Governance Characteristics* | | | |
| DinD_Δ Board independence | 0.0426 | 0.294 | 0.036 |
| | (1.693) | (0.591) | (0.809) |
| DinD_Δ Board size | **-0.0642**** | **-0.0954**** | -0.0945 |
| | (-3.055) | (-1.997) | (-0.154) |
| DinD_Δ CEO tenure | **0.0210*** | **0.383**** | 0.079 |
| | (1.849) | (2.110) | (1.711) |
| DinD_Board duality | -0.0152 | -0.783 | -0.071 |
| | (-0.165) | (-0.507) | (-1.580) |
| DinD_Δ CEO cash compensation | -0.0513 | -0.213 | -0.024 |
| | (-1.129) | (-0.369) | (-1.291) |
| DinD_Δ CEO non-cash compensation | 0.003 | 0.002 | **0.006**** |
| | (0.866) | (0.959) | (2.303) |
| *Other Controls* | | | |
| Proceeds | 0.0239 | 0.0287 | 0.0426 |
| | (1.305) | (0.789) | (1.210) |
| Industry FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Number of ECOs | 93 | 93 | 93 |
| Adjusted $R^2$ | 0.205 | 0.273 | 0.206 |

Notes: The data is extracted from SDC and the sample covers ECOs completed during the period 1980 – 2013. The dependent variable in each model is the change in allocative efficiency (RINV in Model 1 and RVA in Model 2) or valuation (EXVAL in Model 3) adjusted by the change in the matched control firm where each control firm is identified using the PSM matching estimator. Change in the governance variables is measured over a period starting one year before and ending one year after the ECO completion. Please refer to Table 1, the Sample and Methodology Section 3 and Appendix A1 for detailed definitions of the dependent and independent variables. The independent variables in each model are also adjusted by the change in the matched control firm sample where each control firm is identified using the PSM matching procedure. t-stats are reported in parentheses. ***, **, and * indicate statistical significance at a 1%, 5%, and 10% level, respectively. All models include year and industry fixed effects.