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

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Abstract

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

JEL classification: G32; G34

Keywords: Internal Capital Markets, Equity Carve-outs, Corporate Governance

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1. Introduction

Whether a conglomerate is an efficient model for a business has been a question for the markets for many years. Prior studies have demonstrated that the market valuation of conglomerates is at discount to the aggregated individual values of their component businesses (Lang and Stulz, 1994; Lamont, 1997; Shin and Stulz, 1998). 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). Several authors 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 divisional managers and top management as well as between divisional managers and shareholders (Scharfstein and Stein, 2000; Rajan, Servaes and Zingales, 2000). Academics have also suggested other reasons for the ICM dysfunctionality, particularly 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 objective value-maximising criteria (Rajan et al., 2000; Stein, 2003).

To address the putative causes of inefficiency in the parent's ICM, diversified firms have the option to undertake divestments of segments of their business in the form of sell-offs, spin-offs and equity carve-outs (ECO). A sell-off is a sale of a business segment to another company, a spin-off is the floatation of the divested part in a stock exchange, with the distribution of the shares in that newly listed company to the shareholders of the parent, 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 (Gertner, Powers and Scharfstein, 2002; Dittmar and Shivdasani, 2003; Burch and Nanda, 2003; Ahn and Denis, 2004; McNeil and Moore, 2005; and Çolak and Whited, 2007). Çolak and Whited (2007) conclude that there is no significant improvement in the allocative efficiency of the parent's ICM following these restructuring events. The impact of an ECO on the ICM efficiency of the parent has surprisingly received scant attention in the literature; and if such an impact exists, it is not clear what drives such changes in the functioning of the parent's ICM following ECOs.

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, and 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 spin-offs and sell-offs, 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 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 relationship (Schipper and Smith, 1986). 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 and sell-offs, monitoring of the offspring by the ECM 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). 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 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 ECO and assess the statistical significance of any improvement. We employ three different metrics of ICM efficiency following the methodology in Çolak and Whited (2007). 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 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 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 Abadie and Imbens (AI) (2006) estimator which corrects for the asymptotic bias that can be present in simple matching estimators, such as 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 PSM estimator and the Heckman (1979) model. Our results based on the AI estimator demonstrate that ECOs lead to an improvement in the allocative efficiency of parent firms, consistent with the hypothesis of ICM inefficiency in these firms prior to ECO. We observe similar but more robust results using the PSM and the Heckman methodologies.

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 composition, CEO compensation structure and CEO tenure. The external governance characteristics that we investigate include the degree of analyst coverage and the accuracy of the analysts' forecasts, the number of institutional investors on the share register of the parent firm and the concentration of their ownership. We show that the analyst coverage 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, smaller board size and CEO compensation based more on stock-based incentives than cash.

More importantly, we demonstrate 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. We find that higher analyst coverage and board independence lead to larger improvements in the parent's *RINV* and *RVA*. Additionally, higher levels of non-cash CEO compensation are positively related to changes in all three measures of the parent's allocative efficiency. Finally, the valuation of the parent firms is significantly enhanced by more analysts following the parent, higher proportion of shares owned by institutional investors and higher non-cash CEO compensation but is reduced by larger board size and overlap between the roles of the CEO and chairperson. This analysis carries important implications for the corporate managers who seek to improve the allocative efficiency of their companies by demonstrating that ECOs could be a more effective mechanism to restructure company operations than spin-offs and sell-offs.

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

2. Literature review and hypotheses

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 do less diversified firms that rely 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 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 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 (DD). Several explanations have been offered for the existence of the DD. Among them is a dysfunctionality of the ICM arising from both the complexity and diversity of internal 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). 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 divestment.

Diversified firms undertake divestments of segments of their business to cure one or more of the putative causes of the dysfunctionality of the parent ICM and the DD. The Parent firm's shareholders experience significant positive returns when divestments in the form of sell-off, spin-off 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; Lee and Madhavan, 2010; Desai, Klock, and Mansi, 2011). 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 DD. They also imply a pre-divestment allocative inefficiency of the parent.

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)[1]. This approach is however affected by an endogeneity problem. 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. In this paper we choose to account for the endogenous nature of the ECO decision in the spirit of Çolak and Whited (2007) (CW, hereafter). In particular, CW assess whether the allocative efficiency of diversified firms improves significantly following a spin-off or a sell-off. 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. To assess post-restructuring allocative efficiency, CW advocate using a new methodology that addresses the issue of endogeneity. CW find no evidence of significant change in allocative efficiencyand conclude that any improvement reported by prior studies is likely to be the artefact of a flawed methodology that ignored the endogeneity bias.

In this sense, the issue of whether diversified parents have dysfunctional ICMs and whether divestments contribute 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 sell-offs and spin-offs 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).[2]

[1] 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).

[2] 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

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. 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 residual business segments of the parent as well as the offspring to be independently valued by analysts who have

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.

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 spun-off or sold-off 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.

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.[3]

3. Sample, methodology and explanatory variables

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 and a sample of companies that do not perform any divestment activity over the entire sample period from 1980 to 2013. 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. Following the sample construction methodology in CW, 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. We exclude parent companies for which company- and segment-level data are not available. 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

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

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 Abadie and Imbens (2006) procedure and a probit model of the likelihood of performing an ECO. Table 1 provides detailed definitions of the 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; and Çolak and Whited, 2007). We also employ an indirect measure of allocative efficiency, namely, *EXVAL* (Ahn and Denis, 2004; Çolak and Whited, 2007). 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 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 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 can 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* 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 Abadie and Imbens (AI) (2006). This sample matching technique provides an adjustment for the asymptotic bias present in simple matching estimators such as the PSM estimator. Appendix A2 provides a discussion of the methodology for obtaining treatment effect estimates based on the AI procedure. A detailed description of the implementation of the AI estimation procedure with the Stata software is provided by Abadie, Drukker, Herr and Imbens (2004). All matching results are based on one nearest neighbour, i.e. one with propensity closest to a treated observation, selected from the control group. In unreported results we also perform matching based on more than one nearest neighbour control firms and our conclusions remain unchanged.

Next, we estimate the treatment effects on each of our performance variables, i.e. the control sample-adjusted results. We firstly 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. 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) relative to the ECO year. For *Before*, we do not report level treatment effects.[4] The variable *After* is the average for each conglomerate company over a period t+1 to t+2 (t+1 to t+3) around the ECO year, relative to the average

[4] In the level treatment effects, it is invalid to adopt the level of *RINV*, *RVA* and *EXVAL* as controls. This is because these variables would be self-explained (Çolak and Whited, 2007).

of a matched sample of diversified firms using the AI method. Following CW, we define the variable *Change* as the difference between the variables *After* and *Before*.

The *Difference in Difference (DinD)* treatment effects 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:

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

It should be noted that the *DinD* variable accounts for unobservable time-invariant control factors, whereas the level treatment-effect estimator does not. When the variables *Change* or *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 AI 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:

$$\mathrm{Probit\ (ECO)} = \alpha + \beta_n \mathrm{Controls} + \varepsilon_n \quad (2)$$

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

As alternative tests, we employ two other familiar estimators, namely, the PSM estimator developed in Dehejia and Wahba (1999, 2002) and the Heckman (1979) procedure to correct for self-selection.[5] According to CW, the AI technique is arguably superior to other matching methods such as the Dehejia and Wahba (2002) PSM and the Heckman bias adjustment methods since it does not involve any parametric assumptions regarding the distributions of the variables. Relaxing such assumptions is particularly important when using data from Compustat, as these distributional assumptions are likely

[5] Villalonga (2004) applies PSM methodology to the study of conglomerate discount.

to be untenable and could result in biased standard errors. In addition, the distribution of many income and balance-sheet statement items may not be accurately captured by the logistic or normal distributions and these are the two distributions assumed by the PSM and the Heckman bias adjustment methods.

The PSM and Heckman methods employ the same first stage probit model as the AI procedure above. For the PSM, as with the AI approach, all matching results are based on one nearest neighbour selected from the control group. In unreported results we also perform matching based on more than one nearest neighbour control firms and our conclusions remain unchanged. In the Heckman (1979) 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. β_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, ε_i is correlated with ΔS and the estimate of β_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 β_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 winsorised variables at the 1st and 99th percentile of the sample.

3.4. Modelling the impact of governance changes on allocative efficiency

To examine whether enhanced corporate governance of the parent and offspring post-ECO is associated with greater allocative efficiency, we match the offspring and its parent firm with the BoardEx and Execucomp 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 composition, CEO compensation structure 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 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), 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. We regress the changes in our allocative efficiency measures on the changes in corporate governance characteristics 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 significantly greater *Financing gap* than non-ECO firms. The other significant differences are in *IPO Activity, Market share and Largest segment profit*.

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 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 increase in allocative efficiency and not the ECO event *per se.*[6]

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 *Total proceeds*). The parent retains a median 72% of equity in the newly listed segment. The median of *Total proceeds* is around 30% ($97m over $311m) of the median ECO market value, which is consistent with the *Equity retained* statistics. 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

[6] 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.

To perform the AI 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 described 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 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 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 a more favourable profit performance of their largest segments (*Largest segment profit)* are associated with 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, we employ the AI 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 AI method. 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.

4.3. Treatment effects results

We proceed with the evaluation of the average treatment effect of ECOs on the allocative efficiency and valuation of the parents. The results from the analysis are presented in Table 4, Panels A and B for the analysis of change in allocative efficiency and valuation over periods respectively of (-2, +2) years and (-3, +3) years centred on the year of the ECO completion, t = 0. As defined in the methodology section, *Before* is the average for each conglomerate company over a period starting two (or three) years before and ending one year before the completion of the ECO i.e. the average of t-2 and t-1 (t-3 to t-1) values. The variable *After* is the average for each conglomerate company over a period starting one year after and ending two (or three) years after the completion of the ECO, relative to the average of the matched sample. *Change* is the difference between *Before* and *After*.

[Please Insert Table 4 about Here]

We find that the average values of *RINV* and *RVA* before the performance of ECOs are negative but not significantly different from zero, i.e. companies that perform ECOs do not appear to be characterised by significant levels of investment inefficiency before the completion of the event. However, to gain a better understanding of whether investment inefficiency existed before the ECOs, we also need to examine whether the allocative efficiency improves following the ECO, after addressing any possible endogeneity bias. The analysis presented in Table 4, Panels A and B, demonstrates that the allocative efficiency of the parent is improved significantly during the first three years following an ECO. In particular, the *Change* coefficients for *RINV* (+0.02) and *RVA* (+0.01) measured over the window (-2, +2) years are statistically significant. Furthermore, *DinD* coefficients are positive (+0.01) over the (-2, +2) years event window and statistically significant (at the 10% level significance).

Table 4, Panels A and B indicate that there is also significant improvement in the parent's *EXVAL*. Specifically, this finding is supported by the positive and strongly significant *Change* coefficient (+0.57) over the (-2, +2) years event window, and *DinD* coefficient (+0.53) over the (-3, +3) years event window. These results 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 ECOs suggests that these pre-restructuring parents were suffering from inefficiency of their ICMs.

In Table 5 we repeat the analysis of the impact of ECO on conglomerate allocative efficiency and valuation with the use of the Dehejia and Wahba (1999, 2002) PSM technique in Panel A and the Heckman (1979) bias adjustment procedure in Panel B. We find consistent results. Our analysis shows that the *Change* coefficients of *RINV* and *RVA* are positive and statistically highly significant when using the PSM technique over the two- and three-year event window following ECO. We also find that the coefficient corresponding to the *DinD* variable is positive and significant over the (-3, +3) years event window and across the three measures of allocative efficiency when using this technique. The *DinD* variable for *EXVAL* is also significant over the (-2, +2) years window albeit at a lower level of significance at 10%.

[Please Insert Table 5 about Here]

We note that all coefficients associated with the variable *InvMills* presented in Table 5 are positive and significant. This finding highlights the importance of correcting for the self-selection bias. In other words, the characteristics that lead companies to choose ECOs as a refocusing mechanism are likely on average to impact positively their allocative efficiency. 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. These results demonstrate that there is a significant enhancement in the allocative efficiency of parent companies following ECOs and that this enhancement is due to the impact of the ECO event itself and not just due to the characteristics of the parent firms.

It is important to point out that the AI 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 are almost identical to the *DinD Treatment Effects* coefficients without the bias adjustment.[7] This result suggests that our analysis based on the PSM in Table 5, Panel A is as reliable as the AI result in Table 4. Since the PSM result is stronger, in terms of statistical significance, and it is not tainted by any unadjusted asymptotic bias, it lends even stronger support for our hypothesis of allocative efficiency improvement following ECOs. Our Heckman result in Table 5, Panel B is also stronger than the result based on the AI technique. Overall, although the methodologically superior AI matching procedure generates a weaker result, it does not detract from the reliability of the analysis based on the PSM and Heckman methods.

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 and offspring 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 composition, and CEO compensation structure. 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. 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

[7] In the analysis presented in Table 4 we only report the bias-adjusted *DinD Treatment Effects* values since these are almost identical to the non-bias-adjusted values.

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, Panels A and B investigate the changes in the governance structure of parent firms over periods of respectively (-2, +2) and (-3, +3) years centred on the year of the ECO completion, t = 0. The results show that the ratio of non-executive to executive board members increases after the ECO over each of the two event windows that we consider. Specifically, we observe a positive and statistically significant change in the variable *Board indep.* amounting to +0.59 and +0.72 during the (-2, +2) and (-3, +3) years event windows respectively. At the same time, we find that *Board size* decreases significantly by 0.40 and 0.46 during the (-2, +2) and (-3, +3) years event windows respectively following the ECO. These results suggest an improvement in the governance structure of the parent, as smaller board size could imply a 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). Furthermore, we find that the *Analyst Coverage* increases significantly by 5.4 and 6.1 more analysts during the (-2, +2) and (-3, +3) years event windows respectively 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, 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.

[Please Insert Table 6 about Here]

We observe no change in the average CEO's cash compensation during the (-2, +2) years but identify a significant increase over the (-3, +3) years window amounting to $208,314. We also observe a significant increase in the CEO's non-cash based compensation during the (-2, +2) and (-3, +3) year windows. The latter increase in the CEO's compensation package also accounts for the largest proportion of increase in the total average CEO compensation in the parent firm. Specifically, our analysis demonstrates that the CEO's non-cash based compensation increases on average by US $1.22 million and US $ 1. 39 million over (-2, +2) and (-3, +3) years respectively. This is interesting, given that the parent company is likely to be a more focused business following the ECO. As a result, 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 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 better align managerial and shareholder interests than in the more diversified parent. This link is investigated further below.

In sum, the analyses presented in this section provide supporting evidence that there are some considerable improvements in the internal and external governance characteristics, including a better calibrated CEO incentive pay, of parent firms following ECOs.

Table 7, Panels A and B present the analysis of the change in corporate governance characteristics in the offspring firm in the first two- and three-year periods following ECO completion respectively[8], 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*.

[Please Insert Table 7 about Here]

The results show that, in the offspring, *Board size* as well as the ratio of non-executive directors to executive directors (*Board indep.*) tend to increase following ECO. Specifically, we observe a statistically significant increase of 0.65 and 0.22 in *Board size* and *Board indep.* respectively over the

[8] 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. For example, in Table 7, Panel A, data for analyst coverage are available for 206 offspring companies while data for the number of institutional investors is available for only 81 offspring companies. This large sampling variation needs to be kept in mind in assessing the significance of the offspring-related improvements.

(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, 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. 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.

Our analysis also shows that there is an increase in the number of institutional investors 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 amounting to 0.56 and 0.45 in the number of institutional investors (*Number of instit. investors*) 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. While the average CEO's compensation falls together with its equity and cash components 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 in the over the (0, +3) event window after the ECO. As a result, there appears to be a trade-off between leadership demands 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 these changes in governance characteristics of parents on their allocative efficiency metrics in a multivariate framework.[9]

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. For each parent company the change in allocative efficiency or valuation is adjusted for the corresponding change in the matched control firm, where each control firm is identified using the AI 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 AI matching procedure that is based on the set of significant predictor variables in our probit model (see Table 3). 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 contributes 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 relation between the increase in the number of analysts following parent firms (Δ *Analyst coverage*) as well as the increase in the stock ownership of institutional investors (Δ *Shares of instit. investors*) and improvements in Δ *RINV* following ECOs. 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 indep.*) and the decrease in the number of board

[9] We do not model the direct impact of improvements in the offspring on the allocative efficiency of their parents measured over windows starting before the ECO event and model only the impact of improvements in the parents.

members (Δ *Board size*) are positively and significantly related to changes in Δ *RVA*. Our results also demonstrate that higher non-cash based CEO compensation is likely to lead to a better alignment between the interests of managers and the interests of shareholders, thus leading to an improvement in the allocative efficiency of the parent firm. Specifically, we find that the variable Δ *CEO non-cash comp.* is positively and significantly related to Δ *RVA* while the variable Δ *CEO cash comp.* has a negative and statistically significant effect on Δ *RVA*. 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.[10] We also find that enlarging the board significantly (Δ *Board size*) reduces the Δ *EXVAL* variable and, as a result, causes value losses to shareholders.

These findings are robust, and indeed stronger, when we consider the longer (-3, +3) years window around the ECO completion. We find that higher values of the variables Δ *Analyst coverage* and Δ *Board indep.* are positively and significantly associated with changes in Δ *RINV* and Δ *RVA*. We also find that higher values of Δ *CEO non-cash comp.* are positively related to changes in all three measures of the parent's allocative efficiency. While larger boards (Δ *Board size*) are significantly associated with declines in Δ *RVA*, higher institutional ownership (Δ *Shares of instit. investors*) enhances Δ *RINV*. The valuation of the ECO parent (Δ *EXVAL*) is significantly enhanced by higher numbers of analysts following the parent (Δ *Analyst coverage)*, by higher proportion of shares owned by institutional investors (Δ *Shares of instit. investors)*, and by higher non-cash CEO compensation (Δ *CEO non-cash comp.*) but reduced by larger boards (Δ *Board size*) and the combining of the roles of CEO and chairperson (*Board duality*). In unreported results we repeat the analysis presented in Table 8 Panels A and B above using the change in governance characteristics over a (-2, +2) and (-3, +3) years window respectively and our results remain qualitatively similar.

[10] 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 instit. Investors* instead of *Share of instit. Investors* and confirm that our results remain qualitatively unchanged.

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 analysis 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 are 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 difference in difference 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 using the AI matching procedure and estimate the following regression model:

DinD_treatment effects (Δ *RINV, RVA or EXVAL)* = α + β_i *DinD_treatment* (Δ *corporate governance characteristics)* + ε_i (4)

Table 9 shows the results from this analysis. We note that there was insufficient information for some of the companies in the matched control sample and, as a result, we could not include all measures of internal and external corporate governance quality measures in our regression model. Specifically, we had to exclude the following variables: Δ *Shares of instit. Investors*, Δ *CEO tenure*, and Δ *Analyst forecast error*.

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 board independence (*DinD_*Δ *Board indep.*), separation of the roles of CEO and chairperson (*DinD_Board Duality*) as well as higher non-cash CEO compensation (*DinD_*Δ *CEO non-cash comp.)* all significantly improve *DinD* Δ *RVA* measured over the window of (-2, +2) years. In addition, higher analyst coverage (*DinD_*Δ *Analyst coverage*), smaller board size (*DinD_*Δ *Board size*) and higher non-cash CEO compensation (*DinD_*Δ *CEO non-cash comp.*) significantly improve *DinD* Δ *RINV* over the same event window. Similarly, higher analyst coverage (*DinD_Δ Analyst coverage*), smaller board size (*DinD_Δ Board size*), non-duality of the roles of CEO and chairperson (*DinD_Board Duality*) as well as higher non-cash CEO compensation (*DinD_Δ CEO non-cash comp.*) enhance *DinD Δ EXVAL.*

[Please Insert Table 9 about Here]

Over the longer event window, (-3, +3) years , we find that greater board independence (*DinD_Δ Board indep.*), smaller board size (*DinD_Δ Board size*), separation of the roles of CEO and chairperson (*DinD_Board Duality*) as well as higher non-cash CEO compensation (*DinD_Δ CEO non-cash comp.*) are all significantly related to Δ *RVA* and Δ *EXVAL*. Additionally, increased analyst coverage (*DinD Δ Analyst coverage) significantly improves EXVAL*. Increased board independence (*DinD Δ Board indep.) also significantly improves RINV*. 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 methodology in Çolak and Whited (2007) and 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 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 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 and relative investment ratio 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 non-cash based compensation following ECOs. 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.

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.[11] Our analysis carries important implications for the corporate managers who seek to improve the allocative efficiency of their companies by demonstrating that carve-outs could be a more effective mechanism to restructure company operations than spin-offs and sell-offs. 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.

[11] 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. We find evidence that the ICM 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 the 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.

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Table 1. Variable definitions

Variable name	Description and source of data	Expected relation to likelihood of ECO
Equity carve-out (ECO)	Dummy variable that is equal to one if the company performs a carve-out and zero otherwise. (Source: SDC)	N/A
Assets	Total assets of the conglomerate company.* (Source: Compustat)	N/A
Investment	Measures the capital expenditures of the conglomerate divided by the total sales in the year prior to carve-out completion.* (Source: Compustat)	N/A
Number of segments	Number of segments of the conglomerate company.* (Source: Compustat)	
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.* (Source: Compustat)	
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 *i*th 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).* (Source: Compustat)	+
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.* (Source: Compustat)	+
Log sales (Size)	Parent size proxy and measure of likelihood of ECO (Haynes, Thompson, and Wright, 2003). Measured as natural logarithm of Net Sales.* (Source: Compustat)	+
Market share	Parent sales/ 3-digit (primary SIC-code) industry sales. Parent primary SIC code defined by Compustat.* (Source: 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.* (Source: Compustat)	+
EBITDA/Sales	A parent firm liquidity is measured as EBITDA/Net sales. (Source: Compustat)	-
Largest segment profit	Proxy for positive demand shock (Maksimovic and Phillips, 2002) operating profits of firm's largest segment/ its net sales.* (Source: Compustat)	+
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). (Source: Compustat)	+
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.* (Source: Compustat)	+/-

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.* (Source: Compustat)	-
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.* (Source: Compustat)	-
Excess value (EXVAL)	Indirect proxy for allocative efficiency measured as the parent's market value of equity to sales ratio relative 3-digit 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.* (Source: Compustat)	-
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 indep.	Number of non-executive directors/number of executive directors (Non-executive directors is used in BoardEx).* (Source: BoardEx, Edgar)	+
Number of instit. investors	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)	+
Share of instit. investors	Proportion of shares owned by institutional investors.* (Source: Edgar)	+
CEO cash comp.	Sum of salary and bonus (Zajac and Westphal, 1994; Feldman, 2016).* (Source: BoardEx, Execucomp, Edgar)	+/-
CEO non-cash comp.	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)	+
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)	-

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.

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

Notes: The sample covers ECOs completed during the period 1980 - 2013.

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***** (11.821)	3,786	5,613	-1,827 (1.232)
Investment	0.078	0.057	**0.021***** (3.730)	0.057	0.045	0.012 (1.491)
Number of segments	4.09	2.63	**1.46***** (2.833)	4.00	2.00	**2.00**** (2.362)
Log sales	8.077	5.056	**3.021***** (21.672)	7.275	5.084	**2.191***** (149.3)
MTBV	2.113	2.074	**0.039**** (2.023)	1.646	1.380	**0.266***** (18.609)
Debt/Assets	0.287	0.205	**0.082***** (10.058)	0.271	0.182	**0.089***** (94.210)
EBITDA/Sales	0.156	0.092	**0.064***** (6.473)	0.142	0.101	**0.041***** (21.840)
Relative entropy	0.930	0.598	**0.332***** (11.305)	0.970	0.622	**0.348***** (49.984)
RVA	-0.001	-0.022	**0.021**** (1.650)	-0.0003	-0.0002	**-0.0001***** (18.724)
RINV	-0.0004	-0.006	**0.006**** (2.228)	-0.0002	0.0003	**-0.0005***** (17.580)
EXVAL	-0.330	0.180	**-0.510***** (-2.737)	-0.119	0.0648	**-0.184***** (10.467)
Financing gap	-0.089	-0.020	**-0.069***** (-5.384)	-0.064	-0.049	**-0.015***** (8.270)
IPO activity	0.003	0.004	-0.0002 (-0.550)	0.0008	0.0003	**0.0005***** (2.703)
M & A activity	0.076	0.150	-0.074 (-1.078)	0.041	0.039	0.002 (0.020)
Industry sales growth	-0.030	0.024	**-0.055***** (-7.359)	0.025	0.031	**-0.006**** (2.613)
Market share	0.095	0.048	**0.047***** (7.701)	0.056	0.005	**0.051***** (126.877)
Largest segment profit	0.073	0.099	**-0.026**** (-2.178)	0.100	0.081	**0.019**** (4.655)
Sample size	354	3,695		354	3,695	

Notes: The sample covers ECOs completed during the period 1980 - 2013. Assets are measured in millions of US dollars (USD). t-stats or Pearson chi^2 statistics are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels respectively.

Panel C. Additional ECO characteristics

Statistics	Equity retained	Market value of ECO (Million USD)	Market value of parent (Million USD)	Total proceeds (Million USD)	Same SIC3 ECO	Different SIC2 ECO	Same SIC2 but different SIC3 ECO
Mean	66.50%	2,519.159	21,178.497	584.925	-	-	-
Median	72.00%	311.400	5,649.530	96.855	-	-	-
Number of ECOs	184	259	244	354	155	115	84

Notes: The sample covers ECOs completed during the period 1980 - 2013. **SIC3 (SIC2) = 3 (2) digit standard industrial classification.**

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: *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. Change in allocative efficiency and firm value of parents following ECO

Panel A. Change in allocative efficiency (-2, +2) years event window

	RINV	**RVA**	**EXVAL**
Level Treatment Effects			
Before	-0.0004	-0.001	-0.330
	(-0.080)	(-1.025)	(-0.914)
After	**0.018****	**0.007*****	0.241
	(2.571)	(3.531)	(1.303)
Change	**0.018****	**0.008*****	**0.571****
	(2.545)	(4.147)	(3.440)
DinD Treatment Effects			
DinD	0.011	**0.009***	-0.147
	(1.069)	(1.801)	(-0.817)
Number of ECOs	354	354	354

Panel B. Change in allocative efficiency (-3, +3) years event window

	RINV	**RVA**	**EXVAL**
Level Treatment Effects			
Before	-0.0004	-0.001	-0.330
	(-0.080)	(-1.023)	(-0.914)
After	0.011	**0.004*****	-0.644
	(0.164)	(4.013)	(-0.974)
Change	0.012	**0.005****	-0.314
	(0.203)	(2.524)	(-0.502)
DinD Treatment Effects			
DinD	0.098	0.002	**0.529*****
	(0.685)	(0.511)	(3.977)
Number of ECOs	354	354	354

Notes: *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 Abadie and Imbens (2006) matching procedure. *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, adjusted for the corresponding averages of the matched sample. *Change* is the difference between *Before* and *After*. *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.

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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

Change in allocative efficiency (-2, +2) years event window

	RINV	RVA	EXVAL
Level Treatment Effects			
Before	-0.0004	-0.001	-0.330
	(-0.080)	(-1.000)	(-0.914)
After	**0.013***	**0.024****	0.025
	(1.857)	(2.182)	(0.926)
Change	**0.014*****	**0.025*****	**0.355*****
	(3.500)	(5.000)	(2.934)
DinD Treatment Effects			
DinD	0.0231	0.013	**0.050***
	(1.036)	(0.500)	(1.667)
Number of ECOs	354	354	354

Change in allocative efficiency (-3, +3) years event window

	RINV	RVA	EXVAL
Level Treatment Effects			
Before	-0.0004	-0.001	-0.330
	(-0.080)	(-1.000)	(-0.914)
After	**0.017****	**0.025****	**0.155****
	(2.125)	(2.273)	(2.300)
Change	**0.018*****	**0.026*****	**0.485*****
	(4.500)	(4.333)	(2.580)
DinD Treatment Effects			
DinD	**0.028***	**0.002****	**0.0603***
	(1.867)	(2.222)	(1.774)
Number of ECOs	354	354	354

Notes: Panel A and Panel B 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. *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, adjusted for the corresponding averages of the matched sample. *Change* is the difference between *Before* and *After*. *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

Change in allocative efficiency (-2, +2) years event window

Variable	RINV	RVA	EXVAL
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)
Number of ECOs	354	354	354

Change in allocative efficiency (-3, +3) years event window

Variable	RINV	RVA	EXVAL
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 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 carve-out 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 0 otherwise. In addition, β_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 α 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

Average	Board duality	Board size	Board indep.	Number of instit. investors	Share of instit. investors	CEO total comp. (Million USD)	CEO cash comp. (Million USD)	CEO non-cash comp. (Million USD)	CEO tenure	Analyst coverage	Analyst forecast dispersion
Before	**0.553*** **	**11.529*** **	**4.948*** **	**1.979*** **	**0.190*** **	**4.899*** **	**1.822*** **	**3.153*** **	**5.920*** **	**11.021*** **	**0.165*** **
	(12.61)	(20.899)	(18.767)	(11.868)	(11.187)	(8.264)	(10.874)	(6.034)	(9.639)	(16.488)	(8.397)
After	**0.541*** **	**11.131*** **	**5.534*** **	**2.107*** **	**0.179*** **	**6.244*** **	**1.856*** **	**4.372*** **	**5.560*** **	**16.441*** **	**0.199*** **
	(12.357)	(22.744)	(19.971)	(10.879)	(10.084)	(9.024)	(10.177)	(6.894)	(15.148)	(19.184)	(10.371)
Change	-0.012	**-0.398** **	**0.586*** **	0.127	-0.011	**1.345*** **	0.034	**1.218.96** **	-0.359	**5.420*** **	**0.033** **
	(-0.467)	(-2.610)	(3.098)	(1.052)	(-0.857)	(3.356)	(0.294)	(2.906)	(-0.614)	(12.297)	(2.134)
Number of ECOs	122	122	122	98	98	123	123	123	157	147	147

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

Average	Board duality	Board size	Board indep.	Number of instit. investors	Share of instit. investors	CEO total comp. (Million USD)	CEO cash comp. (Million USD)	CEO non-cash comp. (Million USD)	CEO tenure	Analyst coverage	Analyst forecast dispersion
Before	**0.585*** **	**11.851*** **	**4.962*** **	**2.300*** **	**0.190*** **	**3.786*** **	**1.642*** **	**2.172*** **	**6.270*** **	**11.017*** **	**0.158*** **
	(12.840)	(17.330)	(17.126)	(12.723)	(10.104)	(9.714)	(10.268)	(6.555)	(10.192)	(15.169)	(7.483)
After	**0.599*** **	**11.387*** **	**5.678*** **	**2.371*** **	**0.177*** **	**5.394*** **	**1.850*** **	**3.560*** **	**5.932*** **	**17.108*** **	**0.188*** **
	(13.583)	(18.414)	(19.011)	(11.232)	(9.192)	(9.524)	(9.909)	(6.803)	(14.580)	(18.187)	(8.642)
Change	0.014	**-0.464** **	**0.716*** **	0.070	-0.013	**1.607*** **	**0.208* **	**1.387*** **	-0.338	**6.091*** **	**0.029* **
	(0.498)	(-2.637)	(3.303)	(0.452)	(-0.888)	(3.902)	(1.723)	(3.307)	(-0.538)	(12.268)	(1.789)
Number of ECOs	94	94	94	81	81	102	102	102	127	120	120

Notes: *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*. T-stats are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively

Table 7. Governance characteristics of ECO offspring

Panel A: Event window (0, +2) years

Average	Board duality	Board size	Board indep.	Number of instit. investors	Share of instit. investors	CEO total comp. (Million USD)	CEO cash comp. (Million USD)	CEO non-cash comp. (Million USD)	CEO tenure	Analyst coverage	Analyst forecast dispersion
Before	**0.574*****	**7.515*****	**3.807*****	**1.839*****	**0.203*****	**2.589*****	**0.947*****	**1.678*****	**1.669*****	**3.493*****	**0.173****
	(13.474)	(26.870)	(18.402)	(8.452)	(8.662)	(6.341)	(7.706)	(4.627)	(4.868)	(20.715)	(2.433)
After	**0.576*****	**8.169*****	**4.019*****	**2.395*****	**0.233*****	**2.136*****	**0.910*****	**1.235*****	**3.397*****	**6.015*****	0.808
	(13.679)	(28.820)	(20.610)	(10.891)	(10.543)	(6.566)	(9.816)	(4.375)	(9.803)	(16.865)	(1.338)
Change	0.007	**0.654*****	**0.216****	**0.555*****	0.030	-0/453	-0.036	-0.442	**1.728*****	**2.521*****	0.634
	(0.446)	(3.916)	(1.978)	(3.603)	(1.332)	(-1.421)	(-0.458)	(-1.383)	(17.804)	(9.285)	(1.186)
Number of ECOs	136	136	136	81	81	81	81	81	136	206	206

Panel B: Event window (0, +3) years

Average	Board duality	Board size	Board indep.	Number of instit. investors	Share of instit. investors	CEO total comp. (Million USD)	CEO cash comp. (Million USD)	CEO non-cash comp. (Million USD)	CEO tenure	Analyst coverage	Analyst forecast dispersion
Before	**0.587*****	**7.611*****	**3.923*****	**1.855*****	**0.189*****	**2.665*****	**0.996*****	**1.710*****	**2.616*****	**3.467*****	**0.181****
	(13.054)	(25.238)	(17.359)	(8.981)	(7.410)	(5.814)	(7.035)	(4.182)	(4.373)	(20.201)	(2.335)
After	**0.860*****	**8.397*****	**3.968*****	**2.304*****	**0.228*****	**2.105*****	**0.971****	**1.143*****	**4.849*****	**6.259*****	0.830
	(27.095)	(28.381)	(16.635)	(10.453)	(9.378)	(6.050)	(7.9570)	(3.840)	(8.10)	(15.644)	(1.279)
Change	**0.273*****	**0.785*****	0.045	**0.449****	0.039	-0.560	-0.024	-0.478	**2.232*****	**2.792*****	0.648
	(5.810)	(3.670)	(0.258)	(2.300)	(1.506)	(-1.535)	(-0.179)	(-1.582)	(6.740)	(8.524)	(1.130)
Number of ECOs	121	121	121	69	69	81	81	81	121	189	189

Notes: *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
Δ Analyst coverage	**0.195*** **	-0.016	-0.329
	(3.804)	(-1.061)	(-0.123)
Δ Board indep.	-0.048	**0.024*** **	-3.149
	(-1.475)	(2.942)	(-1.487)
Δ Board size	0.353	**-0.041** **	**-3.730** **
	(1.049)	(-2.549)	(-2.155)
Δ Shares of instit. investors	**0.034** **	0.057	0.110
	(2.224)	(1.116)	(1.439)
Δ CEO tenure	-0.002	0.075	0.260
	(-0.451)	(0.808)	(1.089)
Board duality	0.093	0.042	-0.089
	(1.020)	(0.040)	(-0.072)
Δ CEO cash comp.	0.136	**-0.058* **	0.219
	(1.108)	(-1.763)	(0.193)
Δ CEO non-cash comp.	-0.024	**0.018** **	-0.048
	(-0.939)	(2.104)	(-0.073)
Δ Analyst forecast dispersion	-0.216	-0.033	0.832
	(-1.412)	(-0.727)	(0.200)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of ECOs	93	93	93
Adjusted R^2	0.183	0.341	0.268

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
Δ Analyst coverage	**0.021****	**0.763****	**0.418****
	(2.491)	(2.703)	(2.631)
Δ Board indep.	**0.002*****	**0.548****	0.516
	(4.042)	(2.454)	(0.936)
Δ Board size	-0.004	**-0.021***	**-0.371***
	(-1.391)	(-1.767)	(-1.834)
Δ Shares of instit. investors	**0.009****	0.035	**0.111****
	(2.668)	(1.449)	(2.376)
Δ CEO tenure	0.077	0.051	0147
	(1.411)	(0.615)	(0.829)
Board duality	0.164	-0.118	**-0.534***
	(1.396)	(-0.337)	(-1.959)
Δ CEO cash comp.	0.008	0.033	0.510
	(1.491)	(0.559)	(1.199)
Δ CEO non-cash comp.	**0.002***	**0.004*****	**0.006****
	(1.895)	(3.648)	(2.418)
Δ Analyst forecast dispersion	-0.003	-0.360	-0.002
	(-0.561)	(-1.182)	(-0.436)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of ECOs	93	93	93
Adjusted R^2	0.148	0.331	0.252

Notes: 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 AI matching estimator. 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: Analysis of 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
DinD_Δ Analyst coverage	**0.715*** **	0.002	**0.603*** **
	(4.129)	(0.979)	(3.407)
DinD_Δ Board indep.	0.005	**0.188***	0.041
	(0.049)	(1.937)	(0.862)
DinD_Δ Board size	**-0.241*** **	-0.151	**-0.984** **
	(-2.813)	(-0.799)	(-2.301)
DinD_Board duality	-0.025	**-0.799***	**-0.897*** **
	(-1.811)	(-1.848)	(-2.920)
DinD Δ CEO cash comp.	**0.004*** **	**0.003***	0.019
	2.953	(1.789)	(1.078)
DinD_Δ CEO non-cash comp.	**0.002*** **	**0.015***	**0.003** **
	(3.551)	(1.957)	(2.235)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of ECOs	93	93	93
Adjusted R^2	0.377	0.315	0.261

Panel B: Analysis of 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
DinD_Δ Analyst coverage	0.115	0.0111	**0.139*** **
	(1.310)	(1.614)	(11.575)
DinD_Δ Board indep.	**0.233***	**0.0311*** **	**0.169** **
	(1.908)	(4.925)	(1.974)
DinD_Δ Board size	0.134	**-0.147*** **	**-0.897*** **
	(0.488)	(-8.984)	(-6.474)
DinD_Board duality	0.784	**-0.178*** **	**-0.120*** **
	(1.642)	(-2.871)	(-2.449)
DinD Δ CEO cash comp.	-0.208	0.002	**0.712*** **
	(-1.433)	(0.270)	(3.890)
DinD_Δ CEO non-cash comp.	-0.057	**0.016*** **	**0.682** **
	(-1.479)	(7.669)	(2.313)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Number of ECOs	93	93	93
Adjusted R^2	0.382	0.313	0.231

Notes: 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 AI matching estimator. 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 AI 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.

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:

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

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: A note on the Abadie and Imbens (2006) matching procedure

We discuss the general problem of obtaining consistent treatment effect estimates here. Let T be a variable which takes the value of one if a company decides to perform a carve-out and zero otherwise. Let $S_n(T)$ be the level of allocative efficiency as a function of T for observation *n*. Using this notation, $E(S_n(1)|\ T=1)$ represent the expected effect of restructuring (the treatment) on the group of refocusing firms (treated group). Likewise, $E(S_n(0)|\ T=1)$ represents the 'counterfactual' expected effect of deciding not to refocus, given that the firm engaged in refocusing (i.e. treatment took place). In our analysis we examine the change in $S_n(T)$ relative to its level before the refocusing, which is denoted as $\Delta S_n(T)$. By taking the change in the allocative efficiency we can control for time-invariant and unobservable differences between the refocusing and non-restructuring (control) subsamples. This procedure is like differencing to remove fixed effects in a panel data set.

We estimate the average impact of the decision to refocus on allocative efficiency for a group of companies that decided to refocus, i.e. the average treatment impact on the treated:

$$\theta|_{T=1} \equiv E(\Delta S_n(1) - \Delta S_n(0)|T=1 \tag{1}$$

Since we cannot directly measure the effect of both the decision to refocus and the decision not to refocus on the same company, $E(\Delta S_n(0)|\ T=1)$ represents a hypothetical event that cannot be observed.

Previous studies on the impact of refocusing on company allocative efficiency have measured:

$$E(\Delta S_n(1)|\ T=1) \tag{2}$$

by averaging the difference in allocative efficiency for refocusing companies before and after the refocusing event. The problem with this method is that, in any case apart from when$E(\Delta S_n(0)|\ T=1)=0$. The latter situation would happen if the companies that engaged in refocusing would not have experienced any change in allocative efficiency in the absence of the refocusing. This condition would only be true if the act of refocusing is the sole way to enhance allocative efficiency or if the refocusing companies have no other characteristics that impact allocative efficiency. The first requirement is false and the second one is a matter that can be determined only empirically.

Since we cannot observe $\theta|_{T=1}$, we need to make certain assumptions to estimate the unobservable part of the function: $E(\Delta S_n(0)|\ T=1)$. The typical assumption in the treatment effects literature is that allocation to treatment is random, dependent on a group of observable pre-treatment characteristics (i.e. observable variables that distinguish between refocusing and non-restructuring firms), Z. Simple matching procedures use this assumption by matching each treated observation to one or more untreated observations with similar pre-treatment characteristics, Z. Then, $E(\Delta S_n(0)|\ T=1)$ is estimated by taking the average of $\Delta S_n(0)$ over the matches (control subsample). This makes it possible to obtain an estimate of $\theta|_{T=1}$ by taking the difference between $\Delta S_n(1)$ and estimate of $E(\Delta S_n(0)|\ T=1)$. This type of treatment effect estimation is usually performed without replacement (Dehejia and Wahba, 1999).

Simple matching estimators described above are asymptotically biased when the vector of company characteristics Z contains more than one variable. When the matches of treated and non-treated observations are not exact, the treatment effects estimator is asymptotically biased. Abadie and Imbens (2006) (AI) introduce matching with replacement to minimise the asymptotic bias and estimate a term that corrects for the bias. The bias correction is only necessary for the estimate of $E(\Delta S_n(0)|\ T=1)$ as the term $E(\Delta S_n(1)|\ T=1)$ can be observed directly and is an estimate of the difference between two components. The first component is the impact of treatment on the control subsample with perfect matching. The second component is the actual impact of treatment on the control subsample. To obtain these two terms it is necessary to estimate the conditional expectation of $\Delta S_n(0)$ given Z_n which is given by regressing $\Delta S_n(0)$ on Z_n based on the control subsample. To estimate the conditional expectation, we need to take $\widehat{\omega_0}(Z_n) \equiv \widehat{\beta_0} + \widehat{\beta_1} Z_n$, where $\widehat{\beta_0}$, a scalar, and $\widehat{\beta_1}$, a vector with the same dimension as Z_n, are the estimated coefficients from the regression. The bias corrected estimate of $E(\Delta S_n(1)|\ T=1)$ is equal to the simple regression estimate presented above plus a component which we denote as $\widehat{\omega_0}(Z_n) - \widehat{\omega_0}(Z_i)$. This component is defined as the difference between the predicted values of $\Delta S_n(0)$ using a group of controls for the n^{th} treated observation and the group of controls for its associated match.