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Essays on Corporate Finance

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Abstract

My dissertation is composed of three corporate finance studies, documenting the effects of firm policies with deep regulatory implications. In particular, I examine corporate actions taken in contexts of distress, such as defaults on syndicated bank loans, or taken in contexts of very asymmetrical information, such as private equity investment and corporate diversification.

In syndicated loans, violations of financial covenants lead to the transfer of firm control rights from shareholders to creditors. I find that that firms increase disinvestment following covenant violations, both through asset sales and spin-off equity deals. Divesting firms can anticipate their exit from a default status, through one-off adjustments of their accounting variables. In diversified firms, multiple business centres exist in different divisions. We show that the addition of dedicated financial divisions to non-financial conglomerates is shown to have a positive impact in the efficiency of capital allocation within firms, by playing the role of redistributor and common provider of external financing. In private equity, managers and investors are bound by pre-set compensation contracts and governance rules, since the fund's inception. I study the relationship between compensation, investment strategies and performance in this particular setting, exploring distinct rules for bonus payments.

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Introduction

In the first chapter, I study the impact of covenant violations on firm disinvestment. I find that firms increase disinvestment following financial covenant violations in credit agreements, both through asset sales and spin-off equity deals. Firms in violation status increase their asset sales by 10 to 15% in the following 3 months. Using a regression discontinuity design, I find that firms are 81% more likely to sell assets when a covenant is marginally breached, while the probability of spinning off increases from 0.1 to 3.8 percentage points. Divesting firms adjust covenant variables discretely, thus anticipating their exit from violation status. My findings highlight how long-term firm policies can be quickly reshaped by contingent control rights.

In the second chapter, my co-authors and I study non-financial conglomerates that have a dedicated financial division. We hypothesize that financial divisions improve the operation of internal capital markets. We develop a simple model based on this idea, which predicts that financial divisions are more valuable for larger firms, for firms with more diverse segments, and also for firms with more segments. We show empirical evidence that financial divisions run more efficient internal capital markets in conglomerates. Conglomerates with a financial division appear to command a value premium when compared to otherwise similar firms.

In the third chapter, I examine that deal-by-deal compensation rules in Private Equity Under deal-by-deal rules, bonus payments to General Partners are a function of each deal within the fund, resembling a portfolio of call options. Using a novel dataset of fees and investor cash flows, I study the relationship between compensation, investment strategies and performance in deal-by-deal funds. I find that higher bonus payments decrease net-of-fee performance. A stronger effect is observed in deal-by-deal funds with heterogeneous firm portfolios.

Chapter 1

Covenant violations and disinvestment

1.1 Introduction

Covenant violations are known to enhance creditors' bargaining power. Credible threats of accelerating loan payments or terminating credit agreements can empower lenders decisively. This empowerment is most relevant for creditors who seek to intervene in the firm's management for their own protection. However, managers can anticipate creditors' empowerment. They may try to limit the transfer of control through quick disinvestment actions that yield liquidity and meet due payments. Disinvestment can both be materialized through pure asset transactions, such as fixed asset sales; or by equity deals, such as spin-offs or carve-outs.

In this paper, I show that covenant violations trigger disinvestment actions. Firms can target different outcomes as they implement new policies. In addition to flow variables (such as investment and financing needs), defaulting firms often act upon stock variables in their balance sheet, through large reductions of fixed assets. Asset reductions have immediate effects in firms' operations and human resources. By prompting the dismantlement of firm's operations, or a change in its scope, covenant violations can have irreversible effects on firm policies which last for many years.

My main finding is that firms tend to carry out asset sales and spin-offs following implied covenant violations, relinquishing illiquid assets. Effects of technical defaults are sizeable in my baseline specification. Firms increase their asset sales by 10 to 15% in the three months after a fiscal quarter in violation. In that period, the propensity of spin-offs and the share of spun-off assets both increase by more than 50%. The total effect of a violation can be significantly larger, as firms tend to remain in a violation state for several consecutive quarters.

I employ a regression discontinuity design to estimate the marginal effect of violating a covenant. Firms are 81% likelier to sell assets at the mean, as the probability of selling asset increases by 13.9 percentage points.[1] Marginal violations increase the probability of spinning off assets from 0.1 to 3.8 percentage points and the share of spun-off assets by 1.1 standard deviations (4.7% of total assets).

This study documents how covenant violations lead firms to disinvest. Following previous empirical work on the impact of covenant violations[2], this paper investigates settings in which the timely implementation of firm policies can be critical for the protection of both shareholders' and creditors' interests. This paper's focus on disinvestment through asset sales and equity deals, whose effects are studied in separate. According to prior studies, equity deals can have deeper implications on the pledgeability of firm's assets, thus on default risk.[3]In this context, they may signal an attempt by management

[1]The positive effect in the share of assets sold attains 6.7% of total assets (92% of the mean).

[2]Throughout the paper, I refer to several papers that explored the impact of violations in different financial variables, following the first studies by Chava and Roberts (2008) and Roberts and Sufi (2009).

[3]The literature on spin-offs (Maxwell and Rao (2003)) has supported the idea that creditors of

and/or other stakeholders to bend the restructuring process in their favour.

Theoretical literature in Finance has pointed to constrained disinvestment actions under financial distress (Shleifer and Vishny (1992), Caballero and Simsek (2013)), in particular upon technical default events (e.g. Brunnermeier and Pedersen (2005)). In practice, constrained disinvestment could be achieved both as part of a renegotiation (under the threat of loan termination) or later, upon the legal acknowledgement of covenant violations. Managers and creditors have incentives to accelerate restructuring events, in stages of the process where their control rights are enhanced. Attempts to anticipate or circumvent reorganization outcomes can be expected from managers (and shareholders) before violations are legally recognized and creditors receive any court protection. Such attempts can also be expected from creditors, either at loan termination stages or if they can threaten managers with imminent insolvency.[4]

I give empirical support to the prediction that quick interventions are undertaken by firm stakeholders. For every type of disinvestment (asset sales, spin-offs, carve-outs), outcome variables are both written with a binary structure (whether there was an event of that type in that quarter) and as a ratio of the total value disinvested per quarter (in that type of events), over total assets. I lag explanatory variables by one, two or three quarters. Both asset sales and disinvestment overall are most frequent one quarter from a violation. In specifications with longer lags, distinct disinvestment patterns are revealed, as I exclude the most immediate disinvestment actions at the start of violation periods. Equity deals are more prevalent, suggesting that more complex and restructuring transactions occur after six or nine months.

largest resulting entities become less guaranteed than under the spun-off firm. Not least, this prediction has strong grounding in investment banking guidelines and practises.

[4]Yet strategies facing the counterpart with irreversible accomplishments are not always feasible, between creditors and debtors, in insolvency settings.

Covenant violations can be well predicted for a large proportion of firms, in horizons of several quarters. A clear counterfactual cannot be established for firms with no real possibilities of either entering or exiting a violation state. These concerns can only be alleviated with the inclusion of fixed effects and a wide set of control variables. Hence, in a refinement of baseline specifications, I restrict my analysis to a narrow sample of firms close to covenant thresholds.

As noted by Chava and Roberts (2008), covenant violations identify a specific mechanism, the transfer of control rights, revealing conflicts of interest between stakeholders. Covenants define discrete and verifiable conditions allowing creditors to claim additional control rights in the court system. The potential for exogenous identification comes from the random assignment of firms around covenant thresholds, according to minor variations in their accounting variables. I make use of a regression discontinuity design to address the concern that disinvestment actions, the availability and liquidity of firm assets, covenant variables (e.g. net worth) and covenant thresholds (e.g. a binding minimum net worth) may be jointly determined. The source of exogenous variation is the minimum distance between covenant variables and covenant thresholds, in each firm-quarter observation. When this distance is non-negative, a firm is in a violation state.

The existing literature documents the impact of covenant violations on investment (e.g., Chava and Roberts (2008), Falato and Liang (2016)), capital structure (e.g. Roberts and Sufi (2009), Nini, Smith, and Sufi (2009,0)), payout and compensation policies (e.g. Ferreira, Ferreira, and Mariano (2018)). This paper complements these findings by highlighting one-off changes in firms' assets. Such sharp adjustments are consistent with deep governance changes depicted in Ferreira et al. (2018). In their paper, they document longer-term changes in firm policies that are preceded and driven by governance changes[5] and examine permanent one-off changes to a firm's asset portfolio. Changes in firm boundaries constrain long-term firm policies by changing the reach of management bodies (the agency relationship), rather than the membership of those bodies (the agent).

Covenant violations are a precise mechanism found in the literature to identify sudden control transfers from shareholders to creditors. Creditors can immediately threaten managers with a court procedure of loan termination, when certain accounting variables reach their pre-defined threshold levels.

In practice, creditors rarely need to obtain court recognition of technical (non-cash) defaults; most breaches in debt contracts lead to contract renegotiations (Roberts (2015)). Renegotiations are often launched when creditors' cash flow projections forecast defaulting financials in the near future. This paper defines covenant breaches as implied covenant violations, where a formal violation may not have occurred. Hence, some of these violations have resulted in covenant waivers obtained through renegotiations. Because disinvestment actions are one of the quickest ways to rebalance a firm, they are likely to be taken as part of renegotiations, namely in implied covenant violations. These observations are crucial for addressing the research question and should be retained.

I propose that large divestitures can be motivated by the prospect of a one-off movement that restores the firm's non-violation status. As managers achieve a return to compliance, they strengthen their bargaining power in renegotiations with creditors. Creditors can always threaten managers with loan termination upon one past violation, in most contracts. Yet the recognition process of violations is long and lengthy. Managers can commit to behave in a creditor-friendly way only if bankruptcy is avoided. As the firm

[5]This literature has described improvement in creditors' bargaining power as an increase in creditor control rights.

return to regular financials, the cost of settling a legal covenant violation becomes high.

Violations result from a key trait of syndicated loans: a traditional covenant structure.[6] This covenant structure is not often found in other types of credit arrangements. Under financial covenants, firms can be flagged much sooner as defaulting or in financial distress, often at times when bankruptcy can still be avoided.

Concerns with appropriate early warnings gain relevance in a context of emergence of covenant-lite financing instruments (Becker and Ivashina (2016)), a current matter of priority for North-American and European policymakers. Under similar circumstances, covenant-lite mechanisms have the potential to conceal financial distress situations from external stakeholders until much later stages.[7] In this paper, I aim at documenting how decision-making under "covenant-full" loans can shape a firm's restructuring through constrained disinvestment. Resulting policy implications may then be considered for the potential disbandment of this loan category, as it is replaced by non-bank channels for corporate financing.

Across non-bank agents, it cannot be ruled out that key decisions such as investment screening and exposure management may be taken away from established practises in banking deals. Markets refrain from loans which are simultaneously low in collateralization and covenant-setting standards. Under these loan packages, clearly insolvent firms could not be tagged as defaulting for long time and help compound uncertainty in loan markets. Creditors would not be entitled to intervene before any default event occurred.

[6] This structure may be binding in key circumstances, where some anticipation of outright insolvency can be attained.

[7] For the last years, capitalization and solvency concerns have bound bank lending to corporates for the last years. Non-bank channels for corporate financing benefited from a constrained supply of traditional corporate loans. Within the so-called "shadow banking system", direct lending by private equity funds has followed a remarkable upward trend since the 2008 crisis (Pozsar and Singh (2011), Nesbitt (2017)).

It has been argued that bankruptcy risk can be reduced by mechanisms for early creditor intervention. However, there is insufficient evidence that such interventions may be timely in anticipating and reversing management's own initiative to shape the firm's future outlay. This paper intends to shed light on this issue.

My paper makes several contributions to the literature. My results add to the literature on the effect of loan covenant violations in firm outcomes (Chava and Roberts (2008), Roberts and Sufi (2009), Ferreira et al. (2018) and others). Asset sales and equity deals impact covenant variables in a more discrete and irregular way than previously studied mechanisms. Disinvestment can transform firms in a structural way, through a single event, with immediate effects and long-lasting implications.

My findings assert the empirical relevance of models associating asset sales to financial constraints (Shleifer and Vishny (1992), Caballero and Simsek (2013), Brunnermeier and Pedersen (2005)) in settings of enhanced creditor control. Under the threat of loan termination, evidence of disinvestment actions is consistent with predatory trading and fire sale models. My evidence on covenant violations thus generalizes effects of strict trading or regulatory constraints in financial markets. I show that the breach of contract rules can also prompt large scale transactions in non-financial firms, whose assets tend to be less liquid.

I do not just provide additional evidence to the literature on the effects of covenant violations. Importantly, I provide a new plausible motivation for large disinvestment transactions, such as large asset sales, spin-offs and equity carve-outs. I document that firms divest large scale assets in specific default circumstances: when they need to return to compliance with financial covenants.

I contribute to the literature on asset sales, by proposing that financial constraints can play an important role in defining a firm's target scale. In the abscence of M&A deals, asset purchases and sales are the lead mechanism (Warusawitharana (2008)) through which firms revise their scale and scope. My findings point out to quick adjustments to firms' sizes, through asset sales, driven by a transfer of control to creditors. Hence, I propose that conflicts of interest in the firm's governance can supersede strategic factors in determining firms' boundaries.

I also contribute to the literature on spin-offs and carve-outs. Prior empirical studies have addressed both types of equity deals from the vantage point of investors, identiying positive market reactions (Hite and Owers (1983), Cusatis et al. (1993)). This paper measures one critical determinant of these managerial decisions. I point out to instances where equity deals follow disruptions in competing sources of financing - internal funds and debt, as admitted by the managerial discretion hypothesis and predicted by the pecking order theory (Maxwell and Rao (2003), Allen and McConnell (1998)). My results document firms' preference for equity deals under financial constraints and provide details on their chosen deal structures.

The remaining part of the paper is organized as follows. Section 2 reviews the literature related to the paper. Section 3 describes the data and the methodology used. Section 4 presents the main empirical findings. Section 5 describes the discontinuity analysis, discusses identification strategies and the robustness of results. Section 6 concludes.

1.2 Literature review

My work is related to a number of studies that focus on the impact of credit agreements on firm policies. Chava and Roberts (2008) are the first to document empirical evidence for a mechanism of transfer of control rights through the channel of debt covenants.

As expected, this mechanism plays a crucial role in financing and investment decisions. They find that capital expenditures decline in response to a covenant violation by approximately 1% of capital per quarter—a 13% decline relative to investment prior to the violation.

In Chava and Roberts (2008), investment reductions are presented as an easily implementable policy to boost short term cash flows, so that firms can cope with debt service. The authors suggest that Capex reductions can be used to thwart inefficient investment or to punish management's misbehaviour, according to the agency theory of covenants (Jensen and Meckling (1976), Myers (1977). Bradley and Roberts (2015)).[8] Investment is presented as the main channel for financial rebalancing policies, as opposed to labour policy, inventory management and Research and Development.

In their paper, Chava and Roberts (2008) address identification issues through an innovative application of RDD and quasi-RDD techniques, targeting the objectivity of violation events in continuous covenant variables. This method provides both a between-firm (vs. a non-violator) and a within-firm counterfactual (vs. the same firm before violation) from a quasi-random assignment of firms around the threshold. Evidence of investment reductions is robust to the inclusion of a host of control variables in the regression specification, including firm and year-quarter fixed effects, proxies of investment opportunities, financial health, debt overhang and other contractual features. Several smooth functions of the distance to the covenant threshold were used to determine bandwidths: linear, quadratic and higher order polynomials.

Based on a 15-year sample, between 1994 and 2008[9], Ferreira, Ferreira, and Mariano

[8] Chava and Roberts (2008) was the first of several papers documenting firm rebalacing policies taken upon covenant violations. Evidence of such actions confirms the hypothesis that covenants enable creditors to mitigate conflicts of interest with shareholders, by enhacing their control rights in states of the world where (payments) default risk is higher.

[9] The authors add data for the 2009-2014 period for robustness purposes.

(2018) show that the number of new independent directors is around 25% higher for firms having breached a covenant or entered into an implied violation of it. These new directors are often shared with other creditor firms of the same lenders. Firms appointing directors following a violation are likelier to cut payout, reduce investment and operational risk (in ROA). Highly levered firms and those with the most established lending relationships are the likeliest to appoint new board members. These appointments are not a replacement for executive directors. Covenant violations are defined as implied, by an accounting criterion. Results show a stochastic structure of two-year lagged effects of covenant violations in the appointment of directors. Effects are stronger for more repeated bank relationships and for less tight covenants at origination.

Additional evidence in Ferreira et al. (2018) links incentive conflicts (between firms and creditors) to corporate debt policy. Net debt issuing activity experiences a sharp and persistent decline following debt covenant violations. Creditors use their acceleration and termination rights to increase interest rates and reduce the availability of credit. The effect of creditor actions on debt policy is strongest when the borrower's alternative sources of financing are costly. In addition, despite the less favourable terms offered by existing creditors, borrowers rarely switch lenders following a violation.

Roberts and Sufi (2009) use novel data set that includes the universe of financial covenant violations reported on firms' annual and quarterly securities and exchange commission (SEC) filings between 1996 and 2005. Their analysis considers a legal definition of covenant violation. Hence the paper complements other studies that include all covenant violations foreshadowed by accounting data. The authors test to the degree of permission in "implied violation" criteria, which intend to remove potential biases of omission of non-registered defaults.

Roberts and Sufi (2009) use a sample of violators comprising 3,603 private credit agreements entered into by 1,894 of the firms. Almost 97% of these credit agreements contain at least one financial covenant. Two main types of covenants are found, according to their underlying ratios: debt to cash flow (58% of total) and debt to balance sheet. Among the population of publicly listed firms in the United States, more than one quarter are found to violate a financial covenant at some point during their sample horizon. The high incidence in the general population implies that covenant violations are relevant for a large number of public firms.

On average, financial policy exhibits a sharp change following a covenant violation. Specifically, net debt issuing activity experiences a large and persistent drop immediately after the violation. In the four quarters before a violation, borrowers have an average net debt issuance scaled by lagged assets of 80 basis points per quarter. In just two quarters after the violation, net debt issuance falls to 25 basis points. Firms move from increasing net debt issuance by 0.8% of assets per quarter to reducing net debt issuance in just two quarters. This decline is persistent, lasting for over 2 years after the violation, and leads to a corresponding decline in leverage of over 3%.

Additional results in Roberts and Sufi (2009) reveal cross-sectional features that increase the likelihood of violations. Firms with and without a corporate credit rating violate covenants at approximately similar rates. However, smaller firms violate financial covenants more frequently than larger firms. For instance, firms with total assets less than $100 million are almost 20 percentage points more likely to violate a financial covenant than firms with total assets over $5 billion. Firms rated "A" or better have a 1-year probability of violating a covenant of 1%, while firms rated BB have a 7% probability. Probabilities of a covenant violation are significantly larger in every rating category except firms rated "CCC" or worse, which includes some firms that have already defaulted on a payment.

In another strand of the literature, a number of studies has developed comprehensive hypotheses for endogenous disinvestment actions. Warusawitharana (2008) proposes a model in which firms are expected target under-performing assets in asset sales. Firms should divest when their performance is lower and their capital employed is higher. Consistently, in empirical tests, operating performance (ROA) and size are shown to be the main predictors of asset purchases and sales. These findings indicate that asset sales are consistent with efficient investment decisions.

Several studies have hypothesized the signalling effects of different types of disinvestment. For equity carve-outs, a prominent signalling theory has been depicted in the literature. The managerial description hypothesis states that a partial relinquishment of control of assets of a subsidiary can signal an attempt to cash out the firm: reducing its net cash position, increasing its debt. This the case when cash is paid out for repurchases or dividends as a result of the carve-out. (Allen and McConnell (1998))

Alternatively, under the managerial description hypothesis, managers could use the proceeds of a carve-out to reinvest in other projects. From a manager or dominant shareholder point of view, a carve-out requires a much larger relinquishment of control than debt or internal financing. It is then signalled in a quite clear way that if reinvestment is done through (the proceeds of) a carve-out, then managers must have been pushed towards that choice for other reasons. Possibly, managers can not access debt financing, do not want to disclose as much information, or can not be convincing to external market agents.

The managerial description hypothesis sees equity carve-outs as directly linked to the pecking order theory. Managers may find hard to present their investment prospects as opportunities with net present value, not driven by private benefits or empire-building goals. If external stakeholders of the firm can not be attracted, carve-outs can be seen as last-resort option, yet preferred to issuing equity.

Another special case of disinvestment is that implied by splitting parts of the firm under autonomous legal and operating units, in what is usually known as a spin-off. Spin-offs that have no effect on debt-to-equity ratios send very distinct signals from equity carve-outs. We can see this as a subtle transfer of value from debtholders to equity holders, in the sense that these imply reductions of critical mitigators of default risk. Fixed assets and collateral value that can be pledged by each creditor tend to be reduced. Moreover, spun-off firm structures lose diversification benefits from the uncorrelatedness of firm segments' performances. (Maxwell and Rao (2003)). [10]

1.3 Data and methodology

1.3.1 Data

I construct my sample from the non-financial firms in the SDC database, from which I obtain panel data on asset sales, spin-offs and carve-outs. I obtain accounting and segment data from Compustat, stock returns from CRSP and data on syndicated loans from the DealScan database. I restrict the sample to loans with information on the spread over Libor, on maturity and origination dates, and I eliminate firms with loans without any covenant information or that do not include a covenant on the net worth, tangible net worth, debt-to-EBITDA, book leverage, interest coverage and current ratios.

My main sample uses accounting data from 1990 to 2018 (fiscal years) and SDC data from 1991 to 2018. Specifications with lagged variables eliminate data for the 1990

[10]A remarkable exception to creditors' harm is when spin-offs suit the interest of creditors, by detaching them from more uncertain, upside-generating firm operations. These deals can be mutually advantageous if they somehow improve somehow the relative position of shareholders.

fiscal year (first quarter of 1991). SDC data is available starting with 1991 (fiscal year): this determines the beginning of the sample period. Matching of accounting data to calendar events (e.g. spin-offs, carve-outs, etc.) is such that every event in SDC data is matched to the most recently finished fiscal quarter of accounting data. Hence, counts and total values of events per fiscal quarter refer to at most three months subsequent to the end of that quarter. Implied covenant violations occur precisely at end of the quarter they are assigned to.

My final (baseline) sample covers 4255 firms and 109,773 firm-quarter observations. For this sample, I find that 45.9% of the firms have at least one covenant violation during the sample period (1951 firms), and 11.5% of the firm-quarter observations include a violation (12,571 firm-quarter observations).

Ferreira et al. (2018) use a yearly structure in their accounting data, thus having firm-year observations and tagging covenant violations per year. While their proportion of firms ever violating a covenant is close to this study, the proportion of firm-year observations with a technical default in their paper (60%) is mechanically higher than the corresponding share of firm-quarter observations in my study. This paper's proportion of defaulting observations is comparable to those of other studies using quarterly data, such as Chava and Roberts (2008), who report a figure of 15%.

For each loan, I first obtain covenant thresholds on the net worth and the tangible net worth balances, as well as on the book leverage, debt-to-EBITDA, interest coverage and current ratios. The first five of this list (net worth, tangible net worth, book leverage, debt-to-EBITDA, interest coverage) are the five most frequent covenant variables in my sample. The sixth is the current ratio covenant, which is by far the most frequent one measuring liquidity, as opposed to solvency. The use of the current ratio covenant is common in previous research papers (Chava and Roberts (2008), Ferreira et al. (2018)).

Within the list of six covenants, I consider violations of the three most frequent covenants (net worth, tangible net worth, Debt-to-EBITDA) in my baseline models. In additional tests, all covenants in the list are included. When considering the full list of six covenants, the share of observations in violations increases to 19.17% and the number of observations increases to 118,099.

The choice of three covenants narrows the analysis to one of the dimensions of technical default: insolvency. Given the extended impact of disinvestment actions in a firm's balance sheet, their use as a rebalancing policy is more plausible when an imbalance in firm's stock variables is to be addressed.

I assume that covenants are binding every quarter until the maturity of the loan. Quarters during which loans mature are then fully comprised. Since a firm might have more than one active loan in a given quarter, I use most binding threshold for each covenant across all active loans in a given quarter. This is the minimum threshold for covenant variables with a maximum cap (debt-to-EBITDA ratio, book leverage ratio) and a maximum threshold for those with a minimum level (current ratio, interest coverage ratio, net worth and tangible net worth).

As previously mentioned, I use Compustat data at a quarterly frequency to compute the accounting variables. From here onward, I will refer to distances to threshold as positive when not in violation, and negative when in violation, regardless of the sign of breaches. Hence, negative distances to threshold are associated with financial distress. Thus the minimum distance to threshold across all covenants shall determine how close a covenant is to be breached or to return to conformity.

The relevant accounting variables have different units of measurement (dollar values versus ratios). Thus I measure the distance to the covenant threshold as a proportion of the threshold. If the accounting variable with a minimum (maximum) level covenant is below (above) or equal to the threshold, there is an implied covenant violation. In the exceptional case where the binding threshold is exactly zero, this measure is void. I call the minimum distance to the threshold across the list of covenants the binding distance, which is defined as follows:

1.3.1.0.1 $D_{ijt} = min(\widetilde{D_{itjk}})$, with

$\widetilde{D_{itjk}} = min_z(C_{itjk} - T_{itjk})/T_{itjkz}$

1.3.1.0.2 An implied covenant violation event is a firm-quarter observation in which the firm breaches at least one covenant threshold.

As in Chava and Roberts (2008) and Ferreira et al. (2018)), I acknowledge implied violations from loan and accounting data. The number of violations may be understated due to under-coverage of threshold renegotiations in the Dealscan database. Roberts (2015) shows that credit agreements are renegotiated on average every nine months, often outside violation events. Denis and Wang (2014) show that covenant thresholds are often renegotiated when firms are close to the threshold, such that many more firm would be in default if original thresholds had been kept until maturity.

The number of actual violations may be misstated also because banks may waive covenants and because the accounting numbers, such as earnings-based measures and net worth, used in credit agreements may differ from those reported on financial statements. In sum, there are a number of possible sources of measurement errors. However, I find no a priori reason to suspect that such errors would bias the results toward finding a positive effect of covenant violations on disinvestment actions.

1.3.2 Methodology

1.3.2.1 Empirical challenges

I estimate the average effect of an implied covenant violation on disinvestment actions, conditional on firms having loans with restrictive covenants. The main empirical challenge is to isolate the pure effect of a violation in disinvestment from the effect of financial performance, past investment decisions and other confounding factors. I measure the effect of violations in one-off events (disinvestment actions), with potential continued effects in the future. In all periods after the event, the effect of the violation event needs to be disentangled from both contemporaneous and lagged predictors of affected variables. Lagged predictors can potentially be variables measured before the violation.

Should negotiations not succeed after a violation, creditors typically have the right to terminate the credit agreement and request the full repayment of the loan. Before loan termination is recognized, no coercion exists in creditors' actions. Controlling for financial performance and other factors, a violation can affect firm outcomes only because creditors are able to make threats that were not possible before the violation. This does not mean that creditors actually use their enhanced control rights to obtain concessions from the firm. Management or large shareholders could promote changes in policies in response to increased creditor control rights, even absent any indication that creditors favour a particular policy.

As discussed in the introduction, an analysis of disinvestment types may give indications on the likelihood that creditors' influence has been directly exerted. However, these two channels are not clearly detachable.

I show that an increase in creditor control rights caused by covenant violations leads to disinvestment actions. To reduce firm heterogeneity around covenant thresholds, I focus primarily on results obtained in discontinuity subsamples constructed using narrow windows around the threshold. However, this approach is arguably not sufficient to address identification problems in this particular application. A standard regression discontinuity design is presented with critical challenges when applied to this problem. Following the literature on this topic (Ferreira et al. (2018)), I briefly summarize them:

First, the probability of firms exiting or entering a sample around the threshold may be correlated with the existence of disposable assets or the feasibility of restructuring through equity deals.

Second, violations may directly affect the distance to threshold. After violations, if a firm takes actions that improve the underlying accounting variables, the firm may rapidly exit the violation sample, creating an unbalanced distribution of observations on either side of the threshold. For the subsample of violators taking disinvestment actions, the likelihood of a rapid exit from the violation sample could even be higher, given the scale of some disinvestment deals.

Third, the use of ratios as “running" variables could affect the sample's symmetry around the threshold. To understand this problem, consider, for example, the interest coverage variable. Much of the variation in this variable comes from its denominator, because debt is often refinanced under different terms and the debt stock typically have either a reduction or a projected growth path, concentrating interest expense in certain periods. Because interest coverage is a convex function of interest expenses, for a given amount of variation in interest expenses, this ratio will vary more when it is initially low (i.e. low EBIT) than when it is initially high. Thus, observations in violation of this covenant are likely to be farther from the threshold than observations that are not in violation. Any narrow window that is symmetric around the threshold is more likely to include observations that are not in violation than observations in violation.

Fourth, covenant thresholds differ across firms. Although I normalize all covenant thresholds to make them comparable across firms, the underlying thresholds are different. Thus, the effects of violating a covenant might differ across firms because the breach of a tight covenant might have different implications from the breach of one that is not as tight.

Furthermore, covenant thresholds are endogenously chosen (Garleanu and Zwiebel (2008) and Demiroglu and James (2010)), in such ways that firms may self-select themselves into a group with certain restructuring mechanisms. This self-selection could be based on prior default expectations for identical firms, or more broadly on peer group practises and market conditions. Consequently, any managerial effect identified for covenant violations can reveal, at least qualitatively, contingent events that could be expected when loan contracts were once signed. To some extent, investors and managers may be motivated to include covenants in loan contracts by such future events they expect and account for, with some probability.

To address these concerns, I proceed as follows. First, I use industry or firm fixed effects, targeting time-invariant omitted variables. Second, I control for a long list of time-varying firm variables, including measures of financial strength, investment needs and operating performance.

1.3.2.2 Empirical model

My two baseline specifications are given by:

1.3.2.2.1 $\mathbf{1}y_it = \beta v_{(t-a)} + \gamma_{it} + \theta_i + \delta_t;$

$\frac{y_{it}}{at_{it}} = \beta v_{(t-a)} + \gamma_{it} + \theta_i + \delta_t$

1.3.2.2.2 y_{it} denotes the outcome variable chosen, for a given firm and quarter. The coefficient of interest is β, while v is a binary variable denoting any covenant violation in a given quarter. a is a non-negative number of quarters, varying between 1 and 4, according to specifications, to which we lag violations from current quarter t, denoting $v_{(t-a)}$. γ_{it} is a set of firm-quarter control variables. θ_i and δ_t are fixed effects at firm and quarter levels, respectively.

For different types of disinvestment actions (sales, spin-offs, carve-outs) and for their combinations, outcome variables are both written with a binary structure (whether there was an event of that type in that quarter) and as a ratio of the total value disinvested per quarter over total assets. My approach allows to capture quantitative effects of covenant violations in each disinvestment action (values of assets disinvested). It also measures qualitative effects of covenant violations (whether any disinvestment action of that type was taken, whichever its scale). I avoid the use of count variables, considering that those can be imprecise when occasional events such as disinvestment actions. Count variables would raise concerns related to outliers, which could possibly group several related or small-sized transactions.[11]

I lag explanatory variables by one, two or three quarters. There are reasons to expect a lag. First, the date of a covenant violation (actual or implied) may indicate

[11]With spin-offs and carve-outs, this problem could be even more material, since the distribution of count dependent variables would be strongly bi-modal, between the values zero and one.

the start of negotiations between the firm and its lenders. Some disinvestment actions are expectedly taken as a result of either an imminent or an accomplished agreement. Second, some disinvestment actions are restructuring actions, which may take longer to implement, both for their contractual complexity and for the operating strain they can impose. For example, the lag between an initial covenant violation and the implementation of a spin-off or a carve-out can be substantial. It is not then unexpected that the spin-off actions may be recorded with a delay of at least 2 quarters.

As my baseline specifications depend on lead periods from firms' last recorded violations, they can be affected by test observations without a clear counterfactual. In particular, firms in recent violation states may yet be breaching covenant variables by large margins. Such firms have no credible prospects of reversing implied violations, under the same contract terms. Hence, their counterfactual is not appropriately defined by non-violator firms, namely by those at risk of breaching a covenant.

Large short-term variations in covenant variables, in any direction, imply concurrent firm adjustments that may not be fully captured by control variables. For this reason, the counterfactual of large (however recent) violations is neither well specified by quarters where the same firm does not default on its covenants.[12]

In a refinement of baseline specifications, I restrict my analysis to a narrow sample of firms close to covenant thresholds. As is typical in regression discontinuity designs, this subsample includes only those observations for which the absolute value of the binding distance is less than h (the bandwidth). I do not use a theoretically derived bandwidth (for example, Imbens and Kalyanaraman (2012)) because some of the necessary assumptions are unlikely to hold in my application. I choose instead an ad hoc narrow

[12]Firms in non-violation could resemble firms in recent violation states in several dimensions. If a firm's violation state is not plausibly reversible, though, control transfers (to creditors) are likely occur by other channels than the enforcement of debt covenants.

bandwidth (h = 0.20) as the baseline, which generates a sample that includes 8866 observations (8.1% of the full sample). The standard deviation of the binding distance (in the [-10; 10] interval) is 2.53; thus, one unit of binding distance is equivalent to 0.395 of a standard deviation. Therefore, the h = 0.20 bandwidth is roughly equivalent to 0.08 of a standard deviation.

Narrower bandwidths improve sample balance but reduce sample size. Since there are strong flaws in the validity of estimates from small subsamples, I choose to focus on sample defined by h = 1:5 and check the robustness of the results to larger and smaller bandwidth choices. In particular, I repeat my complete analysis with a bandwidth of h = 0.40, following Ferreira et al. (2018).

The combination of fixed effects and the use of observations near the threshold mitigates concerns about omitted variables. With fixed effects, my key identification assumption is that the suitability of assets for quick disinvestment and the effectiveness of disinvestment in transferring control do not make firms less likely to manipulate accounting earnings, so as to narrowly avoid violations.

In my baseline specifications, industry and quarter fixed effects are included, while I employ fixed effects at the firm level in additional OLS models and for all RDD tests. Firm fixed effects imply the loss of some external validity, as cross-sectional variations in disinvestment across firms are not measured. Firms without covenant violations do not contribute to the estimation of the violation coefficient. Only cross-sectional models include all non-violator firms in the counterfactual group, in baseline specifications. Nonetheless, firm fixed effects are key in ensuring an improved identification of results, which is developed in section 4 of this paper. Following prior applications (e.g. Roberts and Sufi (2009), Nini et al. (2012)), my identification tests perform extensive pre-treatment of observations, through saturated models.

My approach in discontinuity tests is close to Ferreira et al. (2018)). I estimate the following equation:

$$y_{it} = \beta v_{it-1} + \sum_{p=1}^{P} \left[\gamma_{p0} + \gamma_{p1} v_{it-1}\right] D_{it-1}^{2} + \alpha_t + f_i + \mathbf{x}'_{it-1} + \varepsilon_{it}, \tag{1.1}$$

where y_{it} is either an indicator denoting the occurence of a disinvestment action, or the ratio of disinvested Assets to total assets, like in my baseline specifications. v_{it} is an indicator variable that takes the value of one if firm i breaches a covenant threshold in quarter $t-1$ ($D_{it} \leq 0$); $\sum_{p=1}^{P} \left[\gamma_{p0} + \gamma_{p1} v_{it}\right] D_{it}^{2}$ is a polynomial of order 2 of the distance to threshold, where coefficients γ_{p0} and γ_{p1} can differ across negative ($v_{it} = 0$) and positive ($v_{it} = 1$) binding distances ; α_t is a quarter fixed effect; f_i is a firm fixed effect; and $\mathbf{x}_{it-1}$ is a vector of control variables, lagged by one quarter. Standard errors are estimated through a nearest-neighbour algorithm (minimum order of 3), within firm clusters.

Some of the model's variables require methodological assumptions. Disinvestment events from the SDC dataset are split in three categories: two identified as such in the database (spin-offs, carve-outs) and a residual one (sale of assets). The residual category comprises all reductions of assets with an offsetting cash inflow that are not associated with events in the remaining two categories. Total debt is defined as long-term debt plus debt in current liabilities. I measure EBITDA as net income minus extraordinary items, plus income taxes, interest expenses, and depreciation and amortization costs.

1.3.3 Summary statistics

In table 1, disinvestment actions are described, both in terms of event indicator variables (per quarter) and in terms of value disinvested, per quarter and disinvestment type. While asset sales are much more common than restructuring disinvestment, through spin-offs or carve-outs, each sale amounts to much lower value than the average spin-off or carve-out transaction. Spin-offs and carve-outs tend to concern a very high proportion of the firm, whether in terms of total assets, turnover or profits. While in asset sales, it is value, rather than the event indicator, to exhibit a clearer univariate increase in violating firms, in spin-offs and carve-outs, very large relative effects are both found in transaction quantities and values.

In Table 2, I report statistics that could help ascertain whether firms in violation differ from their compliant counterparts in any unexpected dimension that would not be associated to lower solvency or liquidity. While size, both measured in assets and sales, does not differ considerably, leverage is clearly higher for firms in violation. Investment and dividend payments are clearly lower for those firms, as predicted by Chava and Roberts (2008) and Roberts (2015).[13] The subsample of firms in violation has lower credit ratings and worse profitability, which is also expected.

For control variables, mean differences are all significant, even when economically modest. The univariate test applied to (contemporary) outcome variables reveals positive significant differences in asset sales and spin-offs for violator firms. Asset sales measures increase in a larger absolute scale, but the relative effect in spin-offs is much higher. Increased spin-off measures are likely to reflect the large size exceptional accent of spin-offs in any firm. Carve-out deals occur in a lower share of firms in violation and in

[13]Subsample statistics are reported for both variables, although capital expenditures and dividend payments are not included in the set of control variables.

lower transaction values, although this difference is not significant for the value metric.

Table A1 in the appendix presents summary statistics for the discontinuity sample (h = 0.2). Compared to the full-sample statistics in Table I, firms in the discontinuity sample are smaller (average value of assets \$2.7 billion) and more levered (31%). They are also more likely to violate covenants (32%). These differences are not surprising: by definition, the discontinuity sample contains only observations that are close to the violation threshold. All other variables in Table IA.VI appear similar to those in the full sample.

In Table A2, panel A gives detail on sub-sample distributions of both outcome and control variables. In panels B and C, critical variables are, respectively, measured in their original scales and as absolute distances to covenant thresholds. All main covenants chosen have an expected univariate behaviour for their critical variables, being lower in violating firms for minimum value covenants and higher in violating firms when covenants are an upper cap to the critical variable.

1.4 Empirical findings

1.4.1 Disinvestment through the sale of assets

Within the set of disinvestment actions, the most prevalent effect of covenant violations is the sale of assets. As discussed in previous sections, this action implies the least interference in the firm's legal organization and control structure. However, it may have immediate and drastic effects over operations, if the firm is to be deprived of essential operating assets. Examples of such assets are factories, machines or commercial networks.

In Table 3, I look at the effect of covenant violations in asset sales. Equations (2) and (6) contrast the main specifications for the number of transactions and for the number of transaction values, respectively. In the same table, I show regression equations for the same outcome variables, but without the effect of covenant violations (equations (1) and (5)). The main explanatory variable is the contemporary covenant violation dummy. The baseline specification is changed by including a 2 quarter lag in covenant violations (equations (3) and (7)) and by including a 3 quarter lag in that variable (equations (4) and (8)).

In baseline specifications, the marginal effect of covenant violations on asset sales can be measured as a 1.65% increase in the chance of selling assets (equation (2)) or as an increment of 0.676 percentage points in the share of divested assets (equation (3)). To better illustrate these magnitudes, I evaluate them at the subsample average for non-violator firms. Both effects are similar, in relative terms: 10.1% and 9.3%, respectively. Predicted revenues per firm-quarter are just slightly lower for firms in violation. Across the sample, the average transaction size of violator firms is also marginally lower (19.5% of total assets vs. 21.9% of total assets).

By including 2 and 3-quarter lagged violations in equations (3) and (4), the effect of violations in the binary variables is qualitatively similar and significant, while for the share of asset sales I find insignificant coefficients with a similar magnitude in equations (7) and (8). Both effects show some persistence, but decline as observations in the first and second quarters of violation are excluded from the treatment group.

Total assets (positive), debt-to-assets (positive), Tobin's q (negative), the EBIT-to-assets ratio (negative) and the investment in Property, Plant and Equipment are the main predictors of asset sales, in the absence of violations as explanatory variable. These effects all remain significant at 1% when included along the variable of interest, even though their magnitude decreases for leverage, mostly in equations (2) and (6).

Asset sales are regular events from an economical point of view, such that many occur at times with no financial distress. However, the effect of violations is sizeable as a quarterly measure. Firms that remain in violation state for several quarters will be more propense to disinvest throughout all that period.

1.4.2 Disinvestment through equity deals: spin-offs

A different class of actions could be taken under financial distress: those that directly restructure the firm's control structure. Equity deals transform the main contractual relationships commanding firm's assets and daily operations, by assigning control rights to different agents.

We would expect that such transactions are less frequent, given how complex it is to set them up. Moreover, one spin-off or one carve-out per firm are the maximum frequency found in almost all time periods. Not only are their average values much higher, but we would also expect their long-term impact to be potentially larger. Given their complexity, they could take longer to implement, as discussed in section 3.

Spin-offs can be characterized, in a context of financial distress, as a way to potentially split a cohesive, well-functioning and solvent segment of the firm. This is achieved by detaching its assets (to some extent) from the pledge of credit relationships of the incumbent larger firm. In essence, the size of the spun-off component could vary. This size should mostly depend upon operating divisions or collateralization constraints (in particular, if some fixed assets are shared across segments.

In Table 4, I look at the effect of covenant violations in spin-offs. Equations (3) and (7) exhibit the main specifications for number of transactions and transaction values, respectively. I also present regression equations for the same variables, without the effect of covenant violations (equations (1) and (5). The main explanatory variable is the covenant violation dummy. The baseline specification is changed by including the first lag covenant violations (equations (2) and (6)) or by lagging those by 2 or 3 quarters (equations (3), (4), (7) and (8)).

In baseline specifications, the marginal effect of covenant violations in spin-offs can be measured as an increase of 0.18 percentage points in the likelihood of spinning off, or as an increase of 0.18 to 0.19 percentage points in the share of total assets. In the baseline group of non-violator firms, 0.33% of firm assets are spun-off in average; hence the effect of violations increases this number by 54.4% in the first quarter and by 55.3% in the second. By contrast, the share of spun-off assets exceeds in 81.5% the average of non-violator firms.

The magnitudes of both effects imply that spin-offs by violator firms increase in relative size (16.70% in average). The scale of the effect is yet short of the univariate mean difference in transaction sizes (79.2% vs. 65.5% of the book value of assets).[14] By including 1-quarter and 2-quarter lagged violations in equations (4) and (8), effects do not suffer but minor changes, if anything being reinforced in lag 1.

In contrast with asset sale estimates, effects over spin-offs show high persistence in the first three quarters after violations. Effects seem to be best estimated when the first (or the second) quarter of violation is excluded from the treatment and I include the first (or the second) quarter where a firm returns to a non-violation state. This finding supports the hypothesis that spin-offs have longer implementation periods than asset sales, due to their greater complexity. To be captured by the first lag, a transaction

[14]The average number of spin-offs per quarter in positive observations is approximately one in both subsamples.

must occur within a maximum period of three to five months after the accounting date when a violation is acknowledged (according to fiscal calendars). Plausibly, extending this period to a maximum of six to eight, or nine to eleven months can best target this effect.

Spin-offs are much less predicted by firm covariates than asset sales. However, there is a significant (negative) association with leverage. The complex re-assignment of debt claims and pledgeable assets implied by a spin-off may often not be feasible in highly levered firms. This mechanism seems to be kept when I include violations as regressors. For highly levered firms, this result provides some evidence against the use of spin-offs to shape, or precondition future restructuring processes. In particular, it can not be excluded that spin-offs are deterred by increased creditor control rights when firms are more levered.

1.4.3 Other equity deals

1.4.3.1 Carve-outs

Equity deals can be carried out in different ways than the rigid structure of a spin-off, involving a total relinquishment of control over some unit(s), while control over the remaining ones is totally kept. Carve-outs allow for a partial transfer of control of one (or more) sub-units of the firm. These sub-units gain full legal length, as separate firms, upon the carve-out. Critically, carve-outs may break some creditor relationships towards carved-out assets. At the same time, they allow the parent firm to realize cash without removing any business or asset from the corporate group.

Carve-outs imply that new equity is issued and placed, usually through an initial public offer or a private placement. Equity offerings are lengthy and heavily regulated processes, whose success depends on market reactions. Although carve-outs can be attractive options to generate cash for debt repayment, their practical requirements may limit their undertaking in technical default situations. Firms in financial difficulties could find more opportunities to carve-out assets while not having yet entered a violation state.

In Table 5, I investigate the effect of covenant violations in carve-outs. Equations (3) and (7) present the main specifications for number of transactions and transaction values, respectively. In the same table, I exhibit regression equations for the same variables, without the effect of covenant violations (equations (1) and (5)). The main explanatory variable is the covenant violation dummy, lagged by one quarter. The baseline specification is changed by including 1-quarter lagged violations (equations (3) and (7)) or by lagging those by 2 quarters (equations (4) and (8)).

The marginal effect of covenant violations in carve-outs is not significantly different from zero. It can be measured as a reduction of 0.005 percentage points in the likelihood of carving out, or decreased 0.006% of carved out assets, in baseline specifications for a 1-quarter lag. By including 2-quarter lagged violations in equations (3) and (6), this effect remains insignificant, but with a positive estimate. Overall, no evidence is found of a greater prevalence of carve-outs upon covenant violations.

Carve-outs are well predicted by some control variables, mostly by firm size (positive) and the Tobin's q (negative). Two other predictors (profitability and industry diversification) are significant at 10%. Industry diversification can be interpreted as a proxy for the suitability of a firm to split its control structure across distinct business units. Yet a significant effect of this variable is not found for another clss of equity deals: spin-offs.

1.4.3.2 Choice between disinvestment types

In Table 6, I report regression results for both OLS and Probit models where only firms undertaking disinvestment actions are considered. In this test, I document the effect of violations over the choice between two alternative types of disinvestment: asset sales and equity deals. Equity deals comprise spin-offs and carve-outs. The dependent variable is an indicator of the occurrence of an equity deal, which can either be a spin-off or a carve-out. Hence, the outcome variable takes the value of zero when a firm has not undertaken equity deals in a given quarter, but at least one asset sale transaction has occurred.

In equations (1), (3) and (5), OLS linear probability models are estimated for the violation indicator lagged by one, two or three quarters. Some evidence is found of an increased preference for equity deals over asset sales, following covenant violations. Coefficients for the three lags of violations are significant at a minimum level of 10%. The third lag has a significant coefficient at 5%. It is also the largest coefficient in magnitude, yet measuring the effect of violations over equity at less than 1 basis point (0.009), within the subsample of divesting firms. Since in the control group of non-violator firms, 4.69% of observations where disinvestment occurs contain an equity deal, marginal effects define an increase of this share between 14.9% (first lag) and 19.2% (third lag)

Equations (2), (4) and (6) estimate Probit models for the same sets of variables. Coefficients measuring the effect of covenant violations over equity deals are materially smaller, with average marginal effects totalling 0.55, 0.62 and 0.51 percentage points, for the three lags. Only the 3-quarter lagged effect is significant at 10%.

Overall, results point out to an increased or non-decreased preference for equity deals, following covenant violations. Equity deals, which define more restructuring transactions, are chosen over asset sales, which preserve the firm's control structure (see Introduction). The shift in preferences for equity deals is not drastic, yet it denotes that restructuring properties of equity deals are attractive to defaulting firms.

1.5 Identification strategy

1.5.1 Within-firm analysis

As discussed in section 2, potential identification problems are raised in studying the effects of covenant-related events. Covenants are a persistent firm covariate, despite the occurrence of renegotiations in particular periods of the corporate lifecycle. Not only do they have strong explanatory power in firms' time-invariant characteristics, but they are also potentially determined by other explanatory variables at the time of origination of loan facilities (both invariant and time-dependent). At that moment, covenants are specified for usually long periods to maturity. Arguably it is the result of both a bargaining mechanism and a self-selection decision taken by the borrower.

In baseline models of previous sections, invariant characteristics of business industries and time trends are captured through industry and quarter fixed effects. I allow for some cross-sectional variation between firms to be captured by estimated effects of covenant violations.

In this section, all results reported refer to models with firm fixed effects. Additional tests include replications of Tables 4, 5 and 6 with firm fixed effects and RDD models. At the cost of some external validity, these tests alleviate validity concerns related to firms' invariant characteristics. Moreover, RDD models address time-variant sources of endogeneity in binding distances to threshold, by exploring small exogenous variations around the threshold. [15]

In Table 7, I report regression results for asset sales, in models with firm fixed effects. Equations (2) and (6) present the main specifications for number of transactions and transaction values, respectively, with regression equations for the same variables without the effect of covenant violations (equations (1) and (5)). The main explanatory variable is the contemporary covenant violation dummy. The baseline specification is changed by including a 2-quarter lag in covenant violations (equations (3) and (7)) and by including a 3-quarter lag in that variable (equations (4) and (8)).

The marginal effect of covenant violations in asset sales can be measured as a 2.34% increase in the chance of selling assets, or additional 1.136% of total assets, in baseline specifications. Again I illustrate these magnitudes by evaluating them at the subsample average for non-violator firms. Both effects are close, in relative terms: 14.3% and 15.6%, respectively. Predicted revenues per firm-quarter are slightly higher for firms in violation than for those in compliance. Unlike the within-firm effect, both the average transaction size of asset sales and its cross-sectional estimate are comparatively lower for violator firms (section 3).

By including 2 and 3-quarter lagged violations in equations (3) and (4), the effect of violations in the binary variables is qualitatively similar, but steadily declining in magnitude, while for the share of asset sales I find an insignificant coefficient in the third lag.

Results from fixed effect models show that the sign and the magnitude of effects in asset sales coincide with those estimated in cross-sectional models. For the first two lags, effects are economically larger and statistically more significant. For the share of

[15] A within-firm RDD specification excludes most firms that are either unlikely to ever breach covenants or unlikely to ever exit violation states without covenant waivers.

assets sold, the baseline coefficient becomes significant at the 1% level.

A within-firm analysis of asset sales provides strong evidence that transactions in violator firms are clustered in the first violation quarters and have comparatively larger values than counterfactual transactions in non-violation quarters.

I have estimated similar fixed effect models for spin-off and carve-out measures (Tables A7 and A8). Positive insignificant coefficients were found for spin-offs in both variables and all the three lags. For carve-outs, I found significant coefficients at the 10% level for the second and third lags of the binary measure and the third lag of the share of carved-out assets. These estimates define marginal effects of 8.1 to 8.8 percentage points in the propensity to undertake carve-outs and of additional 6.5% of the book value of assets. Given their low frequency, equity deals appear unsuitable for a within-firm analysis, in particular since firms tend to make no more than one deal of this class in their lives. However, the clustering of these few observations around violation thresholds provides the opportunity to upgrade this analysis (see subsection 5.2).

One key identification assumption is that the expectation of divesting assets upon covenant violations does not deter firms from preventing default events, namely by (narrowly) manipulating earnings. It is plausible that disinvestment does not act as an ensuring mechanism, reducing managers' perceived cost of violations *ex ante*. Relinquishing the control of firm assets bears direct welfare costs to managers. Further, disinvestment induces changes that arguably increase the risk of manager replacement.

I address some potential self-selection patterns related to choices of specific covenants, by varying the set of covenants included in my analysis, through my definition of violation. In subsection 4.3, I report regression results using a comprehensive list of six financial covenants.

More generally, both self-selection and other firm-specific forms of endogeneity are targeted by my identification strategy. This strategy can be defined as a "quasi-regression discontinuity design", since it employs two-dimensional fixed effects: firm and quarter. Conditional independence of the treatment through covenant violations is reinforced with the use of the same set control variables in baseline models.

1.5.2 Discontinuity sample

Figures 1 to 6 illustrate the distribution of disinvestment variables and model residuals within the discontinuity sample. Each figure refers to one outcome variable. The first two charts in each figure are scatters plot that illustrate the distribution of the outcome variable across different values of binding distance to threshold, computed for the three main covenants in this paper. Linear and quadratic polynomials are fit for each of two branches of the function domain: negative binding distances (not violation any covenant) and positive binding distances (in violation).

Quarterly asset sales are much concentrated around median transaction sizes, in the [0, 0.1] interval [16]. In Figures A1 to A6, identical charts are presented for a wider discontinuity sample, with a bandwidth of h = 0.4. A broader perspective highlights the presence of more extreme transaction values across the whole spectrum, with greater prevalance in the boundaries of the wider sample. Both the linear and the quadratic fitted functions define quasi-concave graphs across both segments, where a naïve estimate of the discontinuity would clearly be positive.

Spin-offs and carve-outs are almost absent from the baseline discontinuity sample in its negative branch. This stylized fact is in contrast with the wider bandwidth version. By

[16]With an average number of transactions close to 1.45 per quarter in the discontinuity sample, the median share of asset sales for divesting firms is 47.2%

comparing both universes, it is clear that large equity deals are clustered in the [-0.4, 0.25] region (carve-outs being the largest). Without the use of econometric or modelling techniques, it becomes apparent that firms do not typically resort to these transactions when they are close to violating covenants, in a sheer contrast with periods in which they default on covenants, but are close to comply. In this sense, discontinuity estimate reflects both the high concentration of deals in the positive segment (in particular, for spin-offs, in the interval [0.1, 0.15]) and the unlikelihood of deals in the left neighbouring region.

The remaining two charts illustrate the distribution of the residual of a regression discontinuity model, using the baseline RDD specification for each variable, with a bandwidth of 0.2 for the kernel function. This distribution is computed within bins of 5 percentage points of binding distance, measured as a percentage of its threshold. Means and 95% confidence intervals are portrayed. Polynomials of the binding distance are fit into the bin-level average points, for each sign of the binding distance: a quadratic one in the third chart and a forth-degree one in the fourth.

For asset sales variables, differences between both polynomials are mild, with an exception for the largest negative bin of the binding distance. Negative and positive bins are, without exception, distributed with non-overlapping counterdomains. It is apparent that higher-degree polynomials could artificially increase the discontinuity estimate. This graphical inferrence provided support for the choice of quadratic functional forms.

With spin-offs, the discontinuity seems to be the result of extremely high frequencies in the first positive bin for each variable. The fourth-degree function is further detached from bin averages and the quadratic polynomial, placing the discontinuity upper bound at outlier values in the distribution of the first positive bins. For the asset share measure, the first positive bin is very steeply detached neighbouring parts of the domain, but mainly from the distributions in the first negative bins. This would be expected to drive RDD estimate results, equalling them across different bandwidth choices.

In both carve-out variables, the most positive residuals are found in the second and fourth positive bins. The discontinuity estimate is positive, but small, while wide confidence intervals in positive bins are expected reduce estimation power. A wider sample window (figure 12) produces a more concave and continuous functional shape, with a steep positive slope to the right of the cutoff and a non-negligible negative slope to its left. Graphical evidence of a discontinuity is therefore weak.

In Table 9, I apply the identification strategy described in section 4. In this table, each equation corresponds to a single main specification tested for a different dependent variable. In equations (1) and (4), asset sales variables are tested against last-quarter violations. In equations (2) and (5), I apply this test to spin-offs and, in equations (3) and (6), to carve-outs.

RDD specifications are not as sensitive to the persistence of dependent variables towards close future lags (second or third) as baseline models. Firms remain in the discontinuity subsample for several consecutive quarters, particularly once they violate covenants. The total 9478 observations in this subsample correspond to 1371 firms (6.91 observations per firm). In violation states, 959 firms are treated for an average number of 4.17 quarters (3994 observations). Hence, the increased flexibility of RDD models in quarterly data creates an opportunity to measure total effects over disinvestment, irrespective of their exact timing.

For that reason, effects of larger magnitude than in baseline models are not unexpected. The discontinuity estimate for asset sales can be measured as a 13.95% increase in the chance of selling assets, or additional 6.73% of total assets, in baseline specifications. I evaluate these magnitudes at the (full-)sample average, for non-violator firms. Although both coefficients are close, in relative terms, the value effect is dominant: 92.1% vs. 85.6%. Predicted revenues per firm-quarter are again higher for firms in violation, as in other firm fixed effects models.

For spin-offs, the discontinuity estimate defines a 3.58% increase in the chance of selling assets, or as additional 4.70% of total assets spun-off, in baseline specifications. In relative terms, the binary measure is nearly multiplied by six (+ 463.7% or 5.63x). This corresponds to no more than 0.62 standard deviations, given the rare frequency of spin-offs. With the asset share variable, a 19.41x relative effect represents an increase of 1.02 standard deviations.

Carve-outs do not allow for the estimation of a significant discontinuity effect for the propensity measure. However, the share of carved-out assets is shown to increase following covenant violations. Though modest from an economic point of view, its coefficient is significant at the 5% level. Additional 0.77% of total assets amount to 0.23 standard deviations and increase the control subsample mean by 9.47x. Although effects over carve-outs can not be identified in the cross-section, high value carve-outs, evaluated at stock market prices, contribute to positive within-firm effects based on a low number of observations, concentrated in the cutoff neighbourhood. The low number of observations is a likely deterrent of findings concerning the propensity to undertake an equity carve-out.

Polynomial estimates define more concave non-linearities (in the binding distance) for the negative segments of asset sale and carve-out shares of total assets, as well as for the positive segments of the ratio of spun-off assets. Functional forms are here consistent with stylized facts observed in the graphical analysis.

In Table A9, I replicate the six baseline regression discontinuity models in a wider discontinuity sample with a bandwidth of h = 0.4.

1.5.3 Effects of disinvestment over covenant variables

An important conclusion to an analysis of disinvestment in the neighbourhood of covenant thresholds is the subsequent feedback effect it has in covenant variables. From a theoretical point of view, assessing the effectiveness of disinvestment is key to the understanding of its underlying mechanisms.

In Table 10, I test for effects of disinvestment actions in the binding distance to threshold. For this purpose, I estimate first difference models, measuring disinvestment in two alternative ways: with the asset sales binary measure or with a binary measure comprising any of three types of disinvestment: asset sales, spin-offs or carve-outs. The dependent variable is a contemporary first difference of the binding distance to threshold, scaled by one, two or three quarters. Disinvestment variables are respectively lagged to the second (*t-1*), third (*t-2*) or fourth (*t-3*) quarters from the end of the variation period in the dependent variable. Violations are further lagged by one quarter. Control variables are set at the beginning of the difference period (fourth last quarter).

With these tests, I turn to the interaction of disinvestment variables and covenant violations (*Asset sale* × *violation*, *Any disinvestment* × *violation*). This interaction provides the estimation of a distinct effect of disinvestment in violation states, assessing whether it is as effective in adjusting covenant variables as in normal. From a theoretical standpoint, this is a largely open question. While it could be argued that disinvestment should be more targeted at the binding covenant variables, upon covenant violations, firms' reduced bargaining power could justify that disinvestment may end up being less effective.

Equations (1) and (5) isolate the total effects of disinvestment variables, specified along quarter fixed effects and the vector of control variables defined in baseline models for asset sales. All the three specified lags are pooled. For both variables, I find insignificant coefficients, negative for the first two lags. The second one has a clearly higher magnitude (third and fourth last quarter).

In equations (2), (3) and (4), covenant violations are added, for each of three lags considered, along with the main parameter of interest: the interaction term (*Asset sales in violation*. Negative significant effects are found for the three lags, comprised between -1.63 (*t-4*, *t-5*) and -4.20 (*t-2*, *t-3*) percentage points of the threshold. For the second quarter in the difference, the coefficient (-1.82) is significant at the 1% level. Disinvestment effects in non-violation are not totally subsumed, being significant at the 10% level for the first two lags, with magnitudes between 0.9 and 2 percentage points. Under that assumption, for violator firms, the total effect of asset sales could attain 2.7 (*t-1*) or 5.2 (*t-2, t-3*) percentage points.

Equations (6), (7) and (8) repeat the same analysis for *Any disinvestment*, again with a violation indicator and an interaction term (*Disinvestment post violation*) for each of the three lags. All interactions have negative coefficients. The first two coefficients are significant at the 5% level. For both the second (-1.56) and the third and fourth quarters (-3.93), the size of effects is close to the magnitude of asset sales estimates. Similarly, baseline effects of disinvestment are slightly lower than for the asset sales measure.

Given the high concentration of divesting firms in the region of narrow violations, by less than one decimal point of binding distance (10% of the threshold), the size of these effects is economically significant and plausible to have strong influence in debt renegotiations. In most covenant-full contracts, exits from violation states are not automatically accomplished when covenant variables return to compliance, since loan termination provisions can be enacted through the registry of covenant violations. For these provisions to be waived by creditors or not to be requested beforehand, negotiated outcomes are required.

1.5.4 Robustness

I run several robustness tests, both to my baseline models and to my findings in the discontinuity sample.

In Tables A2 to A5, I retake all my main tests in Tables 3, 4 and 5 with a wider sample based on violations of the 6 most frequent covenants. No qualitative changes are found in results, with asset sales and spin-offs still revealing significant positive effects of covenant violations. The economic significance of these effects is similar, while only contemporary effects in the binary measure of spin-offs are sizeably less significant than under the baseline list of three covenants. Through these tests, I argue that the initial choice of covenants was sufficiently general to provide a relevant degree of external validity, at least in the context of syndicated loans. Covenant variables included in this wider list are those described in Table 1.1.

In Tables A11 and A12, I examine some cross-sectional variations in effects over disinvestment, based on other policies firms may implement upon covenant violations. While other policies could contribute to improvements in the their financial situation, it is a priori unclear whether other measures would be adopted as replacement or a complement to disinvestment actions. I refer to two of the most documented effects of covenant violations, investment reductions and reductions in leverage. I study their effects in disinvestment actions, two quarters later, I also study interactions of covenant violations with the effects of investment and leverage reductions in disinvestment.

Some evidence is found that investment and leverage reductions, on a year-on-year measure, correlate positively with subsequent asset sales, although the economic significance of differences is small, denoting that disinvestment effects do not truly overlap or subsume other. The effect of leverage reductions is smaller, but it is strongly identified in the interaction with covenant violations. Past de-leverage is specifically associated to disinvestment, for violator firms, but the magnitude of this effect is small: rounding 1 percentage point for a 10% leverage reduction. For spin-offs, no significant effects are estimated, either for level or interaction variables.

In Tables A13 and A14, I test for the simultaneous implementations of investment reduction and leverage reduction policies. For this purpose, I restrict my sample to firms selling assets in the most recent calendar quarter and redefine the violation binary variable to the two last fiscal quarters before the disinvestment period.

A first test involves yearly first differences of investment and leverage. Investment reductions follow the predictions of Chava and Roberts (2008). Reducing investment is consistent with level reductions of a firm's capital stock, through disinvestment and no evidence of a contemporaneous trade-off is found. The same does not occur with leverage. A negative insignificant coefficient is found, such that leverage can possibly be more effectively reduced by firms that disinvest in non-violation states. In a second test, I run firm fixed effects models for the investment and leverage (integrated) variables. Effects have larger magnitudes, being benchmarked by firm means, rather than by the dependent variable fourth lag. Results are consistent and significant at the 1% level.

Some of the robustness tests cover key aspects of the regression discontinuity design.

In Tables A15 and A16, I report estimates of the discontinuity coefficient for binary measures of asset sales and spin-offs, with several *ad hoc* choices of bandwidth, at every decimal point from 0.1 to 0.4. For the bandwidth h = 0.4, I provide extra detail on the polynomial model in Table A9. As discussed in subsection 4.2, binary variables are the most affected by bandwidth choice in this sample, given irregular their frequencies. High average volumes (as a share of assets) in these few observations partially offset reduced estimation power in the value measures of disinvestment.

Although the number of sampled observations ranges from roughly one half of to approximately twice its size, estimates are close. For asset sales, there is almost no variation in the [0.2, 0.4] interval. For spin-offs, the coefficient changes by less than one third. At h = 0.1, both coefficients remain significant. For asset sales, the effect's magnitude decreases by 28%; for spin-offs. Both remain significant at the 5% level.

Finally, I search for spurious correlations that could jump discontinuously close to the covenant thresholds, but not exactly at it. Should the discontinuity result from the effect of omitted variables, I would expect to find similar results, in magnitude and significance, at other points within the discontinuity sample. I perform placebo tests using "placebo" of "fake" thresholds in the interval [-0.2, 0.2] of binding distance, using six cutoff points: -0.2, -0.1, -0.05, 0.05, 0.1, 0.2. Following Ferreira et al. (2018), I interpret these tests as discontinuity-based exogeneity tests. Bandwidth and polynomial order are the same than in my main specification. For each placebo threshold, I redefine the binding distance variable such that it becomes centred at the new threshold and choose the discontinuity sample accordingly.

Results are reported in Tables A17 and A18 for the asset share measures of asset sales and spin-offs. As it was shown in subsection 4.2, value measures are the most propense to non-linearities in the binding distance. For both variables, coefficient signs flip more than once, namely around the threshold c = -0.10. Effect magnitudes are small in comparison the true coefficients (6.401, 2.654). Only one coefficient is significant at the 10% level, for spin-offs: it is negative and has a small magnitude (c = -0.1). The null hypothesis is thus not rejected at the 5 % confidence level.

1.6 Conclusion

I find that violations of financial covenants significantly increase the likelihood of disinvestment actions. This effect is best observed for firms narrowly defaulting on their covenants, regardless of the exact time period elapsed since their first violation. Once disinvestment plans are implemented, violator firms experience fast reductions in the binding distance to their nearest covenant threshold: in the next six months to one year.

My results show that violations trigger large one-off disinvestment transactions, with effects on financial stock variables. This is consistent with managers preventing large transfers of control to creditors, through preemptive actions that reduce leverage and increase liquidity. Quick disinvestment actions can help unblock creditor agreements that waive covenants. These may also facilitate reductions in debt service through renegotiated debt terms and early repayments.

In violator firms, most of disinvestment occurs through asset sales, taking place at varying stages of violation states. Their increased likelihood of selling assets is not associated with larger transaction sizes. In contrast, equity deals are rarer, larger and implemented in longer time horizons of more than six months. Their transaction sizes are comparatively larger in violator firms.

The occurrence of spin-offs is well predicted by covenant violations, whereas a higher propensity to undertake carve-outs is not observed.

The choice of spin-offs is consistent with constraints in accessing equity markets upon violations, while it still depends on legal permissions and on shareholder support. It is also consistent with the view that disinvestment is used to increase managers' bargaining power and to influence future reorganization outcomes in bankruptcy procedures.

While disinvestment decisions may sometimes contribute to cooperative negotiation outcomes in restructurings, they are likely to imply the loss of fundamental value, through a fire sale effect. Covenant structures can have a strict effect of discipline, when firms disinvest, but also imply overshooting firm reactions and even hamper more efficient restructuring outcomes that creditors could promote.

Appendix of Chapter 1

Figures

Figure 1.1: **Scatter plots and fitted polynomials: asset sales** The following six figures comprise four charts each, referring to each of the six dependent variables of this paper. These are as defined in Table 1, but scaled here between 0 and 1. The first chart in each figure is a scatter plot that illustrates the distribution of the outcome variable across different values of binding distance to threshold, computed for the three main covenants considered in table 8 (Net Worth, Tangible Net Worth, Debt-to-EBITDA). A linear polynomial of the binding distance is fit to the scatter, for each of two branches of the function domain: negative binding distances (not violation any covenant) and positive binding distances (in violation). The second chart reproduces the same scatter plot as in the first. Differently, a quadratic polynomial of the binding distance is fitted to the data. The third chart illustrates the distribution of the residual of a regression discontinuity model, using as covariates the same control variables and fixed effects as in table 8. The equations estimated are identical to those in table 9, with a bandwidth of 0.2 for the kernel function. This distribution is computed within bins of 5 percentage points of binding distance, measured as a percentage of its threshold. A quadratic polynomial of the binding distance is fit into the bin-level average points for each sign of the binding distance. The fourth chart illustrates the residuals of the same model than the third chart, distributed across the same bins. It differs in that fourth-degree polynomials are fitted to bin-level averages, for either negative or positive binding distances. This figure reports results for the binary variable denoting the occurrence of asset sales in a given quarter.

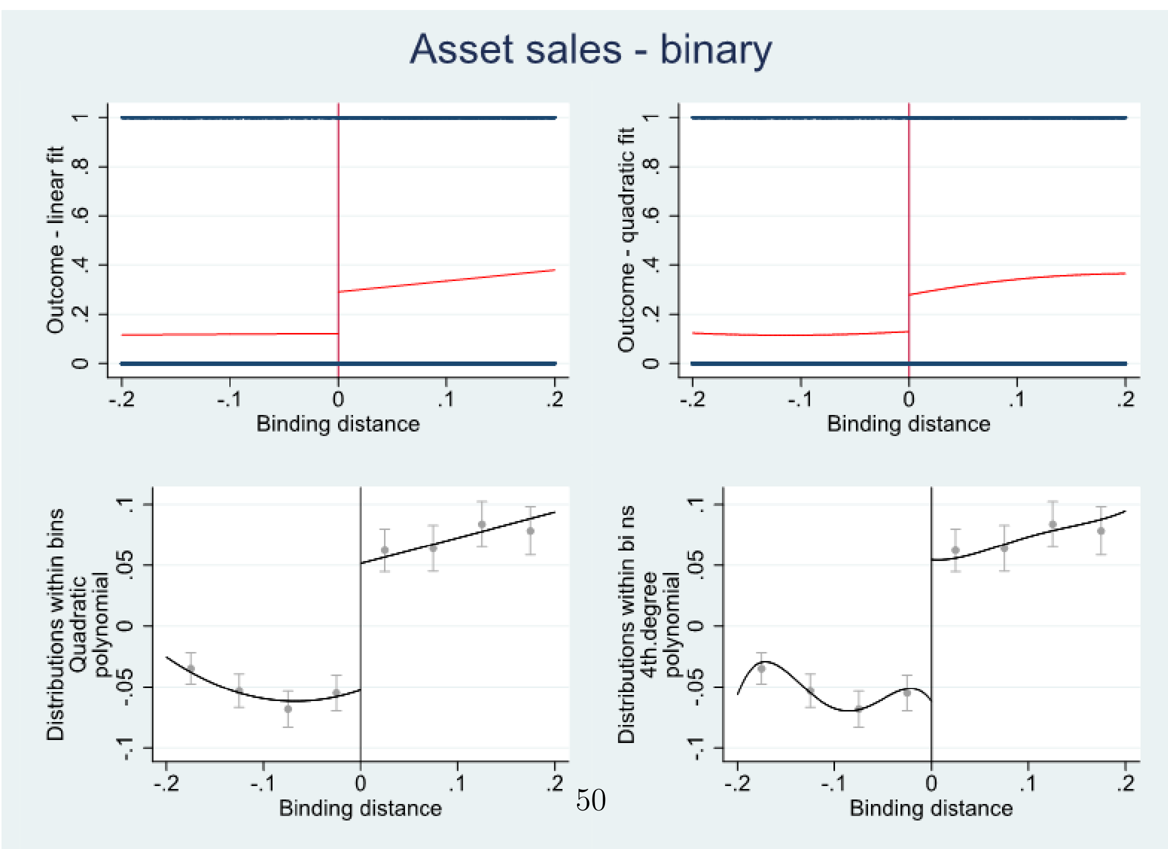


Figure 1.2: **Scatter plots and fitted polynomials: spin-offs** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of spin-offs in a given quarter.

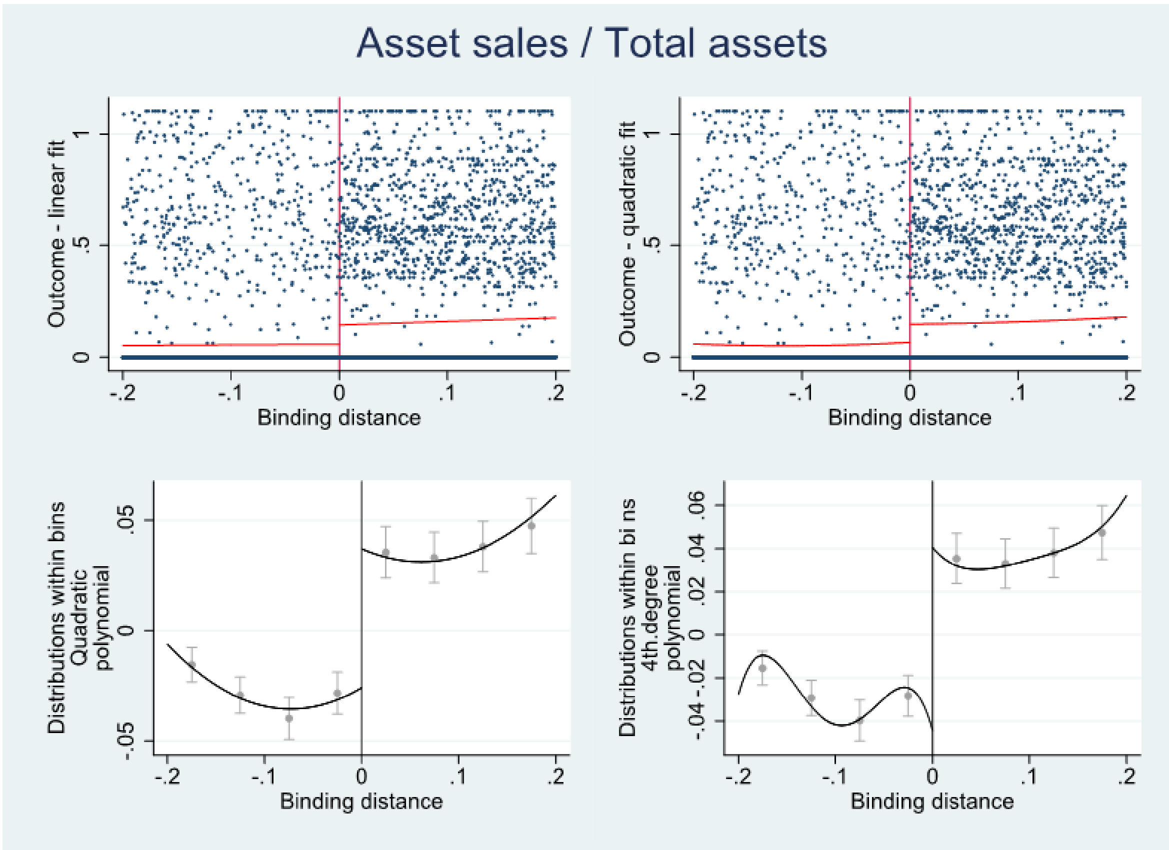


Figure 1.3: **Scatter plots and fitted polynomials: carve-outs** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of carve-outs in a given quarter.

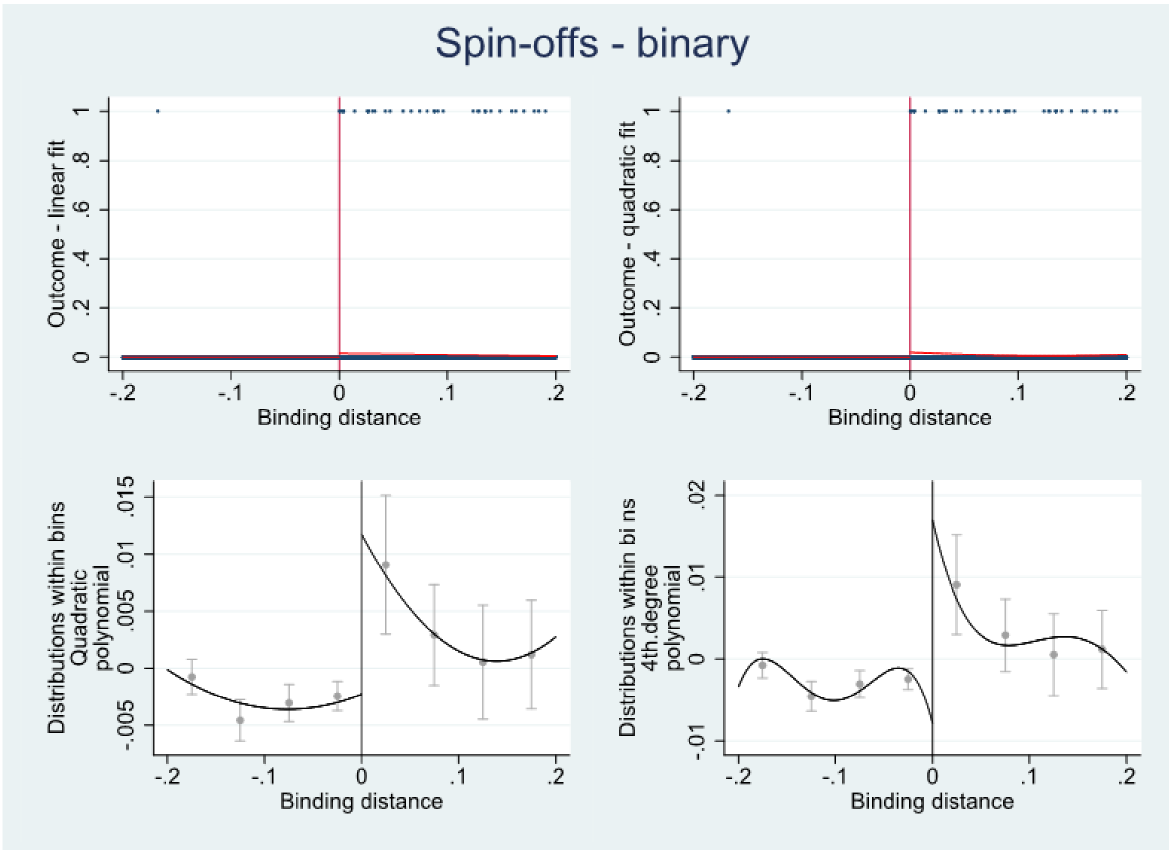


Figure 1.4: **Scatter plots and fitted polynomials: asset sales** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of asset sales in a given quarter.

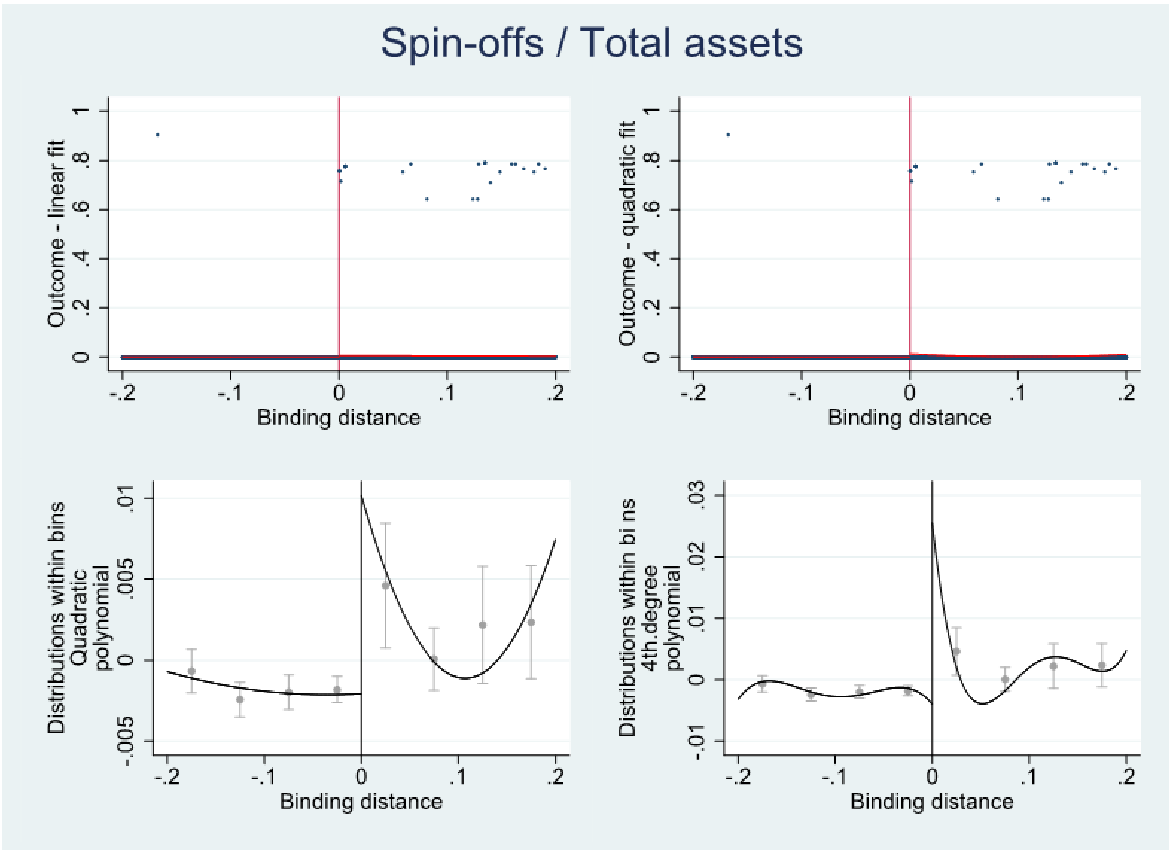


Figure 1.5: **Scatter plots and fitted polynomials: spin-offs** This figure presents an identical set of charts to those in figure 1, for the ratio of the value of spin-offs to total assets in a given quarter.

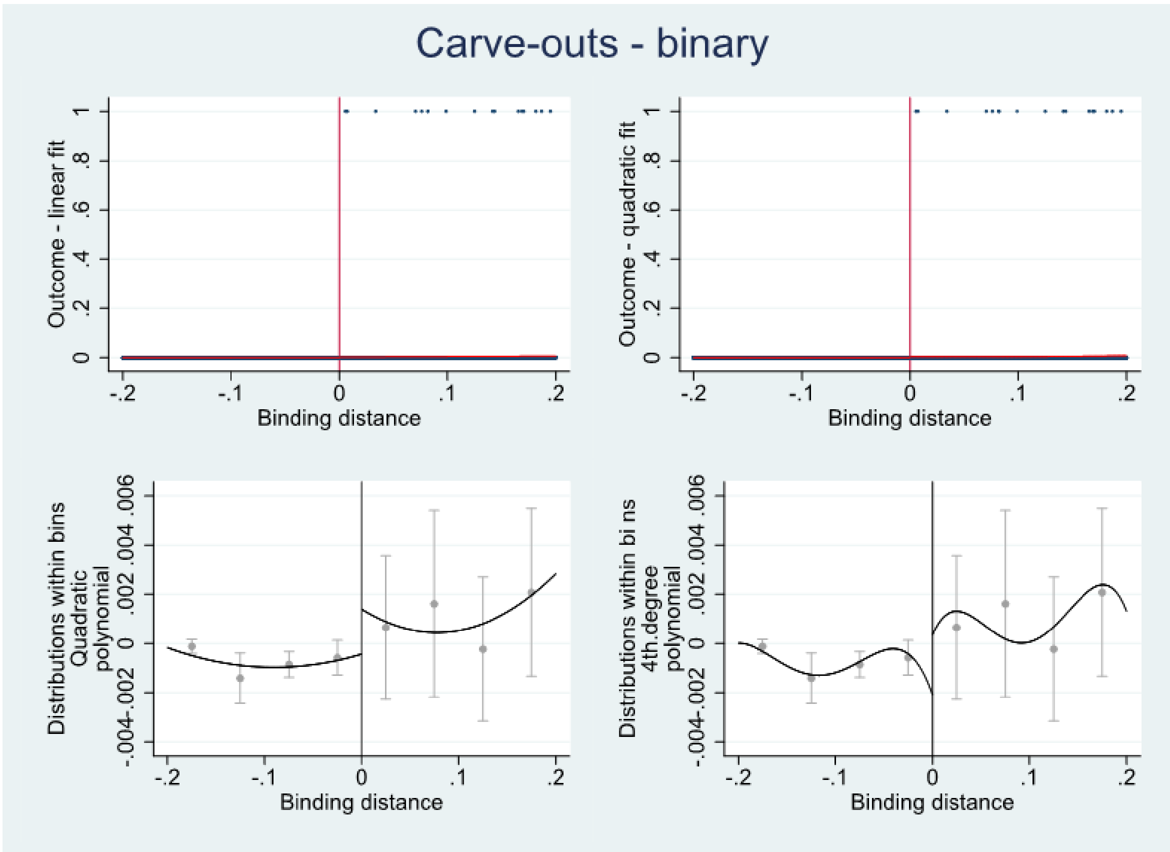
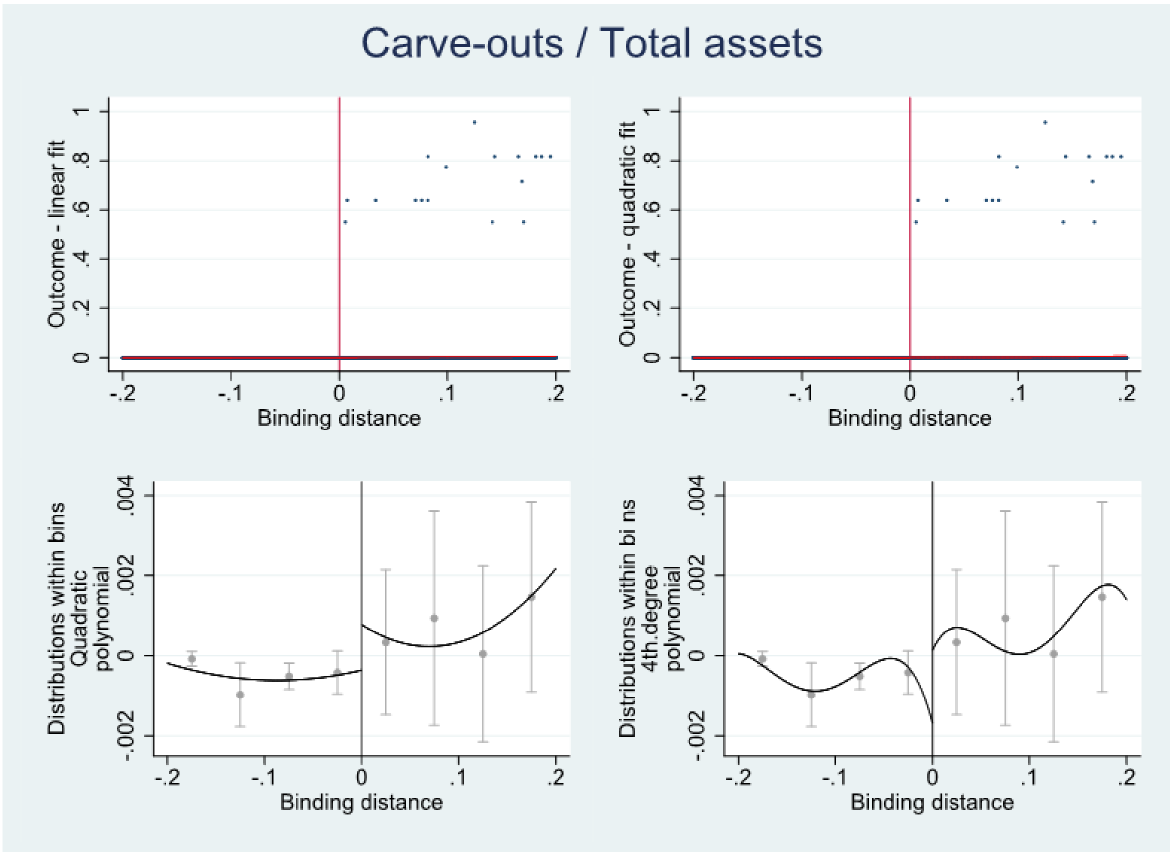


Figure 1.6: **Scatter plots and fitted polynomials: carve-outs** This figure presents an identical set of charts to those in figure 1, for the ratio between carved-out assets and total assets in a given quarter.



Tables

Table 1.1: **Summary stats - all firms reporting covenants**

This table shows summary statistics for the full sample of firms reporting financial covenants. Statistics are reported for all baseline disinvestment variables. *Asset sales – binary* is a binary variable denoting the existence of any asset sale in the next full calendar quarter. *Asset sales / Total assets* is the ratio between the value of sold assets and the value of total assets, for the same period. Similarly, *Spin-offs – binary* is a binary variable denoting the existence of any spin off and *Spin-offs / Total assets* is a relative measure of the value of spun off assets, in the next full calendar quarter. *Carve-outs – binary* is a binary variable denoting any occurrences of carve-outs and *Carve-outs / Total assets* is the ratio between the asset value divested in carve-outs and the total value of assets, in the next full calendar quarter. I also report statistics for several firm control variables: *Log(assets)* is the logarithm of the book value of total assets, from which goodwill is deducted. *Investment* is the ratio of annual capital expenditures to the book value total assets in the end of that year. *Leverage* is the book ratio of total debt to total assets. Panel B displays several disinvestment variables. *Tobin's q* is the ratio between the market value of assets and the book value of assets. *Cash-to-assets* is the quarterly ratio of cash holdings to the book value of assets. *Sales growth* is the growth rate of total sales revenue, for the last four quarters. *PPE growth* is the growth rate of Property Plant and Equipment for the last four quarter. *PPE/Assets* is the ratio between Property Plant and Equipment and the book value of total assets. *Industry diversification* is a binary variable that takes the value of one when a firm reports at least two different business segments in a given quarter, and zero otherwise.

All firms reporting financial covenants						
Financial variables	Mean	Median	Standard Deviation	Min	Max	Number of obs.
Asset sales – binary	16.60%	0	37.2%	0	1	109773
Asset sales / Total assets	7.48%	0%	23.0%	0%	110.2%	109 773
Spin-offs - binary	0.338%	0	5.8%	0	1	109773
Spin-offs / Total assets	0.242%	0%	4.6%	0%	118.5%	109 773
Carve-outs - binary	0.118%	0	3.4%	0	1	109773
Carve-outs / Total assets	0.081%	0%	2.4%	0%	95.7%	109 773
Log (assets)	6.92	6.89	1.79	2.68	11.07	109773
Leverage	28.86%	27%	21.4%	0%	100.9%	109773
Tobin's q	2.00	1.62	1.24	0.66	7.47	109773
Cash-to-assets	10.01%	5.1%	12.6%	-0.7%	110.4%	109773
EBIT-to-assets	1.90%	2.0%	2.8%	-11%	9.9%	109773
PPE growth	1.91%	0.5%	-90.0%	-26.0%	60.3%	109773
Sales growth	3.55%	1.8%	-79.1%	-52.2%	104.3%	109773
PPE / Assets	29.93%	21.9%	24.7%	0.0%	91.7%	109773
Industry diversification	14.66%	0.0%	35.4%	0.0%	100.0%	109773

Table 1.2: **Summary stats - decomposition by violation status**

This table shows summary statistics for two subsamples: No violation is composed of firms that do not violate any of the three most frequent covenants in a given quarter and Violation is composed of firms that violate at least one of these. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *Investment* is the ratio of annual capital expenditures to the book value total assets in the end of that year. Dividend is a binary variable, taking the value of 1 when a firm has paid dividends in the last fiscal quarter. All other variables are as described in Table 1. The t-statistics presented correspond to an hypotheses tests on mean differences. For each variable, the null hypothesis states that both subsample means are equal.

Summary stats - decomposition by violation status					
Financial variables	No violation - mean	Number of obs.	Violation - mean	N	t-Statistic
Asset sales – binary	16.29%	88 850	19.01%	20 923	9.60
Asset sales / Total assets	7.30%	88 850	8.93%	20 923	9.36
Spin-offs - binary	0.331%	88 850	0.390%	20 923	1.33
Spin-offs / Total assets	0.233%	88 850	0.314%	20 923	2.34
Carve-outs - binary	0.128%	88 850	0.048%	20 923	-2.92
Carve-outs / Total assets	0.087%	88 850	0.036%	20 923	-2.72
Log (assets)	6.99	88 850	6.01	20 923	-67.67
Leverage	26.51%	88 850	40.30%	20 923	73.40
Tobin's q	2.01	88 850	1.81	20 923	-21.40
Cash-to-assets	10.13%	88 850	9.38%	20 923	-7.69
EBIT-to-assets	2.10%	88 850	0.51%	20 923	-57.54
PPE growth	2.29%	88 850	0.99	20 923	-44.14
Sales growth	3.78%	88 850	2.10%	20 923	-9.65
PPE / Assets	30.01%	88 850	29.52%	20 923	-2.67
Industry diversification	15.35%	88 850	12.42%	20 923	-11.39
Investment	3.43%	88 850	2.89%	20 923	-1.58
Dividend	45.80%	88 848	32.17%	20 922	-37.48

Table 1.3: **Disinvestment - asset sales**

This table reports the results of LPM and OLS regressions for *Asset sales – binary*, a binary variable denoting the existence of any asset sale and *Asset sales / Total assets*, a relative measure of the value of sold assets, in a given calendar quarter. *Violation of most frequent covenants t-1* is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar quarter. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry fixed-effects are included at the SIC 3 level of the standard industry classification, alongside quarter fixed effects. Standard errors are clustered at the firm level. The values in parenthesis represent t-statistics. The standard error for each star is mentioned below the table. All other control variables are as described in Table 1.

	Asset sales - binary $_t$				Asset sales / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		1.645***				0.639*		
		(2.611)				(1.761)		
Violation of three main covenants $_{t-2}$			1.597**				0.537	
			(2.508)				(1.476)	
Violation of three main covenants $_{t-3}$				1.410**				0.426
				(2.249)				(1.193)
Log (Book value of assets)	4.942***	4.987***	4.986***	4.983***	1.359***	1.376***	1.374***	1.372***
	(22.509)	(22.553)	(22.545)	(22.524)	(11.759)	(11.864)	(11.845)	(11.819)
Leverage ratio $_{t-1}$	6.060***	5.275***	5.280***	5.402***	4.419***	4.114***	4.156***	4.220***
	(4.484)	(3.789)	(3.779)	(3.881)	(5.455)	(4.980)	(5.012)	(5.108)
Tobin's q $_{t-1}$	-0.927***	-0.940***	-0.944***	-0.941***	-0.502***	-0.508***	-0.508***	-0.507***
	(-4.690)	(-4.760)	(-4.778)	(-4.762)	(-4.252)	(-4.295)	(-4.300)	(-4.288)
Cash-to-assets ratio $_{t-1}$	-4.787**	-4.761**	-4.761**	-4.784**	-1.943	-1.933	-1.935	-1.943
	(-2.167)	(-2.158)	(-2.158)	(-2.168)	(-1.512)	(-1.505)	(-1.506)	(-1.512)
EBIT-to-assets ratio $_{t-1}$	-65.348***	-62.701***	-63.053***	-64.042***	-20.015***	-18.988***	-19.244***	-19.621***
	(-8.545)	(-8.231)	(-8.285)	(-8.428)	(-4.170)	(-3.946)	(-4.005)	(-4.096)
PPE growth $_{t-1}$	-5.299***	-5.006***	-5.031***	-5.007***	-1.774**	-1.660**	-1.684**	-1.686**
	(-4.047)	(-3.835)	(-3.855)	(-3.832)	(-2.101)	(-1.971)	(-2.000)	(-2.000)
Sales growth $_{t-1}$	-0.844*	-0.907*	-0.917**	-0.914**	-1.102***	-1.126***	-1.126***	-1.123***
	(-1.822)	(-1.955)	(-1.977)	(-1.971)	(-3.643)	(-3.718)	(-3.716)	(-3.707)
Constant	-15.630***	-16.054***	-16.030***	-15.996***	-1.539*	-1.704**	-1.674**	-1.650**
	(-10.595)	(-10.798)	(-10.788)	(-10.761)	(-1.879)	(-2.068)	(-2.034)	(-2.003)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109770	109770	109770	109770	109770	109770	109770	109770
R-squared	0.116	0.116	0.116	0.116	0.060	0.060	0.060	0.060

Table 1.4: **Spinoffs - baseline**

This table reports the results of LPM and OLS regressions for *Spin-offs – binary*: a binary variable denoting the existence of any spin off and Spin-offs / Total assets: a relative measure of the value of spun off assets, in a given calendar quarter. *Violation of most frequent covenants* is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *Violation of three main covenants* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar quarter. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Spin-offs - binary $_t$				Spin-offs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		0.180**				0.190**		
		(1.990)				(2.563)		
Violation of three main covenants $_{t-2}$			0.183**				0.190**	
			(2.026)				(2.539)	
Violation of three main covenants $_{t-3}$				0.178**				0.179**
				(1.963)				(2.415)
Log (Book value of assets)	0.180***	0.185***	0.185***	0.185***	0.122***	0.127***	0.127***	0.127***
	(6.293)	(6.367)	(6.368)	(6.365)	(5.756)	(5.845)	(5.839)	(5.826)
Leverage ratio $_{t-1}$	-0.376***	-0.462***	-0.466***	-0.459***	-0.224**	-0.315***	-0.317***	-0.308***
	(-2.988)	(-3.527)	(-3.531)	(-3.498)	(-2.248)	(-2.904)	(-2.901)	(-2.844)
Tobin's q $_{t-1}$	-0.021	-0.022	-0.023	-0.023	-0.006	-0.007	-0.007	-0.007
	(-0.841)	(-0.889)	(-0.909)	(-0.900)	(-0.272)	(-0.337)	(-0.363)	(-0.349)
Cash-to-assets ratio $_{t-1}$	-0.082	-0.078	-0.078	-0.080	0.039	0.043	0.043	0.041
	(-0.277)	(-0.261)	(-0.261)	(-0.269)	(0.197)	(0.222)	(0.222)	(0.208)
EBIT-to-assets ratio $_{t-1}$	-1.455	-1.167	-1.192	-1.291	-0.301	0.005	-0.027	-0.135
	(-1.587)	(-1.255)	(-1.285)	(-1.403)	(-0.569)	(0.009)	(-0.053)	(-0.261)
PPE growth $_{t-1}$	-0.237	-0.205	-0.206	-0.200	-0.126	-0.093	-0.095	-0.089
	(-1.645)	(-1.402)	(-1.412)	(-1.366)	(-1.126)	(-0.810)	(-0.827)	(-0.778)
Sales growth $_{t-1}$	-0.104	-0.110*	-0.112*	-0.112*	-0.113**	-0.120**	-0.122***	-0.122***
	(-1.624)	(-1.708)	(-1.729)	(-1.736)	(-2.441)	(-2.570)	(-2.599)	(-2.604)
PPE-to-assets ratio $_{t-1}$	-0.265	-0.257	-0.256	-0.255	-0.247	-0.237	-0.237	-0.237
	(-1.031)	(-0.999)	(-0.994)	(-0.991)	(-1.257)	(-1.211)	(-1.205)	(-1.203)
Industry diversification $_{t-1}$	-0.013	-0.009	-0.010	-0.010	0.040	0.044	0.043	0.043
	(-0.123)	(-0.088)	(-0.093)	(-0.096)	(0.456)	(0.503)	(0.495)	(0.490)
Constant	-0.631***	-0.681***	-0.681***	-0.681***	-0.451***	-0.503***	-0.502***	-0.501***
	(-3.044)	(-3.243)	(-3.230)	(-3.220)	(-2.841)	(-3.106)	(-3.087)	(-3.061)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109770	109770	109770	109770	109770	109770	109770	109770
R-squared	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013

Table 1.5: **Carve-outs - baseline**

This table reports the results of LPM and OLS regressions for Carve-outs – binary, a binary variable denoting any occurrences of carve-outs in a given calendar quarter and Carve-outs / Total assets: a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. *Violation of three main covenants* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the disinvestment period. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Carve-outs - binary $_t$				Carve-outs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		-0.005				-0.006		
		(-0.102)				(-0.163)		
Violation of three main covenants $_{t-2}$			0.002				-0.001	
			(0.045)				(-0.028)	
Violation of three main covenants $_{t-3}$				0.009				0.006
				(0.180)				(0.178)
Log (Book value of assets)	0.086***	0.086***	0.086***	0.086***	0.055***	0.055***	0.055***	0.055***
	(4.650)	(4.642)	(4.639)	(4.643)	(4.744)	(4.736)	(4.737)	(4.739)
Leverage ratio $_{t-1}$	0.200	0.202	0.198	0.195	0.150	0.153	0.151	0.148
	(1.403)	(1.331)	(1.311)	(1.311)	(1.643)	(1.545)	(1.532)	(1.535)
Tobin's q $_{t-1}$	-0.031**	-0.031**	-0.031**	-0.031**	-0.018**	-0.018**	-0.018**	-0.018**
	(-2.341)	(-2.331)	(-2.331)	(-2.337)	(-2.041)	(-2.024)	(-2.022)	(-2.032)
Cash-to-assets ratio $_{t-1}$	0.539	0.539	0.539	0.540	0.319	0.319	0.319	0.319
	(1.267)	(1.267)	(1.267)	(1.267)	(1.428)	(1.428)	(1.428)	(1.428)
EBIT-to-assets ratio $_{t-1}$	-0.844*	-0.852*	-0.841*	-0.836*	-0.571*	-0.581*	-0.573*	-0.566*
	(-1.850)	(-1.832)	(-1.817)	(-1.825)	(-1.770)	(-1.750)	(-1.737)	(-1.739)
PPE growth $_{t-1}$	-0.054	-0.055	-0.054	-0.052	-0.016	-0.017	-0.016	-0.015
	(-0.526)	(-0.524)	(-0.513)	(-0.496)	(-0.226)	(-0.236)	(-0.225)	(-0.203)
Sales growth $_{t-1}$	-0.012	-0.012	-0.012	-0.013	-0.006	-0.006	-0.006	-0.007
	(-0.316)	(-0.309)	(-0.315)	(-0.323)	(-0.218)	(-0.209)	(-0.214)	(-0.226)
PPE-to-assets ratio $_{t-1}$	0.140	0.140	0.140	0.141	0.109	0.109	0.109	0.110
	(0.988)	(0.988)	(0.991)	(0.994)	(1.111)	(1.112)	(1.115)	(1.119)
Industry diversification $_{t-1}$	0.148*	0.148*	0.148*	0.148*	0.118*	0.118*	0.118*	0.118*
	(1.646)	(1.646)	(1.647)	(1.647)	(1.731)	(1.732)	(1.733)	(1.732)
Constant	-0.570***	-0.569***	-0.571***	-0.573***	-0.376***	-0.374***	-0.376***	-0.378***
	(-3.352)	(-3.380)	(-3.379)	(-3.379)	(-3.616)	(-3.665)	(-3.664)	(-3.658)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109770	109770	109770	109770	109770	109770	109770	109770
R-squared	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.008

Table 1.6: **Asset sales vs. equity deals - LPM and probit models**

This table reports the results of regressions for a binary variable denoting the existence of an equity deal in a given calendar quarter (Asset sales vs. Equity deals). For firms not undertaking any equity deal, but disinvesting through asset sales in that period, it takes the value of zero. *Violation of most frequent covenants* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the disinvestment period. Those three covenant variables correspond to the three most frequent covenant types included in tables 3, 4 and 5. *t-2* and *t-3* denote lagging to the second and the third quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Asset sales vs. Equity deals $_t$					
	OLS	OLS	OLS	Probit	Probit	Probit
	(1)	(2)	(3)	(4)	(5)	(6)
Violation of three main covenants $_{t-1}$	0.007*			0.201		
	(1.789)			(1.503)		
Violation of three main covenants $_{t-2}$		0.008*			0.221	
		(1.910)			(1.613)	
Violation of three main covenants $_{t-3}$			0.009**			0.227*
			(2.047)			(1.663)
Log (Book value of assets)	0.006***	0.006***	0.006***	0.226***	0.226***	0.227***
	(5.278)	(5.286)	(5.305)	(6.267)	(6.279)	(6.328)
Leverage ratio $_{t-1}$	-0.010	-0.011	-0.011	-0.588*	-0.596*	-0.595*
	(-1.488)	(-1.546)	(-1.566)	(-1.834)	(-1.838)	(-1.835)
Tobin's q $_{t-1}$	-0.002	-0.002	-0.002	-0.013	-0.014	-0.014
	(-1.489)	(-1.517)	(-1.505)	(-0.276)	(-0.301)	(-0.294)
Cash-to-assets ratio $_{t-1}$	0.011	0.011	0.011	0.322	0.315	0.311
	(0.497)	(0.499)	(0.486)	(0.514)	(0.501)	(0.494)
EBIT-to-assets ratio $_{t-1}$	-0.009	-0.009	-0.013	1.889	1.946	1.832
	(-0.295)	(-0.281)	(-0.408)	(0.923)	(0.947)	(0.888)
PPE growth $_{t-1}$	-0.006	-0.006	-0.005	-0.159	-0.157	-0.130

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Table 1.6 continued from previous page

	(-0.936)	(-0.914)	(-0.837)	(-0.447)	(-0.438)	(-0.362)
Sales growth $_{t-1}$	-0.006**	-0.006**	-0.006**	-0.317***	-0.321***	-0.324***
	(-2.142)	(-2.177)	(-2.197)	(-2.622)	(-2.634)	(-2.634)
PPE-to-assets ratio $_{t-1}$	0.007	0.007	0.007	0.053	0.050	0.046
	(0.562)	(0.569)	(0.568)	(0.194)	(0.182)	(0.169)
Industry diversification $_{t-1}$	-0.002	-0.002	-0.002	0.110	0.112	0.112
	(-0.360)	(-0.354)	(-0.351)	(0.738)	(0.750)	(0.752)
Constant	-0.028***	-0.028***	-0.028***	-4.069***	-4.071***	-4.072***
	(-2.975)	(-2.985)	(-3.001)	(-12.260)	(-12.270)	(-12.324)
Industry FE	Yes	Yes	Yes	No	No	No
Quarter FE	Yes	Yes	Yes	No	No	No
Observations	18215	18215	18215	18220	18220	18220
R-squared	0.039	0.039	0.039			

Table 1.7: **Asset sales with Firm FE**

This table reports the results of regressions for *Asset sales – binary*, a binary variable denoting the existence of any asset sale, and *Asset sales / Total assets*: a relative measure of the value of sold assets, in a given calendar quarter. *Violation of most frequent covenants* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the disinvestment period. Those three covenant variables correspond to the three most frequent covenant types included in tables 3, 4 and 5. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Firm and quarter fixed-effects are included. Standard errors are clustered at the firm level. The values in parenthesis represent t-statistics. The standard error for each star is mentioned below the table. All other control variables are as described in Table 1.

	Asset sales - binary $_t$				Asset sales / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		2.336***				1.136***		
		(3.253)				(2.669)		
Violation of three main covenants $_{t-2}$			2.087***				0.786*	
			(2.823)				(1.812)	
Violation of three main covenants $_{t-3}$				1.531**				0.408
				(2.093)				(0.963)
Log (Book value of assets)	6.897***	7.091***	7.087***	7.044***	2.750***	2.844***	2.821***	2.789***
	(11.443)	(11.694)	(11.680)	(11.611)	(7.325)	(7.509)	(7.451)	(7.378)
Leverage ratio $_{t-1}$	5.363***	4.061**	4.091**	4.516**	3.235***	2.602**	2.756**	3.009**
	(2.833)	(2.117)	(2.115)	(2.355)	(2.773)	(2.187)	(2.289)	(2.518)
Tobin's q $_{t-1}$	-0.902***	-0.899***	-0.909***	-0.904***	-0.243	-0.242	-0.246*	-0.243
	(-3.564)	(-3.559)	(-3.597)	(-3.573)	(-1.638)	(-1.628)	(-1.656)	(-1.641)
Cash-to-assets ratio $_{t-1}$	-14.590***	-14.476***	-14.463***	-14.511***	-8.707***	-8.651***	-8.659***	-8.686***
	(-5.672)	(-5.637)	(-5.627)	(-5.644)	(-5.342)	(-5.319)	(-5.320)	(-5.333)
EBIT-to-assets ratio $_{t-1}$	-27.251***	-25.280***	-25.816***	-27.218***	-4.910	-3.952	-4.370	-4.902
	(-3.548)	(-3.306)	(-3.372)	(-3.548)	(-1.017)	(-0.817)	(-0.904)	(-1.015)
PPE growth $_{t-1}$	-1.938	-1.788	-1.818	-1.776	-0.636	-0.564	-0.591	-0.593
	(-1.577)	(-1.459)	(-1.483)	(-1.446)	(-0.821)	(-0.728)	(-0.764)	(-0.765)
Sales growth $_{t-1}$	-1.464***	-1.533***	-1.540***	-1.514***	-1.269***	-1.303***	-1.298***	-1.283***
	(-3.369)	(-3.539)	(-3.551)	(-3.492)	(-4.337)	(-4.450)	(-4.429)	(-4.382)
Constant	-28.806***	-30.268***	-30.174***	-29.881***	-10.981***	-11.692***	-11.496***	-11.267***
	(-6.706)	(-7.003)	(-6.978)	(-6.905)	(-4.115)	(-4.343)	(-4.274)	(-4.194)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109610	109610	109610	109610	109610	109610	109610	109610
R-squared	0.266	0.266	0.266	0.266	0.239	0.239	0.239	0.239

Table 1.8: **Large asset sales, firms with no asset sale covenants**

This table reports the results of regressions for *Asset sales – binary*, a binary variable denoting the existence of any large asset sale, and *Asset sales / Total assets*: a relative measure of the value of assets sold in large asset sales transactions, in a given calendar quarter. The sample is composed by firms with no covenants restricting asset sales, such as (total or partial) asset sale sweeps. *Violation of most frequent covenants* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the disinvestment period. Those three covenant variables correspond to the three most frequent covenant types included in tables 3, 4 and 5. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Firm and quarter fixed-effects are included. Standard errors are clustered at the firm level. The values in parenthesis represent t-statistics. The standard error for each star is mentioned below the table. All other control variables are as described in Table 1.

	Asset sales - binary $_t$				Asset sales / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants t-1		5.912***				3.634***		
		(3.879)				(3.404)		
Violation of three main covenants t-2			6.034***				3.728***	
			(3.755)				(3.306)	
Violation of three main covenants t-3				5.610***				3.421***
				(3.494)				(3.061)
Log (Book value of assets)	3.732***	4.109***	4.185***	4.135***	2.063***	2.295***	2.365***	2.336***
	(7.428)	(7.958)	(7.871)	(7.583)	(5.912)	(6.390)	(6.381)	(6.095)
Leverage ratio	6.410**	2.510	2.153	2.359	5.350**	2.953	2.565	2.564
	(2.093)	(0.753)	(0.627)	(0.680)	(2.338)	(1.191)	(1.010)	(0.998)
Tobin's q	-1.160**	-1.388***	-1.421***	-1.435***	-0.755**	-0.895**	-0.927**	-0.909**
	(-2.308)	(-2.747)	(-2.775)	(-2.894)	(-2.076)	(-2.446)	(-2.503)	(-2.467)
PPE growth $_{t-1}$	-10.238**	-9.891**	-9.575**	-9.267**	-5.787**	-5.574**	-5.297*	-5.148*
	(-2.531)	(-2.498)	(-2.360)	(-2.228)	(-2.023)	(-1.980)	(-1.830)	(-1.732)
Constant	-8.488**	-10.899***	-11.727***	-11.677***	-3.625	-5.106**	-5.778**	-5.771**
	(-2.526)	(-3.218)	(-3.389)	(-3.312)	(-1.525)	(-2.122)	(-2.340)	(-2.271)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22202	22202	21079	20235	22202	22202	21079	20235
R-squared	0.117	0.119	0.124	0.128	0.105	0.106	0.112	0.118

Table 1.9: **Regression discontinuity design**

This table reports the results of regression discontinuity design models. These models are applied to measures of three different types of disinvestment: asset sales, spin-offs and carve-outs. *Covenant violation* is the coefficient for a regression discontinuity in a distance-to-threshold running variable. This running variable is the minimum distance to threshold in one of three covenants (Tangible Net Worth, Net Worth, Debt-to-EBITDA). For a better illustration of results, I report proportional effects at the subsample mean of violator firms. I also report marginal effects measured as a ratio of sample standard deviations. I consider the last quarter before the disinvestment event year. I report the second degree polynomial estimates, both for negative and positive binding distances, fixed effects and estimates for control variables. Models employ a non-parametrical kernel function of the Epanechnikov type. A total fraction of 8.6% of observations is included in the RDD sample (9478). The size of the subsample bandwidth is 0.2, measured in the running variable, as a fraction of the threshold. Fixed effects are included at the firm and quarter levels. Standard errors are clustered by firm according to the nearest neighbour method. *Binding distance (negative)* denotes the distance to the nearest covenant, for observations that are not in violation state, measured in percentage points of the covenant threshold. *Binding distance (positive)* is the same binding distance for observations violating one of the three covenants. *Squared binding distance(negative)* denotes the quadratic term of the second degree polynomial of binding distances, for *Binding distance (negative)*, rescaled in percentage points of the covenant threshold. *Squared binding distance(positive)* denotes the equivalent quadratic term for *Binding distance (positive)*. All other control variables are as described in Table 1.

	Asset sales - binary $_t$	Asset sales / Total Assets $_t$	Spinoffs - binary $_t$	Spin-offs / Total Assets $_t$	Carve-outs - binary $_t$	Carve-outs / Total Assets $_t$
	(1)	(2)	(3)	(4)	(5)	(6)
Covenant violation	13.948***	6.737***	3.579***	4.699***	0.428	0.767**
	(4.139)	(3.172)	(3.766)	(5.104)	(1.031)	(2.246)
Proportional effects (at violation subsample mean)	0.461	0.480	0.823	0.951	0.770	0.904
Marginal effects (standard deviations)	0.375	0.617	0.223	1.216	1.167	1.209
Second order polynomial						
Binding distance (negative, × 100)	0.680**	0.504***	0.065	0.014	0.084	0.019
	(2.198)	(2.577)	(0.981)	(0.330)	(1.094)	(0.578)
Squared binding distance (negative, × 100)	3.153**	2.559***	0.340	0.088	0.425	0.103
	(2.133)	(2.738)	(1.073)	(0.432)	(1.159)	(0.643)
Constant (negative)	11.681***	6.818***	0.906**	0.897***	1.125**	0.068
	(5.836)	(5.388)	(2.115)	(3.250)	(2.270)	(0.313)
Binding distance (positive, × 100)	0.693*	0.077	-0.025	-0.128***	-0.049	0.026
	(1.958)	(0.346)	(-0.326)	(-2.626)	(-0.553)	(0.688)
Squared binding distance (positive, × 100)	-1.436	0.801	-0.016	0.649***	0.158	0.015
	(-0.827)	(0.729)	(-0.043)	(2.709)	(0.367)	(0.080)
Firm-level controls						
Log (Book value of assets) $_{t-1}$	8.223***	4.632***	-1.079***	0.206	-0.827**	0.109
	(6.076)	(5.412)	(-3.708)	(1.101)	(-2.458)	(0.741)
Tobin's q $_{t-1}$	-0.010	-0.351	-0.099	-0.259***	-0.123	-0.105
	(-0.014)	(-0.783)	(-0.652)	(-2.641)	(-0.696)	(-1.366)
Cash-to-assets ratio $_{t-1}$	-1.599	-2.687	-1.890	-1.397	-1.926	-1.251*
	(-0.235)	(-0.624)	(-1.275)	(-1.463)	(-1.123)	(-1.672)
EBIT-to-assets ratio $_{t-1}$	-42.370**	3.014	5.573	1.468	7.741	3.077
	(-2.035)	(0.229)	(1.250)	(0.511)	(1.501)	(1.368)
Sales growth $_{t-1}$	-2.098	-2.333**	-0.502	-0.462*	-0.664	-0.328
	(-1.126)	(-1.980)	(-1.258)	(-1.796)	(-1.439)	(-1.629)
PPE-to-assets ratio $_{t-1}$			1.559	1.313	1.644	0.244
			(1.118)	(1.462)	(1.019)	(0.347)
Industry diversification $_{t-1}$			0.159	0.277	0.475	0.224
			(0.444)	(1.202)	(1.148)	(1.240)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9478	9478	9478	9478	9478	9478
R-squared	0.640	0.633	0.273	0.265	0.240	0.310

Table 1.10: **Variation in the binding distance to threshold**

This table reports regression results for first differences of the binding distance of the most stringent of 3 covenants (Binding Distance), for periods of two *(t, t-1)*, three *(t, t-2)* or four *(t, t-3)* quarters. These covenants are net worth, tangible new worth and Debt-to-EBITDA. Asset sale × violation is a binary variable taking the value of 1 when a firm sells assets in the next year following a covenant violation (starting in violation state. Any disinvestment × violation is a binary variable taking the value of 1 when a firm sells assets or disinvests through an equity deal (any type of disinvestment) in the next quarter after a violation. Disinvestment variables are lagged to the second (*t-1*), third (*t-2*) and fourth (*t-3*) quarters from the end of the variation period in the dependent variable. Disinvestment occurs in the first quarter of that variation period. Quarter fixed effects are included. All control variables are described in Table 1.

	Binding Distance: variation (as a fraction of the threshold)							
	Asset sale - binary				Disinvestment - binary			
	(t, t-1)	(t, t-1)	(t, t-2)	(t, t-3)	(t, t-1)	(t, t-1)	(t, t-2)	(t, t-3)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Asset sale in violation, t-1		-0.112**						
		(-2.036)						
Asset sale in violation, t-2			-0.155*					
			(-1.823)					
Asset sale in violation, t-3				-0.107				
				(-0.983)				
Disinvestment post violation, t-1						-0.094*		
						(-1.797)		
Disinvestment post violation, t-2							-0.099	
							(-1.052)	
Disinvestment post violation, t-3								0.001
								(0.009)
Asset sale, t-1	0.013***	-0.077**						
	(6.268)	(-2.438)						
Asset sale, t-2			-0.162***					
			(-3.128)					
Asset sale, t-3				-0.233***				
				(-3.277)				
Any disinvestment, t-1					0.013***	-0.073**		
					(6.553)	(-2.436)		
Any disinvestment, t-2							-0.144***	
							(-2.953)	
Any disinvestment, t-3								-0.202***
								(-2.990)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	76507	103961	99168	94708	76507	103961	99168	94708
R-squared	0.044	0.010	0.019	0.024	0.044	0.010	0.019	0.023

Appendix tables

Table A1. Panel A: **Summary statistics - discontinuity sample** This table reports summary statistics for the baseline discontinuity sample, composed of observations with a binding distance within 20% of the corresponding threshold, for the same covenant variable. All financial variables are as defined in table 1. *Binding distance* is the distance of the most stringent covenant variable to its threshold, from the set of three main covenants defined in tables 3 to 10. Summary statistics are reported for both the negative and the positive intervals of the domain of this variable.

Summary statistics - discontinuity sample						
Financial variables	Mean	50th percentile	Standard deviation	Min	Max	No. observations
Asset sales - binary	20.9%	0	40.6%	0	1	9478
Asset sales / Total assets	9.89%	0%	25.1%	0%	110.2%	9478
Spin-offs - binary	0.45%	0	6.7%	0	1	9478
Spin-offs / Total assets	0.24%	0%	4.3%	0%	90.4%	9478
Carve-outs - binary	0.18%	0	4.2%	0	1	9478
Carve-outs / Total assets	0.13%	0%	3.1%	0%	95.6%	9478
Log (assets)	6.63	6.62	1.84	2.68	11.07	9478
Leverage	32.50%	31%	20.5%	0%	100.9%	9478
Tobin's q	1.78	1.44	1.12	0.66	7.47	9478
Cash-to-assets	7.9%	3.9%	10.2%	0.0%	85.3%	9478
EBIT-to-assets	1.47%	1.7%	2.5%	-11%	9.9%	9478
PPE growth	0.83%	-0.2%	9.0%	-26%	60.3%	9478
Sales growth	2.6%	1.3%	19.5%	-52.2%	104.3%	9478
PPE / Assets	31.3%	25.2%	24.2%	0.0%	91.7%	9478
Industry diversification	13.3%	0.0%	34.0%	0.0%	100.0%	9478
Binding distance	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile	No. Observations
[-0.2, 0]: Mean = -0.104	-0.182	-0.155	-0.107	-0.055	-0.023	5491
[0, 0.2]: Mean = 0.095	0.016	0.044	0.091	0.145	0.176	3987

Table A1. Panel B: **Summary stats - discontinuity sample, by violation status** This table shows summary statistics for the baseline discontinuity sample, composed of observations with a binding distance within 20% of the corresponding threshold, for the same covenant variable. Statistcs are reported for two subsamples: No violation is composed of observations where *Binding distance* is negative. Violation is composed of observations with positive values *Binding distance*. All other variables are as described in Table 1. The t-statistics presented correspond to an hypotheses tests on mean differences. For each variable, the null hypothesis states that both subsample means are equal.

Summary stats - decomposition by violation status					
Financial variables	No violation - mean	N	Violation - mean	N	*t*-statistic
Asset sales - binary	11.87%	5 491	33.30%	3987	24.78
Asset sales / Total assets	5.54%	5 491	15.92%	3987	19.10
Spin-offs - binary	0.073%	5 491	1.052%	3987	6.11
Spin-offs / Total assets	0.028%	5 491	0.549%	3987	5.07
Carve-outs - binary	0.018%	5 491	0.426%	3987	4.00
Carve-outs / Total assets	0.017%	5 491	0.305%	3987	3.93
Log (assets)	6.58	5 491	6.71	3987	3.21
Leverage	31.06%	5 491	34.48%	3987	7.96
Tobin's q	1.79	5 491	1.77	3987	-0.80
Cash-to-assets	7.92%	5 491	7.88%	3987	-0.18
EBIT-to-assets	1.63%	5 491	1.25%	3987	-7.15
PPE growth	0.49%	5 491	1.07%	3987	3.09
Sales growth	2.69%	5 491	2.69%	3987	0.00
PPE / Assets	31.56%	5 491	31.17%	3987	-0.77
Industry diversification	13.60%	5 491	13.10%	3987	-0.71

Table A2: **Summary statistics - subsamples**

This table shows summary statistics for two subsamples: in Panel A, firms that do not violate any of the three most frequent covenants in a given quarter and, in Panel A2, firms that violate at least one of these. Panel A displays several firm financial covariates. All these variables are as defined in table 1. Panel B shows, in each column, summary statistics for the distance between a covenant variable (from a set of six covenants) and its threshold, across all firms reporting that particular covenant. Panel C shows, in each column, the summary statistics for a covenant variable (from the set of covenants in panel B), across all firms with data on that particular accounting variable.

Panel A: Firm financial variables									
No violation		80.83%	**Panel A1:**	Firm covariates, non violator-firms					
Stats	Log (assets)	Leverage	Tobin's q	Cash-to-assets	EBIT-to-assets	PPE growth	Sales growth	PPE / Assets	Industry diversification
Mean	6.99	26.5%	2.01	10.1%	2.10%	2.29%	3.78%	30.0%	15.3%
t-Statistic	19.71	-50.95	3.65	5.09	34.28	18.97	-2.56	1.63	10.51
50th percentile	6.75	1.7%	24.0%	1.52	2.17%	5.0%	5.25%	0.0%	0.0%
Standard deviation	1.75	19.6%	1.24	12.7%	2.70%	9.83%	20.7%	24.8%	36.0%
Min	2.68	0.0%	0.66	0.0%	-10.80%	-26.04%	-52.%	0.0%	0.0%
Max	11.07	100.9%	7.47	110.4%	9.89%	60.31%	1044.3%	91.7%	100.0%
Number of obs.	88 850	88 850	88 850	88 850	88 850	88 850	88 850	88 850	88 850
Violation		19.17%	**Panel A2:**	Firm covariates, firms in violation of at least one financial covenant					
Stats	Log (assets)	Leverage	Tobin's q	Cash-to-assets	EBIT-to-assets	PPE growth	Sales growth	PPE / Assets	Industry diversification
Mean	6.61	38.8%	1.97	9.5%	1.02%	0.28%	2.57%	29.6%	11.7%
t-Statistic	-19.71	50.95	-3.65	-5.09	-34.28	-18.97	2.56	-1.53	-10.51
50th percentile	6.61	36.5%	1.57	4.8%	1.35%	-0.59%	0.97%	22.5%	0.0%
Standard deviation	1.92	25.5%	1.26	12.1%	3.24%	10.60%	-78.3	24.4%	32.2%
Min	2.68	0.0%	0.66	-0.7%	-10.80%	-26.04%	-52%	0.0%	0.0%
Max	11.07	100.9%	7.47	94.6%	9.89%	60.31%	104.%	91.7%	100.0%
Number of obs.	20 923	20 923	20 923	20 923	20 923	20 923	20 923	20 923	20 923

Continued on next page

Table A2 continued from previous page

Panel B: Covenant variables - distances to threshold (only for firms with a covenant)

Stats	**Panel B1**: Firms with no violations of three listed financial covenants						**Panel B2**: Firms in violation of at least one of the listed financial convenant					
	Net worth	Tangible net worth	Debt-to-EBITDA	Leverage ratio	Interest coverage ratio	Current ratio	Net worth	Tangible net worth	Debt-to-EBITDA	Leverage ratio	Interest coverage ratio	Current ratio
Mean	-1042.42	-698.53	-2.66	-0.34	-12.61	-6.12	1350.80	228.80	3.66	-0.20	-1.32	-12.70
t-Statistic	-19.37	-50.36	-74.44	-11.47	-31.07	0.98	19.37	50.36	74.44	11.47	31.07	-0.98
50th percentile	-296.00	-126.54	-1.76	-0.33	-3.82	-1.36	67.34	37.33	1.70	-0.23	-0.26	-1.09
Standard deviation	2821.29	2408.00	3.88	0.19	35.58	37.07	9023.30	848.56	5.92	0.22	7.77	162.84
Min	-92763.00	-73611.00	-25.96	-3.00	-291.60	-821.62	0.00	0.00	0.00	-0.60	-290.10	-3968.75
Max	-0.01	0.00	0.00	0.55	34.03	1.15	101381.00	14487.50	33.04	0.88	15.79	0.94
Number of obs.	28 317	27 692	11 800	6 305	11 394	1 649	5 435	5 554	5 895	352	2 887	603

Panel C: Covenant variables (all firms where reported)

Stats	Panel C1: Firms with no violations of three listed financial covenants						Panel C2: Firms in violation of at least one of the listed financial covenant					
	Net worth	Tangible net worth	Debt-to-EBITDA	Leverage ratio	Interest coverage ratio	Current ratio	Net worth	Tangible net worth	Debt-to-EBITDA	Leverage ratio	Interest coverage ratio	Current ratio
Mean	1625.29	955.89	2.70	0.27	17.41	10.46	1296.37	385.53	4.86	0.41	4.50	10.00
t-Statistic	119.06	94.29	2.62	242.47	81.44	11.71	119.06	94.29	2.62	242.47	81.44	11.71
50th percentile	436.42	251.37	2.30	0.25	6.19	3.26	147.68	38.65	4.30	0.37	2.80	2.39
Standard deviation	4430.48	2957.73	5.38	0.21	42.62	314.82	5675.94	2493.98	8.11	0.34	17.45	203.88
Min	-59 939	-60 615	-24	0.00	-29.03	0.02	-56 970	-57 741	-24.28	0.00	-29.03	0.01
Max	142 763	104 709	34.54	5.44	293.60	78271.66	182 980	47 883	34.54	7.05	293.60	17 598.38
Number of obs.	88 850	88 850	73 504	88 012	73 227	84 557	20 923	20 923	15 616	20 694	15 717	20 253

Table A3: **Correlation matrix**

This table reports correlations for all combinations of predictor variables in baseline specifications. All variables are defined in tables 1 and 3.

	Violation	Log (assets)	Leverage ratio	Tobin's q	Cash-to-assets	EBIT-to-assets	PPE growth	Sales growth	PPE / Assets	Diversified
Violation - 3 covenants	1									
Log (Book value of assets)	-0.0828	1								
Leverage ratio	0.2263	0.1196	1							
Tobin's q	-0.0149	0.0155	-0.0967	1						
Cash-to-assets ratio	-0.0201	-0.1159	-0.3148	0.2476	1					
EBIT-to-assets ratio	-0.1489	0.1454	-0.0621	0.3565	-0.0167	1				
PPE, growth rate	-0.079	0.0248	-0.0356	0.1072	0.0056	0.1368	1			
Sales, growth rate	-0.0227	-0.0064	0.0002	0.0358	-0.0005	0.2464	0.1754	1		
PPE/Assets	-0.0065	0.1234	0.2345	-0.2707	-0.2939	-0.0701	0.0183	0.0028	1	
Industry diversification	-0.0401	0.0003	0.0042	-0.0778	-0.0751	0.0162	0.0062	0.0053	0.0335	1

Table A4: **Asset sales - six covenants**

This table reports the results of regressions for a binary variable denoting the existence of any asset sale and a relative measure of the value of sold assets, in a given calendar quarter. *Violation of most frequent covenants, t-1* is a binary variable that takes the value of 1, when a violation of one of the six most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The six covenant variables are tangible net worth, net worth, debt-to-EBITDA, interest coverage, leverage and current ratio. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Asset sales - binary $_t$				Asset sales / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of six most frequent covenants $_{t-1}$		1.602***				0.647*		
		(2.609)				(1.817)		
Violation of six most frequent covenants $_{t-2}$			1.597**				0.537	
			(2.508)				(1.476)	
Violation of six most frequent covenants $_{t-3}$				1.410**				0.426
				(2.249)				(1.193)
Log (Book value of assets)	4.942***	4.985***	4.986***	4.983***	1.359***	1.377***	1.374***	1.372***
	(22.509)	(22.581)	(22.545)	(22.524)	(11.759)	(11.883)	(11.845)	(11.819)
Leverage ratio	6.060***	5.220***	5.280***	5.402***	4.419***	4.079***	4.156***	4.220***
	(4.484)	(3.734)	(3.779)	(3.881)	(5.455)	(4.920)	(5.012)	(5.108)
Tobin's q	-0.927***	-0.938***	-0.944***	-0.941***	-0.502***	-0.507***	-0.508***	-0.507***
	(-4.690)	(-4.749)	(-4.778)	(-4.762)	(-4.252)	(-4.290)	(-4.300)	(-4.288)
Cash-to-assets ratio $_{t-1}$	-4.787**	-4.780**	-4.761**	-4.784**	-1.943	-1.941	-1.935	-1.943
	(-2.167)	(-2.167)	(-2.158)	(-2.168)	(-1.512)	(-1.511)	(-1.506)	(-1.512)
EBIT-to-assets ratio	-65.348***	-62.113***	-63.053***	-64.042***	-20.015***	-18.708***	-19.244***	-19.621***
	(-8.545)	(-8.144)	(-8.285)	(-8.428)	(-4.170)	(-3.883)	(-4.005)	(-4.096)
PPE growth $_{t-1}$	-5.299***	-4.987***	-5.031***	-5.007***	-1.774**	-1.648*	-1.684**	-1.686**
	(-4.047)	(-3.816)	(-3.855)	(-3.832)	(-2.101)	(-1.953)	(-2.000)	(-2.000)
Sales growth $_{t-1}$	-0.844*	-0.932**	-0.917**	-0.914**	-1.102***	-1.137***	-1.126***	-1.123***
	(-1.822)	(-2.007)	(-1.977)	(-1.971)	(-3.643)	(-3.752)	(-3.716)	(-3.707)
Constant	-15.630***	-16.060***	-16.030***	-15.996***	-1.539*	-1.713**	-1.674**	-1.650**
	(-10.595)	(-10.812)	(-10.788)	(-10.761)	(-1.879)	(-2.082)	(-2.034)	(-2.003)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118099	118099	118099	118099	118099	118099	118099	118099
R-squared	0.116	0.116	0.116	0.116	0.060	0.060	0.060	0.060

Table A5: **Spin-offs - six covenants**

This table reports the results of regressions for a binary variable denoting the existence of any spin off and a relative measure of the value of spun off assets, in a given calendar quarter. *Violation of most frequent covenants,* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the six most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The six covenant variables are tangible net worth, net worth, debt-to-EBITDA, interest coverage, leverage and current ratio. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Spin-offs - binary $_t$				Spin-offs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of six most frequent covenants $_{t-1}$		0.148*				0.169**		
		(1.681)				(2.330)		
Violation of six most frequent covenants $_{t-2}$			0.183**				0.190**	
			(2.026)				(2.539)	
Violation of six most frequent covenants $_{t-3}$				0.178**				0.179**
				(1.963)				(2.415)
Log (Book value of assets)	0.180***	0.184***	0.185***	0.185***	0.122***	0.127***	0.127***	0.127***
	(6.293)	(6.350)	(6.368)	(6.365)	(5.756)	(5.832)	(5.839)	(5.826)
Leverage ratio	-0.376***	-0.454***	-0.466***	-0.459***	-0.224**	-0.313***	-0.317***	-0.308***
	(-2.988)	(-3.458)	(-3.531)	(-3.498)	(-2.248)	(-2.863)	(-2.901)	(-2.844)
Tobin's q	-0.021	-0.022	-0.023	-0.023	-0.006	-0.007	-0.007	-0.007
	(-0.841)	(-0.874)	(-0.909)	(-0.900)	(-0.272)	(-0.321)	(-0.363)	(-0.349)
Cash-to-assets ratio $_{t-1}$	-0.082	-0.081	-0.078	-0.080	0.039	0.041	0.043	0.041
	(-0.277)	(-0.271)	(-0.261)	(-0.269)	(0.197)	(0.208)	(0.222)	(0.208)
EBIT-to-assets ratio	-1.455	-1.156	-1.192	-1.291	-0.301	0.040	-0.027	-0.135
	(-1.587)	(-1.231)	(-1.285)	(-1.403)	(-0.569)	(0.076)	(-0.053)	(-0.261)
PPE growth $_{t-1}$	-0.237	-0.208	-0.206	-0.200	-0.126	-0.094	-0.095	-0.089
	(-1.645)	(-1.419)	(-1.412)	(-1.366)	(-1.126)	(-0.816)	(-0.827)	(-0.778)
Sales growth $_{t-1}$	-0.104	-0.112*	-0.112*	-0.112*	-0.113**	-0.122***	-0.122***	-0.122***
	(-1.624)	(-1.719)	(-1.729)	(-1.736)	(-2.441)	(-2.603)	(-2.599)	(-2.604)
PPE-to-assets ratio $_{t-1}$	-0.265	-0.260	-0.256	-0.255	-0.247	-0.240	-0.237	-0.237
	(-1.031)	(-1.011)	(-0.994)	(-0.991)	(-1.257)	(-1.225)	(-1.205)	(-1.203)
Industry diversification $_{t-1}$	-0.013	-0.010	-0.010	-0.010	0.040	0.043	0.043	0.043
	(-0.123)	(-0.095)	(-0.093)	(-0.096)	(0.456)	(0.496)	(0.495)	(0.490)
Constant	-0.631***	-0.673***	-0.681***	-0.681***	-0.451***	-0.499***	-0.502***	-0.501***
	(-3.044)	(-3.210)	(-3.230)	(-3.220)	(-2.841)	(-3.080)	(-3.087)	(-3.061)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118099	118099	118099	118099	118099	118099	118099	118099
R-squared	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013

Table A6: **Carve-outs - six covenants**

This table reports the results of regressions for a binary variable denoting any occurrences of carve-outs in a given calendar quarter and a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. *Violation of most frequent covenants,* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the six most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The six covenant variables are tangible net worth, net worth, debt-to-EBITDA, interest coverage, leverage and current ratio. *t-2* denotes lagging to the second before the disinvestment period. *t-3* denotes the lagging of the violation binary variable to the third last quarter before the disinvestment period. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Carve-outs - binary $_t$				Carve-outs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of six most frequent covenants $_{t-1}$		0.005				0.003		
		(0.101)				(0.076)		
Violation of six most frequent covenants $_{t-2}$			0.002				-0.001	
			(0.045)				(-0.028)	
Violation of six most frequent covenants $_{t-3}$				0.009				0.006
				(0.180)				(0.178)
Log (Book value of assets)	0.086***	0.086***	0.086***	0.086***	0.055***	0.055***	0.055***	0.055***
	(4.650)	(4.688)	(4.639)	(4.643)	(4.744)	(4.797)	(4.737)	(4.739)
Leverage ratio	0.200	0.197	0.198	0.195	0.150	0.149	0.151	0.148
	(1.403)	(1.318)	(1.311)	(1.311)	(1.643)	(1.534)	(1.532)	(1.535)
Tobin's q	-0.031**	-0.031**	-0.031**	-0.031**	-0.018**	-0.018**	-0.018**	-0.018**
	(-2.341)	(-2.339)	(-2.331)	(-2.337)	(-2.041)	(-2.034)	(-2.022)	(-2.032)
Cash-to-assets ratio $_{t-1}$	0.539	0.539	0.539	0.540	0.319	0.319	0.319	0.319
	(1.267)	(1.267)	(1.267)	(1.267)	(1.428)	(1.429)	(1.428)	(1.428)
EBIT-to-assets ratio	-0.844*	-0.835*	-0.841*	-0.836*	-0.571*	-0.566	-0.573*	-0.566*
	(-1.850)	(-1.734)	(-1.817)	(-1.825)	(-1.770)	(-1.643)	(-1.737)	(-1.739)
PPE growth $_{t-1}$	-0.054	-0.053	-0.054	-0.052	-0.016	-0.015	-0.016	-0.015
	(-0.526)	(-0.505)	(-0.513)	(-0.496)	(-0.226)	(-0.214)	(-0.225)	(-0.203)
Sales growth $_{t-1}$	-0.012	-0.013	-0.012	-0.013	-0.006	-0.006	-0.006	-0.007
	(-0.316)	(-0.318)	(-0.315)	(-0.323)	(-0.218)	(-0.220)	(-0.214)	(-0.226)
PPE-to-assets ratio $_{t-1}$	0.140	0.140	0.140	0.141	0.109	0.109	0.109	0.110
	(0.988)	(0.991)	(0.991)	(0.994)	(1.111)	(1.115)	(1.115)	(1.119)
Industry diversification $_{t-1}$	0.148*	0.148*	0.148*	0.148*	0.118*	0.118*	0.118*	0.118*
	(1.646)	(1.647)	(1.647)	(1.647)	(1.731)	(1.733)	(1.733)	(1.732)
Constant	-0.570***	-0.572***	-0.571***	-0.573***	-0.376***	-0.377***	-0.376***	-0.378***
	(-3.352)	(-3.407)	(-3.379)	(-3.379)	(-3.616)	(-3.701)	(-3.664)	(-3.658)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118099	118099	118099	118099	118099	118099	118099	118099
R-squared	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.008

Table A7: **Spin-offs - firm FE**

This table reports the results of regressions for a binary variable denoting any occurrences of spin-offs in a given calendar quarter and a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. These models include firm and quarter fixed effects. Violation of most frequent covenants is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *Violation of three main covenants,* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar quarter. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2*, *t-3* denotes lagging to the second or third quarter before the disinvestment period. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Spin-offs - binary $_t$				Spin-offs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		0.084				0.066		
		(0.727)				(0.776)		
Violation of three main covenants $_{t-2}$			0.089				0.072	
			(0.823)				(0.875)	
Violation of three main covenants $_{t-3}$				0.076				0.053
				(0.689)				(0.609)
Log (Book value of assets)	0.300***	0.307***	0.308***	0.307***	0.223***	0.228***	0.229***	0.228***
	(3.255)	(3.322)	(3.338)	(3.334)	(2.977)	(3.055)	(3.067)	(3.049)
Leverage ratio $_{t-1}$	-0.687***	-0.734***	-0.742***	-0.729***	-0.278	-0.315	-0.322	-0.307
	(-2.633)	(-2.659)	(-2.643)	(-2.601)	(-1.474)	(-1.604)	(-1.596)	(-1.510)
Tobin's q $_{t-1}$	-0.000	-0.000	-0.001	-0.000	-0.008	-0.008	-0.009	-0.008
	(-0.012)	(-0.008)	(-0.018)	(-0.012)	(-0.277)	(-0.273)	(-0.283)	(-0.277)
Cash-to-assets ratio $_{t-1}$	-0.156	-0.151	-0.149	-0.151	0.159	0.163	0.165	0.163
	(-0.309)	(-0.300)	(-0.297)	(-0.300)	(0.498)	(0.510)	(0.514)	(0.508)
EBIT-to-assets ratio $_{t-1}$	0.843	0.915	0.906	0.846	1.431*	1.488*	1.482*	1.433*
	(0.720)	(0.779)	(0.771)	(0.722)	(1.768)	(1.846)	(1.837)	(1.771)
PPE growth $_{t-1}$	-0.227	-0.221	-0.222	-0.219	-0.111	-0.107	-0.107	-0.106
	(-1.397)	(-1.355)	(-1.357)	(-1.331)	(-0.845)	(-0.807)	(-0.808)	(-0.792)
Sales growth $_{t-1}$	-0.132*	-0.135*	-0.136*	-0.135*	-0.133**	-0.135**	-0.136**	-0.135**
	(-1.849)	(-1.872)	(-1.878)	(-1.870)	(-2.458)	(-2.483)	(-2.492)	(-2.479)
PPE-to-assets ratio $_{t-1}$	0.396	0.401	0.403	0.403	0.063	0.066	0.068	0.067
	(0.614)	(0.623)	(0.626)	(0.625)	(0.125)	(0.132)	(0.135)	(0.133)
Industry diversification $_{t-1}$	-0.081	-0.081	-0.081	-0.081	-0.024	-0.024	-0.024	-0.024
	(-0.507)	(-0.507)	(-0.508)	(-0.509)	(-0.173)	(-0.173)	(-0.173)	(-0.174)
Constant	-1.638**	-1.692**	-1.699**	-1.693**	-1.254**	-1.296**	-1.302**	-1.292**
	(-2.377)	(-2.473)	(-2.488)	(-2.480)	(-2.234)	(-2.320)	(-2.328)	(-2.307)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109610	109610	109610	109610	109610	109610	109610	109610
R-squared	0.091	0.091	0.091	0.091	0.079	0.079	0.079	0.079

Table A8: **Carve-outs - firm FE**

This table reports the results of regressions for a binary variable denoting any occurrences of carve-outs in a given calendar quarter and a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. These models include firm and quarter fixed effects. Violation of most frequent covenants is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *Violation of three main covenants,* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar quarter. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2*, *t-3* denotes lagging to the second or third quarter before the disinvestment period. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Carve-outs - binary $_t$				Carve-outs / Total Assets $_t$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Violation of three main covenants $_{t-1}$		0.071				0.047		
		(1.319)				(1.176)		
Violation of three main covenants $_{t-2}$			0.081*				0.053	
			(1.665)				(1.529)	
Violation of three main covenants $_{t-3}$				0.088*				0.065*
				(1.822)				(1.888)
Log (Book value of assets)	0.027	0.033	0.034	0.035	0.014	0.018	0.019	0.020
	(0.678)	(0.830)	(0.861)	(0.898)	(0.487)	(0.623)	(0.653)	(0.714)
Leverage ratio $_{t-1}$	0.353**	0.314**	0.304**	0.305**	0.282***	0.256**	0.249**	0.246**
	(2.443)	(2.071)	(2.001)	(2.076)	(2.586)	(2.226)	(2.182)	(2.247)
Tobin's q $_{t-1}$	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004
	(0.325)	(0.333)	(0.312)	(0.325)	(0.322)	(0.330)	(0.311)	(0.322)
Cash-to-assets ratio $_{t-1}$	0.303	0.307	0.309	0.309	0.142	0.145	0.146	0.147
	(0.728)	(0.738)	(0.742)	(0.742)	(0.650)	(0.663)	(0.668)	(0.670)
EBIT-to-assets ratio $_{t-1}$	0.109	0.170	0.166	0.112	0.149	0.189	0.186	0.151
	(0.193)	(0.300)	(0.292)	(0.199)	(0.352)	(0.445)	(0.436)	(0.358)
PPE growth $_{t-1}$	-0.223**	-0.218**	-0.218**	-0.213*	-0.139*	-0.136*	-0.136*	-0.133*
	(-2.030)	(-1.971)	(-1.980)	(-1.934)	(-1.884)	(-1.824)	(-1.835)	(-1.783)
Sales growth $_{t-1}$	-0.044	-0.046	-0.047	-0.047	-0.031	-0.032	-0.033	-0.033
	(-1.043)	(-1.089)	(-1.101)	(-1.094)	(-1.004)	(-1.048)	(-1.058)	(-1.057)
PPE-to-assets ratio $_{t-1}$	0.434**	0.438**	0.440**	0.441**	0.288*	0.291**	0.292**	0.294**
	(2.035)	(2.064)	(2.071)	(2.071)	(1.959)	(1.991)	(1.999)	(1.999)
Industry diversification $_{t-1}$	0.207**	0.207**	0.207**	0.207**	0.149**	0.149**	0.149**	0.148**
	(2.210)	(2.210)	(2.209)	(2.208)	(2.147)	(2.148)	(2.147)	(2.145)
Constant	-0.366	-0.412	-0.421	-0.430	-0.226	-0.256	-0.262	-0.273
	(-1.143)	(-1.296)	(-1.315)	(-1.347)	(-1.005)	(-1.151)	(-1.170)	(-1.226)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109610	109610	109610	109610	109610	109610	109610	109610
R-squared	0.073	0.073	0.073	0.073	0.075	0.075	0.075	0.075

Table A9: **Regression discontinuity design: larger subsample (0.4 bandwidth)**

This table reports the results of regression discontinuity design models. These models are applied to measures of three different types of disinvestment: asset sales, spin-offs and carve-outs. For each type of disinvestment, I include both a binary variable (label "-binary") that denotes the occurrence of event and a relative measure of divested assets in that type of events (label "/Total assets"), as a ratio of total firm assets. Covenant violation is the coefficient for a regression discontinuity in a distance-to-threshold running variable. The distance-to-threshold running variable is a measure of the minimum distance to threshold across three possible covenant variables in a given quarter, for a given firm. Those three covenant variables correspond to the three most frequent covenant types included in tables 3, 4 and 5. (Tangible Net Worth, Net Worth, Debt-to-EBITDA). I consider the last quarter before the disinvestment event year. Panel A shows the discontinuity estimates. Panel B shows the second degree polynomial estimates for negative binding distances. Panel C shows the second degree polynomial estimates for positive binding distances. Models employ an Epanechnikov non-parametrical kernel function of the Epanechnikov type. A total fraction of 16.6% of observations is included in the RDD sample. The size of the subsample bandwidth is 0.4, measured in the running variable, as a fraction of the threshold. Fixed effects are included at the firm and quarter levels. Standard errors are clustered by firm according to the nearest neighbour method. All other control variables are as described in Table 1.8.

	Asset sales - binary $_t$	Asset sales / Total Assets $_t$	Spinoffs - binary $_t$	Spin-offs / Total Assets $_t$	Carve-outs - binary $_t$	Carve-outs / Total Assets $_t$
	(1)	(2)	(3)	(4)	(5)	(6)
Covenant violation	13.315***	6.401***	3.017***	2.654***	0.411	0.223
	(4.106)	(3.129)	(3.469)	(4.311)	(1.030)	(0.919)
Proportional effects (at violation subsample mean)	0.461	0.480	0.823	0.951	0.770	0.904
Marginal effects (standard deviations)	0.375	0.617	0.223	1.216	1.167	1.209
Second-order polynomial						
Binding distance (negative, × 100)	0.823***	0.424***	0.062***	0.028**	0.072***	0.006
	(8.936)	(7.216)	(3.440)	(2.294)	(3.451)	(0.620)
Squared binding distance (negative, × 100)	2.184***	1.163***	0.169***	0.078**	0.189***	0.022
	(9.321)	(7.773)	(3.708)	(2.547)	(3.577)	(0.880)
Constant (negative)	-3.234	1.250	7.705***	3.149***	7.717***	1.443***
	(-0.911)	(0.551)	(11.176)	(6.760)	(9.640)	(3.848)
Squared binding distance (positive, × 100)	-2.543***	-1.057***	-0.047	-0.029	-0.063	-0.065**
	(-8.911)	(-5.802)	(-0.843)	(-0.763)	(-0.971)	(-2.153)
Binding distance (positive, × 100)	1.295***	0.591***	0.012	0.012	0.030	0.036***
	(12.400)	(8.869)	(0.613)	(0.891)	(1.285)	(3.279)
Firm-level controls						
Log (Book value of assets) $_{t-1}$	6.137***	2.642***	-0.351**	0.118	-0.270	0.055
	(6.797)	(4.583)	(-1.994)	(0.993)	(-1.324)	(0.575)
Tobin's q	-1.077**	-0.547*	-0.020	-0.128**	-0.014	-0.035
	(-2.230)	(-1.774)	(-0.213)	(-2.013)	(-0.132)	(-0.688)
Cash-to-assets ratio $_{t-1}$	-3.975	-7.498**	-0.824	-0.444	-1.215	-0.640
	(-0.857)	(-2.531)	(-0.896)	(-0.717)	(-1.139)	(-1.286)
EBIT-to-assets ratio $_{t-1}$	-26.276*	-0.275	5.657*	3.449*	5.971*	2.273
	(-1.766)	(-0.029)	(1.952)	(1.766)	(1.776)	(1.448)
Sales growth $_{t-1}$	-1.138	-1.247	-0.359	-0.324*	-0.300	-0.103
	(-0.852)	(-1.462)	(-1.382)	(-1.850)	(-0.995)	(-0.735)
PPE-to-assets ratio $_{t-1}$			1.108	0.901	1.251	0.370
			(1.264)	(1.524)	(1.230)	(0.778)
Industry diversification $_{t-1}$			-0.535**	-0.218	-0.231	0.035
			(-2.485)	(-1.502)	(-0.923)	(0.302)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11533	11533	11533	11533	11533	11533
R-squared	0.640	0.633	0.273	0.265	0.240	0.310

Table A10: **Baseline regressions with three lags included - asset sales and spin-offs**

This table reports the results of regressions for a binary and relative value measures for two types of disinvestment: asset sales and spin-offs - in a given calendar quarter. Violation of most frequent covenants is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar date. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *Violation of three main covenants,* $_{t-1}$ is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar quarter. The three covenant variables are tangible net worth, net worth and debt-to-EBITDA. *t-2* and *t-3* denote lagging to the second or the third quarter before the disinvestment period. Fixed effects and standard errors are as described in Tables 3 and 4. All other control variables are as described in Table 1.

	Asset sales - binary $_t$	Asset sales / Total Assets $_t$	Spin-offs - binary $_t$	Spin-offs / Total Assets $_t$
	(1)	(2)	(3)	(4)
Violation of three main covenants $_{t-1}$	1.038*	0.713**	0.074	0.095
	(1.756)	(1.964)	(0.757)	(1.148)
Violation of three main covenants $_{t-2}$	0.677	0.126	0.056	0.062
	(1.583)	(0.454)	(0.838)	(1.152)
Violation of three main covenants $_{t-3}$	0.027	-0.233	0.073	0.053
	(0.046)	(-0.652)	(0.755)	(0.624)
Log (Book value of assets)	4.990***	1.375***	0.186***	0.128***
	(22.530)	(11.841)	(6.372)	(5.841)
Leverage ratio $_{t-1}$	5.221***	4.125***	-0.473***	-0.324***
	(3.724)	(4.964)	(-3.563)	(-2.943)
Tobin's q $_{t-1}$	-0.943***	-0.507***	-0.023	-0.007
	(-4.772)	(-4.291)	(-0.906)	(-0.356)
Cash-to-assets ratio $_{t-1}$	-4.759**	-1.930	-0.078	0.043
	(-2.157)	(-1.503)	(-0.263)	(0.221)
EBIT-to-assets ratio $_{t-1}$	-62.679***	-18.902***	-1.189	-0.011
	(-8.211)	(-3.920)	(-1.276)	(-0.020)
PPE growth $_{t-1}$	-4.995***	-1.674**	-0.199	-0.088
	(-3.823)	(-1.986)	(-1.359)	(-0.769)
Sales growth $_{t-1}$	-0.916**	-1.123***	-0.113*	-0.122***
	(-1.975)	(-3.708)	(-1.738)	(-2.607)
PPE-to-assets ratio $_{t-1}$			-0.255	-0.236
			(-0.989)	(-1.200)
Industry diversification $_{t-1}$			-0.009	0.044
			(-0.088)	(0.502)
Constant	-16.074***	-1.694**	-0.687***	-0.509***
	(-10.794)	(-2.054)	(-3.252)	(-3.111)
Quarter FE	Yes	Yes	Yes	Yes
sic3	Yes	Yes	Yes	Yes
Observations	109770	109770	109770	109770
R-squared	0.116	0.060	0.013	0.013

Table A11: **Disinvestment and other firm policies - asset sales**

Tables A11 and A12 report the results of regressions for two types of disinvestment, where the effect of other firm policies is estimated under covenant violation states. This table presents models for asset sales. Two outcome variables are considered: a binary variable denoting any occurrences of that particular event in a given calendar quarter and a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. *Investment reduction (p.p)* is the negative absolute variation of annual capital expenditures in the previous fiscal year, scaled in percentage points. *Leverage reduction (d.p.)* is the negative absolute variation of the book debt-to-assets ratio (as defined in Table 3), scaled in decimal percentage points. *Violation of most frequent covenants* is a binary variable that takes the value of 1, when a violation of one of the three most frequent covenants in the sample occurred in the last quarter before the initial calendar date. Those three covenant variables correspond to the three most frequent covenant types included in tables 3, 4 and 5. *t-4, t-5* denotes the lagging of the violation binary variable to the fourth or fifth-last quarters before the disinvestment period. These are the two most recent quarters prior to the period of measurement of investment and leverage policies. Interactions of the non-lagged violation dummy (*Violations of most frequent covenants*) with 1) *Investment Reduction* and 2) *Leverage Reduction* are included in some of the equations, with the label *Interaction – violation*. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Asset sales - binary $_t$		Asset sales / Total Assets $_t$	
	(1)	(2)	(3)	(4)
Interaction - Δ investment, policy	0.037		0.019	
	(1.013)		(0.960)	
Investment reduction (p.p.)	0.007**		0.004**	
	(2.181)		(2.506)	
Interaction - Δ leverage, policy		0.001**		0.001***
		(2.215)		(5.255)
Leverage reduction (d.p.)		-0.000*		-0.001***
		(-1.711)		(-4.028)
Violation of three main covenants $_{t-4,\ t-5}$	1.849***	1.787**	0.818**	0.929**
	(2.662)	(2.451)	(2.027)	(2.218)
Constant	-16.011***	-17.067***	-1.191	-1.812*
	(-9.790)	(-9.731)	(-1.305)	(-1.878)
Industry FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	87134	79032	87134	79032
R-squared	0.124	0.124	0.069	0.070

Table A12: **Disinvestment and other firm policies - spin-offs**

Tables A11 and A12 report the results of regressions for two types of disinvestment, where the effect of other firm policies is estimated under covenant violation states. This table presents models for spin-offs. Two outcome variables are considered: a binary variable denoting any occurrences of that particular event in a given calendar quarter and a relative measure of the asset value divested in those occurrences, as a share of total assets, in that calendar quarter. All variables represented are defined in table A11. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Spin-offs - binary $_t$	Spin-offs - binary $_t$	Spin-offs / Total Assets $_t$	Spin-offs / Total Assets $_t$
	(1)	(2)	(3)	(4)
Interaction - Δ investment, policy	0.000		0.001	
	(0.039)		(0.290)	
Investment reduction (p.p.)	0.000		0.000	
	(0.642)		(0.880)	
Interaction - Δ leverage, policy		0.000		0.000
		(0.977)		(1.086)
Leverage reduction (d.p.)		0.000		-0.000
		(0.110)		(-0.005)
Violation of three main covenants $_{t-2,\ t-3}$	0.086	0.105	0.128	0.133
	(0.872)	(0.996)	(1.576)	(1.509)
Constant	-0.752***	-0.726***	-0.553***	-0.546**
	(-2.939)	(-2.647)	(-2.799)	(-2.564)
Industry FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	85845	77552	85845	77552
R-squared	0.018	0.018	0.018	0.018

Table A13: **Simultaneous policies in firms selling assets**

This table reports regression models for two variable differences, measuring implemented firm policies: *Investment reduction (p.p)* and *Leverage reduction (d.p)*, for the subsample of firms having sold assets in the most recent calendar quarter (Asset sales = 1). Investment reduction (p.p) is the negative absolute variation of annual capital expenditures in the previous fiscal year, scaled in percentage points. Leverage reduction (d.p.) is the negative absolute variation of the book debt-to-assets ratio, scaled in decimal percentage points. The covenant violation dummy variable (Violation of three main covenants, $_{t-2},\ _{t-3}$) respects to the two most recent quarters prior to the period of measurement of disinvestment. Industry and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are lagged four additional quarters, so as not to coincide with the 4-quarters in which the outcome variable is measured.

	Investment reduction (p.p)	Leverage reduction (d.p)
	(1)	(2)
Violation of three main covenants $_{t-2},\ _{t-3}$	0.275***	-1.482
	(2.898)	(-1.146)
Log (Book value of assets) $_{t-1}$	0.165***	0.570***
	(2.738)	(3.209)
Debt-to-assets ratio (book) $_{t-5}$	-0.043	8.052***
	(-0.093)	(3.737)
Tobin's q $_{t-1}$	0.073	-0.608
	(1.039)	(-0.932)
Cash-to-assets ratio $_{t-1}$	-0.668	-10.619
	(-0.514)	(-1.636)
EBIT-to-assets ratio $_{t-1}$	-0.432	4.002
	(-0.118)	(0.297)
Capex (end of year)	12.225***	7.171
	(4.962)	(1.233)
Constant	-2.136***	-5.948***
	(-2.988)	(-3.563)
Industry FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	16333	16105
R-squared	0.028	-0.006

Table A14: **Simultaneous policies in firms selling assets**
This table reports regression models for *Investment* and *Leverage*: the two stock variables differentiated in table A14, for the subsample of firms having sold assets in the most recent calendar quarter (Asset sales = 1). Both these variables are defined as in Table 1. The covenant violation dummy variable (*Violation of three main covenants* - $_{t-2,\ t-3}$) respects to the two most recent quarters prior to the disinvestment period. Firm and quarter fixed effects are included. Standard errors are clustered at the firm level. All other control variables are as described in Table 1.

	Investment	Leverage
	(1)	(2)
Violation of three main covenants $_{t-2,\ t-3}$	-0.344***	6.630***
	(-2.581)	(5.442)
Log (Book value of assets) $_{t-1}$	-0.206	0.005
	(-1.264)	(0.005)
Tobin's q $_{t-1}$	0.317***	1.179
	(4.603)	(1.013)
Cash-to-assets ratio $_{t-1}$	-1.161**	-18.775***
	(-2.421)	(-4.996)
EBIT-to-assets ratio $_{t-1}$	-6.981***	-38.900***
	(-2.968)	(-3.828)
Constant	4.397***	30.148***
	(3.414)	(3.743)
Quarter FE	Yes	Yes
Firm FE	Yes	Yes
Observations	18379	16676
R-squared	0.656	0.770

Table A15: **Regression discontinuity design - robustness to bandwidth selection: asset sales, binary**

This table reports the regression discontinuity estimates for RDD models identical to the first column of table A9. The outcome variable is the binary variable denoting the occurrence of assets sales in a given quarter. A single parameter is changed - the bandwidth of the kernel function, taking a different value in each specification.""

	Asset sales - binary $_t$			
	0.1	0.2	0.3	0.4
Bandwidth (h)	(1)	(2)	(3)	(4)
Regr. discontinuity estimate	9.943**	13.842***	13.335***	13.143***
	(2.039)	(4.115)	(4.889)	(5.551)
Second order polynomial	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Number of observations	4684	9478	14275	18799

Table A16: **Regression discontinuity design - robustness to bandwidth selection: spinoffs, binary**

This table reports the regression discontinuity estimates for RDD models identical to the second column of table A9. The outcome variable is the binary variable denoting the occurrence of spin-offs in a given quarter. A single parameter is changed - the bandwidth of the kernel function, taking a different value in each specification.""

	Spin-offs - binary			
	0.1	0.2	0.3	0.4
Bandwidth (h)	(1)	(2)	(3)	(4)
Regr. discontinuity estimate	4.312**	3.167***	2.600***	2.256***
	(2.554)	(3.345)	(3.711)	(3.893)
Second order polynomial	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Number of observations	4684	9478	14275	18799

Table A17: **Regression discontinuity design: placebo tests, assets sold**

This table reports the regression discontinuity estimates for RDD models identical to the first column of table A9. The outcome variable is the ratio between the value of assets sold and total assets in a given quarter. A single parameter is changed - the thresold binding distance, which is the cutoff for the RDD running varaible. This thresold takes a different placebo value in each specification.""

Placebo threshold - binding distance	(1)	(2)	(3)	(4)	(5)	(6)
	- 0.20	- 0.10	- 0.05	0.05	0.10	0.20
Regr. discontinuity estimate	-1.718	1.259	-3.969	-2.313	-0.047	-3.656
	(-1.148)	(0.920)	(-1.214)	(-0.895)	(-0.018)	(-1.221)
Second order polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	11819	10119	10797	8764	8162	6980

Table A18: **Regression discontinuity design: placebo tests, spun-off assets**

This table reports the regression discontinuity estimates for RDD models identical to the fourth column of table A9. The outcome variable is the ratio between the value of spun-off assets and total assets, in a given quarter. A single parameter is changed - the thresold binding distance, which is the cutoff for the RDD running varaible. This thresold takes a different placebo value in each specification.""

Placebo threshold - binding distance	(1)	(2)	(3)	(4)	(5)	(6)
	- 0.20	- 0.10	- 0.05	0.05	0.10	0.20
Regr. discontinuity estimate	0.093	-0.284*	0.120	-0.217	0.372	0.349
	(1.458)	(-1.817)	(0.913)	(-0.854)	(1.429)	(0.645)
Second order polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	11819	10119	10797	8764	8162	6980

Figures - wider bandwidth (0.4)

Figure A1: **Scatter plots and fitted polynomials: asset sales** The following six figures comprise four charts each, referring to each of the six dependent variables of this paper. These are as defined in Table 1. The first chart in each figure is a scatter plot that illustrates the distribution of the outcome variable across different values of binding distance to threshold, computed for the three main covenants considered in table A10 (Net Worth, Tangible Net Worth, Debt-to-EBITDA). A linear polynomial if the binding distance is fit to the scatter, for each of two branches of the function domain: negative binding distances (not violation any covenant) and positive binding distances (in violation). The second chart reproduces the same scatter plot as in the first. Differently, a quadratic polynomial of the binding distance is fitted to the data. The third chart illustrates the distribution of the residual of a regression discontinuity model, using as covariates the same control variables and fixed effects as in table A10. The equations estimated are identical to those in table A6, with a bandwidth of 0.4 for the kernel function. This distribution is computed within bins of 5 percentage points of binding distance, measured as a percentage of its threshold. A quadratic polynomial of the binding distance is fit into the bin-level average points for each sign of the binding distance. The fourth chart illustrates the residuals of the same model than the third chart, distributed across the same bins. It differs in that fourth-degree polynomials are fitted to bin-level averages, for either negative or positive binding distances. This figure reports results for the binary variable denoting the occurrence of asset sales in a given quarter.

Figure A2: **Scatter plots and fitted polynomials: spin-offs** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of spin-offs in a given quarter.

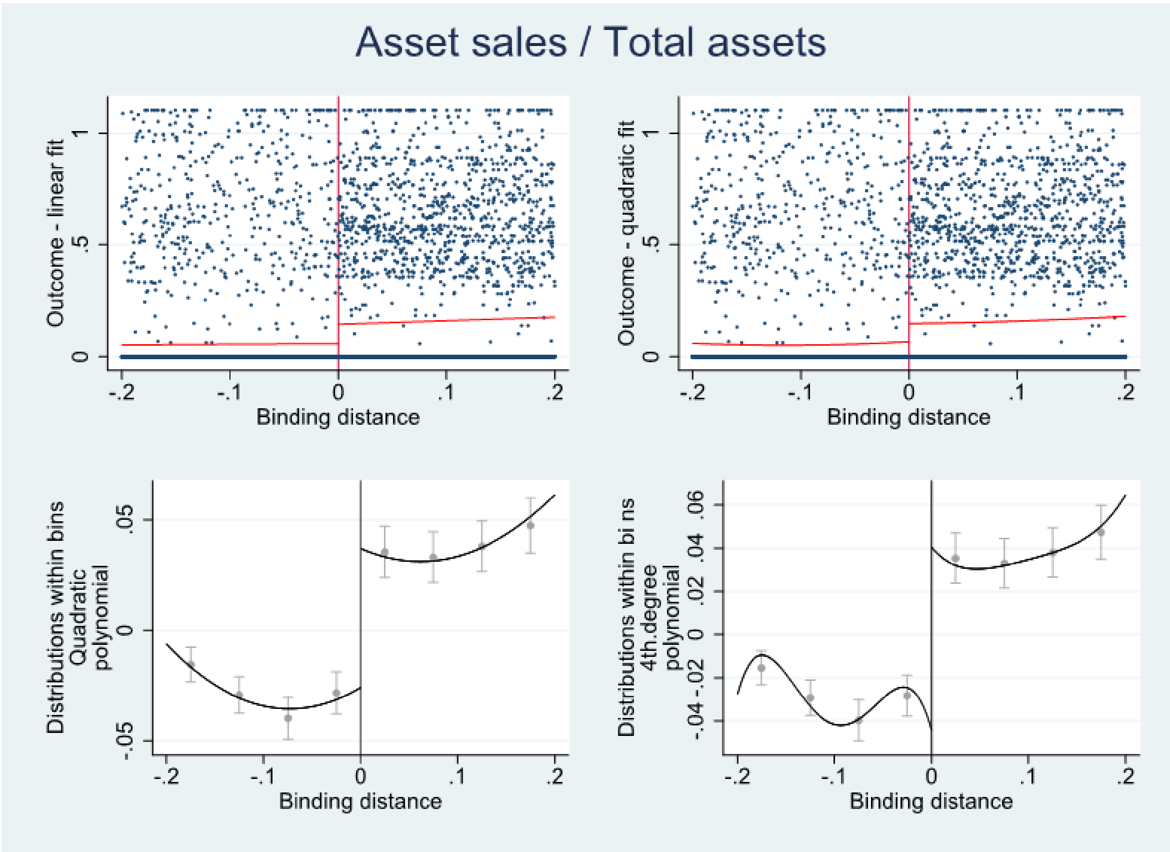


Figure A3: **Scatter plots and fitted polynomials: carve-outs** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of carve-outs in a given quarter.

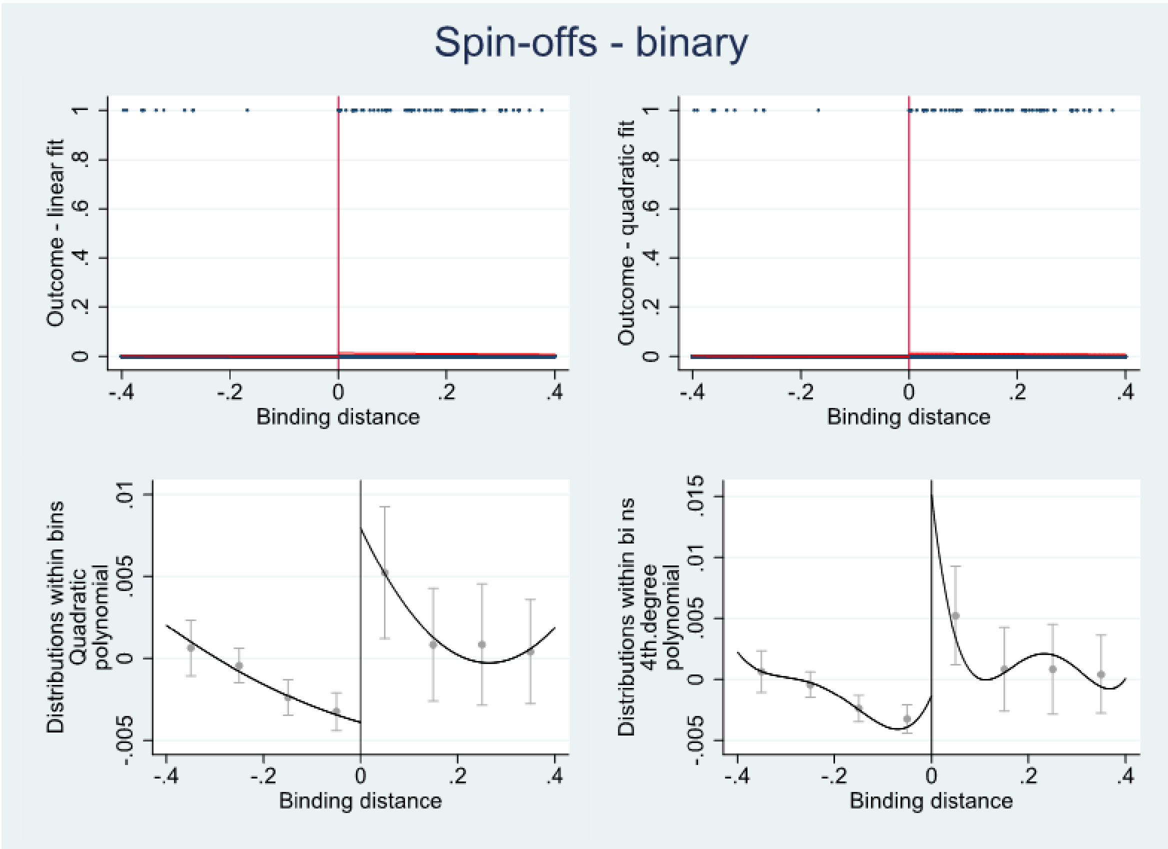


Figure A4: **Scatter plots and fitted polynomials: asset sales** This figure presents an identical set of charts to those in figure 1, for the binary variable denoting the occurrence of asset sales in a given quarter.

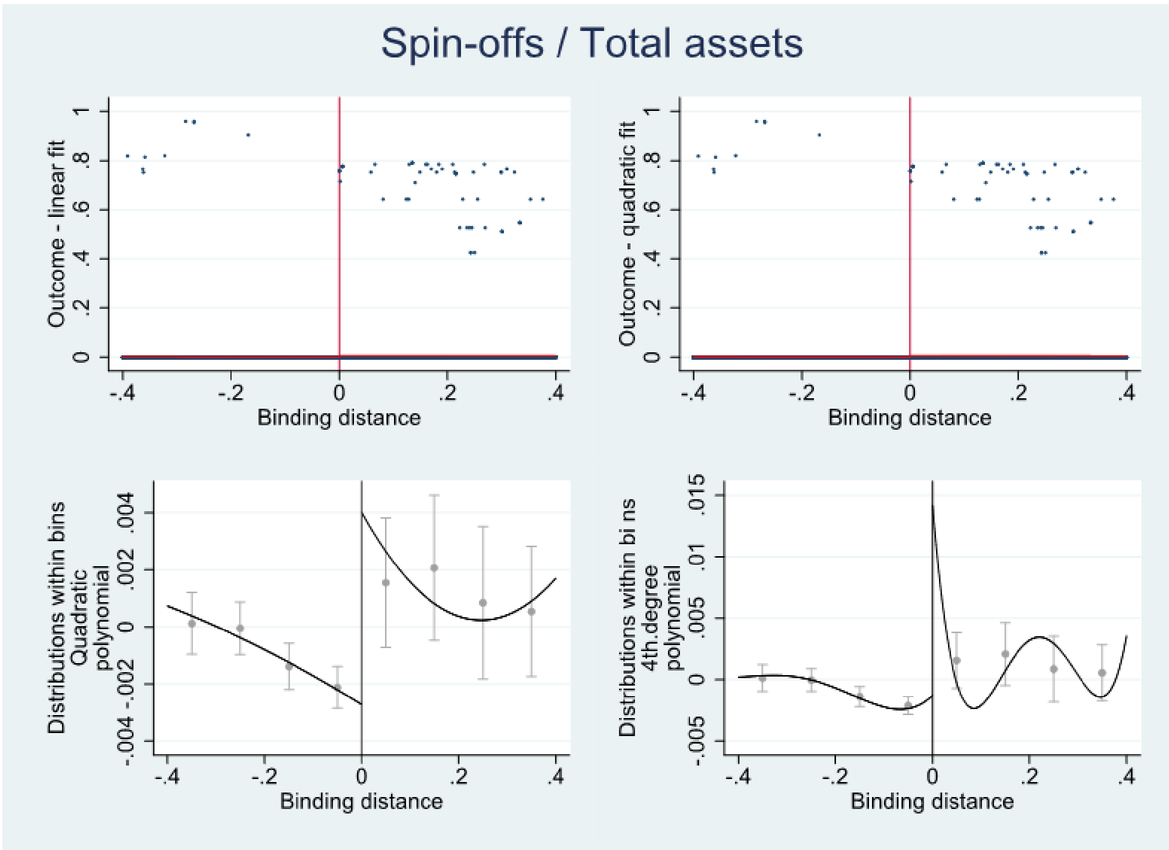


Figure A5: **Scatter plots and fitted polynomials: spin-offs** This figure presents an identical set of charts to those in figure 1, for the ratio of the value of spin-offs to total assets in a given quarter.

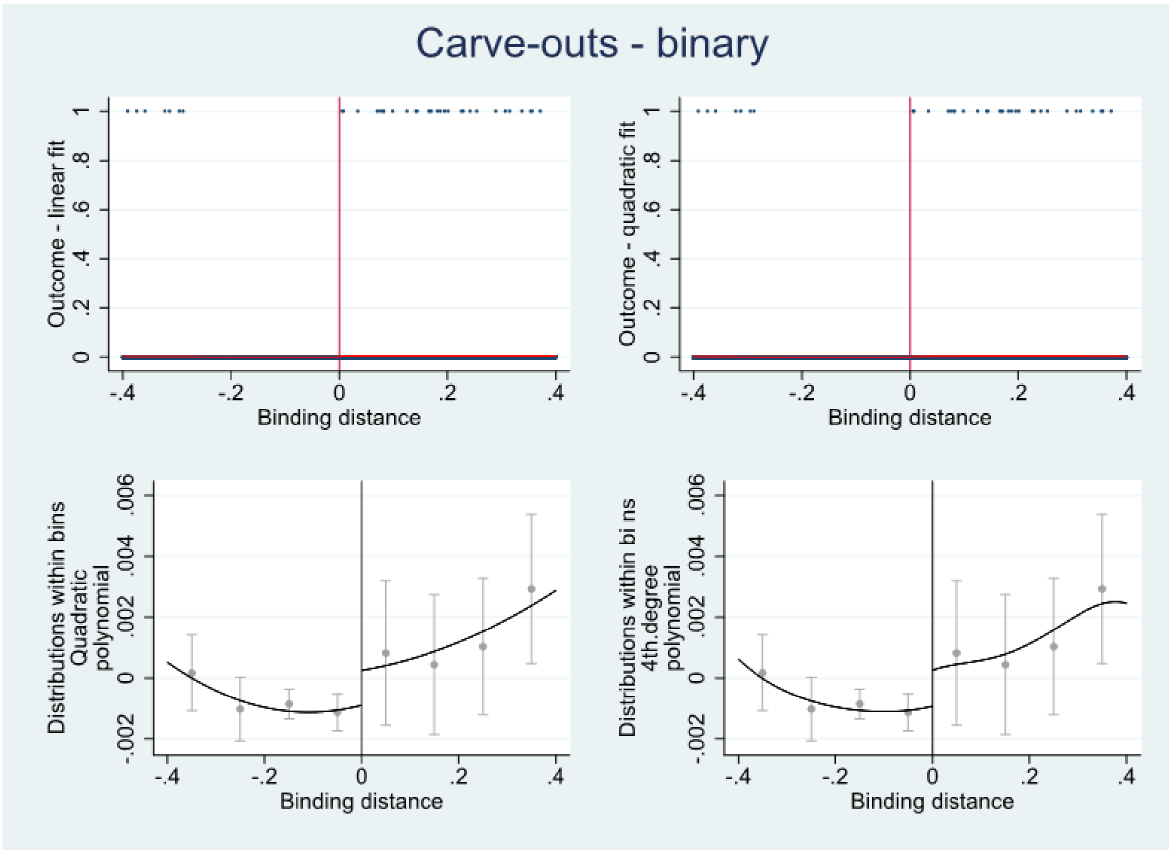
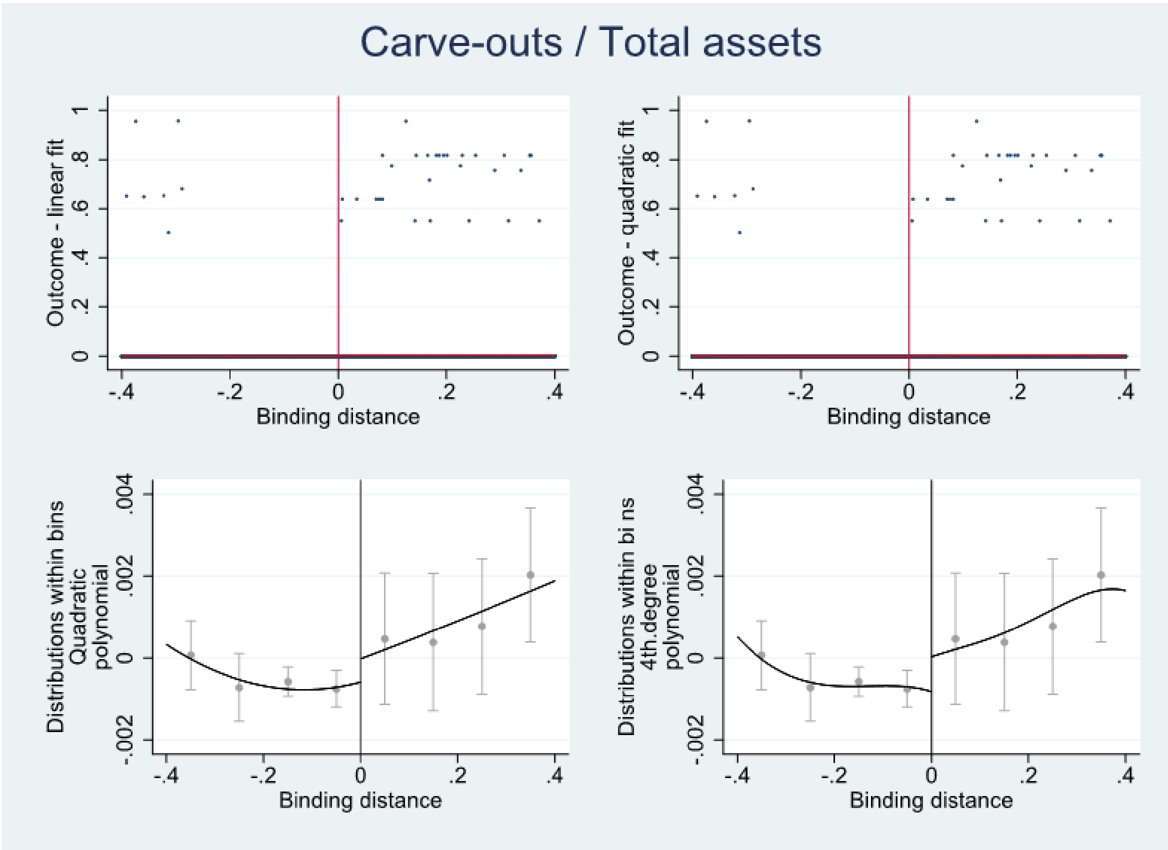


Figure A6: **Scatter plots and fitted polynomials: carve-outs** This figure presents an identical set of charts to those in figure 1, for the ratio between carved-out assets and total assets in a given quarter.



Chapter 2

Financial divisions in diversified firms

2.1 Introduction

Although corporate diversification is one of the most extensively studied topics in finance, most papers exclude conglomerates with financial divisions, claiming that such segments are inherently different and that including them in the analyses would potentially obfuscate results. Notwithstanding these issues of comparability, many conglomerates do have financial divisions and thus it seems natural to study their role, and this is the broad objective of our paper. We start by documenting that most financial divisions of US conglomerates fall under the classification of SIC 67 "Holdings and funds". While a division such as a holding company has potentially many functions, we believe it is plausible that operating *internal capital markets* be at the core of what they do.[2]

[2]When holding divisions exist in a conglomerate, they are responsible for centralizing management functions such as sales, marketing, and human resources management. More importantly for our paper, they are also responsible for strategy and finance, which are the key functional areas of an internal

Specifically, we envision a holding company employing a team of business specialists with a high level of financial expertise, who would be able to produce accurate estimates for each (non-financial) division's investment opportunities and thus guide the process of capital allocation. Based on this idea, we develop a simple model of internal capital markets and financial divisions, which predicts that such divisions would be more prevalent in firms that are larger, more diverse, and have more segments. These predictions are borne out by data, as is the hypothesis that internal capital markets are more efficient when conglomerates have a financial division. Finally, we also show that conglomerates with financial divisions have a valuation premium, as compared to otherwise similar firms.

We propose a simple model of internal capital markets and financial divisions that is closely related to existing literature on the topic (Gertner et al., 1994; Stein, 1997; Scharfstein and Stein, 2000; Rajan et al., 2000). The economy comprises business units that can be organized as standalone firms or diversified conglomerates. Each of these business units is endowed with a certain level of productivity and, ideally, more productive units would invest more capital. However, raising capital is costly, especially for large amounts, and this can compromise the unit's ability to operate at the ideal capacity. Such a friction is plausible and it follows the spirit of seminal literature on financial constraints (Froot et al., 1993).

In our model, division-level costs of raising capital are convex, and thus a collection of business units can raise funds more efficiently by having all units raise the same amount. Once these funds are pooled together, they can potentially be allocated to the units (or divisions) that are more productive. Alongside this potential advantage of internal capital markets, our model introduces a friction that can have a limiting effect.

capital market.

In particular, we assume that diversified firms bear a cost that is proportional to the heterogeneity of capital allocations across divisions, which implies that conglomerates will tend to display a *socialist* capital allocation (a term we borrow from Scharfstein and Stein, 2000). The mechanism we have in mind is that if headquarters has a reputation of implementing highly heterogeneous allocations, then this directs significant managerial effort to rent-seeking activities, which is in the spirit of Scharfstein and Stein (2000).

In the model, having a dedicated financial division comes with a fixed cost, but such a division minimizes the costs of implementing heterogeneous allocations. The presence of such a division, with a team of experts who carefully analyze the prospects presented by each division to headquarters, would limit the incentive of managers to direct effort in pretending to have better opportunities than they really do. By reducing costs associated with heterogeneity, the dedicated financial division would then allow more capital to flow to high-productivity segments. The contribution of such a division will be higher for larger firms (given the presence of a fixed cost), for firms with more diverse divisions in terms of productivity (otherwise there is no advantage in having heterogeneous allocations to begin with), and also for firms with more segments (holding diversity and total size constant). The latter effect is the least obvious and more novel, and it follows from our assumption that divisions benchmark their allocation to that of the top division. With more segments, the top segment is more of an outlier in terms of productivity even after accounting for "first-order diversity", which means the firm has more to gain in relaxing the costs associated with allocation heterogeneity.

We now turn to our empirical results. Using a sample of conglomerates from the United States, we find that 9% of conglomerates have a financial division, representing 12% in assets value. Moreover, despite the general downward trend in corporate diversification, the proportion of conglomerates that have a financial segment has mostly increased over time, decreasing only after the 2007/2008 financial crisis (see Figure 2.4). As mentioned before, "Holdings and funds" are the most frequent financial segment in conglomerates with financial divisions, and are present in more than 50% of these conglomerates. The second most common financial divisions are "credit agencies", which are present in 26% of these firms. The role of these credit agencies is usually to provide finance to the conglomerate's customers (Bodnaruk et al., 2016). "Banks", "insurance", and "market dealers" are fairly uncommon divisions. Given the much larger frequency of holdings, we focus most of our analysis on them. As explained above, we conjecture that holding divisions help to more formally operationalize the internal capital market of the conglomerate.

As predicted by the model, we find that conglomerates with financial divisions are larger, have more business segments, and have more diverse investment opportunities. In fact, in univariate results we show that conglomerates with financial divisions are more than double the size of conglomerates without a financial division as measured by sales or assets. We also run probit and linear probability model regressions to understand which conglomerates chose to have a holding division, which confirm the univariate results.

To test our key assumption that financial divisions improve the operation of internal capital markets, we look at efficiency measures from previous literature: absolute value added by allocation (AVA) and value added by cross-divisional transfers (VAT). These measures, proposed by Rajan et al. (2000), aim to capture the extent to which the conglomerate efficiently allocates capital across its divisions, by transferring resources from divisions with relatively low resource-weighted growth opportunities to the ones with high resource-weighted growth opportunities. We find that financial conglomerates have a significantly more efficient capital allocation when compared to other conglomerates, and that these results are mostly driven by holding divisions. When observing the behavior of financial conglomerates during the crisis, we show that they do not seem as affected by external credit market tightness: they increase their leverage and invest in tangible assets during this period relatively more than other conglomerates.

If indeed financial divisions operate internal capital markets more efficiently, we also expect conglomerates with such divisions to perform better when external capital market conditions are tighter (Matvos and Seru, 2014; Matvos et al., 2016; Kuppuswamy and Villalonga, 2015). We test whether this is the case using the VIX (Chicago Board Options Exchange Volatility Index) as a measure of external market frictions. We find that conglomerates with holding divisions and at least two other non-financial segments perform better in terms of internal capital allocation than other conglomerates otherwise similar when external market conditions are tighter.

In addition to analyzing the determinants of when a conglomerate has a holding division and how such a holding impacts the internal capital market, we also study the association between holding divisions and firm value. We start by comparing the valuation of conglomerates with and without a financial segment. We find that financial conglomerates are valued at a premium when compared to otherwise similar conglomerates. We estimate this premium to be between 5.7% and 9.3% of firm value, and we find that this can be mostly attributed to holding divisions as opposed to other types of financial segments. Although we do not have a clean identification for assessing value effects, we interpret these results as suggesting that financial divisions add to firm value in a quantitatively meaningful way.

Lastly we run what we view as a placebo test of the internal-capital-markets hypothesis. Here we focus on diversified firms that combine a financial division with a non-financial division, and check whether they perform better in terms of internal capital market allocation. For these firms we conjecture the financial division acts just as a placebo: there is really no internal capital market to operate, since there is only a non-financial division. We find no significant correlation between AVA and the presence of a financial division in such conglomerates.

Diversified firms represent a large fraction of the world economy and have been extensively studied by economists. Coase (1937) was the first to discuss firm boundaries. Since then, mixed evidence has emerged with respect to the value of being diversified and operating an internal capital market. Two main views have been offered with respect to the efficiency of capital allocation within these firms. One view is that conglomerates operate an efficient internal capital market, allocating resources optimally across divisions and offering an advantage with respect to standalone firms when external capital markets experience or temporarily face turmoil. The case for the bright side of conglomerates, as proposed by Stein (1997) among others, is supported by evidence that conglomerates perform better than standalone firms during times when capital markets are impaired (Matvos and Seru, 2014; Matvos et al., 2016; Kuppuswamy and Villalonga, 2015) or in economies where external financial markets are less developed (Khanna and Palepu, 2000; Fauver et al., 2004). The alternative view is that internal capital markets work inefficiently by subsidizing poorly performing divisions, which would not happen if these divisions were standalone firms subject to external market discipline (Rajan et al., 2000; Scharfstein and Stein, 2000). Our paper shows that reality is more nuanced, and that whether and how internal capital markets operate depends on the existence of dedicated financial divisions.

We also contribute to the recent literature showing that conglomerates are more valuable when external markets conditions are tighter because they benefit from their own internal capital market (Matvos and Seru, 2014; Matvos et al., 2016; Kuppuswamy and Villalonga, 2015). We offer new insights on how internal capital markets work, and we show that financial divisions, namely, holding divisions, play a role in internal capital allocation. We also document a set of new empirical facts about conglomerates with a financial division that have not been covered by the previous studies. The literature on financial subsidiaries has mostly focused on captive finance and on the advantages of providing credit to your customers. We show that there is a value premium associated with financial divisions that is not restricted to credit agencies but is mostly linked to holding divisions. We propose a new mechanism for this association and argue that holdings are relevant divisions for operationalizing internal capital markets.

The paper proceeds as follows. Section 2.2 develops our theoretical framework. Section 3.3 summarizes the data referring to US conglomerates that have financial segments. Section 2.4 contains our empirical tests. Section 3.6 concludes.

2.2 A model of internal capital markets and financial divisions

A1.1 Single-division benchmark

First let us introduce a model for a benchmark single-segment firm. Its value, denoted by V_b, is given by the following expression:

$$V_b = A\,k - \frac{\gamma}{2}k^2 - \frac{\phi}{2}w^2, \tag{2.1}$$

where k is the amount the firm chooses to invest and w is the level of funds raised by the firm. For simplicity we assume the firm has no internal funds, and thus the constraint $k \leq w$ needs to be verified. As for the other parameters,

- A captures the profitability/productivity of the firm;

- γ captures decreasing returns to scale; and

- ϕ scales the cost of accessing external financing, which increases quadratically with the amount raised. These costs represent, for example: the shadow value of collateral that may need to be pledged, fees of lawyers and other specialists involved in accessing external finance, the opportunity cost of managerial time devoted to outside-financing activities (e.g., roadshows, meetings).

Determining the optimal level of k is a simple optimization problem and thus the details are omitted. The value of the firm evaluated at the optimal k is given by

$$V_b^* = \frac{A^2}{\gamma + \phi}, \tag{2.2}$$

which is economically intuitive. We will use this benchmark value when computing the value added by corporate diversification and, more importantly, the value added by financial divisions.

A1.2 Two-segment conglomerate

In this section, a diversified firm comprises two divisions, indexed by $i \in \{1, 2\}$. Absent a financial division, this conglomerate solves the following maximization problem:

$$\max_{\{k_i, w_i\}} \quad \sum_i \left[A_i k_i - \frac{\gamma}{2} k_i^2 - \frac{\phi}{2} w_i^2 \right] - \underbrace{\frac{\eta}{2}(k_1 - k_2)^2}_{\text{socialism effect}} \tag{2.3}$$

$$\text{s.t.} \quad \sum_i k_i \leq \sum_i w_i \tag{2.4}$$

$$k_i \geq 0 \tag{2.5}$$

The above model of corporate diversification captures two relevant features of internal capital markets (ICMs): (i) diversified firms are allowed to pool raised funds together and allocate these funds to investment in a way that maximizes value; (ii) it is hard for the firm to implement highly heterogeneous policies across divisions, and this *socialism* friction is captured by parameter η;[3] To illustrate the mechanisms we have in mind for how corporate socialism affects value, consider for instance the fact that managers decide to spend more time doing "politics" inside the firm whenever they have lower allocations; the extra time spent in politics could have been used for other valuable managerial activities and thus represents an opportunity cost. Alternatively, and in a more behavioral vein, managers might perceive a lower allocation as being unfair (e.g., due to overconfidence about their own investment opportunities) and become less productive.

After some tedious but simple algebra, it is possible to show that the value of the conglomerate at the optimal, denoted by V_c^*, is given by

$$V_c^* = \frac{1}{4}\left[\frac{(A_1 + A_2)^2}{\gamma + \phi} + \frac{(A_1 - A_2)^2}{\gamma + 2\eta}\right]. \tag{2.6}$$

As with the single-segment benchmark, decreasing returns to scale and external-financing costs reduce firm value. Corporate diversification adds value, relative to the standalone benchmark, by minimizing the convex costs of external funds (it is optimal to set $w_i = w$), while potentially allocating more capital to the more productive segments. However, corporate socialism (the η parameter) can limit these gains, and this cost shows up in the second fraction of (2.6). Intuitively, the η parameter only matters if the divisions are diverse (i.e., have significantly different A_i); although of course without diversity there would be no benefits at all to diversification in this simple model of ICMs.

Turning now to the dedicated financial division, suppose the firm can set up such a segment with some fixed cost F.[4] Further, consider that the benefit of this division is to reduce the cost of socialism, e.g., by limiting the ability of divisional managers to

[3] Here we closely follow the ideas in Scharfstein and Stein (2000) and Rajan et al. (2000).

[4] This fixed cost could capture both the setup and running costs of the financial division.

manipulate the perception of investment opportunities by headquarters. For simplicity, we consider that with a dedicated financial division, corporate socialism vanishes, i.e., $\eta \to 0$. This is an admittedly extreme assumption, but if facilitates the exposition of our argument, which is qualitative in nature. Under these assumptions, the value added by the financial division excluding the fixed cost F, denoted by Δ_{fin}, is simply

$$\Delta_{fin} = V_c^*|_{\eta=0} - V_c^* = \frac{\eta(A_1 - A_2)^2}{2\gamma(\gamma + 2\eta)}. \tag{2.7}$$

If we re-write A_1 and A_2 as follows,

$$A_1 = S(1+\sigma) \tag{2.8}$$

$$A_2 = S(1-\sigma), \tag{2.9}$$

where S captures the scale or level of the division's opportunities and σ captures cross-division diversity, then we can re-write (2.7) as

$$\Delta_{fin} = \frac{2\eta\sigma^2 S^2}{\gamma(\gamma + 2\eta)}. \tag{2.10}$$

According to expression (2.10), we should expect diversified firms to adopt a financial division whenever they are larger (an admittedly trivial implication of our model), but also when the segments are more diverse. Moreover, the value effects and the contribution of the financial division to the functioning of ICMs should also increase in size and diversity.

In our model, the role that financial divisions play when divisions are very diverse can be particularly important. What we mean by this is that for high enough socialism cost η, corporate diversification can only add value if there exists a financial division. Thus, financial divisions sometimes are *enablers* of conglomeration (and not just "improvers"). This is illustrated in Figure 2.1.

A1.3 N-segment conglomerates

This section generalizes the two-division setup to N segments. A key aspect of this more general setup is that is not obvious how to model corporate socialism. In particular, does each division compare itself to every other division? Or, alternatively, to the mean? We chose a specification that nests the two-division instance from before and is also formally simple: divisions compare their allocation to that of the division that obtains the most capital.

A second important modeling choice is how to measure diversity across segments, since we want to understand the effect of the number of segments by itself. We chose an approach where segments are ordered according to their productivity A_i, with $A_{i+1} \geq A_i$, and where we assume

$$A_i = S\left[1 - \frac{2\sigma(N+1)}{N} + \frac{4\sigma}{N} i\right]. \tag{2.11}$$

The key implications of the above definition are contained in lemma 1 (proof is provided in the appendix).

Lemma 1. *Using equation* (2.11) *to define segment-level productivity in an N-segment conglomerate, the following is true:*

1. *The average A_i equals S.*

2. *For even N, the average absolute deviation of A_i equals $S\sigma$.*[5]

3. *The difference between the maximal and minimal A_i is given by*

$$A_N - A_1 = 4S\sigma\left(1 - \frac{1}{N}\right). \tag{2.12}$$

The last point in the proposition is important, since it implies that, controlling

[5] This result does not hold if N is odd. However it holds approximately and, as N grows, the absolute deviation for odd-N conglomerates does converge to $S\sigma$. Given this argument we do not exclude odd N in our numerical examples. Please see the proof of the lemma for details.

for first-order dispersion σ, higher-order diversity increases in the number of segments. Given our assumption that the biggest division (in principle the one with productivity A_N) is the reference point for all others when computing allocation inequality, then this will imply a higher cost of implementing unequal allocations (and, hence, a higher cost of corporate socialism).

The optimization problem solved by the conglomerate is formalized below.

$$\max_{\{k_i,w_i\}} \quad \sum_{i=1}^{N}\left[A_i k_i - \frac{\gamma}{2}k_i^2 - \frac{\phi}{2}w_i^2 - \frac{\eta}{2}(k_i - k_N)^2\right] \tag{2.13}$$

$$\text{s.t.} \quad \sum_i k_i \leq \sum_i w_i \tag{2.14}$$

$$k_i \geq 0 \tag{2.15}$$

$$k_{i+1} \geq k_i \tag{2.16}$$

Relative to the two-division case there are two differences. First, the objective function refers to division N as the reference point and there is a cost of inequality borne by every other division. Second, we introduced the constraint (2.16). We believe this is reasonable, since the firm could also face organizational problems from allocating less capital to a more profitable division. Importantly, this assumption implies that using division N as the reference point makes sense, since it will indeed be the division with the highest capital allocation.[6] These arguments notwithstanding, we focus on cases with interior solutions, i.e., where constraint (2.16) is not binding. The solution to the above optimization problem is outlined in proposition 1 (proof presented in the appendix).

Proposition 1. *An interior solution to the optimization program described by* (2.13)-

[6] Without constraint (2.16), it becomes optimal in some numerical instances to set, for example, $k_N < k_{N-1}$. This tends to occur with high N, since by lowering k_N you are saving corporate-socialism costs in many other divisions (division N is, in a sense, "sacrificed" for the common good of the firm). But this then raises the question of why division N is the reference point. We also note that having an endogenous reference point (the division with maximal k_i) would make the model much less tractable.

(2.16) *is characterized by the following:*

$$w_i = \frac{S}{\gamma + \phi} =: w \tag{2.17}$$

$$k_N = w + \frac{A_N - S}{\gamma + N\eta} \tag{2.18}$$

$$k_i|_{i \neq N} = w + \frac{A_i - S}{\gamma + \eta} + \frac{\eta(A_N - S)}{(\gamma + \eta)(\gamma + N\eta)} \tag{2.19}$$

As in the two-segment case, it is optimal for all divisions to raise the same amount, since this minimizes the (convex) costs of external funds. The allocation for the most productive division (k_N), given by (2.18), increases in the difference between this division's productivity (A_N) and the average productivity (S). k_N decreases in the product of η and N; since corporate socialism is now affecting all other divisions. Therefore, the higher the number of segments, the stronger the distortion to k_N. The capital allocation for all other divisions (k_i) also captures the corporate-socialism effect. Specifically, the last fraction in (2.19) states that, everything else equal, division i should invest more when the highest productivity A_N increases, as long as $\eta > 0$. This follows from the fact that a higher A_N implies a higher k_N, and thus at the margin it becomes optimal to have a higher k_i (to minimize corporate-socialism costs).

As before, we assume that introducing a financial division eliminates corporate socialism costs (i.e., $\eta \to 0$). Figure 2.2 provides an example of how such a financial division would impact allocations in conglomerates with a different number of segments. As expected, the distortion to k_N is stronger when the number of segments N is high, which suggests that the financial division will have a stronger contribution in firms with more segments. Figure 2.3 shows that this is the case, at least for our choice of parameters. Specifically, even after scaling the contribution of the financial division by total conglomerate size, adding the financial division has more impact in firms with more divisions (right panel).

2.3 Data

Firms in the US have to report segment-specific accounts if these segments meet certain conditions: if 10% or more of their total revenue comes from sales to external customers; if 10% or more of total assets are allocated to that segment; or if their net income represents 10% or more of the total net income. We build a firm-segment-year panel using Compustat segment files and Compustat annual firm data from 1976 to 2014 that is collapsed to a firm-year panel for part of our analysis. We apply the most standard filters in the literature to these data: (1) we eliminate duplicates in segment data resulting from updating of accounting data; (2) we eliminate segments with identifier = 99 and segments with SIC codes for primary sector, families/individuals, public sector, membership organizations, and unclassified; (3) firms with negative total assets or sales; and (4) firms with a sum of segment sales differing by more than 5% from firm-level data. We treat firms solely composed of financial segments (e.g., banks, insurance companies, and other financials) as standalone firms. The main ratios and log variables are winsorized at 1%.

Our yearly firm panel has a total of 172,663 firm-year observations and 20,015 firms, with 1.53 segments per firm, on average. We split our data into three subsamples: (1) standalones, (2) conglomerates (firms with more than one segment, and none which are financial), and (3) conglomerates with financial segments. The latter is our group of interest. We define financial divisions as any segment with an SIC code between 6000 and 6999. These include depositary institutions/banks (SIC 60); non-depositary institutions/credit agencies (SIC 61); market brokers, dealers (SIC 62); insurance (SIC 63); insurance agency, brokerage (SIC 64); real estate (SIC 65); and holdings, funds (SIC 67). Conglomerates with financial divisions represent 9% of the total number of conglomerates, and are on average larger than other conglomerates (12% of total assets).

Table 2.1 shows the summary statistics for these three groups. Conglomerates with financial divisions are on average much larger than other conglomerates, being more than double their size as measured by assets. They also have more segments (3.5 vs. 2.9), even though they have similar diversity and concentration as measured by the Herfindahl index. As for performance, these conglomerates show higher Tobin's q (1.7 vs. 1.6) and a higher market-to-sales ratio (4.1 vs. 2.9); and also show more efficient internal capital markets as measured by the absolute value added by allocation (AVA) measure (1.6 vs. 0.2) and the value added by cross-divisional transfers (VAT) measure (0.02 vs. 0.001). Leverage is higher for financial conglomerates (0.35 vs. 0.29), and cash holdings show no significant difference.

These univariate results are in line with the notion that conglomerates with financial divisions are different from conglomerates without financial divisions. They show superior performance by standard metrics, in addition to having more efficient capital markets. The fact that measures of efficiency of capital allocation are significantly larger suggests that financial divisions play an active role in internal capital markets. We further test this hypothesis in the next section.

Finally, even though the number of non-financial conglomerates with financial segments has decreased over time, following the same trend as conglomerates in general (Anjos and Fracassi, 2017), their weight among conglomerates has increased over the last decades; only to fall after the recent financial crisis in 2009 (see Figure 2.4).

A1.1 Conglomerates with financial segments

We use segment-level data to characterize conglomerates with financial divisions. Table 2.2 shows the industry characterization of these conglomerates. Holdings and funds are the most frequent segments (1,416 observations, which represent almost 50% of these conglomerates). Holdings and funds divisions represent 16% of the total number of financial segments for conglomerates with a financial division. Credit agencies are the second most frequent financial segment, with 11% of these segments (table 2.2) and a presence in more than 30% of these conglomerates (table 2.3). All the other financial divisions represent less than 5% of these segments. When looking at assets weights of these segments in their specific conglomerate, the rank is quite different. Banks, credit agencies, and insurance divisions all represent on average more than 30% of the assets of the conglomerate, with holdings and funds having a weight of less than 20%.

Table 2.3 shows summary statistics at the segment level and firm level by financial divisions of conglomerates. Panel A shows statistics at the segment level. Banks, credit agencies, and insurance divisions are the largest divisions. Interestingly, holdings and funds, being the most frequent division in these conglomerates, are also the second smallest by assets and by sales. This is consistent with holdings being important to operationalize internal capital markets. Nevertheless, in order to perform that function, they do not need to represent, at year end, a substantial part of the business/assets of the conglomerate.

Panel B shows statistics at the firm level. Depository institutions, credit agencies, and insurance divisions are part of the largest conglomerates. Conglomerates with these financial divisions are much larger than the average conglomerate, being more than three times the size of the average non-financial conglomerate. Holdings and funds, insurance agencies, and real estate are part of smaller conglomerates, but comparable in size to the average conglomerate.

Conglomerates with holdings divisions are of particular interest because these are the divisions that most likely can play an active role in internal capital allocation. We find that conglomerates with a holding division exhibit striking differences in overall firm performance and metrics of internal capital markets efficiency. The average Tobin's q of conglomerates with holdings divisions is 2.04, in contrast to an average Tobin's q of conglomerates of 1.6. The difference in the market-to-sales ratio is even more pronounced: 6.2 for conglomerates with holdings versus 2.9 for the average conglomerate. When looking at internal capital markets measures, the difference is again striking. Conglomerates with holdings divisions have an AVA of 3.5, whereas other conglomerates with financial divisions have an average value of 0.5. If we compare holdings with other conglomerates that do not have financial divisions, the difference is even larger at 3.3. The results are similar when we look at value added by division transfers. Holdings perform much better in this metric than any of the other conglomerates, including the ones with other financial divisions. Interestingly, these conglomerates also have much larger capex-to-sales ratios: 15% vs. 10% for all the other conglomerates.

The univariate analysis seems to suggest that conglomerates with financial divisions, in particular the ones with holdings and funds segments, enjoy better performance than other conglomerates. We conjecture that holdings divisions play an active role in internal capital allocation by setting goals by area, making investment decisions, and operationalizing the portfolio strategy of the conglomerate. Overall, they should also ensure that cash flows from each division are collected as part of the cash pooling process and then redistributed in an efficient way. Causality cannot be inferred from this analysis. We cannot say if these conglomerates perform better because they have a holding division, or if they have these divisions because they have better-functioning internal capital markets. It might also be that other covariates explain these correlations. Even without being able to establish a causal effect, however, these results clearly show that firms with financial holdings have more efficient internal capital markets.

The most comprehensive presence in this set of non-financial industries is by "holdings/funds" and "real estate" divisions. These most frequent non-financial industries are typically associated to larger companies in most cases, encompassing industrial and construction businesses, as well utilities and regulated sectors (not shown).

Although the industry of holdings/funds mostly presents low shares in the total assets of each subclass, this is notoriously not the case for firms with (building) construction and communication divisions. We infer that a large allocation of resources should not be rare in this type of segments.

2.4 Empirical results

A1.1 Determinants of financial divisions

Table 2.4 shows the results of linear probability and probit models on the determinants to have a holding division. The dependent variable on these regressions is a dummy variable equal to one if the conglomerate has a holding division (SIC 67) and has at least two non-financial divisions. In columns (1) and (3) we find that having a holding division is positively related to the size of the company: the larger the company is, the more likely it is to have a holding division. Based on specifications (1)-(3), a 10 billion USD change in total assets (the standard deviation in total assets is about 9 billion USD for conglomerates) corresponds to a 1 percentage point increase in the probability of having a holding division.

We also find that firms with more current and future investment opportunities, as measured by Tobin's q and CAPX are more likely to have a holding division. A one-standard-deviation (2) increase in Tobin's q is associated with an increase of 0.4 percentage points in the probability of having a holding division (from specification 1). An increase of one standard deviation in CAPX is associated with an increase of 0.1 percentage points in the probability of having such division.

Our model suggests precisely that larger firms, with more investment opportunities, will find it optimal to have a holding division. The model suggests as well that firms with a more diverse set of investment opportunities, for which the potential of corporate socialism is higher, also benefit from the presence of a holding division. Taking specification (2) as a base case, we find that a one-standard-deviation increase in diversity is associated with an increase of 2 percentage points in the probability of a having a holding division. This effect is economically large, especially when we compare to the effect of other firm characteristics. Lastly we look at the number of segments. We find that one more business segment is associated with an increase in the probability of having a holding division by 2 percentage points as well.

The results with probit specifications are very much consistent with the linear probability model.

A1.2 Financial divisions and internal capital markets

A1.2.1 Methodology

Next we use absolute value added by allocation (AVA) (Rajan et al., 2000) to test whether conglomerates with financial divisions do indeed have more efficient internal capital markets. AVA is defined as

$$AVA = \frac{1}{BA}\sum_j BA_j(q_j - 1)\left(\frac{I_j}{BA_j} - \frac{I_j^{sa}}{BA_j^{sa}}\right), \quad (2.20)$$

where BA_j is the book value of assets, and I_j the capital expenditure, of segment j. BA_j^{sa} is the book value of assets, and I_j^{sa} the average capital expenditure, of the corresponding standalone firms.

A1.2.2 Results

Table 2.5 shows the results of regressions of AVA on the main variable of interest, which is the holding division dummy. We find that firms with a holding division show significantly higher AVA. The presence of a holding division is associated with between 0.02 and 0.03 more AVA, which represents 10% more AVA evaluated at the mean for conglomerates with no financial divisions. The result is robust across specifications, also including firm fixed effects, which suggests that not only cross-sectional variation, but also within-firm variation, contribute to this association. In the firm-fixed-effects regressions the identification is coming from firms that either introduce or remove the holding division.

In specifications (4) and (8) we interact diversity with the holding dummy and find a positive and significant coefficient. This result suggests that holding companies are particularly important for high-diversity firms, which is consistent with our theoretical framework.

Overall, these results are consistent with the notion that holding divisions are important for the efficiency of internal capital markets.

The bright side of corporate diversification is typically associated with an efficient and well-functioning internal capital market that takes advantage of resource reallocation and pooling of cash flows when firms face difficulties in accessing external markets. Recent evidence indeed suggests that conglomerates are more valuable when external market conditions are tighter (Matvos and Seru, 2014; Kuppuswamy and Villalonga, 2015).

Our previous results are consistent with a positive effect of holding divisions on the way internal capital markets are run. We search for additional evidence that these divisions are associated with more efficient internal capital markets by exploring variation in external market conditions in the spirit of Matvos et al. (2016) and Kuppuswamy and Villalonga (2015). Specifically, we test if conglomerates with holding divisions have more efficient capital allocation when compared to other conglomerates in times when external market conditions are tighter. We use VIX (Chicago Board Options Exchange Volatility Index) as a measure of external market frictions. Table 2.6 shows the results.

Our dependent variable in all specifications is AVA. We find that holding divisions are associated with higher AVAs, especially in times of high frictions as measured by VIX. We find that the interaction term between VIX and the holding dummy is positive and significant when we explore cross-sectional variation, but also time-series variation within the firm. For instance, focusing on specification (6), which includes firms fixed effects, we find that for a one-standard-deviation change in VIX, firms with holding divisions experience an increase in AVA of 0.03, which corresponds to an increase of 15% evaluated at the mean AVA for conglomerates with no such division.

These results are consistent with our theoretical framework, and conjecture that holding divisions improve the operation of internal capital markets, especially when external financial frictions are high and internal capital markets are potentially more valuable.

A1.3 Financial divisions and firm value

A1.3.1 Methodology

The methodology typically used to study the value of diversified firms against standalones is based upon replicating portfolios, which comprise industry averages or medians of Tobin's q or market-to-sales ratios, weighted by segments' assets or sales. The use of this approach to non-financial conglomerates with financial segments raises concerns because these metrics are not comparable across financial and non-financial firms, mostly due to financial regulation and different accounting practices. In fact, market-to-sales ratios are likely biased upward for financial firms because volumes of total assets tend to have much larger magnitudes than the main flow variables. Conversely, Tobin's q of financial firms is most likely biased toward 1, due to widespread implementation of mark-to-market practices for financial assets.

Hence, this study uses a different method for assessing the valuation discount or premium in conglomerates with financial segments. The purpose is to be as neutral as possible about ex-ante distinctive features of the group of interest. Our method is based on saturated models of firm market value where there is a set of industry marginal contributions according to the weights of each firm segment. Each industry's weight in firms' total assets is used as a variable, while it is also interacted with a diversification dummy. The interaction term tells us, on average, the marginal value of being diversified in a given industry. This is particularly relevant for understanding whether financial segments are valuable divisions in diversified firms.

We test different specifications, including pooled OLS and firm fixed effects, but all of them stem from our main approach, built upon sector marginal contributions and interactions of industry variables with the diversification dummy. We also include year fixed effects in some specifications. When using the pooled OLS specification, we explore cross-sectional differences among conglomerates. With this methodology, we can compare conglomerates with and without a financial segment, and otherwise similar industry exposures. When using firm fixed effects, we exploit within-firm variation, and therefore our identification comes only from firms that change their exposure to a given industry: in the case of our conglomerates of interest, to the financial industry.

In our baseline specification, we pool the contribution of all financial segments into one variable ($FinSegDummy$) comprising the marginal component in the market value of the firms of interest. Industries are otherwise defined and classified according to 67 two-digit SIC codes, 7 of which correspond to financial industries. The following equation summarizes our main specification with firm and year fixed effects:

$$\begin{aligned}\log(MVA_t)_{it} \quad = \quad & \alpha \log(BVA)_{it} + \sum_{s=1}^{66} \beta_s w_{sit} + \sum_{j=1}^{59} \beta_j w_{jit} DivDummy_{it} + \beta_d DivDummy_{it} + \\ & \beta_f FinSegDummy_{it} + \gamma Controls_{it} + \delta_i + \delta_t + \epsilon_{it}, \end{aligned} \tag{2.21}$$

where MVA is the market value of assets of firm i at time t, BVA is the book value of assets, w is the weight of assets for segment s of firm i at time t, and $DivDummy$ is a dummy variable that is set to one if the firm reports more than one business segment at time t and zero otherwise. $FinSegDummy$ is a dummy variable that is set to one if the firm reports a segment in a financial industry. Our basic set of control variables includes the logarithm of a firm's book value of assets adjusted for goodwill, capex-to-sales, and EBIT-to-assets ratios. Additional controls include leverage and cash ratios.

A1.3.2 Results

There is mixed evidence in the literature with respect to the existence of an average diversification discount or premium.[7] However, the previous literature does seem to

[7] Lang and Stulz (1994) and Berger and Ofek (1995) stated the existence of a diversification discount, based upon an excess value measure, with replicating portfolios as benchmarks of Tobin's q's,

agree that most benefits of diversification are associated with an efficient and well-functioning internal capital market.

Our univariate results are consistent with a positive effect of holding divisions, which show higher Tobin's q and Market-to-sales ratios. However, they do not control for other factors that may affect valuation. We search for additional evidence that these divisions are associated with an efficient internal capital management market by studying the valuation of conglomerates with a holding division. Table 2.7 shows the results. We first run a pooled OLS regression of market valuation of firms on a holding division dummy (specification (1)). With this specification, we explore cross-sectional and also time-series variation (we exclude year dummies) in the value of conglomerates with and without a financial division. We also benchmark the value of both these conglomerates with standalone firms and we control for the presence of other financial divisions that do not correspond to a holding division. The holding division dummy coefficient is positive and significant at 0.093, which suggests a value premium of 9.3% of market valuation for having a such a division, when compared to an otherwise similar conglomerate. In specification (2), we add year fixed effects to our previous specification. We find a positive and significant premium of 5.8% for conglomerates with holding divisions. This result suggests that part of the holding premium estimated in specification (1) is associated with overall economic conditions captured by the year dummies.

So far, we have compared conglomerates with and without a holding division, and found a market value premium between 6% and 9% for the first group. When exploring within-firm variation by running firm-fixed-effects regressions, we also find a positive and significant value premium for having a holding division. Columns (3) and (4)

among other relative measures of market value. Campa and Kedia (2002) pointed to the endogeneity of diversification decisions and challenged previous estimations of the diversification discount with new methods (Heckman model, IV). Villalonga (2004) and Custódio (2014) suggest that measurement has important implications for the observed diversification discount.

show the results. In these specifications, identification is coming from firms that add or remove a financial segment. The value premium associated with adding a holding division in a conglomerate is estimated to be between 6% and 7%.

These results show a value premium associated to the presence of a holding division in conglomerates. Although we do not have an identification strategy that allows establishing a causal relation between having a holding division and firm value, we interpret these results as consistent with the notion that holding divisions are relevant to run efficient internal capital markets. Our theoretical framework helps to understand why not all conglomerates have such divisions. For some firms the cost of implementing such division might still be too high when compared to the benefits of enhancing internal capital markets.

A1.4 Placebo test

So far we interpret our results as evidence that holding divisions have an important role in managing internal capital markets. In this section we run what can be viewed as a placebo test. Specifically, we test if the presence of any financial segment in conglomerates with only one other non-financial division is also associated with better measures of internal capital markets efficiency. For these conglomerates the financial division cannot act as a facilitator of internal capital markets for the non-financial divisions, since there is only one of such divisions, and thus we call it a placebo. We show the results on table 2.8.

The dependent variable in all specifications is AVA. The independent variable of interest is Placebo, which is a dummy variable that takes the value one if the conglomerate has only two divisions, one of which is a financial division. We run OLS regressions and firm fixed effects, where we explore within-firm variation in the presence of such combination of divisions (one financial and one non-financial). In all specifications the placebo dummy is not statistically significant. In specifications (5) and (6) we add the holding dummy as previously defined and we obtain similar estimates as in the previous tests. The holding dummy coefficient is positive and significant with a point estimate of 0.03.

This test provides additional evidence consistent with the notion that the role of holding divisions is indeed to facilitate internal capital markets.

2.5 Conclusion

This paper documents a new set of empirical facts about conglomerates with financial divisions, and proposes a model where such financial divisions enhance the efficiency of internal capital markets. We confirm this hypothesis empirically, and we further show that the characteristics of the average conglomerate that chooses to have a financial division are consistent with the model: these firms are larger, more diverse, and have a higher number of segments. We also show that financial divisions are associated with a value premium in conglomerates when compared to otherwise similar firms. We contribute to the literature by analyzing an under-researched dimension of corporate diversification, specifically in understanding the economic role and impact of dedicated financial divisions such as holding companies.

Appendix of Chapter 2

Appendix – Proofs

Proof of lemma 1. Using expression (2.11), let us first establish the following intermediate result for the sum of A_i from 1 to some natural number $M \leq N$:

$$\sum_{i=1}^{M} A_i = S \left\{ M \left[1 - \frac{2\sigma}{N}(N+1) \right] + \frac{4\sigma}{N} \sum_{i=1}^{M} i \right\},$$

which after some simplification can be written as

$$SM \left[1 - \frac{2\sigma}{N}(N-M) \right], \tag{A.1}$$

where we have used the result that the sum of the first M natural numbers is $M(M+1)/2$. Turning to the first result in the lemma, we can set $M = N$ and use expression (A.1) to compute the average A_i:

$$\frac{1}{N} \sum_{i=1}^{N} A_i = S \left[1 - \frac{2\sigma}{N} \times 0 \right] = S.$$

Turning to the second result, we have that the average absolute deviation of A_i is given by

$$\frac{1}{N} \sum_{i=1}^{N} |A_i - S| = \frac{2}{N} \sum_{i=1}^{N/2} S - A_i,$$

which works because N is even (otherwise the absolute deviation would be smaller); and where we used the fact that $A_i < S$ for $i \leq N/2$. Combining the above expression with the result (A.1) (setting $M = N/2$), we can then write the average absolute deviation as

$$S - \frac{2}{N} S \frac{N}{2}(1-\sigma) = S\sigma.$$

The third result is immediately obtained by setting $i = 1$ and $i = N$ in equation (2.11). This concludes the proof.■

Proof of proposition 1. First note that w_i does not interact with A_i; therefore, in order to minimize the total convex costs of finance it must be the case that $w_i = w$ is optimal. Next, and since it is optimal to have the budget constraint bind, we can re-write (2.13) as

$$\sum_{i=1}^{N-1} A_i k_i - \frac{\gamma}{2} k_i^2 - \frac{\eta}{2} \left[\underbrace{Nw - \sum_{j=1}^{N-1}}_{=k_N} - k_i \right]^2$$

$$+ A_N \left(\underbrace{Nw - \sum_{j=1}^{N-1}}_{=k_N} \right) - \frac{\gamma}{2} \left(\underbrace{Nw - \sum_{j=1}^{N-1}}_{=k_N} \right)^2 - N \frac{\phi}{2} w^2 \qquad \text{(A.2)}$$

In an interior solution, the necessary and sufficient first-order conditions for k_i, with $i < N$, are

$$A_i - \gamma k_i + 2\eta(k_N - k_i) - A_N + \gamma k_N + \sum_{l \neq i, N} \eta(k_N - k_l) = 0.$$

After a few steps of algebra, the above simplifies into

$$k_i = \frac{A_i - A_N + k_N[\gamma + \eta(N+1)] - \eta N w}{\gamma + \eta}. \qquad \text{(A.3)}$$

Using (A.3) and combining with the budget constraint, we can write

$$\sum_{i=1}^{N-1} k_i + k_N = Nw \Leftrightarrow$$

$$k_N \left\{ 1 + \frac{(N-1)[\gamma + \eta(N+1)]}{\gamma + \eta} \right\} = Nw \left[1 + \frac{(N-1)\eta}{\gamma + \eta} \right] - \frac{1}{\gamma + \eta} \left(\sum_{i=1}^{N} A_i - N A_N \right).$$

The above simplifies into expression (2.18) in the proposition, where in the simplification we have used the fact that the average A_i is equal to S (or, equivalently, that the sum of A_i equals NS). The next step is to replace k_N in (A.3) with the solution (2.18), which after some manipulation yield (2.19) in the proposition. Finally, we can replace k_N and k_i in (A.3) with (2.18) and (2.19), respectively. Differentiating with respect to w and setting to zero then yields equation (2.17) in the proposition:

$$\sum_{i=1}^{N-1} [A_i - \gamma k_i - \eta(k_N - k_i) \times 0] + A_N - \gamma k_N - N\phi w = 0 \Leftrightarrow$$

$$\underbrace{\sum_{i=1}^{N-1} A_i + A_N}_{=NS} - \gamma \left(\underbrace{\sum_{i=1}^{N-1} + k_N}_{=Nw} \right) = N\phi w \Leftrightarrow w = \frac{S}{\gamma + \phi},$$

which concludes the proof.■

Proof of proposition 2. Let us start by computing the value of the firm when $k_i = w$ for all i:

$$V_c^* = \sum_i \left[A_i w - \frac{\gamma}{2} w^2 \right] - \frac{N\phi}{2} w^2,$$

which simplifies to

$$V_c^* = NSw - \frac{\gamma}{2} N w^2 - \frac{N\phi}{2} w^2. \tag{A.4}$$

Next let us consider the case with the financial division, i.e., setting $\eta = 0$. Then, for division i, we have

$$k_i = w + \frac{A_i - S}{\gamma},$$

where we used equation (2.19). Inserting this last expression into the objective function (2.13), and after some lengthy but trivial algebra, we obtain

$$V_c^*|_{\eta \to 0} = NSw - \frac{\gamma}{2} N w^2 + \frac{1}{2\gamma} \left(\sum_i A_i^2 - NS^2 \right) - \frac{N\phi}{2} w^2. \tag{A.5}$$

Using expressions (A.4) and (A.5), we can then write

$$\frac{\Delta_{fin}}{NS} = \frac{1}{2\gamma} \left(\frac{\sum_i A_i^2}{NS} - S \right),$$

which, again after some lengthy but trivial algebra, simplifies into

$$\frac{S}{2\gamma} \left\{ \left[1 - \frac{2\sigma(N+1)}{N} \right]^2 + \left[1 - \frac{2\sigma(N+1)}{N} \right] \frac{8\sigma}{N^2} \sum_i i + \frac{16\sigma^2}{N^3} \sum_i i^2 - 1 \right\}, \tag{A.6}$$

where we have made used of the definition of A_i from expression (2.11). Using Faulhaber's formulas,

$$\sum_{i=1}^{N} i = \frac{N(N+1)}{2} \quad (A.7)$$

$$\sum_{i=1}^{N} i^2 = \frac{N(N+1)(2N+1)}{6}, \quad (A.8)$$

equation (A.6) reduces, after some straightforward manipulations, to equation (A.7) in the proposition; and this concludes the proof.■

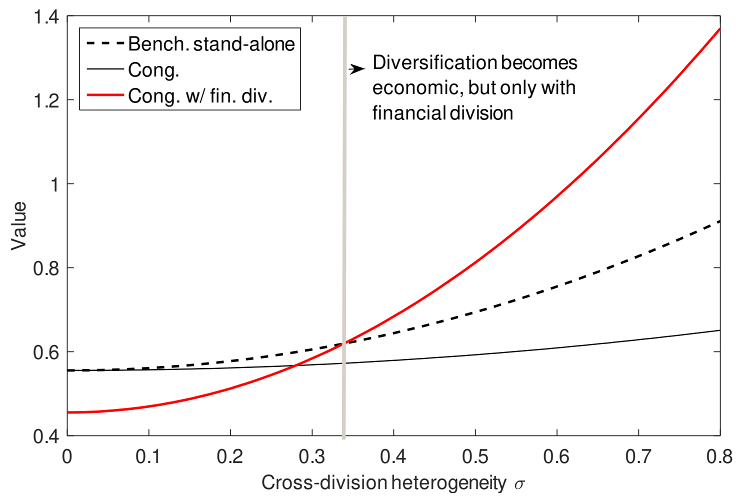


Figure 2.1: **Organizational form, diversity, and value.** The figure plots the value of a standalone benchmark (dashed line), the value of a simple conglomerate (black solid line), and the value of a conglomerate with a financial division (red line); as a function of cross-division diversity σ. Parameter choice: $S = 1$, $\gamma = 0.7$, $\phi = 1.1$, $\eta = 3$, $F = 0.1$.

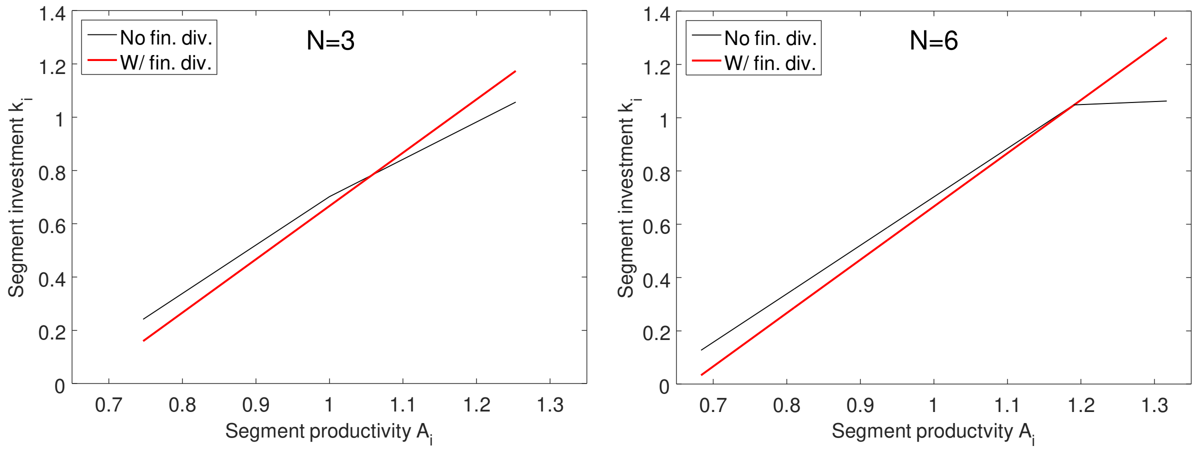


Figure 2.2: **Capital allocation across segments.** The figure plots each segment's productivity A_i (horizontal axis) against its allocation k_i (vertical axis). The left (right) panel depicts a conglomerate with $N = 3$ ($N = 6$) segments. Parameter choice: $S = 1$, $\gamma = 0.5$, $\phi = 1$, $\eta = 0.05$, $\sigma = 0.19$.

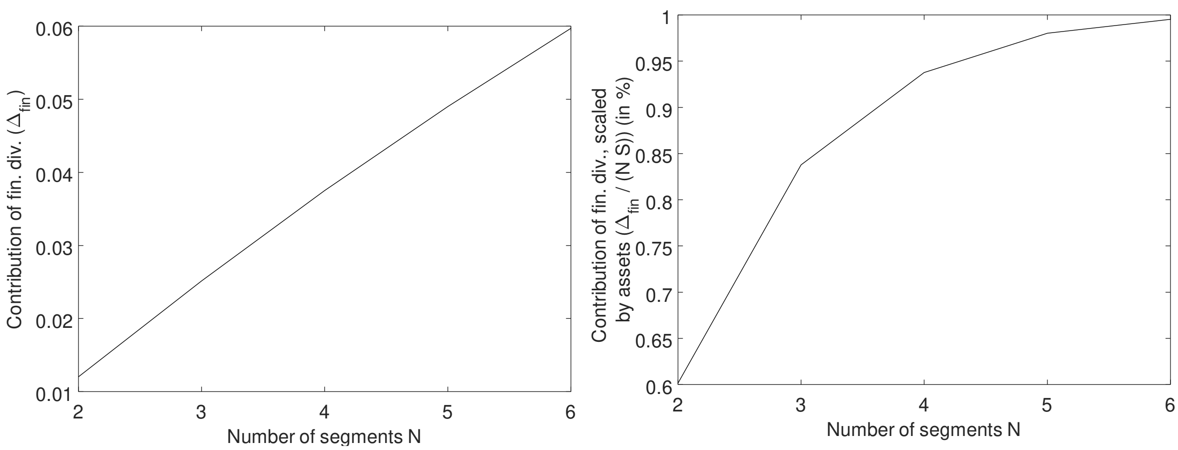


Figure 2.3: **Number of segments and the contribution of a financial division.** The figure plots the contribution of a financial division (excluding the fixed cost F), defined as the difference between the value of a conglomerate with $\eta = 0$ and the value of conglomerate with $\eta > 0$. The left panel depicts the contribution in terms of absolute value Δ_{fin}, the second scales the contribution by total size $N \times S$. Parameter choice: $S = 1$, $\gamma = 0.5$, $\phi = 1$, $\eta = 0.05$, $\sigma = 0.19$.

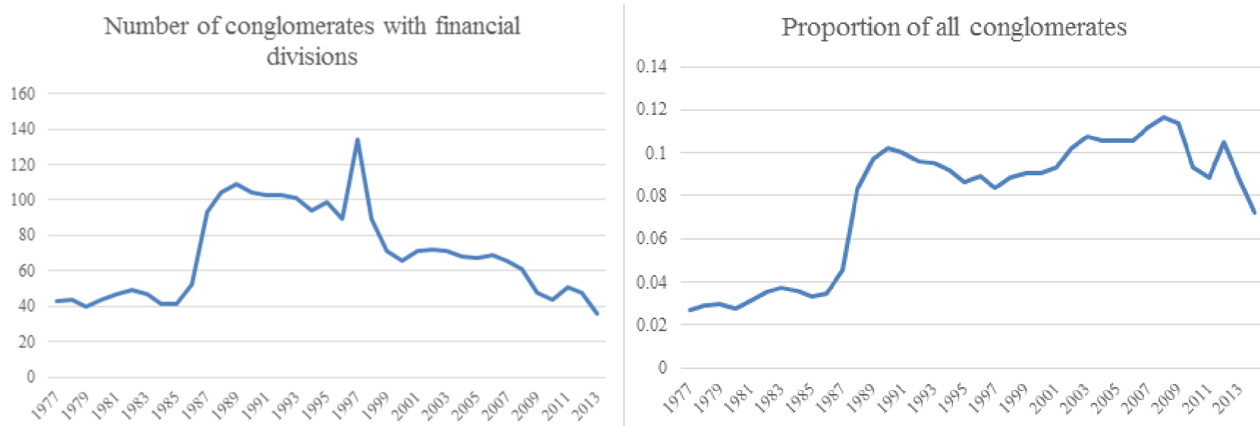


Figure 2.4: **Conglomerates with financial divisions (1977-2014).** The figure shows the number of conglomerates with financial segments over our sample period, and their proportion of all the conglomerates.

Table 2.1: **Summary statistics.** This table shows summary statistics of some financial measures for three subsamples: conglomerates with financial divisions, conglomerates without financial divisions, and standalone firms. Assets is the total stock of book assets of the firm. Sales is the firm's sales revenue. Tobin's q is the ratio of market-to-book value of assets. Market/Sales is the ratio of the market value of assets to sales. Ebit/Sales is the ratio of earnings before interest and tax to sales. Capex/Sales is the ratio of capital expenditures to sales. Leverage is the book ratio of total debt to assets. Herfindahl index is the concentration measure computed from the Herfindahl index of each segment's market shares within the firm. Diversity is the ratio of the standard deviation and the mean of each firm's segment Tobin's q's, winsorized at 1%. AVA is the absolute value added by capital allocation (x100), and VAT is the value added by cross-divisional transfers (x100), both computed according to Rajan et al. (2000).

	Mean	Median	St. dev.	Minimum	Maximum	Obs
	Panel A: Conglomerates with financial divisions					
Assets	4,723.198	684.874	11,282.590	0.015	120,431.0	3,039
Sales	3,076.996	614.070	6,703.807	0.010	45,136.0	3,039
Tobin's q	1.719	1.183	2.561	0.543	30.129	3,039
Market/Sales	4.122	1.620	15.659	0.246	195.901	3,039
Ebit/Sales	-0.048	0.080	1.097	-19.824	0.706	3,039
Capex/Sales	0.113	0.041	0.279	0.000	2.667	3,039
Leverage	0.350	0.293	1.977	0.000	107.800	3,012
Cash/Assets	0.109	0.057	0.138	0.000	0.942	3,039
Goodwill/Assets	0.043	0.000	0.102	0.000	0.813	3,039
Number of segments	3.539	3.000	1.401	2.000	10.000	3,039
Herfindahl index	0.221	0.033	0.320	0.000	1.000	3,039
Diversity	0.867	0.902	0.167	0.000	0.996	3,039
AVA by allocation	1.580	0.000	12.344	-40.251	64.659	3,039
VA by cross-div. transfers	0.018	0.000	1.077	-3.057	3.027	3,039
	Panel B: Non financial conglomerates					
Assets	2,041.969	192.424	8,820.980	0.028	678,346.0	40,553
Sales	1,492.319	211.990	3,992.753	0.001	45,136.0	40,553
Tobin's q	1.591	1.189	1.766	0.543	30.129	40,553
Market/Sales	2.921	1.171	11.480	0.246	195.901	40,553
Ebit/Sales	-0.062	0.069	1.179	-19.824	0.706	40,553
Capex/Sales	0.099	0.042	0.232	0.000	2.667	40,553
Leverage	0.293	0.258	0.453	0.000	42.907	40,465
Cash/Assets	0.103	0.053	0.131	0.000	0.989	40,553
Goodwill/Assets	0.042	0.000	0.097	-0.007	0.958	40,553
Number of segments	2.957	3.000	1.163	2.000	10.000	40,553
Herfindahl index	0.234	0.092	0.285	0.000	1.000	40,553
Diversity	0.841	0.878	0.167	0.000	0.996	40,552
AVA by allocation	0.205	0.000	11.124	-40.251	64.659	40,553
VA by cross-div. transfers	-0.001	0.000	1.134	-3.057	3.027	40,553
	Panel C: Standalone firms					
Assets	1,575.968	59.454	28,224.550	0.001	3,270,108.0	129,071
Sales	632.421	50.474	2,971.544	0.001	45,136.0	129,071
Tobin's q	2.731	1.466	4.205	0.543	30.129	129,071
Market/Sales	11.293	2.003	33.400	0.246	195.901	129,071
Ebit/Sales	-0.867	0.047	3.517	-19.824	0.706	129,071
Capex/Sales	0.173	0.037	0.450	0.000	2.667	129,071
Leverage	0.646	0.187	21.422	0.000	3,770.00	128,550
Cash/Assets	0.201	0.100	0.235	0.000	1.000	129,071
Goodwill/Assets	0.038	0.000	0.102	-0.042	1.0	129,071

Table 2.2: **Industry characterization of conglomerates with financial divisions.** This table shows the most prevalent two-digit SIC industries in the subsample of conglomerates with financial divisions. Along with the number of segments (possibly more than one per firm), we display their share in the total number of segments and the total market value of assets within this subsample.

SIC	Industry	Total number of segments	Percentage of segments	Value weight of segments
67	Holdings, funds	1416	15.7%	19.8%
61	Credit agencies	944	10.5%	30.2%
73	Business services	433	4.8%	33.6%
63	Insurance	409	4.5%	31.3%
35	Machinery, computers	339	3.8%	29.4%
49	Energy, gas, water utilities	298	3.3%	62.9%
65	Real estate	267	3.0%	22.9%
50	Wholesale, durable	265	2.9%	31.9%
13	Oil, gas	232	2.6%	47.4%
15	Construction, building	229	2.5%	56.5%
62	Market brokers, dealers	216	2.4%	24.4%
27	Printing, publishing	210	2.3%	43.1%
48	Communications	204	2.3%	35.9%
60	Banks, credit unions	181	2.0%	40.5%
64	Insurance agency, brokerage	181	2.0%	20.1%
37	Transportation	180	2.0%	38.4%
28	Chemicals	162	1.8%	39.5%
58	Eating, drinking	160	1.8%	44.7%
59	Retail, other	141	1.6%	44.5%
87	Architect., consult., account., research	139	1.5%	29.6%
20	Food	128	1.4%	45.5%
24	Lumber, wood	128	1.4%	26.7%
36	Electronic, electrical equipment	126	1.4%	37.2%
51	Wholesale, nondurable	121	1.3%	31.5%
47	Transportation services	97	1.1%	35.3%
70	Lodging	87	1.0%	31.3%
38	Precision instruments	84	0.9%	29.0%
34	Fabricated metal	83	0.9%	24.4%
	Other	82	17.4%	-
Total		9033	100%	

Table 2.3: **Financial divisions in conglomerates.** This table exhibits summary statistics at the segment level and at the firm level. Assets is the total stock of book assets of the firm. Assets weight is the share of total firm's assets represented by the segment. Sales is the firm's sales revenue. Sales weight is the share of total firm's sales for which the segment stands. Ebit/Sales is the ratio of earnings before interest and tax to sales. Capex/Sales is the ratio of capital expenditures to sales. Leverage is the book ratio of total debt to assets. Division transfers is a measure based on the difference between each segment's rate segment investment rate (capital expenditures as a fraction of assets) and the average investment rate across all segments of the same two-digit SIC industry. To this difference, for each segment, we subtract the corresponding average difference across the different segments of the firm. The measure is finally winsorized at 1%.

	Depositary inst. (Banks)	*Non-depositary (Credit agencies)*	*Market brokers, dealers*	*Insurance*	*Insurance agency, brokerage*	*Real estate*	*Holdings, funds*
	Panel A: Division level summary stats						
Assets	2,428.09	1,880.18	748.28	1,743.42	693.65	283.99	372.99
Assets weight	0.40	0.29	0.23	0.27	0.19	0.22	0.19
Sales	245.29	243.54	353.08	662.06	395.24	79.64	123.08
Sales weight	0.14	0.08	0.18	0.18	0.22	0.14	0.10
Ebit/Sales	0.14	0.06	0.05	0.10	-0.05	-0.21	-0.16
Capex/Sales	0.06	0.08	0.10	0.06	0.11	0.14	0.16
Division transfers	7.38	-0.01	0.01	65.98	198.91	0.01	0.39
Obs	185	974	229	473	187	284	1462
	Panel B: Firm level summary stats						
Assets	6,677.33	7,379.08	5,286.64	7,451.82	2,855.57	3,379.58	2,993.22
Sales	3,646.80	4,816.83	3,526.65	4,900.80	2,397.99	2,056.09	1782.12
Tobin's q	1.304	1.381	1.808	1.274	1.536	1.242	2.041
Market/Sales	3.512	2.169	3.013	2.379	1.986	5.094	6.239
Ebit/Sales	0.139	0.058	0.074	0.095	-0.054	-0.167	-0.166
Capex/Sales	0.063	0.076	0.102	0.058	0.112	0.131	0.148
Leverage	0.264	0.513	0.246	0.268	0.281	0.357	0.291
Cash/Assets	0.111	0.088	0.125	0.101	0.079	0.109	0.127
Goodwill/Assets	0.026	0.035	0.077	0.037	0.086	0.021	0.041
Number of segments	3.917	3.568	3.908	4.174	3.359	4.502	3.491
1-Herfindahl index	0.191	0.242	0.165	0.160	0.250	0.177	0.206
Diversity	0.884	0.852	0.864	0.884	0.798	0.851	0.829
AVA	0.226	-0.364	1.940	-0.364	-0.057	1.693	3.529
VAT	0.065	-0.027	0.124	-0.072	-0.013	0.072	0.176
Obs	180	940	207	409	181	259	1412

Table 2.4: **Determinants of financial divisions.** This table shows a linear probability model (specifications (1)-(3)) and a probit model (specifications (4)-(6)), where the dependent variable is a dummy taking the value of 1 whenever a conglomerate with at least two non-financial segments has a financial division with code SIC 67 (Holdings, funds). Control variables are defined in table 2.1.

	LPM			Probit		
	(1)	(2)	(3)	(4)	(5)	(6)
Total Assets	0.001***	0.001***	0.001***	0.007***	0.007***	0.003***
	[11.337]	[11.312]	[5.424]	[8.621]	[8.679]	[3.550]
Tobin's q	0.002***	0.002***	0.003***	0.022***	0.021***	0.029***
	[4.840]	[4.724]	[6.009]	[4.067]	[3.910]	[5.255]
Ebit/Sales	0.001	0.001	0.001	0.011	0.010	0.013
	[1.047]	[0.850]	[0.976]	[1.164]	[0.983]	[1.306]
Capex/Sales	0.017***	0.016***	0.020***	0.188***	0.179***	0.227***
	[4.302]	[4.074]	[5.159]	[4.353]	[4.095]	[4.960]
Debt-to-assets	-0.001	-0.001	-0.001	-0.019	-0.019	-0.017
	[-0.984]	[-0.947]	[-0.867]	[-0.686]	[-0.667]	[-0.596]
Cash-to-assets	0.047***	0.045***	0.064***	0.530***	0.523***	0.817***
	[6.839]	[6.681]	[9.518]	[6.421]	[6.309]	[9.430]
Number of segments			0.022***		0.236***	0.138***
			[29.699]		[7.885]	[4.387]
Diversity		0.021***	0.011***			0.246***
		[8.351]	[4.333]			[28.138]
	[14.967]	[0.804]	[-17.189]	-1.962***	-2.182***	-2.955***
Observations	0.021***	0.002	-0.057***	[-101.049]	[-63.396]	[-63.244]
R-squared/ Pseudo R-squared	0.005	0.007	0.027	0.0117	0.0163	0.0758

Table 2.5: **Internal capital markets (1/2).** This table shows OLS models where the dependent variable is the absolute value added by capital allocation (AVA). Holding division dummy is one when a company has at least one segment classified as a holding (SIC code 67) and two non-financial ones. All other control variables are as described in Table 1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ebit/Sales	-0.002**	-0.002**	-0.002**	-0.002**	0.003**	0.003**	0.003**	0.003**
	[-2.026]	[-2.026]	[-2.095]	[-2.093]	[2.046]	[2.020]	[2.019]	[2.006]
Log(Assets)	-0.000	-0.000	0.000	0.000	0.003	0.003	0.003*	0.003*
	[-0.756]	[-0.736]	[0.113]	[0.140]	[1.570]	[1.568]	[1.722]	[1.736]
Holding dummy	0.029***	0.030***	0.031***	0.006	0.030***	0.030***	0.031***	0.016**
	[4.664]	[4.746]	[4.916]	[0.558]	[4.707]	[4.701]	[4.863]	[2.233]
Number of segments			-0.002***	-0.002***			-0.001	-0.001
			[-2.746]	[-2.704]			[-1.512]	[-1.494]
Diversity		0.000	0.001	-0.001		0.000	0.001	-0.000
		[0.069]	[0.318]	[-0.286]		[0.171]	[0.256]	[-0.126]
*Holding dummy*diversity*				0.026**				0.015*
				[2.583]				[1.814]
Constant	0.002	0.002	0.005	0.007*	-0.001	-0.002	0.000	0.001
	[0.880]	[0.553]	[1.528]	[1.892]	[-0.187]	[-0.222]	[0.020]	[0.100]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes
Observations	43,592	43,442	43,442	43,442	43,592	43,442	43,442	43,442
R-squared	0.008	0.009	0.009	0.009	0.010	0.010	0.010	0.010

Table 2.6: **Internal capital markets (2/2).** This table shows OLS models where the dependent variable is the absolute value added by capital allocation (AVA). Holding division dummy is one when a company has at least one segment classified as a holding (SIC code 67) and two non-financial ones. All other control variables are as described in Table 2.1.

	(1)	(2)	(3)	(4)
*Holding division *VIX*	0.001***	0.001***	0.001**	0.001**
	[2.915]	[2.943]	[2.238]	[2.233]
Holding dummy	0.011*	0.014**	0.019**	0.020***
	[1.725]	[2.095]	[2.490]	[2.608]
Ebit/Sales	-0.001	-0.001	0.004**	0.004**
	[-1.285]	[-1.353]	[2.077]	[2.038]
Log(Assets)	0.000	0.001	0.003	0.003
	[0.514]	[1.150]	[0.797]	[0.912]
*Diversification dummy*VIX*	-0.007	-0.006	-0.004	-0.004
	[-1.550]	[-1.322]	[-0.738]	[-0.764]
VIX	-0.001	-0.001	-0.001	-0.001
	[-1.148]	[-1.111]	[-1.443]	[-1.472]
Number of segments		-0.003**		-0.002
		[-2.587]		[-1.169]
Diversity		0.003		0.002
		[0.683]		[0.556]
Constant	0.005	0.006	-0.010	-0.009
	[0.370]	[0.457]	[-0.476]	[-0.434]
Firm fixed-effects	No	No	Yes	Yes
Observations	22,652	22,583	22,652	22,583
R-squared	0.009	0.010	0.009	0.009

Table 2.7: **The value of financial divisions in conglomerates.** This table shows the main coefficients of four OLS models for the natural log of the market value of assets. Holding division dummy is one when a company has at least one segment classified as a holding (SIC code 67) and two non-financial ones. Diversification dummy is one when the number of segments of a firm is larger than one and zero otherwise. We include interaction terms for all these weights variables with the diversification dummy, except for the seven financial industries (SIC >6000, <6800). All specifications include asset weights for each of the two-digit SIC industries, except for an omitted baseline group. We allow for interactions of all these weights with the diversification dummy, except for financial industries (SIC >6000, <6800). All other control variables are as described in Table 2.1.

	(1)	(2)	(3)	(4)
Holding dummy	0.093***	0.058*	0.070***	0.057**
	[2.888]	[1.820]	[2.618]	[2.219]
Other financial segment dummy	0.055**	0.050**	0.042*	0.034
	[2.426]	[2.217]	[1.844]	[1.532]
Ebit/Sales	-0.573***	-0.527***	-0.226***	-0.198***
	[-54.532]	[-48.323]	[-17.856]	[-15.886]
Capex/Sales	0.121***	0.125***	0.104***	0.113***
	[16.005]	[16.600]	[13.327]	[14.517]
Log(Assets)	0.981***	0.966***	0.899***	0.860***
	[401.432]	[366.316]	[240.656]	[181.474]
Year dummies	No	Yes	No	Yes
Firm fixed effects	No	No	Yes	Yes
Observations	172,660	172,660	172,660	172,660
R-squared	0.923	0.926	0.712	0.728

Table 2.8: **Placebo test for the role of financial divisions.** This table shows OLS models where the dependent variable is the absolute value added by capital allocation (AVA). Holding division dummy is one when a company has at least one segment classified as a holding (SIC code 67) and two non-financial ones. Placebo is a dummy variable taking the value of one if the conglomerate has only two divisions, one of which is a financial division. All other control variables are as described in Table 2.1.

	(1)	(2)	(3)	(4)	(5)	(6)
Ebit/Sales	-0.002**	0.003**	-0.002**	0.003*	-0.002**	0.003**
	[-2.060]	[1.981]	[-2.091]	[1.963]	[-2.096]	[2.012]
Log(Assets)	-0.000	0.002	-0.000	0.003	0.000	0.003*
	[-0.629]	[1.472]	[-0.197]	[1.489]	[0.102]	[1.690]
Holding dummy					0.032***	0.033***
					[4.889]	[4.726]
Placebo	0.019	0.010	0.018	0.007	0.018	0.016
	[1.593]	[0.833]	[1.540]	[0.714]	[1.575]	[1.381]
Number of segments			-0.001	-0.000	-0.002**	-0.001
			[-1.299]	[-0.391]	[-2.547]	[-1.320]
Diversity			0.001	0.001	0.001	0.001
			[0.398]	[0.263]	[0.305]	[0.260]
Constant	0.002	-0.000	0.003	-0.000	0.005	-0.000
	[0.952]	[-0.033]	[0.878]	[-0.031]	[1.360]	[-0.038]
Firm fixed effects	No	Yes	No	Yes	No	Yes
Observations	43,592	43,592	43,442	43,442	43,442	43,442
R-squared	0.006	0.008	0.007	0.008	0.009	0.010

Chapter 3

Deal-by-deal compensation structures and portfolio diversification

3.1 Introduction

In private equity, compensation contracts and governance rules are established by an agreement known as "fund terms". Fund terms split cash flows between managers and investors through complex, contingent provisions that include large bonus payments (carried interest or carry). Most private equity funds reward their managers with performance-based fees referring to all deals and portfolio firms under their management. However, in other funds, compensation is derived from a string of individual bonus payments per project, resembling a portfolio of call options. The resulting fee is known as deal-by-deal carried interest. This deal-by-deal component aggregates a

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percentage of the total return of each deal (or portfolio firm) within the fund, paid only when positive excess returns are realized. The benchmark for deal-level excess returns is a constant equivalent annual rate (hurdle rate), typically around 8%.

This paper studies the effect of compensation on risk exposures in portfolio investments. Under deal-by-deal rules, diversification in firm portfolios is associated to higher fee payments and thus a lower net-of-fee performance. My findings are consistent with the hypothesis that higher diversification in firm portfolios is optimal for managers receiving deal-by-deal carried interest. For a given level of performance, performance-based fees are maximized if the fund's proceeds are concentrated in a smaller number of extremely well performing deals, rather than split more uniformly across the fund's portfolio. Thus, under deal-by-deal rules, we expect managers to increase the chances of generating high returns in particular deals. One way in which fund managers can dissociate deal returns is through portfolio diversification.

My main finding is that the net performance of diversified deal-by-deal funds is lower than than what is expected for their total returns. I estimate that diversification reduces the net-of-fee internal rate of return (IRR) of deal-by-deal funds by between 1.5 and 3.5 percentage points, through the payment of higher fees. The mean net-of-fee IRR is at 7.7%. On average 3.25 percentage points of the total IRR are allocated to fees (median 2.73). So the effect of diversification amounts to 0.5 to 1.1 standard deviations of the IRR margin paid to managers, under deal-by-deal rules.

I study the effect of deal-by-deal structures on performance, through investment strategies, in the particular setting provided by private equity compensation. Private equity managers (General Partners, or GPs) typically manage funds throughout their entire life cycle under the same compensation terms (see Section 2 for details). Since investors have almost no influence in management decisions, managers are fully responsible for their funds' investment strategies. In the private equity industry, the potential to identify a relationship between compensation and investment decisions comes from the full accountability of managers and from the predictability of fee payments. GPs rely on a certain relationship between compensation and fund performance. While taking investment decisions, GPs can predict their future cash flows under different states of the world, given future fund performance.

In the first part of my analysis, I assess how GP fee structures relate to key characteristics of investment portfolios, such as industry diversification, location and stage focus. I document a higher prevalence of deal-by-deal rules in more diversified funds and GP vehicles. GPs could have an incentive to choose more diversified portfolios in the presence of deal-by-deal compensation structures. More diversified funds have a lower expected correlation between deal returns. Hence they are more likely to generate extremely high return rates (in deal outliers) than more focused funds with the same expected return. GPs also have a plausible incentive to propose and bargain deal-by-deal rules for carried interest at fundraising when they expect to implement diversified investment strategies.

Deal-by-deal models provide asymmetrical incentives for managers, across different deals. GP's are encouraged to assign more time and effort to the best-performing deals and to those with the best prospects of early exits. Differential effort across deals can be inefficient when maximizing the whole fund's performance. The efficiency of deal-by-deal schemes thus increases when effort in seeking early exits presents a larger upside potential for overall performance. Deal-by-deal models may benefit performance when riskier exit strategies are optimal, so that risk-taking is better rewarded at the deal level.

Managers are expected to maximize the chances of strong early exits under deal-by-deal carry models, either when their optimal behaviour is efficient or when it is not. In maximizing the chances of early exits, managers can get a positive contribution from the choice of uncorrelated deals. Under this mechanism, GPs begin by forming a more diversified firm portfolio. They implement diversifying strategies that are feasible under the fund's mandate and within the set of investment opportunities. In the post-investment period, GPs search to mismatch exit timings and performance across deals through their strategic choices. Notorious examples of these decisions include the fast deleveraging of portfolio firms, the anticipation of public offerings and the abandonment of further investment or M&A opportunities.

A particular set of investment opportunities should be highlighted: add-on acquisitions. In seeking synergies, secondary M&A transactions concentrate firm portfolios, going against intended strategies of deal diversification. By definition, they should increase exposure to the risk factors of the primary deal. Most often, add-on firms belong to the same industry and geography of the acquirer or, at least, to closely related ones. When this loss of investment options occurs, we expect it to be harmful to the fund's investors (Limited Partners, or LPs). One of the main value creation drivers of private equity is potentially foregone.[1]

In the second part of my analysis, I show that net-of-fee performance can be harmed when deal diversification strategies are implemented, under deal-by-deal distribution rules. My findings refer to funds performing above their minimum required return, allowing for the (effective) payment of carried interest.[2] In general, deal diversification strategies do not significantly reduce the gross performance of deal-by-deal funds, ac-

[1]A common list of five pillars of value creation: leverage, performance improvements, add-on acquisitions, multiples arbitrage and duration of investment-holding period.

[2]Carried interest can be recorded and taxed in deal-by-deal funds with realized returns below their hurdle rates. However, managers do not freely dispose of earned carry before clawback provisions are released. For more details, see Section 2.

cording to my findings. Therefore, the main mechanism behind the reduction in their net-of-fee performance is an increment in the payment of GP fees. I show that higher fee payments in deal-by-deal funds are not predicted by gross performance measures. My evidence is consistent with the existence of mechanical effects of investment strategies on the present value of carried interest.

In the literature, carried interest models have so far been studied through the collection of detailed contract-level data for small fund samples.[3] This paper broadens the empirical analysis to a wider and more diversified population of funds. The scope of my analysis is extended, since it is built on more comprehensive original databases, containing key strategic and financial information. Diversification of portfolio firms is measured across the fund's portfolio and across any other investments managed by the same GP vehicle.

Hüther et al. (2019) were the first to examine deal-by-deal distribution rules. They find a positive effect on total performance for contracts with deal-by-deal carried interest, seen as the most "GP friendly". This improved performance is, however, not matched by positive significant effects in net returns. The impact of deal-by-deal contracts in performance is decomposed between two channels. The first channel is the recruitment of better quality GPs, who better negotiate their contract terms. Secondly, deal-by-deal rules induce increased effort and risk-taking. Earlier exits and better market timing are two other important facts revealed for deal-by-deal funds in venture capital markets.

Earlier carried interest payments have a negative first-order effect on net-of-fee returns for limited partners, by increasing the present value of fees. When the increase in fees is not outweighed by indirect effects, through incentives, net performance is harmed.

[3] Hüther et al. (2019) have been the first to document differential impacts of carried interest models on gross fund performance, through an analysis of the contract terms of 85 venture capital funds.

My paper is related to several studies that documented PE as inconsistent with their increased risk and illiquidity as compared to stock markets. This pattern has been well documented for a long time period, at least since studies by Kaplan and Schoar (2005) and Phalippou and Gottschalg (2008).

More recent papers, such as Harris et al. (2015), have shown that there are substantial differences across time periods and private equity fund types. Public Market Equivalent measures are worse for venture capital and post-2000 (Harris et al. (2014)) funds. Underperformance is not generalized, but prevails, in particular for funds raised in hot market years (Robinson and Sensoy (2011)).

My work follows several studies that investigated the compensation terms of private equity partnerships, in other dimensions. One of the first papers on this topic was Gompers and Lerner (1999), who focus exclusively on VC funds and explore the cross-sectional and time-series variation in fund terms.

Some other papers have analysed venture capital compensation structures. One of the closest is Litvak (2009), who establishes the importance of carry timing in a sample of contracts with no connected cash flow data. They address similar issues from a legal perspective and extend the Gompers and Lerner (1999) analysis to consider several additional terms from the partnership agreements.[4] Metrick and Yasuda (2010) also analyse contracts without direct access to the detailed cash flows.

Apart from Hüther et al. (2019), only the study by Robinson and Sensoy (2013) contains contract terms and cash flow data. While their dataset is large and comprehensive, it does not contain fee payments. Nor does it cover information on portfolio companies that could support a discussion on motivated investment strategies. Phalippou (2015)

[4]Distribution rules are presented as a third fee component, their impact on the present value of fees being compared to those of management fees and carried interest.

analyses carried interest LP expenses, based on aggregate data from three US pension funds. His study collects information on aggregate carry amounts and funds' total performances.

I contribute to the existing literature on private equity compensation by relating fee payments and their models, to investment and performance outcomes. In particular, I identify a portfolio management mechanism through which the adoption of deal-by-deal rules can impact fees and fund returns. My sample size is larger than studies that make use of hand-collected datasets of contracts, despite lacking their depth in covering contract provisions[5]. It is also cross-sectionally richer, as it includes multiple smaller fund types, GP firms and vehicles with widespread regional focuses and from several locations. In particular, a relevant number of non-American funds is included in the sample. Greater sample heterogeneity across the world private equity industry favours the external validity of my findings. A comprehensive sample allows for a more precise association of my findings with the experimental setting of the private equity business. My sample avoids, therefore, associating the paper's findings with any particular market structure of private equity firms at the regional level.

Hüther et al. (2019) favour the hypothesis that deal-by-deal models create incentive-related gains in venture capital. Deal-by-deal funds have an improved gross performance, but performance gains are mostly or fully captured by higher fees. Consistent with Hüther et al. (2019), I find a positive effect on gross performance for venture capital funds. My analysis deepens and broadens their results, by examining the whole private equity industry and identifying a specific mechanism generating higher fees. Moreover, I find that the sign of the total effect on performance is reversed for other fund types

[5]For this reason, some assumptions on underlying compensation rules are needed. The reasoning followed is in the spirit of a components' analysis, based upon realized fee cash flows and their distribution across fund lives.

than venture capital.

This study applies a financial and strategic analysis of compensation rules to a larger and more comprehensive set of funds. The description of compensation models is achieved for an extended sample, for which access to contract provisions is not required. I undertake a thorough process of classification of fee and carried interest waterfalls from observed payments. Although I do not include all the time series of my data in the same analysis, multiple sections of this dataset provide a rich picture of industry trends in GP fee payments and in investment strategies. An additional anonymous dataset provides a descriptive picture of fund terms in deal-by-deal contracts, which is key in the study's design.

My contribution includes a refinement of empirical settings in which the links of compensation and investment policies are studied. Several studies examine the efficiency of performance-based compensation of CEOs and other firm managers (e.g. Yermack (1995)). While a relationship between investment firm policies and CEO compensation could be identified in other industries (Malmendier and Tate (2005)), none exhibits all specific features of private equity partnerships. In my study, I benefit from the full involvement of a GP management team throughout the entire investment cycle of private equity funds. The scope of PE managers' decisions essentially differs from investment decisions taken over going concern projects by incoming CEOs. Therefore, studying the PE industry can enrich our prior knowledge of managerial incentives, by testing them under higher managerial discretion.

I also contribute to a broader literature on the performance of private equity funds and on their attractiveness to outside investors. Several mechanisms have been suggested as explanations for the low performance (Kaplan and Schoar (2005)) and the low attractiveness of risk properties of private equity (Cochrane (2005)), compared to stock markets[6]. One of these mechanisms is mispricing Lerner et al. (2007), where the topics of fee adequacy and LP-GP agency conflicts are comprised. I complement the angles of investor literacy and skills, taken by other studies, by identifying a standard information asymmetry in the negotiation of carry distribution rules. GPs benefit from private information in opting for deal-by-deal rules, which is later revealed by their chosen investment strategies. Diversified firm portfolios contribute to a lower net performance of deal-by-deal funds.

The remainder of the paper will be organized as follows. Section 2 exposes some key institutional details of the private equity industry. Section 3 describes the data and my methodology. Section 4 presents the main empirical findings. Section 5 addresses identification problems. Section 6 concludes.

3.2 The empirical setting - institutional details

Private equity funds are organized as limited partnerships, according to limited partnership agreements (LPAs). Under these structures, private equity firms serve as general partners (GPs) of the funds,[7] with great independence in their management. LPAs give GPs a broad mandate for selecting investments, choosing deal structures, business and exit strategies. Large institutional or individual investors provide almost all capital as Limited Partners (LPs), yet have very limited influence over funds beyond the agreement's terms.

Contractual arrangements between general partners and their investors create a very

[6]Empirical support is still scarce for mechanisms that lower the performance in private equity funds, well below their risk-adjusted cost of capital.

[7]GP firms are often split between several legal vehicles ("GP vehicles" henceforth), according to differential focuses on industries, stages or geographies. GP vehicles would typically manage a pipeline of successive funds, from several generations, raised at different years. Each generation could overlap prior and following funds, since their expected life ranges between 7 and 12 years, approximately.

precise setting, with contingent governance and compensation rules that are seldom amended at later stages. Partnership agreements signed at funds' inception clearly define the expected payments to GPs, according to performance outcomes. It is thus plausible that investment strategies should be influenced by managers' expectations over fees.

Fee payments consist of both fixed components (management fees) and variable ones (carried interest / carry). In most cases, carried interest is either not due or withheld until the fund as a whole attains a minimum realized rate of return, undiscounted. This minimum hurdle rate is named as preferred return.

Historically, two main approaches have been followed in choosing a carried interest basis. Deal-by-deal carry provisions entitle GPs to earn carried interest on each deal with a strong exit. Whenever a positive excess return is reached (above the preferred return rate), it is split between investors (distribution) and managers (carried interest). The deal-by-deal model resembles the structure of a portfolio of call options.

In a strict version, nowadays uncommon, GPs receive carried interest as deals are exited, regardless of losses of previous deals.[8] More common versions follow a realized loss model that does not entitle GPs to carried interest before the preferred return is reached for all realized deals, making up for realized losses, while clawback provisions leave carried interest withheld until the whole fund attains that return rate.

In contrast, whole fund carry provisions ensure that limited partners receive a certain hurdle rate on performance of the fund as a whole, before GPs are entitled to receive any carried interest. Its structure thus resembles that of a call option over the whole fund's portfolio. This paper studies differential incentives generated by this same dichotomy of

[8] In rare cases, strict versions could potentially allow current income, such as dividends, to be subject to carry provisions.

option-like compensation structures for GPs: between a portfolio of one call option per each individual private equity deal invested and a call option over the entire portfolio of private equity deals under their management.

Once the rate of preferred return is attained, most funds enter a period when returns are entirely allocated to GP managers. Such clauses, known as catch-up provisions, ensure that the total share of returns paid as compensation converges from zero to a pre-specified formula, to be applied henceforth. In whole fund structures, the carried interest rule is usually a linear split of total fund returns. In deal-by-deal models, returns of previously divested deals (rather than the fund's returns) are linearly split, only once returns ensure that the preferred rate is delivered to investors. In this paper, I test whether distinct split rules for deal-by-deal funds produce a better financial outcomes for GPs following diversification investment strategies.

My research question stems from the fierce competition in pledging realized returns. Outside investors (LPs) compete with fund managers (GPs), aiming at higher and earlier cash distributions. I investigate whether a pre-defined compensation scheme for GPs induces distinct investment decisions during the first years of their mandate as fund managers, and whether induced investment decisions allow GPs to pledge a higher share of the fund's proceeds. It is common knowledge that all proceeds not paid as carried interest (GP's bonus compensation) will end up being distributed, since private equity funds are self-liquidating. [9]

Carry distribution rules can be illustrated with two simple examples. In the first case, a fund with a preferred return of 8% manages two investments of the same size. One is exited with an annual return of 12% and another one is divested with a -12% return

[9] Private Equity funds are legal entities with a time-limited mandate to invest and divest LP's capital, with each deal tranche being employed and divested only once. As such, the fund's balance sheet is progressively emptied; rare exceptions apply.

rate. A second fund, with the same preferred return, manages two other investments of the same size, but each one yields a 0% return rate.

In a strict deal-by-deal model, GPs would be entitled to receive carried interest from the first fund, in any circumstance. However, non-strict models are nowadays adopted by a vast majority of deal-by-deal funds.[10] Under a non-strict deal-by-deal model, carried interest would only be due on the strong exit if that deal were first exited, since the realized return rate up to that date would be above the 8% hurdle in that case. Clawback provisions would require carried interest to be withheld in an escrow account, only to be reimbursed when the second deal is exited. Yet the first fund would have its net performance harmed by the opportunity cost of the clawback deposit and by tax implications of early carry payments (Schell (2019)). In contrast, whole fund carry models would not require any carried interest payment. No carry would ever be paid unless, at liquidation, the return rate for the fund ("as a whole") attained 8%. In this example, it ends up amounting to 0%.

In a second example, two funds reach the preferred return rate of 8% in their seventh year of life. The first fund has had two strong exits at return rates of 20%, while the second fund has divested all its deals with annual returns between 8% and 12%. Carried interest starts to be released after the fund reaches the preferred return rate. Under a deal-by-deal model, catch-up provisions allow earned GP income to converge to carried interest generated in divested deals with strong exits, up to that date. The paid bonus converges to a fraction of realized excess returns in profitable deals. Those excess returns are based on capital invested in deals with returns above the hurdle rate. Under whole fund carry models, GP earned income converges to a fraction of excess

[10] As documented by Litvak (2009), some VC funds follow a rarer “Payback” distribution rule. With this rule, early carry charges are paid to GPs as fund securities. GPs, in exchange, incur in a liability equal to the capital contribution that would generate that profit (i.e. that value of carry).

returns on the fund's total invested capital.

For the first fund, carried interest withheld under deal-by-deal exceeds the corresponding amount pledged in whole fund carry models, since it is based upon excess returns for very strong exits. For the second fund, without any exit below preferred return, both models yield identical fees, for the same carry and hurdle rates. On a deal-by-deal basis, a portfolio of companies with either close to zero or very high returns yields higher compensation than an otherwise equal return portfolio with all returns closer to the hurdle rate.

There can be significant variations in the timing of carried interest, with much earlier payments being driven by early exits of the best deals. Consequently, the proportion of realized returns allocated to managers can be much higher than the final split rate throughout most of the fund's life. A graphical illustration of cash flow waterfalls is provided in Figures C2 and C3.

General Partner firms tend to redistribute fees from concomitant deals, namely at the GP vehicle level. During the investment period, fund managers often have pre-existing assignments from active funds at later stages of their life cycles.

Any pre-existing assignments of fund managers to other funds could have a significant influence in investment strategies of their latest fund. If fees from managers' previous accounts are not yet fully determined, managers ought to account for them as part of their fee-generating portfolio. Even if managers do not directly intervene (anymore) in other funds' management decisions, it is expected that their access to carried interest should be kept.

Overall, the industry presents unique experimental conditions. Fund managers are tied by strict anti-turnover provisions ("key man clauses") since the fund-raising stage. For the entire fund lifecycle, GP turnover is reduced to "force majeure" events. Compensation terms are virtually impossible to amend, once agreed at fund-raising. Fund terms, more generally, cannot be amended without the consent of GPs and a qualified majority of investors.

Hence, private equity allows us to examine how "blue sky" investment strategies, built from inception by a single management team, are implemented in the presence of highly powered (and nearly irrevocable) incentives.

Welfare implications of private equity contracts are a current issue of concern for policymakers in all major economies. Private equity contracts have often been linked to disputed industry practices, such as over-leverage, fund life extensions, advisory fees and risky exit strategies. Concerns about the effectiveness of fund governance rules have inspired the creation of sector-specific regulatory frameworks, in several countries. Both in the regulatory and in the self-regulatory spheres, rules and guidelines have been created, so as to increase disclosure and transparency.

3.3 Data and methodology

3.3.1 Data

3.3.1.1 Main financial database

From 2016 Preqin Fund Terms Advisor report, yearly compensation cash flows (GP fees) were extracted for 1596 identified funds, for the period 2001-2015. Data on fund transactions, cash distributions and (quarterly) book values were collected from the Preqin dataset, for 2535 funds, in the period 1992-2013. 1100 identified funds were matched between these two databases.

The final panel is constrained, on its baseline version, to funds with 8 years of fee payments reported (or a shorter, but complete time window) and with all fee cash flows from the first year after vintage until 2013. All fund vintages from 2001 to 2008 are comprised. Valid reporting of fee payments during the investment period is imposed, in the estimation of an upper bound for management fees. Hence, the final panel is composed of a total of 360 funds meeting all the sampling criteria.

All yearly cash flows available are used in my classification mechanism (2001-2015). Gross performance of funds is estimated as of 2013, its measure being the Internal Rate of Return given by total realized cash flows and the fund's residual value in the last period reported. Net performance of funds is estimated as of the same year, through an Internal Rate of Return given by historical investor (LP) cash flows. Both performance measures are thus based on a total value to paid in (TVPI) waterfall.

I assume that the fund's residual value (from the ninth year onward) is fully distributed to investors, unless the fund has been tagged by my classification algorithm as paying carry. In carry-paying funds, residual values are assumed to include a provision for carry for unrealized investments, amounting to 20% of that residual value.

In my baseline empirical specifications, I model the expected net-of-fee value for investors (LPs), using the fund's expected gross performance as one of its determinants. As explained in the previous section, share value foregone through fee payments to GPs is largely determined by gross performance. From a contractual standpoint, fees are a function of absolute performance metrics. No public market benchmarks are involved. More comprehensive performance measures, such as the public market equivalent (PME), are not best suited to isolate unexpected reductions in net performance, the focus of this paper.

3.3.1.2 Descriptive data and stylized facts

My analysis is supported by a descriptive dataset, with detailed data on fund terms. It is composed of anonymous contracts from the 2016 Preqin Fund Terms Advisor report. It does not contain any financials. Funds are explicitly classified as deal-by-deal, whole fund or other (including mixed versions of carried interest payments). In my descriptive dataset, it is possible to associate fund characteristics to most of the key elements of GP compensation. Anonymous information is available for 3372 funds.

In Tables A15 to A19, the univariate analysis of the fund terms reveals some interesting stylized facts. Deal-by-deal funds are essentially based in North America, whereas whole fund funds are more evenly distributed across the US, Europe and other geographies.

A clearly higher proportion of deal-by-deal funds comes from vintage years in the period 2000-2005. The reverse pattern is found in the period 2012-2016, while the years of 2006 and 2011 can be easily depicted as transition moments.

In Figure 4, a surge in the number of European funds is shown in the 2005 and 2006 vintages. These cohorts are almost entirely whole fund. In North America, for a much larger universe of funds, a rebalancing effect is observed for carried interest models: the proportion of deal-by-deal funds decreases from 47% to 22% between 2005 and 2006.

In Figure 3.5, for the year of 2011, a peak is shown in the proportion of North American deal-by-deal funds. (49%). The 2011 surge is followed by a permanent reduction in the number of deal-by-deal funds, to less than 20% in 2013. Both these trends will be examined in section 5 of this paper. Details are shown in Table A20. Deal-by-deal funds have higher carried interest rates, both in Europe and in North America. Fee reduction schemes based on reduced rates charged on investment capital are much more frequent in the deal-by-deal subsample. For deal-by-deal funds, average management fees are also higher, yet this is due to other fund types than buyout.

In Europe, the average share of transaction fees rebated is much lower for deal-by-deal funds. Most deal-by-deal funds are either focused on buyout or direct lending transactions, while a smaller number invests in venture capital and direct lending. Growth and balanced funds have similar relative weights within both subpopulations. Secondary and fund of funds classes are almost totally concentrated on the whole fund subsample.

In the main dataset, some qualitative differences are crucial. One is the absence of the "Direct Lending" class. A second one is that a great number of less common or alternative fund classes are represented. Many of those comprise focused funds (e.g. real estate, infrastructure), while some can be seen as subcategories of venture capital and buyout types (e.g. seed, early stage, direct secondaries). Finally, geographic areas outside North America are present in small numbers, making it difficult to draw conclusions from the univariate distribution of carried interest models.

3.3.1.3 Sampling statistics

Qualitative data on private equity vehicles and funds were obtained from the Palico platform. Palico is an industry-level marketplace where private equity firms self-report managerial information. Matching between GP vehicles and funds was done carefully, through hand collection, upon verification of background information. In some cases, information was verified with use of Zephyr data on private equity deals.

Portfolio companies are identified and briefly described, along with their geographies and timings of entry and exit. 50 managers per vehicle are identified, along with the full historical list of funds (as self-reported) and the list of firm offices. Industry, region and country-level investment propositions are also included in my qualitative database.

My classification across industries was obtained through a text-mining algorithm. The machine-learnt output was further revised in a manual process.

From a total of 992 funds matched, 340 of a total 360 in the final panel are included. From those, 218 compose my main sample of funds, where my two diversification measures can be examined. I will refer to this fund panel as Main sample.

In Table 3.1, several statistics of the final panel are shown. In panel A, it can be seen that no major distortions to the fund type structure of the sample are imposed by its reduction - according to the availability of fee data.

My dataset is very diversified across fund types, adding to previous studies on more homogeneous populations. Few material changes in the fund type composition are observed through this sampling process. Some less frequent classes, such as mezzanine, real estate and funds of funds are underweighted, while the buyout type is around 10% more prevalent in the main sample.

Early stage funds, comprising all their sub-categories, amount for a fraction above 10% of funds in both samples, expectedly adding to their diversity in compensation terms. Real estate funds, usually known for the use of peculiar deal-by-deal structures, are the only category to be most affected by the sub-sampling process.

Regarding fund size, both distributions are considerably skewed to the right, with a significant overweight in the region of funds with sizes between 250 and 750 million dollars. No striking differences are found when looking at the main sample. Net-of-fee performance is similar in both groups overall; however, greater dispersion exists in the main sample, mostly for funds below median performance. The regional mix of funds is similar both in the sample and the main sample. Details are provided in Table C1.

Performance results follow trends identified in Harris et al. (2014).[11] Venture capital internal rates of return are comparatively low in the sample period, comprising the 2000 "dot-com bubble", as well as vintages affected by the 2008 financial crisis. (table C2, panel A). Main sample statistics present greater dispersion in the time series, but do not differ from a qualitative standpoint (Table C2, panel B). In most recent vintages, my performance data series is one year shorter - putting greater weight at these funds' residual values.

3.3.2 Methodology

In my baseline specifications, I study the effect of deal-by-deal carry models and deal diversification strategies on the net-of-fee performance of private equity funds. My performance measure is the net internal rate of return (Net IRR). Performance effects are conditional on gross performance, before fees, measured by the total internal rate of return (Total IRR).

The same specifications are repeated for both versions of the counterfactual group ("not classified deal-by-deal" and "whole fund"). A single adjustment in control variables distinguishes general diversification (HHI) and specific diversification (Exposure to Risk) models, apart from the diversification measure.

The dependent variable is Net IRR. Fund IRR is a control variable. With this specification, I introduce a flexible structure to study the total impact of regressors over fees, for the entire life of funds, by measuring the implied cost in net return terms. I avoid imposing a structure on this relationship (such as a difference or a log ratio). Firstly, lost returns are more meaningful to investors than discounted or undiscounted total fee

[11] I have excluded: (1) Funds with a DPI ratio above RVPI; (2) Funds with a net internal rate of return above 30%, raised in 2006 or later. 12 funds fulfil these conditions, 11 of those being in the main sample.

payments. Secondly, the correct shape of the net-gross performance relationship can vary from one-to-one marginal functions.

The main regressor of interest is the interaction between the diversification measure and the deal-by-deal binary variable. Both these variables are included separately. I control for the effects of the economic cycle and the number of yearly fee payments through the use of vintage fixed effects. Additionally, funds from different vintages have a varying weight of unrealized value in performance measures and different likelihood of being liquidated.

Specifications adding 1) fund type fixed effects and 2) fund type and manager fixed effects (for GP vehicles) are included. Fund type fixed effects aim at controlling for much narrower diversification options in fund classes with a focused mandate. At the manager level, fixed effects intend to capture self-selection patterns in the choice of fee structures. Standard errors are clustered by fund type and region focus.

The first diversification measure (HHI) is continuous, while the second one (Exposure to Risk) is binary. In the case of binary diversification, the "deal-by-deal" coefficient should be interpreted as a constant differential vs. whole fund observations. The general diversification measure assumes an exponential functional form: -exp(HHI). The sign of the HHI index is switched, so that it can be interpreted as a measure of dispersion. The empirical model is specified as follows:

$$y_i = \rho r_i + \beta_x(d_i \times exp(-f_i)) + +\beta_d d_i + \beta_f \exp -f_i + \gamma_i + \theta_i + \delta_i \quad \text{(A.1)}$$

The dependent net internal Rate of Return (y_i) is estimated as a function of the total, pre-fee IRR (r_i). d_i is a binary variable denoting whether a fund is classified as deal-by-deal. f_i is the HHI index for the share of portfolio investments in each industry. γ_i is a set of fund-level control variables. θ_i are fixed effects at the vintage, fund type and manager levels.

For the specific diversification measure, I estimate a similar empirical model. The coefficient of interest measures the effect of deal-by-deal structures for funds with balanced exposures to at least one of a set of specific risk factors. f_i now denotes the "Exposure to risk" binary variable:

$$y_i = \rho r_i + \beta_x(d_i \times f_i) + \beta_d d_i + \beta_f f_i + \gamma_i + \theta_i + \delta_i \tag{A.2}$$

3.3.2.1 Diversification measures

My chosen set of diversification variables aims at testing the hypothesis that deal diversification affects net performance. The focus of this test is not the heterogeneity in the distribution of realized deal returns, *ex post*. Differently, I examine the causes and implications of uncorrelatedness in a fund's expected deal returns. For best capturing the unrelatedness of portfolio deals, I measure diversification dimensions linked to firms' time-invariant characteristics.

The least varying firm characteristics are the ones expected to shape their risk profile for a horizon of several years, during which they will be included in the fund's portfolio. In adjusting portfolio diversification, invariant characteristics are the best fund manager's knowledge, at the time of entry.

Not all stable characteristics of private portfolio firms are observable by outsiders.

However, my data give access to their business descriptions and locations. From this information, two main dimensions can be analysed: industry and geography.

I construct two main diversification measures. The first measure is taken from previous studies of finance and strategy. The Herfindahl-Hirschman index, introduced as a measure of market concentration by Herfindahl (1950), has been used in prior corporate diversification studies, namely by Demsetz and Strahan (1997), who applied it to the banking industry. An equally weighted HHI index of diversification, based upon the number of deals in each industry, is built for each GP vehicle in our sample.

The second diversification attempts to capture exposures to specific risk factors. An extension of my main hypothesis is that GPs may have beneficial investment strategies derived from specific patterns of diversification. The purpose of GPs is to diversify the occurrence of early strong exits, across deals, in different states of the world. Their optimal strategies do not generally imply larger levels of diversification across all dimensions affecting performance. Instead, managers are expected to target specific drivers of performance risk, such that deals can be assigned to each of these factors in a nearly binary way. Expected GP fees should increase if the upside potential of individual deals depends upon opposite realizations of the same risk factor.

My definition of diversification as *Exposure to risk* captures the existence of any large exposure to a number of risk factors, in any direction. These factors are either industrial or industrial and geographical, by definition. A large exposure is defined by the existence of a number of deals below 25% or above 75% of the number of deals of the whole portfolio.

The existence of this mechanism is supported by the market's views of diversifiable risk. In private equity and investment management industries, survey data often refer to uncertain political events, technological changes and asymmetrical shocks of the business cycle as major concerns at each point in time.[12] In private firm investments, entry and exit timings can be seen as under greater dependence of "deal waves" and industry-specific trends.

A second motive to measure diversification as *Exposure to risk*, in addition to the HHI, is that specific risk factors can produce comparable effects across distinct industries, while distinct effects may occur within the same industry. Hence a measure of diversification based on specific risk is (at least) partially orthogonal to the HHI index. For instance, industry splits by geography can capture significant risk components that are not at all intrinsic to each industry's activity, instead resulting from local market structures or from other local frictions or shocks.

3.3.3 Measurement

3.3.3.1 Upper bounds for management fees

My data on compensation consists on total fee payments recorded every year. For an analysis of carried interest payments to be possible, it is necessary to estimate how these payments are split between performance and management fees.

In the simplest version of fee models, management fees, applied to committed capital, should correspond to the whole amount of fee payments during the investment period. It would then be easy to depict the management fee rate and to subtract it to total fee payments, post-investment period, so as to estimate carried interest.

In practice, however, models are much more complex. In my descriptive dataset, 59% of funds charge management fees on invested capital, post-investment period. 39% charge

[12] Individual events and shocks are realizations of specific risk factors, for which exposures can be optimized. Those factors add to the systematic components of expected returns in private equity.

reduced rates, either on invested or on committed capital, in the same period. Carried interest payments can occasionally be seen in later years of investment period, under deal-by-deal models. Fund formation fees are charged at the fund's onset. Other small components can plausibly be included.

Smaller fee components fixed in distributed-to-paid-in (DPI) returns, such as transaction fees, are earned by GPs from portfolio companies in the majority of funds, as documented by Metrick and Yasuda (2010). As it is shown by Phalippou et al. (2018) and validated by my descriptive dataset, transaction fees are almost always rebated to management fees at rates above 50%. Rebates should be taken into account when attempting to estimate management fee rates, which would be applied in their full amount in periods without rebates. I do so by assigning an expected rebate to each fund type, both in investment and post-investment periods.

Given all sources of variation in investment period fees, I establish a procedure for binding management fee rates. The first step is to exclude either very low or very high fee records during investment period, beyond thresholds that would not be feasible as management fee rates. Minimum and maximum thresholds are listed, for each fund type, in Table C4.1.

An adjustment in minimum thresholds is included for fee reductions. Fee reductions are likely to occur at every period, due to rebates of transaction fees paid by portfolio companies. An expected rebate is then assumed, by fund type, both during investment and post-investment period.

Thresholds are particularly low for alternative classes of funds, requiring the allocation of less resources in their routine management. A key distinction between lower and larger size venture funds was considered when specifying a stricter threshold for those below 500 million dollars in commitments.[13]

I then proceed to the calculation of an upper bound for management fees. This upper bound allows for a conservative estimate of carried interest, which could be seen as a lower bound. Thereby, a more conservative classification of funds as deal-by-deal should be achieved.

The upper bound is based on the lowest yearly fee payment during the investment period, as a percentage of assets under management, within both thresholds. That minimum fee payment is added to the fund's presumed fee rebate. The first year is excluded, as it is heavily affected by fund formation fees.

A second upper bound is separately computed for post-investment period, wherever a reduced rate can be identified. In post-investment period, the upper bound is estimated as a rate charged on invested capital. When no reduced rate fits the interval between fee thresholds, the process is repeated for cashflows expressed as a fraction of committed capital. In case of doubt, should both rates be available, the highest rate is chosen as the upper bound.

Upper bound stats are shown in Tables A4.2 and A4.3. A key concern of this method is to fit the distribution of management fee rates to that of the anonymous dataset, wherever possible, with some over-estimation. There is significant variation by fund type. As expected, venture capital funds and alternative fund classes are found on the opposite end of the distribution, with most private debt funds also being found towards the lower end.

The residual component of annual fees is classified as variable fee, if positive. The estimated variable fee is a lower bound for carry, which will be used for classifying funds

[13]This distinction is based on information from the Preqin Fund Terms report.

according to the likelihood of adopting a deal-by-deal carried interest basis. Likewise, negative residual components are classified as fee reductions. Post-investment period, reduced rates are employed when available.

By first expressing thresholds as a fraction of invested capital, I take a conservative approach, yielding higher upper bounds than otherwise. Expressing upper bounds as a proportion of invested capital does not affect the value estimate of carry estimates other than by fee thresholds. As I will expose next, classification rules only depend on committed and distributed capital.

Investment period upper bounds are calculated at the fund type level. Management fee rates are overstated by the final estimates (table C5.2).[14] Highest values are found for venture debt and venture capital fund types. The accuracy of my estimates partially ensured by the choice of thresholds for yearly fees (Table C5.1). Non-primary and focused fund types yield the lowest rates.

Post-investment period reduced rates for primary equity fund types are, in average, close to 10% below the main upper bounds, with slight variations across fund type means (Table C5.3). For debt and secondary funds, dispersion is the highest. Progressive fee reductions are often applied along the post-investment period. So the estimated reduced rate is largely expected to be an upper bound.

3.3.3.2 Classification method

A specific set of identification criteria allows for the classification of funds in three subsamples: deal-by-deal, whole fund and unclassified. These criteria are based on the pace at which proceeds are shared between General Partners and investors (LPs).

[14] In Table C15, descriptive statistics from anonymous PE contracts (fund terms) can be used as a benchmark. For the fund type breakdown, I refer to the original source: the Preqin Fund Terms Advisor.

Three main patterns are searched in the recognition of deal-by-deal fee waterfalls. The first of these is "catch up" regions. One simple way in which distinct catch up regions can be conceived for deal-by-deal contracts is that larger consecutive carry payments are recorded at the "full fund back" stage, compared to whole fund models. Large consecutive payments would happen when withheld carry from early strong exits is released to GPs.

We expect the catch-up carry amount to be higher than the amount used to converge for a proportional split, under whole fund models. However, it is possible that payments are recorded at prior dates. So a threshold is set, as a return rate over committed capital, for carry payments between consecutive distributions, at any point of the fund's life before contributed capital is repaid. Payments are considered when recorded at the end of an equal or greater calendar year, prior to the calendar year of the next distribution.

The threshold value is the carried interest amount that would result from a 20% carry rate and a 9% hurdle rate or from an 8% hurdle rate and a 31% hurdle rate, applied to a rate of return[15] of 10% of contributed capital. In practice, the majority maximum carry payment sequences are clustered between DPI ratios of 0.85 and 1. Adjustments to the definition of repaid capital, for clawback purposes, could explain this pattern.

For funds having repaid capital, a share of proceeds of the last distribution is deducted, so as to filter regular distributions under a whole fund model. Most of the remaining distributions can then be found in positive return regions, where, in practice, a higher "catch-up" amount could be paid.

A second criterion is the existence of carry payments in investment period years. A margin of safety is added to the management fee estimate. By depicting early carry pay-

[15]Total return rates discussed henceforth are raw returns per annum.

ments, I identify purer deal-by-deal contracts that generate and possibly release carry at the time of the first strong exits. Carry payments originated by partial divestures or dividend distributions are also targeted. The margin of safety for venture capital funds is increased, since management fees have greater dispersion and non-recurring payments are likelier.

A third criterion is the cumulative ratio of performance fees to cash distributions. This cumulative ratio is measured for funds having achieved a minimum total return rate, such that GPs should be paid carry at a proportional rate in whole fund models.[16] It only applies to funds with realized profits, yet it allows to capture funds with significant amounts of fractioned carry payments before capital is repaid. The threshold for the "carry-to-distributed" ratio is the value expected for a fund with a hurdle rate of 8% (or less) and a carried interest rate of 25%. A higher hurdle rate would decrease the ratio. In Table C6, descriptive statistics are presented for threshold measures. Robustness checks are performed to these criteria, in sections ahead.

The subsample aggregating unclassified and whole fund funds is the most comprehensive counterfactual for deal-by-deal funds. It is believed that funds not achieving carried interest regions progressively lose all incentives linked to their carry model. Most importantly, the impact of any investment strategies over performance fees is potentially null.

Classification as whole fund serves is a refinement of the baseline group. When none of the deal-by-deal classification criteria is verified, it is required that the fund has distributed enough capital for having revealed its carry model. Revelation of the carry model is assumed when funds have reached a total annual return of at least 8%. Venture

[16]Consecutive carry payments are adjusted for distributions exceeding 10 per cent of called capital that bind the payment period. 20% of transaction value is deducted when the fund has already attained 8% total return.

capital funds often implement 0% hurdle rates.

Funds raised in 2005 and later have been affected by the 2008 financial crisis. Not just has this affected their performance, but also the shape of their cash flow waterfalls, through their entry and exit timings. Classification according to positive return rates creates a distorting effect in more recent years, by narrowing the whole fund subsample and constraining it to the best-performing funds. On the contrary, during crisis years incentives have presumably been adjusted in many funds, so that manager's options could not be totally out-of-the-money.

For funds raised between 2005 and 2008, requirements are adjusted when information on fees for 2014 can be used. In the 2005-2008 vintages, the total return threshold is adjusted to 0%. Funds differing from the total return threshold by less than 10% of paid-in capital are classified as whole fund if their ratio of residual value to paid-in capital (RVPI) is 3x larger than the original fund gap. I reclassify funds that are expected to reach profitability within the fee sample period (before 2014). Robustness tests are performed excluding post-2005 vintages.

In Table 3.3, the classification is illustrated for my main sample.[17] 69% of funds are classified. 36% of those (25% of total) are identified as deal-by-deal. The proportion of buyout funds classified as deal-by-deal is slightly below this average (28%), but above that of all venture capital funds (21%). Generalist venture capital ones are dominantly whole fund (88% of classified), in contrast with the early stage VC class. Smaller classes of funds have higher prevalence of funds identified as deal-by-deal. Infrastructure funds are a remarkable exception, with 50% of funds classified as deal-by-deal in a total of 10 observations.

[17] In total 246 sampled funds are classified (68%), from a total of 360.

When decomposed by vintage (Table C2), both within the sample and the main sample, the prevalence of deal-by-deal is greater in years before 2005 is significantly higher. In the years of 2005 and 2006, a sizeable increase in the prevalence of whole fund models coexists with growth in the total number of funds and in the number of unclassified ones.

Generally, the proportion of deal-by-deal contracts is moderate and plausible when compared to the descriptive dataset, even though my main dataset is a much smaller sample.

3.3.4 Summary statistics

In Table 3.4, some descriptive statistics are provided for the general diversification variable. Funds classified as deal-by-deal are more diversified in this dimension, yet the unconditional difference is not very large, particularly compared to classified whole fund funds. General partner vehicles where sampled funds are affiliated have very diverse features, namely concerning the number of portfolio firms. HHI is unconditionally very similar across subsamples.

However, within fund types where both whole fund and deal-by-deal are widely present, deal-by-deal funds belong to more diverse GPs. Their deal-by-deal funds are concentrated in the most common fund classes, which tend to invest in more diversified assets. Other cross-sectional differences exist, namely across vintages, with an important influence in the paper's results.

Specific risk factors are considered in my second definition of diversification. Exposures to each of those factors are defined as extreme when in above 25% or below 75% of deals by the associated GP vehicle. The measure is a binary variable, defining any non-extreme exposure to one of the specific risk factors. ("exposure to risk")

The industrial component of factors is made of seven categories, which group EVCA industries.[18] *Energy*, *life sciences*, *utilities* ("energy and environment") and *financial sector* correspond each to a single asset class. Three other factors aggregate two industries: *housing* ("construction" + "real estate"), *consumption* ("consumption products" + "consumer goods") and *energy shock* ("utilities" + "transportation"). The most comprehensive factor is *regulation risk*, adding five industries ("utilities", "transportation", "communications", "construction" and "financial sector").

Each factor intersects the industrial component with the location of portfolio firms' headquarters (in Europe or the United States), except for the finance and energy factors. Two factors per industry combination are defined in all the remaining cases. For analysis purposes, the set of investment countries is divided into seven areas (North America, Europe, Asia Pacific, Africa, Latin America, Middle East, CIS).

Around 2.7% of funds in the main sample belong to GP vehicles declaring at least one investment in a different geographical area than their main one, while 35% of funds belong to PE firms with multi-regional investment in their reported mandates. Europe and North America are the dominant combination of areas.

Two general measures of geographical diversification are defined: (1) the existence of any firm investment in a different geography than the main one and (2) the mean distance between capital cities of portfolio firms. Specific risk factors do not have a very high prevalence in any of the subsamples, with the exception of "Regulation America" - the factor comprising a larger number of industries. As they occur without much overlap, more than half of funds are classified as exposed to "any specific risk factor". (Table

[18]Original industry names are mentioned between brackets, when not coincident with categories' names.

C7)

In Table 3.5, performance variables are presented for six subsamples, in the interaction of the 3 classification categories (deal-by-deal, whole fund, other) and the binary "exposure to risk" measure. Large cross-sectional differences exist between deal-by-deal funds and the remaining sub-samples, both in terms of gross and net performance. Performance effects are of particular size and interest in the comparison between diversified deal-by-deal funds (panel D) and the two remaining diversified categories (panel B and F).

Differences in the mix of fund types, sizes and vintages contribute to amplify the results. In particular, focused fund categories with lower performance numbers have a larger weight in the deal-by-deal sample. In section 4, I show that divergences are not so large when we condition them on standard control variables.

Funds classified as whole fund are in average more profitable than the larger group of funds nor classified as deal-by-deal. The profitability gap reflects the whole fund classification, which is a refinement of the counterfactual group, implying that funds must have returned invested capital and, during that period, revealed their carried interest model. The main results of the paper use both versions of the counterfactual.

Gross performance, before fees, is similar between funds in panels C and E (no diversification, deal-by-deal vs. other funds), in contrast with the corresponding panels for diversified funds.

My baseline empirical setting is one where qualitative data are organized at the institutional level of GP vehicles. While investments cannot be exclusively assigned to all funds in the sample, other holdings of GP vehicles are potentially under the management of common team members. Managers could be assessed for deals at different stages of their lifecycles. For example, General Partners could manage deals invested by funds released after the first exits of the previous fund generation, but before its liquidation.

In a setting of multiple assignments, some level of co-determination between diversification variables and carry models is plausible. My empirical analysis provides some insights on these relationships. For this purpose, deal-by-deal funds are split according to the classification criteria each one satisfies:

1) "pure deal-by-deal" cases, which are classified through high fee payments in investment period years (among other criteria);

2) mitigated "realized loss" funds,[19] which are classified according to consecutive and/or cumulative carry payments, but not by investment period fees.

Both versions of the counterfactual group are used in my analysis. For prediction of the two main diversification measures (HHI and Any factor), a linear OLS model is estimated with a "pure deal-by-deal" binary variable as main regressor of interest. A positive relationship is found, for both measures and counterfactual versions, for different combinations of covariates and vintage fixed effects. Association is stronger for the "exposure to risk" variable.

In the opposite direction, a Probit prediction model was estimated for a "deal by deal" binary variable (Table C9) with extended use of other predictor variables – including geographical diversification, along with the two main diversification measures.

The "Pure deal by deal" variable has the strongest predictive power for all specifications

[19]In naming of this class, I resort to a simplification, not implying that all realized loss funds have long-lasting clawback provisions or that these provisions must necessarily pay carried interest post-investment period.

in the main sample. A weaker positive relationship is revealed by sub-selecting funds "Pure deal by deal" funds that meet one of the remaining two criteria. This analysis is replicated in a panel including funds excluded from the main sample by lack of net performance data (60 observations: 1998-2000).

However, in the case of HHI, an adjustment for the number of industries is crucial in improving predictions. It is plausible that deal-by-deal funds diversify by having a more balanced number of deals across the industries where their firms are present, rather than by expanding to additional sectors. Controlling for the number of industries precludes the potential bias of an *ex ante* determinant of industry diversification.

Diversification appears to be linked to heterogeneity within deal-by-deal carry models. It shows no predictive power in identifying deal-by-deal funds from the "realized loss" group, while its informativeness is high as the analysis is constrained to funds with purer deal-by-deal structures.

3.4 Empirical findings

3.4.1 Fee costs of diversification in deal by deal funds

In Tables 3.6 and 3.7, I compare funds classified as deal-by-deal with all the remaining ones from the main sample, whether classified or not.

Industry diversification of GP deal portfolios decreases the net performance of deal-by-deal funds. This relationship has an exponential shape, in which the impact of dispersion is increasing in the concentration index.

Intuitively, the largest marginal effect of HHI occurs when a fund invests in just one industry (HHI =1); as fund portfolios become more diversified, the impact of further dispersion (across a 14-industry scale) is modest. As more industries are added, gains decrease in relation to the benefits of diversifying in other dimensions: such as stage, region or deal size.

A 0.25 increase in dispersion (1-HHI) from HHI = 1 leads to a decrease of the net IRR by between 2.52 and 2.85 percentage points, due to fee payments. A 0.5 increase in dispersion (1-HHI) leads to a similar decrease of the net IRR by between 3.25 and 3.65 percentage points.

Specific risk factors are examined in Table 7. GP diversification against any of the defined risk factors decreases funds' net performance in a linear manner. My classification regarding specific risk leads to a decrease of the net IRR between 1.62 and 1.91 percentage points, due to fee payments. A negative effect of adopting deal-by-deal models is not found for non-diversifying funds under this measure.

Both general and specific forms of diversification do not affect performance, other than by their effect on deal-by-deal funds.

3.4.2 Differential effects vs. whole fund models

In this section, I compare funds classified as deal-by-deal with funds classified as whole fund and exclude unclassified funds from my analysis. Under this refinement of my sample, net performance is also reduced by dispersion of deals across industries (HHI index), due to fee payments. In Table 3.8, I show that this relation is also exponential[20]. Effects are smaller in magnitude, but consistent in sign and significant.

[20] The linear relationship between HHI dispersion and the fee component of net performance is also positive, but less significant. The order of magnitude of the coefficient is smaller, implying that a decrease in HHI from HHI = 1 to HHI = 0.5 would have an expected impact between 1 and 1.5 percentage points in net performance.

A 0.25 increase in dispersion (1-HHI) from HHI = 1 leads to a decrease of the net IRR by between 1.70 and 2.21 percentage points, due to fee payments. A 0.5 increase in dispersion (1-HHI) leads to a similar decrease of the net IRR by between 2.19 and 2.24 percentage points.

In subsamples just including smaller funds, the effect of HHI dispersion on net performance is still found. In particular, the effect is stronger in magnitude and significance for small funds sizes below 1000 million dollars (Table A10). This finding points out to a potential concentration effect on smaller funds, for identical levels of industry diversification.

Larger funds must invest in a large number of deals, to the extent that average deal sizes cannot be increased proportionally. A larger number of portfolio firms implies that diversification against some forms of firm-specific risk is increased, ceteris paribus. This could mitigate effects of industry concentration.

In Table 3.9, I show that specific risk factors have a similar effect on net performance. According to the specific risk measure, diversification leads to a decrease of the net IRR between 1.62 and 1.91 percentage points, due to fee payments. This effect fails to achieve 10% significance when manager fixed effects are included.

An overall effect of deal-by-deal structures over performance is again found under the general diversification measure (HHI). Diversification measures do not impact performance through the whole fund subsample. The only exception is found in column (2) of Table 3.9. The effect of specific diversification is positive and significant – for within-vintage, within-type variation. Nevertheless, its magnitude is small when compared to the (negative) interaction with deal-by-deal models.

3.4.3 Robustness

I carry out a large set of robustness tests to validate my main results. In one of these I remove all the GP vehicles where portfolio investments cannot be clearly split between two (or more) sample funds (table B1). A smaller sample of 182 funds is defined as a result. In this panel, the number of portftolio investments per funds ranges from 10 to 75.

All portfolio firms included in this analysis have been acquired in an investment period year of their funds. It is imposed that no other fund within the same GP vehicle may be issued before the acquisition, unless that fund's mandate is incompatible with the portfolio firm. Funds with a conflicting geographic focus or a conflicting constraint to certain industries or assets (e.g. real estate) are allowed to have a conflicting time window.

I examine the sensitivity of the fund classification method to the minimum return required for the "whole fund" category (tables B2 to B5). This threshold is changed from 8%, the typical hurdle rate for private equity funds, to 0% for all fund types other than venture capital. With this calibration, I minimize the impact of any measurement error in the timing of funds' cash flows, where it may not coincide with the timing of LP's accounts. In particular, fund managers are known to use short-term fund leverage around acquisition dates, so as to delay capital calls.[21] Moreover, distinctions between fund types are removed, with regard to benchmark hurdle rates.

Standard errors are clustered by GP vehicle, at the qualitative data unit-level. Alternative time periods are tested, including data from the vintage year 2000. This

[21] For measurement purposes, investment is only realized when capital is called from LPs, possibly later than the actual investment date. Shorter holding periods increase deal and fund gross IRR statistics. Yet this effect may be seen as a distortion, as GPs incur financial costs that could be passed through to limited partners as portfolio company fees.

additional vintage has a significant impact in the dynamics of the economic cycle, since it comprises funds raised just before the dot-com crisis. For this purpose, I replace gross and net performance measures by equivalent internal return rates, computed from the second year of funds' lives onward.[22] This is done for the panel years 2000-2008 (Table D8) and, significantly, to years 2000-2005 (Table D9). In the latter case, I impose that no funds with negative realized returns are classified as whole fund.

Finally, I examine the impact of deal by deal models in performance statistics, both gross and net-of-fee. As predicted by Hüther et al. (2019), venture capital funds with deal by deal rules perform better, this effect being stronger before fees (Table D10). Nevertheless, other fund types (Table D11) do not follow this trend. If any effects in performance exist, these are negative.

3.5 Identification

3.5.1 Threats to identification

In Section 4, I present evidence of a positive effect of deal diversification on fee payments, for deal-by-deal funds. This finding is consistent with the hypothesis that deal diversification can be an optimal strategy for GPs paid under deal-by-deal rules.

However, my baseline results do not clarify whether invariant PE firm policies are among the mechanisms behind "deal-by-deal diversification". Managing teams that best combine skills for managing a diversified deal portfolio are likely to be assigned to deal-by-deal funds. Other firm characteristics could influence the feasibility and the optimality of these actions.

[22]General partner fee data are only available for the 2001-2015 period.

Hüther et al. (2019) point out to a potential self-selection effect on the negotiation of deal-by-deal contracts, with the assumption that these are preferred by general partners and avoided by LPs (according to common wisdom). In this setting, best-performing PE managers are the likeliest to extract this rent from limited partners. It cannot be ruled out that best-performing managers react differently to early exit or diversification incentives.[23]

Under those conditions, firms would be more likely to bargain deal-by-deal funds in a frequent basis. In particular, this would be done when market conditions might be more favourable, and the assignment of staff might be best suited for this purpose. Such mechanisms could lead to the self-selection of GP managers with the right profile to pursue diversification strategies and to be rewarded on a deal-by-deal basis.

Manager fixed effects contribute to the absorption of some firm characteristics, when managers are involved in different GP vehicles; and to the absorption of pure skill or status effects, when managers have been engaged in more than one firm. Yet this is not the ideal setting for a within-manager effect to be found.

For a better identification of my results, I study two particular time periods in which equilibrium conditions in manager-investor negotiations were strongly determined by external events. These time periods are defined around two exogenous shocks to the industry, determined by regulatory events. Temporary and unexpected changes in the market structure create an opportunity to randomize the assignment of distribution rules over managers and funds raised in these periods.

[23]It should also be noted that, regardless of diversification, overall effects of deal-by-deal models over fees could be due to increased manager bargaining power and status, in an average deal-by-deal contract.

3.5.2 IFRS and institutional investors - a supply shock

The first period of focus will be the year of 2006. This was a year that culminated the sudden development of the European Private Equity market (2005-06) and, coincidentally, a period when many institutional investors, in particular European, entered the US market for the first time as LPs.

This transition was well documented by Cumming and Johan (2007), in a contemporaneous survey with Dutch institutional investors. In large numbers, investors revealed intentions to add the PE asset classes and evoked the main motives: IFRS fair value accounting rules, the treatment of PE investments by Basel II standards and generally improved investor protection and disclosure practices.[24]

The authors propose two main channels, by which regulatory harmonization could reshape the Private Equity industry. A first channel is harmonization of accounting standards across industries, which made compliance by GP firms more feasible towards different classes of institutional investors. A second is harmonization across countries, which made LP investments from different jurisdictions more compatible.

The main event to prompt regulatory changes was the adoption of the International Financial Reporting Standards (IFRS) by the European Union (and other jurisdictions), for listed firms, in 2005.[25] Following this movement, fair value accounting was implemented in the United State[26] in 2006 by the SFAS 157. Illiquidity and opacity of PE investments was an historical barrier for the participation of institutional investors as LPs. A legally accepted framework became available to handle this problem.

[24] The decision stated that no information on portfolio companies may be regarded as a trade secret, with regard to disclosure to investors (Jan 2006).

[25] Beyond legal compliance, many institutions engaged in voluntary reporting under the IFRS rules. Their principles were progressively transposed to default accounting standards of EU member-states.

[26] Two additional exemptions exist: for foreign private advisers and for advisers to licensed small business investment companies.

Coincidentally, other regulatory changes contributed to the external shock. In 2006, Basel II rules were under implementation in the US and in Europe, two years after their approval. The new banking regulation framework introduced a more favourable risk weighting of PE investments.

In the United States, two court settlements have enhanced the protection of LP rights and forced GPs to improve disclosure standards. A first one was a case won by CalPERS, the largest public pension pension fund in the country. The disclosure of rates of return and management fees paid was imposed, on a detailed fund basis. As a consequence, trustees could make pension fund managers liable to request this information from private equity funds, as a prior condition to committing capital.[27] A second case opposed Ohio Bureau of Workers' Compensation to all PE firms (General Partners) on its portfolio, over disclosure practices.

Figure 3.4 illustrates market trends in distribution rules, with data from by descriptive dataset. A dramatic growth in the number of European PE funds is shown, in vintages of 2005 and 2006. This market became dominated by whole fund distribution rules, adopted by more than 85% of documented funds in every vintage.

A milder effect of atypical market conditions was felt in the US, where improved LP protection mechanisms coincided with a discontinuous increase in the share of whole fund fundraisings. The proportion of deal-by-deal funds dropped from 47% to 22% from the 2005 to 2006 vintage. A slight rebound on that share is observed after the shock, yet far from prior levels.

[27] The CalPERS decision led to efforts by the Association for Investment Management and Research (AIMR) and the British and European Venture Capital Associations to reach greater agreement on disclosure standards in reporting the results of private-equity investments. The case details one set of standards, AIMR's Global Investment Performance Standards (GIPS), which would become effective January 1, 2005.

All in all, evidence suggests that an extra supply of funds was driven by concessions in GP bargaining power, which allowed funds to abide by the standards of potential new investors. The adjustment movement has produced a sizeable number of unexpected whole fund funds in the European and North American markets in the year of 2006. This can be qualified as a regulatory shock.

I do not rule out a possible feedback effect, where a shortening of excess demand for LP funds could increase GP bargaining power. However, evidence is in favour of a first-order impact in the opposite direction. In exploring this off-equilibrium period, I employ two binary diversification measures. The first one is binary variable set as 1 when the HHI industry concentration index is greater than 0.6 and 0 otherwise. The second measure is the previously used "exposure to risk" dummy – a measure of diversification against specific risk factors.

I study the effect of diversification variables on net performance, through fees, for deal-by-deal funds in the year of 2006 (Post-IFRS) and in neighbouring years 2003-2005 (Pre-IFRS). Fund type and region focus fixed effects are included. Standard errors are clustered by fund type, region focus and pre/post-IFRS vintage.

In Table 3.10, I investigate the incremental effects of diversification in deal-by-deal funds during the year of 2006, using a triple-difference framework for the general diversification measure. The first two differences were explored in Section 4: distribution rule (deal-by-deal vs. whole fund) and diversification measure. The third one is a time difference, distinguishing Post-IFRS and Pre-IFRS funds. The model is specified as follows:

$$y_i = \rho r_i+\beta(d_i\times f_i\times s_i)+\beta_x(d_i\times f_i)+\beta_y(d_i\times s_i)+\beta_z(f_i\times s_i)+\beta_d d_i+\beta_f f_i+\beta_s s_i+\gamma_i+\theta_i+\delta_i \tag{A.3}$$

The net internal Rate of Return (y_i) is again estimated as a function of the total, pre-fee IRR (r_i). d_i is a binary variable denoting whether a fund is classified as deal-by-deal and f_i is one of the portfolio diversification measures: functions of the HHI index and Exposure to Risk. s_i is a binary variable, denoting whether a fund was raised during the post-IFRS period (2006). γ_i is a set of fund-level control variables. θ_i are fixed effects at the vintage, fund type and region focus levels.

General diversification has a greater negative effect over performance, for post-IFRS deal-by-deal funds. The differential effect of the HHI measure funds has a large magnitude, around 3 percentage points, in all specifications. The total effect of distribution rules and diversification (vs. whole fund funds) is close to two percentage points, while, for the remaining years, this effect is not significantly positive.

In a triple difference setting (Table C11). both this measure and the specific diversification variable have significant negative effects on net performance for post-IFRS funds. When the period 2003-2005 is included, performance effects remain, while they are not matched by a pre-IFRS effect of deal-by-deal diversification.

3.5.3 PE supervision under the Dodd-Frank act - a regulatory rush

In this section, I will test the hypothesis that the adoption of the Dodd-Frank Act, by enacting SEC supervision over all private equity vehicles, should have discouraged the raising of deal-by-deal funds to be filed under the new regulatory framework (scheduled for 21/07/2011, delayed until 21/03/2012).

Title IV of the Dodd-Frank Wall Street Reform and Consumer Protection Act makes numerous changes to the registration, reporting and recordkeeping requirements of the Investment Advisers Act of 1940. Among these changes is the requirement that advisers to most private funds (hedge funds and private equity funds) register with the Securities Exchange Commission (SEC).

Historically, many fund advisers had been exempt from registration under the so-called "private adviser" exemption. The Dodd-Frank Act replaces this exemption with several narrower exemptions for advisers that advise exclusively venture capital funds and advisers solely to private funds with less than $150 million in assets under management in the United States.

The Commission is given the authority to collect data from registered investment advisers about their private funds for the purposes of the assessment of systemic risk by the Financial Stability Oversight Council. The SEC has discretion in setting up disclosure requirements, both in the act of fund registration and at subsequent times. To fulfil its data collection obligations under the Dodd-Frank Act, the SEC Division of Investment Management adopted a new form, Form PF.14. It requires private fund advisers to disclose a long list of strategic and financial indicators, including a list of products, performance and risk metrics, financing information, counterparties and credit exposure.

SEC's data collection process was oriented towards targeted monitoring actions, directed to some of the most unlawful practices in the industry, as perceived by supervisors.[28] Fund terms set up under the new regime were constrained. The Commission has listed some of these priorities in its policy papers. Some notorious examples are deductions of transaction fees paid by portfolio companies, fair value accounting and financial report-

[28] Administrative infraction proceedings, in large numbers, enforced these actions in the next years.

ing, accelerated monitoring fees[29] and side interests of fund GPs. Among those, one is of particular interest to this analysis: lack of transparency in co-investment agreements.

In particular, much greater scrutiny was brought over funds launched with "deals in prospect". Such deals can be offered as a private benefit of co-investment, if a GP fund manager wishes to attract a valuable investor. (Greenberger (2007)). If this practice is not disclosed to other LPs at the time of commitment, it can be seen as a hidden rent transfer between LPs. It can also be interpreted as an untruthful signal, by which a reputable investor makes a large commitment supposedly based on standard fund terms, while it is being endowed with a separate account.

Promised opportunities to co-invest are most effective when specific deals are set to be invested early in fund's life. Pre-screened investments have more likely upside potential (entry arbitrage). As these deals are the first to be entered, they are also likelier to be first exited. Likelihood of strong early exits increases, creating optimal conditions for the adoption of deal-by-deal models. This is one of the most profitable *ex ante* settings in which a deal-by-deal contract can be agreed upon.

SEC intervention on co-investment practices could be anticipated. LPs were also likely to be empowered, in future rounds, by other regulatory constraints to be implemented. Conditions were created for a regulatory rush in registering deal-by-deal funds under the old legal framework.

In Figure 3.5, an abnormal surge in the share of deal-by-deal funds is seen at the 2011 US vintage (49%, +11%), in contrast with a then in-adjustment from the 2012 vintage onward, where whole fund structures have started to be more pervasive (with lasting

[29] Monitoring fees are paid yearly, as a function of each portfolio firm's EBITDA. Early exits reduce firm holding periods before expectation. LPs are sometimes forced to pay amounts that could be due if firms were not exited early.

effects). By 2013, this share had declined to 19%.[30]

The suggested hypothesis is that pre-Dodd-Frank deal-by-deal funds were incentivized to close earlier, giving rise to an abnormal peak in the use of deal-by-deal structures and to a significant change in bargaining mechanisms associated to managers (and investors) with deal-by-deal preferences.

In Table 3.11, I test all my main diversification variables, as for their impact in North American funds raised in 2011, when an off-equilibrium market period occurred just before the adoption of the Dodd-Frank Act. My dependent variable is the undiscounted total of fees paid in the first three years of fund's lives.

In recent vintages, funds do not have a sufficiently long time series to be classified as for carried interest models. However, it is possible to look at their investment strategies of their GP vehicles, for which data is available until 2016. Instead of studying effects for funds classified as deal-by-deal, I look here at funds belonging to private equity firms that raised deal-by-deal funds in my sample (of 380 firms), for the years 1998-2008.

The share of classified deal-by-deal funds in sampled firms ranges between 55% and 70% for the period 2004-2008. During a peak of deal-by-deal fundraising, this probability is expected to be higher. In Table C13, I show that the proportion of deal-by-deal funds in my main sample (2001-2008) is well below the share of deal-by-deal funds predicted during this peak. If not all funds in "deal-by-deal firms" are deal-by-deal, they are at least expected to have negotiated under this prospect, with the intention to capitalize on specific conditions of this period. Namely, these firms were likelier to raise deal-by-deal funds in the next year, according to a regular pipeline, and to be bound by this anticipation effect.

[30] Rewarding key investors with co-investment is also likely to increase LPs ability to bargain those conditions.

My analysis of the 2011 shock does not measure specific effects of diversification over fees, through carried interest. However, it sheds light on a complementary issue: on whether deal-by-deal funds with diversification strategies practice generally worse fee conditions, at times when GP firms are incentivized to raise them.

As in Section 5.2, I employ two binary diversification measures. The first one is a binary variable, set as 1 when the HHI industry concentration index is greater than 0.6 and 0 otherwise. The second measure is the previously used "exposure to risk" dummy – a measure of diversification against specific risk factors. In addition to this, I employ the continuous measure of general diversification (1-HHI).

In this analysis, the sample is different from previous Tables, comprising funds raised from 2008 to 2012 – for which the first three years of fees are observed. Details of the time series can be seen in Table C13.

I specify a triple difference model. In a setting with a new dependent variable and a small sample size, four changes were made. First, vintage fixed effects are not included – as management fees are determined by the economic cycle; second, standard errors are not clustered; third, I test for linear relations with the HHI index; fourth, I control for raised post-shock, in 2012. The specification is otherwise similar to that employed in Section 5.2:

$$z_i = \beta(d_i \times f_i \times s_i) + \beta_x(d_i \times f_i) + \beta_y(d_i \times s_i) + \beta_z(f_i \times s_i) + \beta_d d_i + \beta_f f_i + \beta_s s_i + \gamma_i + \theta_i + \delta_i \quad \text{(A.4)}$$

The outcome variable measures funds' management fees paid for the first 3 years of life (z_i). d_i is a binary variable denoting whether the fund's parent firm raised funds classified as deal-by-deal (2001-2008) and f_i is one of the portfolio diversification measures: functions of HHI and Exposure to Risk. s_i is a binary variable, denoting whether a fund was raised during the Dodd-Frank shock period (2010-11). γ_i is a set of control variables, including a "Post-Dodd Frank" binary variable, for funds raised in 2012. θ_i denotes fund type fixed effects.

In Table 3.11, all the three diversification variables have positive effects in funds belonging to "deal-by-deal firms". Stronger differential effects are identified for HHI variables, the fee total increasing by more than 6 percentage points in the binary variable case. Conversely, in the absence of diversification interactions, the deal-by-deal propense subsample does not evidence any increase in fees paid by the 2011 fund vintage.

Evidence suggests that General Partners negotiate distinct fund terms in firms prone to raise deal-by-deal funds. This is consistent with hypothesis that deal-by-deal diversification is implemented by GPs at times when their bargaining power is high in fund closings. GP managers are expected to diversify industry exposures under deal-by deal rules, according to evidence from the 2001-2008 fund vintages. I find no "a priori" reason to exclude this hypothesis for subsequent funds, raised between 2009 and 2011.

As a robustness verification, the test on the first three years of fees is replicated in the 2006 shock period, using the Main sample. Post-IFRS funds (Table C21) also pay significantly higher fees for their first three years of life. Magnitudes of 2006 effects on management fees are comparable to those found for the 2011 shock (Table 3.11).

3.6 Conclusion

Private equity partnerships are characterized by a strong empowerment of managers (GPs), at the expense of investors (LPs). The governance of private equity vehicles resembles the setting of public firms without controlling shareholders. However, PE funds have a unique feature: compensation rules and levels are set with great contingency and detail before fund activity starts. Later amendments are exceptional.

Deal-by-deal carry rules entitle managers to earn a bonus (carried interest) whenever a portfolio firm is sold or divested in a profitable manner. If the most profitable deals of a fund are first divested, deal-by-deal rules have the potential to anticipate bonus payments in several years, increasing their time value. Some funds might also increase the nominal value of carried interest.

Diversification increases chances of having extremely good deals (alongside the chances of having the lousiest ones). Thus, according to my findings, managers are expected to diversify portfolio investments when they receive deal-by-deal bonus payments, both across industries and specific risk factors.

For the same reason, private equity firms with a penchant for diversification should prefer purer deal-by-deal models. Bargaining optimal fund terms at fundraising is key for both parties. Yet managers are more informed about future investment plans and about their own skills.

When diversification strategies are implemented, I find that net performance of deal-by-deal funds is lower than what is predicted by their total levels of value creation. My finding holds for general industry diversification, across the fund's portfolio and other investments managed by the GP vehicle. It also applies to non-extreme exposures to specific risk factors, where PE fund managers best gamble in their opposite realizations, such that any may generate strong exits.

High bargaining power seems to be associated with deal-by-deal diversification, notoriously at times when LPs' position is strengthened. Plausibly, some of the best performing managers self-select themselves to pursue diversification strategies. To alleviate self-selection concerns, I examine fund returns and fee payments in two off-equilibrium periods where the industry faced regulatory shocks (2006 and 2010-2011).

When market conditions are propense to funds with whole fund rules, I find that diversified deal-by-deal funds still charge higher fees than predicted. Conversely, when an incentive exists for deal-by-deal funds to be raised, diversified deal-by-deal funds charge much higher management fees than focused funds or those with whole fund rules.

Diversifying strategies have a positive impact in fee payments even when managers lose their ability to choose deal-by-deal distribution rules. However, deal-by-deal terms make diversification most beneficial to managers, due to the implicit GP incentives to pursue strong early exits carried interest payments.

I do not claim that diversification strategies followed under deal-by-deal models are value-destroying or inefficient per se. Nonetheless, they are potentially pursued with motivations alien to value-delivery to LPs.

They can potentially push funds to diversify investments and seek early firm exits at any cost. This could mean skipping important investment options. A famous example is "add on acquisitions" — typical private equity structures in which an additional firm is acquired and combined with an existing portfolio firm of the same industry.

On the other hand, they can increase the fund's set of investment opportunities, not least since managers have more powered incentives to take risks at the deal-specific level. They can also be optimal in building on the management team's set of skills.

It is plausible that investors should benefit from giving managers some extra "skin in the game". However, authorities should be aware of unintended incentives investors may be paying for. Deal-by-deal structures can induce risk-taking behaviour that is beneficial for managers but can be undesired from the standpoint of investors.

Authorities should examine welfare implications of deal-by-deal rules and impose appropriate restrictions and disclosure requirements. In an industry where investment positions are illiquid and their valuations are opaque, transparency of manager in incentives is a key endeavour.

Appendix of Chapter 3

Figures

Figure 3.1: **Sequential payments in whole fund and realized loss deal-by-deal models.** The figure plots a stereotypical example of cash flow waterfalls for GPs and LPs, under different distribution rules.

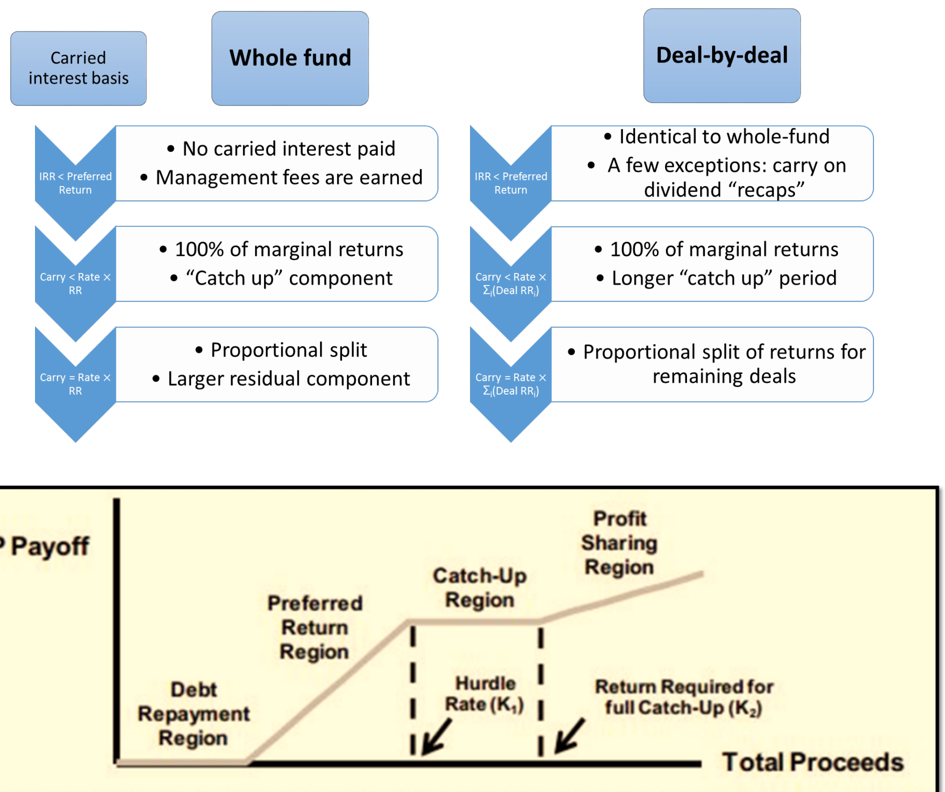

Figure 3.2: **Sequential payments in whole fund and realized loss deal-by-deal models.** This figure plots cash flow waterfalls from the first example in the text, both for GPs and LPs, under different distribution rules.

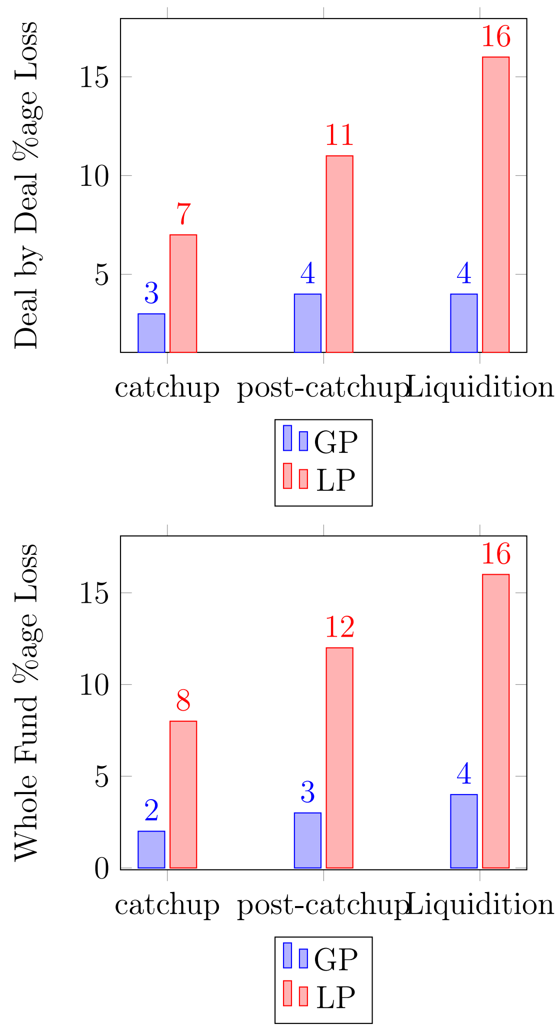

Figure 3.3: **Graphical illustration of realized loss deal-by-deal model vs. whole fund.** This figure plots cash flow waterfalls from the second example in the text, both for GPs and LPs, under different distribution rules.

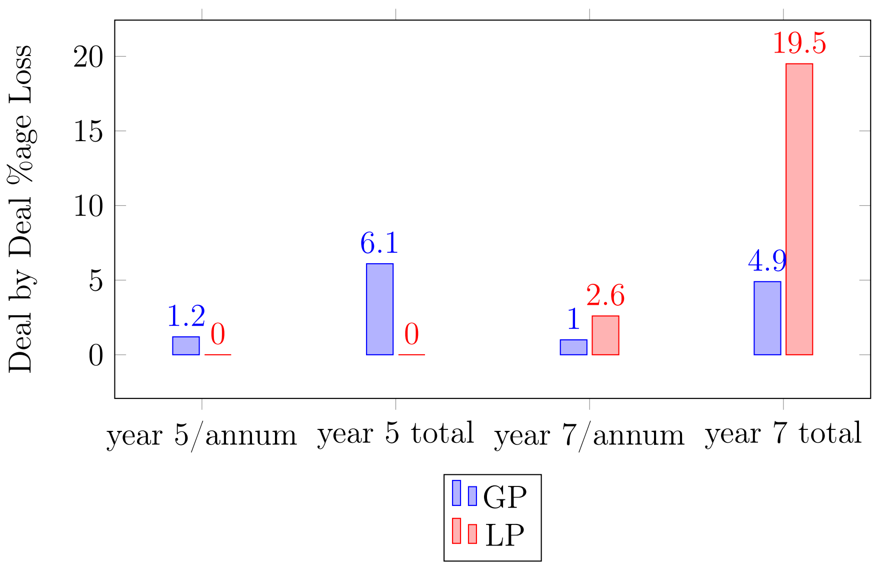

Figure 3.4: **Deal-by-deal classification – time series from anonymous database - IFRS shock years** The figure plots time trends in the choice distribution rules, for funds raised in years close to the shock period (2006-2007). The first graph provides a detailed illustration for all funds raised in raised the Europe. The second graph comprises all funds raised the United States. The third graph isolates venture capital funds raised in the United States.

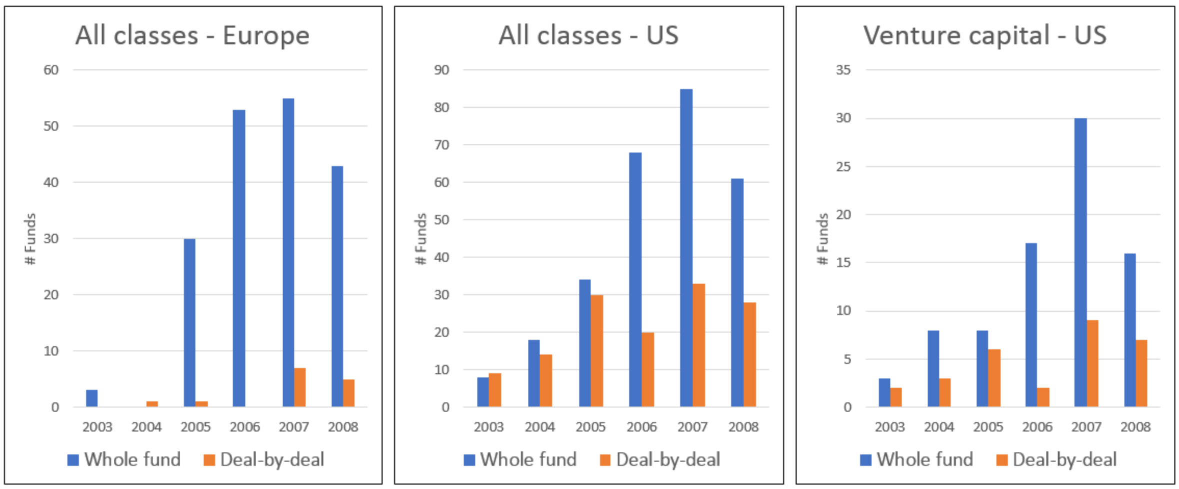

Figure 3.5: **Deal-by-deal classification – time series from anonymous database Period around Dodd-Frank Act adoption** This figure plots time trends in the choice distribution rules, for funds raised in years close to the shock period (2010-2011). The first graph comprised all funds raised in the United States, in years 2008-2013. The second graph and the third graphs provide a detailed illustration of American buyout and direct lending funds, respectively.

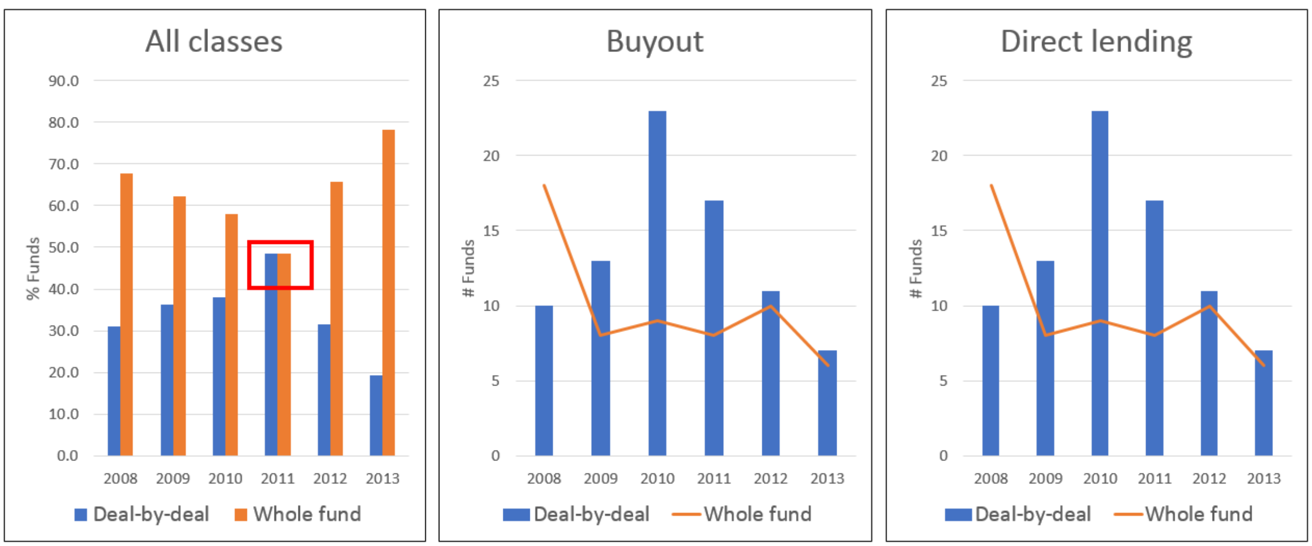

Figure 3.6: **Sectorial classification, major grouping.** This figure lists all first-level industries of the classification proposed by Invest Europe, as a recommended framework to be used in Private Equity investment.

	EVCA 14-industry classification
1	Agriculture
2	Chemicals and materials
3	Business and Industrial Products
4	Business and Industrial Services
5	Construction
6	Transportation
7	Consumer goods and retail
8	Consumer services: other
9	Energy and environment
10	Financial services
11	Real estate
12	Communications
13	Computers and consumer electronics
14	Life Sciences

Tables

Table 3.1: **Frequency of fund types.** This table presents the number of funds and its proportion for all fund types, as classified in the Preqin dataset. That decomposition is replicated for the relevant subsamples, built in accordance with data exclusion criteria

	Panel A: All merged data		Panel B: Funds with data on performance, post 1998					
			Sample		*Main sample*		*Not in the main sample*	
Fund type	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Balanced	27	2.5%	10	2.8%	7	3.2%	3	2.1%
Buyout	384	34.9%	126	35.0%	82	37.6%	44	31.0%
Co-Investment	11	1.0%	4	1.1%	2	0.9%	2	1.4%
Direct Secondaries	3	0.3%	2	0.6%	2	0.9%	0	0.0%
Distressed Debt	52	4.7%	22	6.1%	10	4.6%	12	8.5%
Early Stage	87	7.9%	40	11.1%	26	11.9%	14	9.9%
Early Stage: Seed	9	0.8%	5	1.4%	4	1.8%	1	0.7%
Early Stage: Start-up	11	1.0%	4	1.1%	3	1.4%	1	0.7%
Expansion/Late Stage	27	2.5%	10	2.8%	3	1.4%	7	4.9%
Fund of Funds	55	5.0%	15	4.2%	5	2.3%	10	7.0%
Growth	51	4.6%	17	4.7%	13	6.0%	4	2.8%
Infrastructure	21	1.9%	5	1.4%	5	2.3%	0	0.0%
Mezzanine	22	2.0%	4	1.1%	2	0.9%	2	1.4%
Natural Resources	44	4.0%	10	2.8%	8	3.7%	2	1.4%
Real Estate	69	6.3%	5	1.4%	3	1.4%	2	1.4%
Real Estate Co-Investment	1	0.1%	0	0.0%	0	0.0%	0	0.0%
Secondaries	26	2.4%	12	3.3%	6	2.8%	6	4.2%
Special Situations	9	0.8%	2	0.6%	2	0.9%	0	0.0%
Timber	2	0.2%	0	0.0%	0	0.0%	0	0.0%
Turnaround	2	0.2%	1	0.3%	0	0.0%	1	0.7%
Venture Capital (All Stages)	182	16.5%	64	17.8%	34	15.6%	30	21.1%
Venture Debt	5	0.5%	2	0.6%	1	0.5%	1	0.7%
Total:	1100		360		218		142	

Table 3.2: **Fund performance by vintage - net of fees.** This table presents detailed summary statistics for the total internal rate of return (IRR), by year of vintage. Detailed data are reported for funds in the buyout and venture capital fund classes. The list of yearly statistics comprises a value-weighted average (*Weighted IRR*), an equal-weighted average (*Mean IRR*) and a median (*Median IRR*). In panel A, these statistics are reported for the entire sample and, in panel B, the same statistics are reported for the Main Sample, composed of classified funds only.

Panel A		*Buyout*			*Venture Capital*			*All Fund Types*		N
Year	Weighted IRR	Mean IRR	Median IRR	Weighted IRR	Mean IRR	Median IRR	Weighted IRR	Mean IRR	Median IRR	348
1998	7.31	9.67	8.54	-0.53	-4.02	-6.92	5.97	3.78	6.56	21
1999	15.37	12.10	12.93	-4.95	-6.16	-6.26	8.32	4.47	4.15	19
2000	17.79	17.39	17.87	-4.92	-6.64	-7.87	12.00	5.88	3.76	50
2001	15.24	14.84	13.99	5.50	1.54	2.67	9.44	6.00	5.08	28
2002	26.02	18.53	16.91	2.49	3.18	-1.87	20.33	12.59	8.01	23
2003	17.16	14.30	14.30	-0.47	0.38	3.17	2.89	1.36	5.08	14
2004	11.15	9.09	9.93	1.05	3.77	5.74	11.60	8.78	6.78	34
2005	10.55	12.83	10.27	-1.58	-3.21	-0.28	9.77	9.89	8.93	44
2006	5.35	4.27	7.38	0.45	-1.20	-0.58	5.71	3.10	4.74	63
2007	5.75	9.50	5.18	0.72	-2.02	-2.02	7.56	7.62	6.52	34
2008	4.28	4.56	0.71	-4.52	-4.52	-4.52	10.13	6.27	3.03	18
Panel B		*Buyout - main sample*			*Venture capital - main sample*			*All Fund Types - main sample*		N
	Weighted IRR	Mean IRR	Median IRR	Weighted IRR	Mean IRR	Median IRR	Weighted IRR	Mean IRR	Median IRR	207
2001	15.24	14.84	13.99	6.60	4.58	2.78	10.49	7.81	7.44	21
2002	26.41	20.28	20.58	-1.35	-1.43	-3.25	20.69	12.15	5.81	20
2003	20.94	20.94	20.94	-4.14	-2.16	0.12	2.00	-0.44	3.64	11
2004	11.89	9.44	11.85	4.73	5.31	6.10	13.25	9.28	6.78	28
2005	8.78	10.31	10.26	0.94	-2.31	0.70	9.04	9.24	9.98	36
2006	5.35	4.27	7.38	1.30	-0.03	1.67	5.35	3.01	6.12	50
2007	6.67	11.84	6.60	0.72	-2.02	-2.02	7.79	8.36	6.58	26
2008	4.28	4.56	0.71	-4.52	-4.52	-4.52	5.39	6.72	3.03	15

Table 3.3: **Deal by Deal Classification - summary statistics by fund type.** This table summarizes the classification of funds according to carried interest models, with a breakdown by fund types

	Panel A: Deal by deal classification overall			Panel B: Deal by Deal Classification - Buyout and Balanced Funds		
Carried Interest Basis	# Funds	% of Classified	% of Total	# Funds	% of Classified	% of Total
Deal by Deal	54	36	25	17	28	19
Whole Fund	97	64	44	44	72	49
Unclassified	67	.	31	28	.	31
Total	218			89		
	Panel C: Deal by Deal Classification - Venture Capital			Panel D: Deal by deal classification - all venture capital		
Carried Interest Basis	# Funds	% of Classified	% of Total	# Funds	% of Classified	% of Total
Deal by Deal	4	7	12	6	21	14
Whole Fund	18	31	53	22	79	51
Unclassified	12	.	35	15	.	35
Total	34			43		

Table 3.4: **GP vehicle portfolios and general diversification variables** Table 4 mentions GP vehicle portfolios and general diversification variables. The data for these variables have been categorized further. Panel A is the Main Sample data containing Mean, Standard Deviation, Minimum, Maximum values as well as the number of observations. Same parameters are mentions in Panel B, C and D but Panel B contains data of Funds classified as Deal by Deal whereas Panel C deals with Funds classified as whole fund and Panel D contains the previously mentioned parameters for all such funds not classified as Deal by Deal. HHI is a variable measuring a Herfindahl-Hirschman index: the commonly accepted measure of market concentration. The HHI index is computed by industry for proportions of the total number of portfolio firms in each fund: measuring concentration of portfolio investments across 14 industries

	Panel A: Main Sample					*Panel B: Funds Classified as Deal by Deal*				
Variable	Mean	St. Dev	Min	Max	Obs	Mean	St. Dev	Min	Max	Obs
Number of Firms	60.70	56.87	1	200	218	53.44	53.21	1	200	54
Number of Industries	8.09	3.75	0	14	218	7.63	3.78	0	14	54
1 - HHI	0.448	0.191	0	0.687	218	0.446	0.193	0	0.686	54
1 - HHI, primary funds	0.460	0.183	0	0.687	207	0.476	0.170	0.04	0.686	47
1 - HHI, buyout + VC	0.492	0.167	0	0.687	145	0.528	0.146	0.12	0.686	26
	Panel C: Funds classified as whole fund					*Panel D: All funds not classified as deal by deal*				
Variable	Mean	St. Dev	Min	Max	Obs	Mean	St. Dev	Min	Max	Obs
Number of Firms	62.15	59.92	1	200	99	63.09	57.98	1	200	164
Number of Industries	8.24	3.65	1	14	99	8.24	3.74	1	14	164
1 - HHI	0.450	0.187	0	0.687	99	0.449	0.191	0	0.687	164
1 - HHI, primary funds	0.457	0.179	0.03	0.687	94	0.455	0.186	0	0.687	160
1 - HHI, buyout + VC	0.476	0.161	0	0.687	83	0.478	0.172	0	0.687	132

Table 3.5: **Fee Margins and Internal Rates of Return by Subsamples.** Table 5 summarizes Fee Margins and Internal Rates of Return. *Fee Margin* is defined as the difference between Fund IRR and Net IRR. Parameters of mean, standard deviation, minimum and maximum values, as well as number of observations are reported for each variable. Data has been categorized by subsamples, combining the two possible realizations of *Exposure to risk* with the two carry distribution models: deal by deal and whole fund. *Exposure to risk* is a binary variable, which takes the value of 1 when a fund takes a "non-extreme exposure" to one of the defined "specific risk factors" - binary variables defined at the portfolio firm level. A fund is classified as having a non-extreme exposure to a factor if at least 25% and no more than 75% of its portfolio firms are exposed to the risk factor in each of its two categories

	Panel A: Whole fund, no specific diversification factor					*Panel B: Whole fund, any specific diversification factor*				
	Mean	St. Dev	Min	Max	Obs	Mean	St. Dev	Min	Max	Obs
Net IRR	11.45	13.12	-16.27	67.01	35	14.60	14.66	-22.31	77.07	62
Fund IRR	14.71	13.72	-12.24	76.32	35	18.08	15.06	-20.02	78.12	62
Fee margin	3.26	1.65	1.42	9.31	35	3.48	2.74	0.30	18.85	62
	Panel C: Deal by deal, no specific diversification factor					*Panel D: Deal by deal, any specific diversification factor*				
	Mean	St. Dev	Min	Max	Obs	Mean	St. Dev	Min	Max	Obs
Net IRR	6.48	7.64	-4.65	19.48	17	5.85	18.75	-62.31	60.75	37
Fund IRR	10.11	7.86	-1.57	24.15	17	10.81	18.41	-43.50	72.81	37
Fee margin	3.62	1.22	1.92	5.83	17	4.97	3.25	1.65	18.81	37
	Panel E: Whole fund or unclassified, no specific diversification factor					*Panel F: Whole fund or unclassified, any specific diversification factor*				
	Mean	St. Dev	Min	Max	Obs	Mean	St. Dev	Min	Max	Obs
Net IRR	6.49	15.31	-71.94	67.01	64	9.37	15.81	-65.67	77.07	100
Fund IRR	10.44	12.60	-21.63	76.32	64	12.70	16.07	-59.50	78.12	100
Fee margin	3.96	6.07	1.42	50.31	64	3.32	2.29	0.30	18.85	100

Table 3.6: **Larger sample - unclassified firms - HHI**
Table 6 reports the results of regression models estimating net performance (*Net IRR*) as a function of internal rates of return before fees (*Fund IRR*). *HHI* is used as regressor, measuring diversification. Models are estimated for the larger sample, including unclassified funds. The main variable of interest is the interaction between the binary indicator of deal-by-deal carry models (*Deal by deal*) and the diversification measure. *Fund Size (M)* is the fund's total committed capital at the time of fundraising. Fixed effects are included at the vintage, fund type and manager levels. Standard errors are clustered by GP vehicle. All other variables are as defined in tables 2.1 and 4

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	0.996***	0.993***
	(32.307)	(31.074)	(29.926)
Deal by deal x -exp(HHI)	-1.969**	-2.185**	-2.218**
	(-2.485)	(-2.486)	(-2.007)
Deal by deal	-4.394***	-5.305***	-5.574***
	(-3.025)	(-3.597)	(-3.101)
-exp(HHI)	0.391	0.200	0.174
	(0.754)	(0.472)	(0.265)
No. of portfolio firms classified	0.005	0.015***	0.020***
	(1.549)	(4.172)	(2.935)
Fund Size (M)	0.218**	0.012	0.033
	(2.216)	(0.181)	(0.336)
Constant	-2.822*	-2.806**	-2.719
	(-1.903)	(-2.488)	(-1.603)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.7: **Larger sample - unclassified firms - Exposure to risk** Table 7 reports the results of regression models estimating net performance (*Net IRR*) as a function of internal rates of return before fees (*Fund IRR*). *Exposure to risk* is used as regressor, measuring diversification. Models are estimated for the larger sample, including unclassified funds. The main variable of interest is the interaction between the binary indicator of deal-by-deal carry models (*Deal by deal*) and the diversification measure. Fixed effects are included at the vintage, fund type and manager levels. Standard errors are clustered by GP vehicle. All other variables are as defined in tables 2.1, 5 and 6.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	1.000***	0.997***
	(32.812)	(31.393)	(29.685)
Deal by deal x Exposure to risk	-1.623***	-1.818***	-1.911*
	(-3.454)	(-3.294)	(-1.942)
Deal by deal	0.124	-0.327	-0.308
	(0.200)	(-0.586)	(-0.361)
Exposure to risk	0.545	0.387	0.606
	(1.453)	(1.036)	(1.057)
Fund Size (M)	0.238**	0.104*	0.141*
	(2.454)	(1.808)	(1.833)
Constant	-3.532***	-2.249***	-2.073***
	(-4.508)	(-3.511)	(-2.731)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.8: **Main sample - HHI - general.** Table 8 reports the results of regression models estimating net performance (*Net IRR*) as a function of internal rates of return before fees (*Fund IRR*). *HHI* is used as regressor, measuring diversification. Models are estimated for the main sample. The main variable of interest is the interaction between the binary indicator of deal-by-deal carry models (*Deal by deal*) and the diversification measure. Fixed effects are included at the vintage, fund type and manager levels. Standard errors are clustered by GP vehicle. All other variables are as defined in tables 2.1, 4 and 6

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	0.978***	0.967***	0.961***
	(30.729)	(28.300)	(25.449)
Deal by deal x -exp(HHI)	-1.338**	-1.359**	-1.327**
	(-2.076)	(-2.070)	(-2.089)
Deal by deal	-3.645***	-3.806***	-4.153***
	(-2.856)	(-3.518)	(-3.449)
-exp(HHI)	0.025	-0.123	0.290
	(0.044)	(-0.199)	(0.374)
No. of portfolio firms classified	0.003	0.012***	0.013***
	(1.211)	(3.042)	(2.796)
Fund Size (M)	0.196*	0.005	0.037
	(1.889)	(0.065)	(0.335)
Constant	-2.903	-2.182	-0.426
	(-1.415)	(-0.854)	(-0.127)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	151	151	151

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.9: **Main sample - Exposure to risk.** Table 9 reports the results of regression models estimating net performance (*Net IRR*) as a function of internal rates of return before fees (*Fund IRR*). *Exposure to risk* is used as regressor, measuring diversification. Models are estimated for the main sample. The main variable of interest is the interaction between the binary indicator of deal-by-deal carry models (*Deal by deal*) and the diversification measure. Fixed effects are included at the vintage, fund type and manager levels. Standard errors are clustered by GP vehicle. All other variables are as defined in tables 2.1, 5 and 6

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	0.977***	0.968***	0.965***
	(0.030)	(0.030)	(0.036)
Deal by deal x Exposure to risk	-1.145**	-1.496***	-1.812
	(0.538)	(0.543)	(1.149)
Deal by deal	-0.542	-0.504	-0.369
	(0.511)	(0.703)	(1.184)
Exposure to risk	-0.145	-0.458**	-0.295
	(0.268)	(0.185)	(0.258)
Fund Size (M)	0.186*	0.027	0.047
	(0.100)	(0.056)	(0.069)
Constant	-2.604**	-0.154	0.852
	(1.113)	(1.313)	(1.699)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	151	151	151

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.10: **2006 shock - differential effect on HHI.** Table 10 reports triple difference regression models, which illustrate the differential effect of deal-by-deal distribution rules (*Deal by deal*) and diversification (*Diversification*) in funds raised in 2006, in the period identified as "IFRS shock" (*Post IFRS*). These models estimate net performance again as a function of internal rates of return before fees. Data are from the last three years preceding the surge in the European Private Equity market (2003-2005) and the year when the shock occurred (2006). *HHI < 0.6* is a binary variable taking the value of 1 when the HHI index of industry concentration for portfolio firms is lower than 0.6 and 0 otherwise. Models contain fund type and region focus fixed effects and a control binary variable for funds raised in the pre-IFRS vintage (2005). Standard errors are clustered by fund type, region focus and sample period. All other variables are as defined in tables 2.1, 4 and 6

	(1) Net IRR	(2) Net IRR	(3) Net IRR	(4) Net IRR
Fund IRR	0.945***	0.945***	0.948***	0.948***
	(25.646)	(26.959)	(25.771)	(27.459)
Post IFRS x Deal by Deal x Diversification	-3.138**	-3.471**	-2.779**	-3.121**
	(-2.299)	(-2.323)	(-2.082)	(-2.127)
Post IFRS x Deal by Deal	3.731**	3.858**	3.493**	3.630**
	(2.540)	(2.497)	(2.424)	(2.417)
Post IFRS x Diversification	2.662**	2.488*	2.403*	2.236*
	(1.999)	(1.904)	(1.838)	(1.761)
Deal by Deal x HHI < 0.6	0.990	1.458	0.954	1.386
	(0.587)	(0.912)	(0.582)	(0.903)
Post IFRS	-2.480**	-2.467**	-2.443**	-2.426**
	(-2.220)	(-2.203)	(-2.226)	(-2.219)
HHI < 0.6	-1.267	-0.989	-1.307	-1.014
	(-1.234)	(-1.037)	(-1.277)	(-1.073)
Deal by Deal	-2.791**	-2.816**	-2.577**	-2.605**
	(-2.317)	(-2.278)	(-2.229)	(-2.230)
Fund Size (M)			0.139**	0.138**
			(2.414)	(2.144)
Constant	0.126	1.648	-0.601	0.949
	(0.108)	(1.016)	(-0.482)	(0.589)
Fund type fixed effects	Yes	Yes	Yes	Yes
Region focus fixed effects	Yes	No	Yes	No
Observations	93	93	93	93
Number of type	28	28	28	28

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.11: **2010-11 shock - effects in first 3 years of fees (undiscounted)** Table 11 reports triple difference regression models, which illustrate the differential effect of the past adoption of diversification (*Diversification*) and the past adoption of deal-by-deal distribution rules, at the firm level (*Deal by deal firm*) in funds raised in 2010 and 2011, in the period identified as "Dodd Frank shock" (*Post Dodd-Fr.*). These models estimate the (undiscounted) total amount of fees paid by funds in their first 3 years of life. *HHI < 0.6* is a binary variable taking the value of 1 when the HHI index of industry concentration for portfolio firms is lower than 0.6 and 0 otherwise. Fixed effects are included at the fund type level. Robust standard errors are estimated. All other variables are defined as in previous tables

	(1) Fees - First 3 years	(2) Fees - First 3 years	(3) Fees - First 3 years	(4) Fees - First 3 years
Pre Dodd-Fr. x Deal by Deal x Diversification	6.756**	14.658**	6.041**	
	(2.667)	(2.462)	(2.048)	
Deal by deal firm x Diversification	-6.629***	-11.888**	-1.541	
	(-3.946)	(-2.663)	(-0.579)	
HHI < 0.6	0.178			
	(0.212)			
1 - HHI		1.123		
		(0.543)		
Exposure to risk			0.125	
			(0.171)	
Deal by deal firm	5.707***	6.185**	1.570	1.193
	(4.045)	(2.418)	(1.315)	(1.172)
Post Dodd-Fr.	-1.041	-1.073	-1.050	-0.617
	(-1.271)	(-1.336)	(-1.362)	(-0.818)
Pre Dodd-Fr. x Deal by Deal firm	-5.117**	-6.531**	-2.446*	-0.385
	(-2.388)	(-2.087)	(-1.886)	(-0.297)
Pre Dodd-Fr.	-0.808	-0.137	-1.029	-0.710
	(-0.973)	(-0.113)	(-1.233)	(-1.323)
Fund Size (M)	-0.000**	-0.000***	-0.000***	-0.000***
	(-2.259)	(-2.758)	(-4.138)	(-3.256)
Constant	4.658***	4.328***	4.898***	4.474***
	(6.127)	(4.016)	(7.633)	(10.265)
Fund type fixed effects	Yes	Yes	Yes	
Observations	57	57	57	76

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix – Statistics and tests

Table C1: **Size, performance and location measures for sampled funds.** This table summarizes, in detail, the distributions of fund size (committed capital) and net-of-fee fund performance and presents the breakdown of funds per geographic area of focus

Size (USD million)	*Panel A: Sample*	*Panel B: Main Sample*
1st Percentile	50	42.2
5th Percentile	127.5	125
10th Percentile	184.5	180
25th Percentile	303	339.4
50th Percentile	606	700
75th Percentile	1405.5	1597.4
90th Percentile	3193.5	3500
95th Percentile	4510.15	5754.1
99th Percentile	10000	10000
Mean	1292.4	1438.4
St. Dev	1888.3	2159.1
Observations	360	218
Net IRR	*Panel C: Sample*	*Panel D: Main Sample*
1st Percentile	-28.8	-62.3
5th Percentile	-12.8	-12.9
10th Percentile	-8.2	-5.8
25th Percentile	0.1	2.6
50th Percentile	7.2	7.9
75th Percentile	13.4	13.6
90th Percentile	20.2	19.7
95th Percentile	26.4	32.5
99th Percentile	60.6	60.8
Mean	7.0	7.7
St. Dev	14.5	15.7
Observations	360	218
Region Focus (%)	*Panel E: Sample*	*Panel F: Main Sample*
North America	84.1	81.2
Europe	10	12.4
Asia	3.9	4.1
Latin America	0.8	0.9
Africa	0.3	0.5
Australasia	0.3	0.5
Multi-Regional	0.3	0.5
Middle East & Israel	0.3	0.5
Observations	360	218

Table C2.1: **Fund performance by fund types: Sample (2001-2008).** This table reports fund performance by fund types for the extended sample of 360 funds. *Net IRR* is the performance measure given by the net-of-fee internal rate of return of all quarterly LP cash flows, after management fees and carried interest are factored in. *Fund IRR* is the fund's total internal rate or return, before fees. *Fee margin* is the difference between the two and is obtained by subtracting Fund IRR by Net IRR. This table contains the Mean, Median and Standard Deviation values of all three performance parameters for different fund types

	Net IRR	**Fund IRR**	**Fee margin**		**Net IRR**	**Fund IRR**	**Fee margin**
Balanced				**Infrastructure**			
Mean	9.24	12.58	3.34	Mean	14.85	18.0	3.18
Median	10.50	13.40	2.64	Median	14.09	17.4	3.33
St. Dev	7.10	8.30	1.51	St. Dev	6.72	6.2	0.90
Obs	7	7	7	Obs	5	5	5
Buyout				**Mezzanine**			
Mean	10.90	14.4	0.78	Mean	11.00	14.3	3.33
Median	9.90	13.0	0.65	Median	6.80	9.4	2.84
St. Dev	11.38	12.2	0.51	St. Dev	7.46	9.1	1.69
Obs	93	93	93	Obs	3	3	3
Co-Investment				**Natural Resources**			
Mean	2.92	4.6	1.63	Mean	9.85	13.4	3.57
Median	2.49	4.2	1.56	Median	9.64	12.8	3.63
St. Dev	9.50	9.7	0.40	St. Dev	17.14	18.0	1.15
Obs	4	4	4	Obs	10	10	10
Direct Secondaries				**Real Estate**			
Mean	5.73	10.1	4.42	Mean	0.61	3.1	2.45
Median	5.73	10.1	4.42	Median	0.04	1.7	1.67
St. Dev	14.67	16.0	1.33	St. Dev	4.87	6.8	1.98
Obs	2	2	2	Obs	4	4	4
Distressed Debt				**Real Estate Co-Investment**			
Mean	12.88	15.0	2.07	Mean			
Median	9.20	11.6	2.15	Median			
St. Dev	18.20	17.7	0.86	St. Dev			
Obs	21	21	21	Obs			
Early Stage				**Secondaries**			
Mean	0.76	5.2	4.42	Mean	11.22	14.5	3.25
Median	2.99	5.9	3.65	Median	11.90	14.3	3.22
St. Dev	19.72	18.9	3.18	St. Dev	4.64	5.0	1.39
Obs	28	28	28	Obs	8	8	8
Early Stage: Seed				**Special Situations**			
Mean	-6.56	-2.3	4.28	Mean	5.55	9.7	4.15
Median	-6.56	-1.1	4.26	Median	5.55	9.7	4.15
St. Dev	5.79	5.9	1.43	St. Dev	0.22	0.9	1.12
Obs	4	4	4	Obs	2	2	2
Early Stage: Start-up				**Timber**			
Mean	-7.39	-3.8	3.61	Mean			
Median	-5.41	-2.1	3.52	Median			
St. Dev	8.07	7.8	0.39	St. Dev			
Obs	3	3	3	Obs			
Expansion/Late Stage				**Turnaround**			
Mean	16.29	19.6	3.28	Mean			
Median	16.47	20.6	2.94	Median			
St. Dev	7.02	7.7	1.74	St. Dev			
Obs	5	5	5	Obs			
Fund of Funds				**Venture Capital (All Stages)**			
Mean	5.64	7.8	2.16	Mean	2.65	8.1	5.46
Median	5.53	8.2	1.97	Median	3.92	7.8	3.82
St. Dev	3.07	3.1	0.63	St. Dev	21.33	19.1	7.31
Obs	11	11	11	Obs	43	43	43
Growth				**Venture Debt**			
Mean	8.37	12.2	3.83	Mean	3.93	7.3	3.40
Median	8.57	11.8	3.32	Median	3.93	7.3	3.40
St. Dev	11.37	11.2	2.10	St. Dev			
Obs	16	16	16	Obs	1	1	1

Table C2.2: **Fund performance by fund types - Main sample.** This table reports fund performance by fund types for the main sample: the subsample grouping all funds classified according to carry distribution rules. All variables are as defined in table 2.1. This table contains the Mean, Median and Standard Deviation values of all three performance parameters for different fund types

	Net IRR	Fund IRR	Fee margin		Net IRR	Fund IRR	Fee margin
Balanced				**Infrastructure**			
Mean	9.24	12.58	3.34	Mean	14.85	18.0	3.18
Median	10.50	13.40	2.64	Median	14.09	17.4	3.33
St. Dev	7.10	8.30	1.51	St. Dev	6.72	6.2	0.90
Obs	7	7	7	Obs	5	5	5
Buyout				**Mezzanine**			
Mean	10.68	14.1	0.78	Mean	13.21	16.8	3.57
Median	10.02	13.0	0.66	Median	13.21	16.8	3.57
St. Dev	10.68	11.3	0.51	St. Dev	9.06	11.4	2.32
Obs	82	82	82	Obs	2	2	2
Co-Investment				**Natural Resources**			
Mean	10.17	12.1	1.91	Mean	5.71	8.9	3.18
Median	10.17	12.1	1.91	Median	8.67	11.6	3.04
St. Dev	6.10	5.7	0.39	St. Dev	16.28	16.8	0.89
Obs	2	2	2	Obs	8	8	8
Direct Secondaries				**Real Estate**			
Mean	5.73	10.1	4.42	Mean	1.33	4.2	2.89
Median	5.73	10.1	4.42	Median	1.61	3.7	2.11
St. Dev	14.67	16.0	1.33	St. Dev	5.70	7.8	2.17
Obs	2	2	2	Obs	3	3	3
Distressed Debt				**Real Estate Co-Investment**			
Mean	14.76	16.8	2.02	Mean			
Median	11.91	14.1	1.90	Median			
St. Dev	26.31	25.6	1.10	St. Dev			
Obs	10	10	10	Obs			
Early Stage				**Secondaries**			
Mean	0.90	5.4	4.51	Mean	11.56	15.0	3.43
Median	3.34	6.6	3.65	Median	11.46	14.2	3.66
St. Dev	20.46	19.6	3.28	St. Dev	5.27	6.3	1.32
Obs	26	26	26	Obs	5	5	5
Early Stage: Seed				**Special Situations**			
Mean	-6.56	-2.3	4.28	Mean	5.55	9.7	4.15
Median	-6.56	-1.1	4.26	Median	5.55	9.7	4.15
St. Dev	5.79	5.9	1.43	St. Dev	0.22	0.9	1.12
Obs	4	4	4	Obs	2	2	2
Early Stage: Start-up				**Timber**			
Mean	-7.39	-3.8	3.61	Mean			
Median	-5.41	-2.1	3.52	Median			
St. Dev	8.07	7.8	0.39	St. Dev			
Obs	3	3	3	Obs			
Expansion/Late Stage				**Turnaround**			
Mean	12.72	15.3	2.54	Mean			
Median	15.23	16.8	1.95	Median			
St. Dev	5.46	6.2	1.38	St. Dev			
Obs	3	3	3	Obs			
Fund of Funds				**Venture Capital (All Stages)**			
Mean	5.32	7.5	2.19	Mean	4.21	10.0	5.75
Median	5.33	8.4	1.87	Median	5.69	8.9	3.79
St. Dev	1.51	1.8	0.67	St. Dev	23.32	20.7	8.20
Obs	5	5	5	Obs	34	34	34
Growth				**Venture Debt**			
Mean	10.76	14.3	3.59	Mean	3.93	7.3	3.40
Median	8.97	12.2	3.25	Median	3.93	7.3	3.40
St. Dev	10.73	10.4	1.80	St. Dev			
Obs	13	13	13	Obs	1	1	1

Table C3: **Carried interest basis by vintage.** This table reports the yearly frequency of funds raised under both carried interest models, according to their classification process. Frequencies are provided both for the Sample and the Main Sample

Sample	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Whole fund	12	9	19	13	6	3	10	24	32	25	10
Deal by deal	2	2	12	9	9	3	11	10	15	6	6
Main Sample	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Whole fund				11	5	2	9	20	24	20	6
Deal by deal				7	8	2	8	7	12	4	5

Table C4.1: **Thresholds for management fees - by fundtype.** This table reports four key parameters of the classification process. Distinct values are assigned to each fund type defined in the Preqin database. Those four variables are the mininum threshold for reported fees (*Minimum threshold*), the investment period and post-investment period fees rebated from portfolio firms (*Rebates* and *Rebates: post-investment* and the total minimum threshold for management fees, including rebates (*Implicit thresholds.*)

Minimum theresholds				
Fund types	Rebates	Rebates: post-investment	Implicit thresholds	Thresholds
Funds of funds	0.20%	0.10%	0.50% / 0.40%	0.30%
Secondaries	0.20%	0.10%	0.50% / 0.40%	0.30%
Co-investment	0.20%	0.10%	0.50% / 0.40%	0.30%
Natural resources	0.20%	0.10%	0.50% / 0.40%	0.30%
Distressed debt	0.50%	0.30%	1.25% / 1.05%	0.75%
Mezzanine	0.50%	0.30%	1.50% / 1.30%	1.00%
Real estate, infrastructure	0.50%	0.30%	1.50% / 1.30%	1.00%
Turnaround	0.50%	0.30%	1.50% / 1.30%	1.00%
Buyout, venture, growth capital	0.50%	0.30%	1.60% / 1.40%	1.10%
Venture, < 500 million USD	0.50%	0.30%	2.00% / 1.80%	1.50%

Maximum theresholds	
Fund types	Thresholds
Funds of funds	0.50%
Secondaries	0.50%
Co-investment	0.50%
Natural resources	0.50%
Distressed debt	1.25%
Mezzanine	2.00%
Infrastructure	2.00%
Turnaround	2.00%
Real estate	2.25%
Buyout, venture, growth capital	2.60%
Venture, < 500 million USD	2.85%

Table C4.2: **Management fee upper bounds - statistics by fund type.** This table summarizes upper bounds for management fees, from the classification process of carried interest models. Statistics are presented by fund type, for all sample funds classified.

Fund Type	Mean	St. Dev	Min	Max	Obs
Balanced	2.27	0.18	2.10	2.60	15
Buyout	2.30	0.21	1.51	2.60	198
Co-Investment	2.34	0.14	2.11	2.47	6
Direct Secondaries	1.30	0.00	1.30	1.30	2
Distressed Debt	1.78	0.27	1.35	2.60	36
Early Stage	2.47	0.15	2.10	2.60	56
Early Stage: Seed	2.71	0.15	2.51	2.85	7
Early Stage: Start-up	2.70	0.17	2.51	2.85	8
Expansion/Late Stage	2.59	0.26	2.11	2.85	14
Fund of Funds	0.88	0.24	0.50	1.30	29
Growth	2.34	0.21	1.62	2.60	36
Infrastructure	1.85	0.19	1.50	2.00	16
Mezzanine	2.16	0.27	1.58	2.54	10
Natural Resources	2.31	0.22	1.74	2.60	19
Real Estate	1.79	0.25	1.50	2.25	33
Secondaries	0.91	0.25	0.54	1.30	18
Special Situations	2.47	0.20	2.18	2.60	4
Turnaround	1.87		1.87	1.87	1
Venture Capital (All Stages)	2.57	0.23	1.73	2.85	100
Venture Debt	2.70	0.22	2.45	2.85	3

Table C4.3: **Reduced rates, management fees - statistics by fund type.** This table summarizes upper bounds for reduced management fee rates, from the classification process of carried interest models. Statistics are presented by fund type, for all sample funds classified.

Fund Type	Mean	St. Dev	Min	Max	Obs
Balanced	2.04	0.15	1.90	2.38	15
Buyout	2.13	0.28	0.83	2.60	198
Co-Investment	2.18	0.14	1.91	2.29	6
Direct Secondaries	1.21	0.08	1.15	1.26	2
Distressed Debt	1.58	0.35	0.82	2.45	36
Early Stage	2.28	0.24	1.85	2.60	56
Early Stage: Seed	2.53	0.18	2.31	2.85	7
Early Stage: Start-up	2.43	0.27	2.01	2.81	8
Expansion/Late Stage	2.40	0.32	1.91	2.85	14
Fund of Funds	0.75	0.25	0.40	1.30	29
Growth	2.21	0.25	1.42	2.60	36
Infrastructure	1.70	0.27	1.30	2.00	16
Mezzanine	1.98	0.26	1.38	2.34	10
Natural Resources	2.14	0.26	1.54	2.60	19
Real Estate	1.65	0.28	1.30	2.25	33
Secondaries	0.68	0.21	0.41	1.05	18
Special Situations	2.17	0.54	1.41	2.60	4
Turnaround	1.67		1.67	1.67	1
Venture Capital (All Stages)	2.38	0.27	1.53	2.85	100
Venture Debt	2.30	0.30	2.04	2.62	3

Table C5: **Statistics for carried interest variables (lower bounds).** This table summarizes three variables of interest, related to estimated lower bounds for carried interest, at the fund level, in the classification process of carried interest models. *Cumulative carry* is the proportion of a fund's commited capital paid as carried interest since the fund's inception. *Cumulative distribution* is the proportion of a fund's invested capital paid as carried interest since the last distribution. *Cumulative carry ratio* is the ratio of *Cumulative carry* and the cumulative amount distributed to Limited Partners.

Panel A - Cumulative carried interest statistics					
Variable	Mean	St. Dev	Min	Max	Obs
Cumulative Carry (% committed)	14.03	12.37	2.50	84.75	95
Cumulative Distribution (/ invested)	1.86	0.73	0.99	6.11	95
Cumulative Carry Ratio	17.2%	4.0%	8.8%	30.7%	93
Panel B - Funds classified by maximum cumulative carry payments					
Maximum Carry (% committed)	4.23	3.05	2.26	24.58	79
Total carry Ratio	7.9%	4.8%	2.2%	22.1%	74
Cumulative Carry Ratio	18.4%	4.2%	8.8%	23.8%	16
Panel C - Funds classified by maximum cumulative carry ratios					
Maximum Cumulative Carry Ratio	30.7%	2.8%	26.7%	34.8%	11
Cumulative Carry	6.7%	3.2%	2.3%	12.1%	11
Cumulative Carry Ratio	19.5%	2.3%	14.6%	21.6%	11
Panel D - Funds classified as pure deal by deal					
Early Fees	3.56	1.51	2.05	9.80	57
Management Fee (% committed)	1.85	0.51	0.41	2.60	57
Total Carry Ratio	7.3%	5.5%	0.1%	22.1%	51
Maximum Cumulative Carry Ratio	27.9%	4.1%	22.0%	34.8%	8

Table C6: **Robustness of classification criteria - sample sizes.** This table reports the frequency of carried interest models in the Sample, when funds are classified according to three distinct algorithms: the adopted classification method and two alternative definitions: 1) funds with consecutive carry payments of at least 2% of committed capital; 2) funds with consecutive carry payments of at least 2.25% of committed capital and with any yearly fee payment exceeding the upper bound for management fees by 1% or more, during the investment period.

	Max consecutive carry payment of 2% and early fees 1% above upper bound		Max consecutive carry payment (2.25%) between any cash distribution (incl. low value)	
Deal by Deal	Alternative definition 1		Alternative definition 2	
	0	**1**	**0**	**1**
0	99	0	98	1
1	4	15	3	24

Table C7: **Specific risk factors - industry exposures.**This table summarizes all the specific risk factors underlying the *Exposure to risk* variable. For each binary factor, the percent frequency of both realizations is summarized: whether a fund's share of portfolio deals exposed to the risk factor is between 25% and 75% or not. Statistics are presented for the Main Sample (panel A) and by carried interest model (panels B and C)

	Panel A: Main Sample		*Panel B: Funds Classified as Deal by Deal*	
Specific Risk Factors	*25-75% Deals*	*Extreme exposures*	*25-75% Deals*	*Extreme exposures*
Electronic America	8.8	91.2	7.5	92.5
Electronics Europe	0.0	100.0	0.0	100.0
Life Sciences America	11.1	88.9	13.2	86.8
Life Sciences Europe	0.9	99.1	1.9	98.1
Housing America	0.9	99.1	0.0	100.0
Housing Europe	0.9	99.1	0.0	100.0
Consumption America	6.5	93.5	9.4	90.6
Consumption Europe	0.9	99.1	1.9	98.1
Regulation America	24.0	76.0	24.5	75.5
Finance Factor	6.5	93.5	9.4	90.6
Any Factor	62.8	37.2	69.8	30.2
	Panel C: Funds classified as whole fund		*Panel D: Funds not classified as deal by deal*	
Electronic America	8.1	91.9	9.1	90.9
Electronics Europe	0.0	100.0	0.0	100.0
Life Sciences America	10.1	89.9	10.4	89.6
Life Sciences Europe	0.0	100.0	0.6	99.4
Housing America	0.0	100.0	1.2	98.8
Housing Europe	0.0	100.0	1.2	98.8
Consumption America	7.1	92.9	5.5	94.5
Consumption Europe	0.0	100.0	0.6	99.4
Regulation America	27.3	72.7	23.8	76.2
Finance Factor	4.0	96.0	5.5	94.5
Any Factor	64.6	35.4	61.0	39.0

Table C8: **Diversification variables and carried interest basis - OLS, Probit models.** This table reports OLS and Probit prediction models for diversification variables. The first 3 equations predict a continuous measure of diversification (*1-HHI*), by estimating OLS models. The last 3 equations estimate Probit models for the binary measure of diversification. *Any factor* denotes the *Exposure to risk* binary variable. *Pure Deal by Deal* is a binary variable, taking the value of 1 when a fund's carried interest model is classified as deal-by-deal due to a yearly fee payment during the investment period. *First generation fund* is binary variable taking the value of 1 when a fund is raised in the first five years of activity of a GP firm. Fixed effects are included at the vintage level. Standard errors are clustered by GP vehicle. All other variables are as defined in previous tables.

Panel A - Main sample, including unclassified funds						
	(1)	(2)	(3)	(4)	(5)	(6)
	1 - HHI	1 - HHI	1 - HHI	Any factor	Any factor	Any factor
Pure Deal by Deal	0.053*	0.049*	0.050*	0.155**	0.160**	0.156**
	(1.844)	(1.733)	(1.760)	(2.044)	(2.012)	(1.995)
Fund size (M)	0.009*	0.008*	0.008	-0.001	-0.008	-0.006
	(1.811)	(1.705)	(1.640)	(-0.079)	(-0.475)	(-0.374)
First generation fund	-0.042		-0.036	0.167**		0.195**
	(-1.084)		(-0.912)	(2.117)		(2.392)
Constant	0.432***	0.449***	0.457***	0.574***	0.666***	0.621***
	(25.978)	(14.494)	(13.780)	(12.094)	(6.578)	(6.081)
Vintage fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	218	218	218	218	218	218
R-squared	0.030	0.050	0.055	0.033	0.043	0.064
Panel B - Main sample, only classified funds						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1 - HHI	1 - HHI	1 - HHI	Any factor	Any factor	Any factor
Pure Deal by Deal	0.067**	0.063**	0.065**	0.174**	0.187**	0.176**
	(2.187)	(1.988)	(2.075)	(2.203)	(2.194)	(2.088)
Fund size (M)	0.010*	0.011**	0.011*	-0.030	-0.035*	-0.032*
	(1.826)	(1.984)	(1.879)	(-1.582)	(-1.897)	(-1.715)
First generation fund	-0.058		-0.049	0.203**		0.241***
	(-1.305)		(-1.057)	(2.442)		(2.646)
Constant	0.427***	0.455***	0.466***	0.621***	0.717***	0.663***
	(20.655)	(13.386)	(12.790)	(10.834)	(6.661)	(5.999)
Vintage fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	151	151	151	151	151	151
R-squared	0.048	0.084	0.092	0.073	0.076	0.109

Table C9: **Diversification variables and carried interest basis - Probit models.** This table reports Probit prediction models for the *Deal-by-deal* binary variable. Panel A estimates the *Deal-by-deal* variable for the entire Main Sample: the outcome variable takes the value of 0 for unclassified funds. Panel B estimates the same outcome varibale for classified funds in the Main Sample. Panel C estimates it for all funds in the larger sample (Sample), with available data on portfolio investments. *First generation fund - 5 years* is binary variable taking the value of 1 when a fund is raised in the first five years of activity of a GP firm. *First generation fund - 2 years* is binary variable taking the value of 1 when a fund is raised in the first two years of activity of a GP firm. Fixed effects are included at the vintage level. Standard errors are clustered by GP vehicle. All other variables are as defined in previous tables.

	Panel A - Main sample, including unclassified funds					
	(1)	(2)	(3)	(4)	(5)	(6)
	Deal by deal All criteria met	Deal by deal All criteria met	Deal by deal Early fees only	Deal by deal Early fees only	Deal by deal Realized loss only	Deal by deal Realized loss only
1 - HHI	2.478**		2.375**		0.778	
	(1.020)		(0.975)		(0.817)	
Any risk factor		0.705***		0.517**		0.271
		(0.271)		(0.238)		(0.208)
Number of industries	-0.106**		-0.091**		-0.057	
	(0.048)		(0.046)		(0.042)	
Mean distance - capital cities	0.059	0.096	0.086	0.122	0.073	0.082
	(0.104)	(0.104)	(0.099)	(0.099)	(0.094)	(0.094)
Fund size	-0.032	-0.035	-0.052	-0.054	-0.100	-0.106*
	(0.061)	(0.060)	(0.059)	(0.058)	(0.063)	(0.063)
First generation fund - 5 years	0.286	0.189	0.120	0.024	0.269	0.250
	(0.396)	(0.400)	(0.392)	(0.394)	(0.348)	(0.349)
First generation fund - 2 years	-0.093	0.034	-0.059	0.062	-0.235	-0.172
	(0.512)	(0.503)	(0.510)	(0.500)	(0.464)	(0.457)
Constant	-1.473***	-1.700***	-1.390***	-1.397***	-0.643**	-0.929***
	(0.354)	(0.271)	(0.338)	(0.235)	(0.277)	(0.199)
Observations	218	218	218	218	218	218

	Panel B - Main sample, only classified funds					
	(1) Deal by deal All criteria met	(2) Deal by deal All criteria met	(3) Deal by deal Early fees only	(4) Deal by deal Early fees only	(5) Deal by deal Realized loss only	(6) Deal by deal Realized loss only
1 - HHI	2.706**		2.706**		0.938	
	(1.101)		(1.101)		(0.908)	
Any risk factor	-0.114**		-0.114**		-0.069	
	(0.053)		(0.053)		(0.047)	
Number of industries	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mean distance - capital cities	-0.000	-0.000	-0.000	-0.000	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fund size	0.306	0.113	0.306	0.113	0.300	0.269
	(0.452)	(0.446)	(0.452)	(0.446)	(0.408)	(0.406)
First generation fund - 5 years	-0.249	0.032	-0.249	0.032	-0.461	-0.314
	(0.575)	(0.551)	(0.575)	(0.551)	(0.530)	(0.514)
First generation fund - 2 years		0.749**		0.749**		0.203
		(0.304)		(0.304)		(0.238)
Constant	-1.302***	-1.560***	-1.302***	-1.560***	-0.346	-0.619***
	(0.391)	(0.309)	(0.391)	(0.309)	(0.317)	(0.229)
Observations	150	150	150	150	150	150

Panel C - Sample, including unclassified funds

VARIABLES	(1) Deal by deal All criteria met	(2) Deal by deal All criteria met	(3) Deal by deal Early fees only	(4) Deal by deal Early fees only	(5) Deal by deal Realized loss only	(6) Deal by deal Realized loss only
1 - HHI	2.167**		1.943**		0.287	
	(0.881)		(0.823)		(0.667)	
Any risk factor		0.415*		0.260		0.152
		(0.225)		(0.202)		(0.179)
Number of industries	-0.099**		-0.070*		-0.034	
	(0.043)		(0.040)		(0.035)	
Mean distance - capital cities	0.019	0.040	0.034	0.055	0.069	0.067
	(0.096)	(0.096)	(0.091)	(0.091)	(0.083)	(0.083)
Fund size	-0.016	-0.016	-0.030	-0.026	-0.119*	-0.121*
	(0.059)	(0.058)	(0.056)	(0.055)	(0.064)	(0.063)
First generation fund - 5 years	0.460	0.424	0.312	0.254	0.300	0.311
	(0.317)	(0.310)	(0.312)	(0.307)	(0.282)	(0.280)
First generation fund - 2 years	-0.331	-0.289	-0.148	-0.115	-0.241	-0.239
	(0.426)	(0.413)	(0.408)	(0.400)	(0.370)	(0.369)
Constant	-1.482***	-1.577***	-1.446***	-1.308***	-0.621**	-0.861***
	(0.316)	(0.225)	(0.299)	(0.199)	(0.243)	(0.174)
Observations	278	278	278	278	278	278

Table C10: **Main sample - HHI - detail.** This table reports the results of regression models estimating net performance (*Net IRR*) as a function of internal rates of return before fees (*Fund IRR*). *HHI* is used as regressor, measuring diversification, in six additional variations of models presented in table 6. Models are estimated for the larger sample, including unclassified funds. The main variable of interest is the interaction between the binary indicator of deal-bv-deal carry models (*Deal by deal*) and the diversification measures. *No. of portfolio firms classified* is the number of portfolio firms in which the fund invests, during its life. In the first and the second equations, I reduce my sample to funds with less than 1.000 million US dollars in total commited capital. In the third and the fourth equations, I exclude funds with total commited capital exceeding 3.000 million US dollars. Fixed effects are included at the vintage and fund type levels. Standard errors are clustered by GP vehicle. All other variables are as defined in previous tables

VARIABLES	(1) Net IRR	(2) Net IRR	(3) Net IRR	(4) Net IRR	(5) Net IRR	(6) Net IRR
Fund IRR	0.996***	0.991***	0.972***	0.962***	0.978***	0.969***
	(0.018)	(0.024)	(0.033)	(0.035)	(31.215)	(28.094)
Deal by deal x -exp(HHI)	-1.907**	-2.885**	-1.449**	-1.878**		
	(0.842)	(1.350)	(0.635)	(0.743)		
Deal by deal x 1 - HHI					-2.448*	-2.512
					(-1.800)	(-1.349)
Deal by deal	-4.742***	-6.651***	-3.965***	-4.949***	-0.213	-0.395
	(1.706)	(2.012)	(1.376)	(1.192)	(-0.276)	(-0.320)
-exp(HHI)	0.192	-0.018	0.288	-0.065		
	(0.779)	(0.780)	(0.594)	(0.610)		
1 - HHI					-1.249	-0.861
					(-0.994)	(-0.632)
No. of portfolio firms classified	0.001	0.010	0.004	0.014**	0.207**	0.087
	(0.003)	(0.007)	(0.003)	(0.006)	(2.084)	(1.083)
Fund Size (M)	0.002*	0.002	0.001***	0.000	0.235	0.622
	(0.001)	(0.002)	(0.000)	(0.000)	(0.239)	(0.602)
Constant	-4.079	-4.013	-2.788	-2.021	-2.905***	-1.494
	(3.091)	(3.565)	(2.223)	(2.840)	(-3.073)	(-1.323)
Vintage fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Fund type fixed effects	No	Yes	No	Yes	No	Yes
Fund Size (M)	< 1000	< 1000	< 3000	< 3000	All	All
Observations	94	94	135	135	153	153

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table C11: **2006 shock - general estimation.**This table reports triple difference regression models, measuring the differential effect of deal-by-deal distribution rules (*Deal by deal*) and diversification (*Diversification*) in funds raised in 2006, in the period identified as "IFRS shock" (*Post IFRS*). These models estimate net performance again as a function of internal rates of return before fees. Data are from the last three years preceding the surge in the European Private Equity market (2003-2005) and the year when the shock occurred (2006). *HHI* < 0.6 is a binary variable taking the value of 1 when the HHI index of industry concentration for portfolio firms is lower than 0.6 and 0 otherwise. Models contain fixed effects only at the fund type level. A control binary variable is added for funds raised in the pre-IFRS vintage (2005). In the second and fourth equations, I exclude all deal-by-deal funds raised before 2006, narrowing the control group of funds prior to the shock. Standard errors are clustered by fund type, region focus and sample period. All other variables are as defined in previous tables

VARIABLES	(1) Net IRR	(2) Net IRR	(3) Net IRR	(4) Net IRR
Fund IRR	0.948***	0.946***	0.949***	0.945***
	(21.079)	(19.608)	(21.142)	(18.685)
Post IFRS x Deal by Deal x Diversification	-2.779**	-3.518**	-1.934*	-1.990**
	(-1.963)	(-2.322)	(-1.946)	(-1.977)
Pre IFRS x Deal by deal x Diversification	0.954		-2.092	
	(0.664)		(-1.488)	
Post IFRS x Deal by deal	0.915	1.472	0.100	0.113
	(0.913)	(1.346)	(0.130)	(0.150)
Post IFRS x Diversification	1.096	1.109	-0.013	0.117
	(1.086)	(1.100)	(-0.025)	(0.228)
Post IFRS	-2.443**	-2.580**	-0.681	-0.882
	(-2.222)	(-2.258)	(-1.219)	(-1.463)
Pre IFRS x HHI < 0.6	-1.307**	-1.508**		
	(-1.985)	(-2.148)		
Pre IFRS x Any factor			-0.261	-0.355
			(-0.548)	(-0.651)
Pre IFRS x Deal by deal	-2.577**		-0.356	
	(-2.251)		(-0.282)	
Fund Size (M)	0.139**	0.126**	0.128***	0.139***
	(2.367)	(2.354)	(3.231)	(2.942)
Constant	-0.601	-0.967	-1.198	-2.221*
	(-0.527)	(-0.738)	(-1.060)	(-1.789)
Fund type fixed effects	Yes	Yes	Yes	Yes
Pre-IFRS deal by deal funds included	Yes	No	Yes	No
Observations	110	93	110	93

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table C12: **Carried interest basis by vintage - IFRS event.** This table reports the frequency of each carried interest model, for the period between 2003 and 2006

Event Sample	2003	2004	2005	2006	**Total**
Whole fund	8	12	28	33	81
Deal by deal	2	8	7	12	29
Total	10	20	35	45	110

Table C13: **Carry basis: past record of fund's parent firms - Dodd Frank event.** This table reports the frequency of both realizations of the *Deal by deal firm* binary variable, across sampled funds: 1) belonging to a parent GP firm that has never raised any deal-by-deal fund and 2) belonging to a parent firm with at least one deal-by-deal fund raised in the past. Frequencies are for the period between 2008 and 2011

Event Sample	2008	2009	2010	2011	2012	**Total**
All whole fund	34	9	7	23	17	257
Deal by deal firm	18	3	6	8	4	133
Total	20	4	1	2	21	390

Vintage	as % committed	Whole fund	Deal by deal
2003	3y fees	0.0	-
	N	1	0
2004	3y fees	3.0	3.1
	N	22	13
2005	3y fees	3.0	3.9
	N	24	17
2006	3y fees	3.6	4.2
	N	39	26
2007	3y fees	3.1	4.3
	N	41	20
2008	3y fees	3.6	4.4
	N	30	17
2009	3y fees	5.6	3.8
	N	8	3
2010	3y fees	3.4	3.9
	N	6	6
2011	3y fees	3.6	3.7
	N	17	7
2012	3y fees	3.7	2.5
	N	8	2

Table C14: **2011 shock - effects in first 3 years of fees.** This table reports cross-sectional regression models using a triple difference, measuring the differential effect of the past adoption of diversification (*Diversification*) and the past adoption of deal-by-deal distribution rules, at the firm level (*Deal by deal firm*) in funds raised in 2010 and 2011, in the period identified as "Dodd Frank shock" (*Post Dodd-Fr.*). These models estimate the (undiscounted) total amount of fees paid by funds in their first 3 years of life. *HHI < 0.6* is a binary variable taking the value of 1 when the HHI index of industry concentration for portfolio firms is lower than 0.6 and 0 otherwise. Robust standard errors are estimated. All other variables are defined as in previous tables

	(1) Fees - First 3 years	(2) Fees - First 3 years
Post IFRS x Deal by Deal x Diversification	7.472**	7.511**
	(3.186)	(3.170)
Post IFRS x Deal by deal	-3.343***	-3.387***
	(0.735)	(0.733)
Post IFRS x Diversification	-0.626	-0.620
	(0.853)	(0.849)
Post IFRS	1.389*	1.388*
	(0.760)	(0.758)
Diversification	0.370	0.357
	(0.722)	(0.721)
Fund Size (M)	0.000	0.000
	(0.000)	(0.000)
Constant	2.485***	2.468***
	(0.507)	(0.506)
Diversification variable	HHI < 0.6	Exposure to risk
Observations	80	67

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table C15: **Fee statistics - anonymous dataset with contract terms.**This table summarizes carried interest rates (*Carried interest*), hurdle rates (*Preferred return*) and management fee rates (*Management fees*) for all funds reporting this numbers in the anonymous dataset. Statistics are split per carried interest model, across the two main categories: "Deal by Deal" and "Whole fund"

Deal by deal					**Whole fund**				
Carried interest									
Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
393	19.75%	3.37%	2%	50%	1344	19.11%	3.96%	1%	50%
Preferred return									
Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
334	8.12%	1.05%	4%	15%	1110	8.18%	2.06%	3%	40%
Management fees									
Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
402	1.91%	0.48%	1%	6%	1370	1.90%	0.49%	0%	5%

Table C16: **Size statistics - anonymous dataset.**This table reports the frequencies of size classes in the anonymous dataset. Statistics are split per carried interest model, across the two main categories: "Deal by Deal" and "Whole fund".

Deal by deal				**Whole fund**			
Size class	Freq.	Percent	Cum.	Size class	Freq.	Percent	Cum.
< 50	26	6.33	6.33	< 50	205	14.57	14.64
50-100	35	8.52	14.84	50-100	194	13.79	28.43
100-250	98	23.84	38.69	100-250	428	30.42	58.85
250-500	78	18.98	57.66	250-500	269	19.12	77.97
500-1 bn	80	19.46	77.13	500-1 bn	175	12.44	90.41
1 -2 bn	42	10.22	87.35	1 -2 bn	78	5.54	95.95
>2bn	51	12.41	99.76	>2bn	57	4.05	100
Total	411	100		Total	1407	100	

Table C17: **Time series of carry models - anonymous dataset.** This table reports the frequencies of carried interest models per year of vintage in the anonymous dataset. Carried interest models are classified in two main categories: "Deal by Deal" and "Whole fund". Data are for the period 2000-2016

Deal by deal				**Whole fund**			
Vintage	Freq.	Percent	Cum.	Vintage	Freq.	Percent	Cum.
2000	17	4.08	4.08	2000	7	0.49	0.49
2001	8	1.92	6	2001	6	0.42	0.91
2002	2	0.48	6.47	2002	4	0.28	1.19
2003	9	2.16	8.63	2003	14	0.98	2.18
2004	15	3.6	12.23	2004	29	2.04	4.21
2005	32	7.67	19.9	2005	72	5.06	9.27
2006	26	6.24	26.14	2006	130	9.13	18.4
2007	44	10.55	36.69	2007	158	11.1	29.49
2008	37	8.87	45.56	2008	120	8.43	37.92
2009	27	6.47	52.04	2009	66	4.63	42.56
2010	46	11.03	63.07	2010	123	8.64	51.19
2011	43	10.31	73.38	2011	101	7.09	58.29
2012	27	6.47	79.86	2012	110	7.72	66.01
2013	22	5.28	85.13	2013	140	9.83	75.84
2014	25	6	91.13	2014	142	9.97	85.81
2015	20	4.8	95.92	2015	85	5.97	91.78
2016	17	4.08	100	2016	116	8.15	99.93
Total	417	100		Total	1424	100	

Table C18: **Carried interest basis by fund type.**This table reports the frequencies of carried interest models per fund type in the anonymous dataset. Carried interest models are classified in two main categories: "Deal by Deal" and "Whole fund". In this dataset, funds are classified across nine fund types, which include "Direct lending", a category that is absent from my sample

Deal by deal				**Whole fund**			
Fund type	Freq.	Percent	Cum.	Fund type	Freq.	Percent	Cum.
Balanced	5	1.2	1.2	Balanced	17	1.19	1.19
Buyout	181	43.41	44.6	Buyout	340	23.88	25.07
Co-Investment	5	1.2	45.8	Co-Investment	11	0.77	25.84
Direct Lending	104	24.94	70.74	Direct Lending	452	31.74	57.58
Growth	45	10.79	81.53	Growth	144	10.11	67.7
Natural Resources	3	0.72	82.25	Natural Resources	11	0.77	68.47
Private Equity Fund of Funds	8	1.92	84.17	Private Equity Fund of Funds	74	5.2	73.67
Private Equity Secondaries	3	0.72	84.89	Private Equity Secondaries	22	1.54	75.21
Venture Capital	63	15.11	100	Venture Capital	353	24.79	100
Total	417	100		Total	1.424	100	

Table C19: **Carried interest basis by GP location.**This table reports the frequencies of carried interest models per location of the General Partner firm in the anonymous dataset.

Deal by deal				**Whole fund**			
GP Location	Freq.	Percent	Cum.	GP Location	Freq.	Percent	Cum.
Asia	39	9.35	9.35	Asia	137	9.62	9.62
Europe	35	8.39	17.75	Europe	471	33.08	42.7
North America	327	78.42	96.16	North America	694	48.74	91.43
Rest of World	16	3.84	100	Other	1	0.07	91.5
				Rest of World	121	8.5	100
Total	417	100		Total	1.424	100	

Table C20: **Carried interest basis by region focus.** This table reports the frequencies of carried interest models per region of focus in the anonymous dataset. Carried interest models are classified in two main categories: "Deal by Deal" and "Whole fund". Three geographical areas are defined: the European continent (*Europe*); United States of America and Canada (*North America*); all the remaining countries (*Rest of World*)

Deal by deal				Whole fund			
Focus	Freq.	Percent	Cum.	Focus	Freq.	Percent	Cum.
Europe	28	6.73	6.73	Europe	448	31.98	31.98
North America	316	75.96	82.69	North America	632	45.11	77.09
Rest of World	72	17.31	100	Rest of World	321	22.91	100
Total	416	100		Total	1.401	100	

Table C21: **Time series of carry models - anonymous dataset.** This table reports the frequencies of carried interest models per year of vintage for funds reporting their fee rates in the anonymous dataset. Carried interest models are classified in three categories: "Deal by Deal", "Whole fund" and "Other". The share of each category is reported, per year of vintage. Data are for the period 2000-2016

	Deal by deal		**Whole fund**		**Other**		Total
Vintage	Freq.	Percent	Freq.	Percent	Freq.	Percent	Total
2000	17	73.91	6	26.09	3	11.54	26
2001	6	75.00	2	25.00	4	33.33	12
2002	2	40.00	3	60.00	0	0.00	5
2003	9	52.94	8	47.06	14	0.98	2.18
2004	14	43.75	18	56.25	29	2.04	4.21
2005	30	46.88	34	53.13	72	5.06	9.27
2006	20	22.47	68	77.27	1	1.12	89
2007	33	27.50	85	72.03	2	1.67	120
2008	28	31.11	61	68.54	1	1.11	90
2009	21	36.21	36	63.16	1	1.72	58
2010	36	37.89	55	60.44	4	4.21	95
2011	35	48.61	35	50.00	2	2.78	72
2012	22	31.43	46	67.65	2	2.86	70
2013	14	18.99	57	80.28	2	2.74	73
2014	17	19.32	71	80.68	0	0.00	88
2015	11	20.75	42	79.25	0	0.00	53
2016	12	15.19	67	84.81	0	0.00	79
Total	327	100	694	100	22	100	1043

Appendix – Robustness

Table D1: **GP vehicles split in funds - only classified funds.** This table replicates table 6, but reduces the Sample to GP Vehicles either with only one fund, or whose funds have their investment periods fully mismatched.

	(1)	(2)	(3)
	Net IRR	Net IRR	Net IRR
Fund IRR	0.985***	0.978***	0.975***
	(32.076)	(33.003)	(29.910)
Deal by deal x -exp(HHI)	-1.136**	-1.283***	-1.235**
	(-2.312)	(-2.885)	(-2.514)
-exp(HHI)	0.107	0.409	0.564
	(0.167)	(0.586)	(0.698)
Deal by deal	-3.051***	-3.429***	-3.546***
	(-2.804)	(-3.474)	(-3.472)
Fund Size (M)	0.000	0.000	0.000
	(1.585)	(0.482)	(0.352)
Constant	-1.414	-0.853	-0.559
	(-0.832)	(-0.475)	(-0.276)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	182	182	182

Cluster-robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D2: **Whole fund classification for returns above 0 (pre-2005) - all funds, HHI.** This table replicates table 6 for a Sample of funds whose year of vintage was in the period 2000-2004.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	0.996***	0.993***
	(32.307)	(31.074)	(29.926)
Deal by deal x -exp(HHI)	-1.969**	-2.185**	-2.218**
	(-2.485)	(-2.486)	(-2.007)
-exp(HHI)	0.391	0.200	0.174
	(0.754)	(0.472)	(0.265)
Deal by deal	-4.394***	-5.305***	-5.574***
	(-3.025)	(-3.597)	(-3.101)
Fund Size (M)	0.000**	0.000	0.000
	(2.216)	(0.181)	(0.336)
Constant	-2.822*	-2.806**	-2.719
	(-1.903)	(-2.488)	(-1.603)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D3: **Whole fund classification for returns above 0 (pre-2005) - all funds, any risk factor.** This table replicates table 7for a Sample of funds whose year of vintage was in the period 2000-2004.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	1.000***	0.997***
	(32.829)	(31.480)	(29.881)
Deal by deal x Any risk factor	-1.548***	-1.863***	-1.959*
	(-3.219)	(-3.362)	(-1.929)
Any risk factor	0.443	0.448	0.712
	(1.333)	(1.104)	(1.091)
Deal by deal	0.062	-0.306	-0.317
	(0.114)	(-0.556)	(-0.369)
Fund Size (M)	0.000**	0.000*	0.000*
	(2.371)	(1.744)	(1.766)
Constant	-3.465***	-2.300***	-2.116***
	(-4.557)	(-3.562)	(-2.776)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D4: **Whole fund classification for returns above 0 (pre-2005) - only classified funds, HHI.** This table replicates table 8 for a Sample of funds whose year of vintage was in the period 2000-2004. Net-of-fee and gross performance measures are measured from the second to the last year of life of funds

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	0.976***	0.967***	0.961***
	(31.917)	(29.918)	(26.037)
Deal by deal x -exp(HHI)	-1.510**	-1.356**	-1.207*
	(-2.381)	(-2.000)	(-1.699)
-exp(HHI)	0.191	-0.131	0.338
	(0.363)	(-0.234)	(0.528)
Deal by deal	-3.971***	-3.825***	-3.878***
	(-3.212)	(-3.551)	(-3.084)
Fund Size (M)	0.000*	0.000	0.000
	(1.907)	(0.184)	(0.341)
Constant	-2.610	-2.172	-0.022
	(-1.309)	(-0.893)	(-0.008)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	158	158	158

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D5: **Whole fund classification for returns above 0 (pre-2005) - only classified funds, any risk factor**.This table replicates table 9 for a Sample of funds whose year of vintage was in the period 2000-2004. Net-of-fee and gross performance measures are measured from the second to the last year of life of funds

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	0.976***	0.965***	0.962***
	(33.820)	(34.241)	(28.478)
Deal by deal x Any risk factor	-1.182**	-1.516***	-1.795
	(-2.060)	(-2.628)	(-1.505)
Any risk factor	-0.156	-0.439*	-0.265
	(-0.484)	(-1.739)	(-0.746)
Deal by deal	-0.524	-0.514	-0.441
	(-1.180)	(-0.783)	(-0.392)
Fund Size (M)	0.000*	0.000	0.000
	(1.925)	(0.501)	(0.756)
Constant	-2.576**	-0.197	0.774
	(-2.416)	(-0.154)	(0.476)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	158	158	158

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D6: **Clusters by GP firm - all funds.** This table replicates table 6, using clustered standard errors at the GP firm level.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.008***	0.994***	0.991***
	(28.469)	(28.696)	(26.391)
Deal by deal x -exp(HHI)	0.401	0.734***	0.815***
	(1.526)	(3.171)	(2.735)
-exp(HHI)	-0.204	-0.403	-0.395
	(-0.533)	(-0.714)	(-0.521)
Fund Size (M)	0.000***	0.000	0.000
	(3.136)	(0.198)	(0.264)
Constant	-3.961***	-4.008**	-3.983*
	(-3.014)	(-2.285)	(-1.662)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D7: **Clusters by GP firm - all funds**.This table replicates table 7, using clustered standard errors at the GP firm level.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	1.000***	0.997***
	(29.017)	(27.436)	(25.316)
Deal by deal x Any risk factor	-1.500***	-2.132***	-2.207***
	(-2.669)	(-3.472)	(-2.992)
Any risk factor	0.519	0.440	0.650
	(0.900)	(0.626)	(0.769)
Fund Size (M)	0.000***	0.000**	0.000**
	(3.307)	(2.167)	(2.162)
Constant	-3.508***	-2.297**	-2.103*
	(-3.624)	(-2.147)	(-1.710)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	218	218	218

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D8: **All sample, 2000-2008, performance from year 2 to last available year.** This table replicates table 6 for a Sample of funds whose year of vintage was in the period 2000-2008. Net-of-fee and gross performance measures are measured from the second to the last year of life of funds.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.009***	0.997***	0.993***
	(33.298)	(33.600)	(30.988)
Deal by deal x -exp(HHI)	-1.531***	-1.473***	-1.491**
	(-2.932)	(-3.527)	(-2.455)
-exp(HHI)	0.364	0.584	0.450
	(0.699)	(1.203)	(0.740)
Deal by deal	-3.348***	-3.552***	-3.721***
	(-3.349)	(-4.575)	(-3.359)
Fund Size (M)	0.000**	0.000	0.000
	(2.243)	(0.780)	(0.822)
Constant	-1.646	-0.932	-1.167
	(-1.486)	(-0.945)	(-0.838)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	262	262	262

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D9: **All sample, 2000-2005, performance from year 2 to last available year.** This table replicates table 6 for a Sample of funds whose year of vintage was in the period 2000-2005. Net-of-fee and gross performance measures are measured from the second to the last year of life of funds.

	(1) Net IRR	(2) Net IRR	(3) Net IRR
Fund IRR	1.026***	1.004***	0.999***
	(24.533)	(23.871)	(22.375)
Deal by deal x -exp(HHI)	-1.482	-1.590*	-1.826*
	(-1.610)	(-1.741)	(-1.655)
-exp(HHI)	0.385	0.710	0.308
	(0.692)	(1.009)	(0.370)
Deal by deal	-3.390**	-3.970**	-4.405**
	(-1.997)	(-2.386)	(-2.236)
Fund Size (M)	0.000	0.000	0.000
	(1.484)	(0.593)	(0.869)
Constant	-2.161*	-1.249	-2.041
	(-1.883)	(-0.951)	(-1.033)
Vintage fixed effects	Yes	Yes	Yes
Fund type fixed effects	No	Yes	Yes
Manager fixed effects	No	No	Yes
Observations	159	159	159

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D10: **Gross and net performance - venture capital funds.**This table reports models for the gross performance of venture capital funds, before fees (*Fund IRR*. The main explanatory variable of interest is the (*Deal by deal* indicator. Fixed effects are included at the Vintage level. Standard errors are clustered by GP vehicle. All variables are as defined in previous tables.

	(1) Fund IRR	(2) Net IRR	(3) Fund IRR	(4) Net IRR
Deal by deal	6.550*	5.845*	6.826*	6.023*
	(1.984)	(1.779)	(1.950)	(1.768)
Fund Size (M)	7.564**	8.545**	7.588**	8.315**
	(2.175)	(2.376)	(2.139)	(2.371)
First generation	-3.600	-3.633	-1.952	-1.710
	(-1.000)	(-0.971)	(-0.457)	(-0.385)
1 - HHI			-4.329	-2.861
			(-0.494)	(-0.323)
Constant	0.547	-2.467	2.320	-0.984
	(0.144)	(-0.611)	(0.399)	(-0.167)
Vintage fixed effects	No	No	Yes	Yes
Observations	93	93	79	79

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D11: **Gross and net performance - all other fund types.**This table reports models for the gross performance, before fees, of all sampled funds not belonging to venture capital fund types (*Fund IRR*. The main explanatory variable of interest is the (*Deal by deal* indicator. Fixed effects are included at the Vintage level. Standard errors are clustered by GP vehicle. All variables are as defined in previous tables.

	(1) Fund IRR	(2) Net IRR	(3) Fund IRR	(4) Net IRR
Deal by deal	-2.258	-2.982*	-2.677	-3.339*
	(-1.405)	(-1.882)	(-1.461)	(-1.774)
Fund Size (M)	-0.264	-0.126	-0.483*	-0.332
	(-1.058)	(-0.498)	(-1.862)	(-1.256)
First generation	1.311	0.486	1.977	0.990
	(0.491)	(0.197)	(0.662)	(0.357)
1 - HHI			7.491*	8.272*
			(1.764)	(1.827)
Constant	9.230***	8.084***	5.569	3.905
	(3.318)	(2.770)	(1.427)	(0.959)
Vintage fixed effects	No	No	Yes	Yes
Observations	224	224	187	187

Cluster-robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D12: **Diversification variables and carried interest basis.** This table replicates table A8, replacing the *Deal by deal* binary variable by the *Pure Deal by deal* indicator, classifying carried interest models between strict deal-by-deal distribution rules and all the remaining ones.

	Main sample, including unclassified funds					
	(1)	(2)	(3)	(4)	(5)	(6)
	1 - HHI	1 - HHI	1 - HHI	Any factor	Any factor	Any factor
Pure Deal by Deal	-0.154**	-0.161**	-0.164**	0.172*	0.184*	0.182*
	(-2.234)	(-2.397)	(-2.477)	(1.792)	(1.909)	(1.887)
Fund size (M)	-0.007	-0.006	-0.006	-0.028	-0.026	-0.026
	(-0.433)	(-0.416)	(-0.381)	(-1.436)	(-1.188)	(-1.174)
First generation fund	0.099		0.099	0.069		0.056
	(1.111)		(1.072)	(0.691)		(0.535)
Constant	2.803***	2.688***	2.647***	0.555***	0.816***	0.793***
	(67.676)	(43.855)	(36.318)	(9.695)	(7.311)	(6.321)
Vintage fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	151	151	151	151	151	151
R-squared	0.030	0.050	0.055	0.033	0.043	0.064

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