Why Do Institutional Investors Invest Through Intermediaries?

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Abstract

Institutional investors, such as pension funds, often lack direct access to deals they want to invest in, forcing them to spend billions of dollars on intermediation fees. This paper explains intermediaries' better access to deals with their ability to maintain a reputation for protecting firms from the potentially differing strategic objectives of investors. Intermediaries must charge non-trivial fees to have incentives to maintain such a reputation, with competition among intermediaries putting upward pressure on fees. While institutional investors' in-house teams may also develop a similar reputation, they find that harder. When they do, the net-of-fees performance improves, and the proportion of directly invested capital is "wave-shaped" in investor size. Evidence from institutional investors' investments in alternative assets supports the model's predictions.

Keywords: Intermediaries, trusted third parties, fees, competition, pension funds, alternative assets.

JEL Classification: G23, G32

1 Introduction

Pension funds in the OECD invested 27.6 trillion dollars in 2018 (OECD, 2019). About a third of these investments were in alternative assets such as real estate, private equity, and hedge funds. Crucially, over 85% of these investments were not made directly using in-house fund managers but through independent third-parties (Andonov, 2020). Given the typical 2% management and 20% performance fee structure of external intermediaries, billions of dollars are spent each year on intermediation fees rather than on pensions. This problem is also typical for other institutional investors such as insurance companies and sovereign wealth funds. In light of the sheer size of capital involved, it is hard to imagine that such investors cannot attract talent to form in-house teams that manage investments in alternative assets to save on intermediation fees. Indeed, many do, but there is vast cross-sectional and time-series variation in the proportion of internally managed investments. Empirically, one of the main arguments seems to be that institutional investors lack access to the best deals (Hochberg et al., 2007; Sensoy et al., 2014; Lerner et al., 2020). This lack of access cannot be fully explained by a lack of skill, as the evidence is that deals made directly by institutional investors outperform intermediated deals (Fang et al., 2015). A lack of critical size is also not an issue in many cases.

This paper proposes that institutional investors often do not have direct access to deals they want to invest in, as *firms* might want to avoid dealing with investors with different strategic objectives. In particular, pension funds, insurance companies, and sovereign wealth funds must comply with stringent fiduciary rules on how to invest the capital under their management and must match investment returns with strategic considerations, such as meeting pension obligations. The fiduciary duty to act prudently and minimize risk could slow down their decision process and make them unable to commit to timely financial support that may be critical in the course of restructurings or the pursuit of risky growth strategies. In such cases, an intermediary, such as a private equity fund, can act as a trusted third party assuming the control rights on how the raised capital is spent. By creating sufficient distance between firms and investors, intermediaries allow investment capital to flow.

To characterize the choice between direct and intermediated investment, the paper develops a model in which firms seek capital to start risky projects, whose success depends on the effort of firm insiders. Investors can either invest directly or through an intermediary, with both investors and intermediaries being long-lived and competing on prices. Once a firm has raised capital and more becomes known about its risky project's success likelihood, it can abandon its risky strategy and switch to a safe one (e.g., by withdrawing or delaying financial support to the risky project). A potential source for conflicts of interest at this

stage is that investors have a stronger preference for safety.

The first result from this setting is that raising financing through intermediaries is preferable for firms when investors' preference for safety makes it impossible to commit to supporting the firm in case of ambivalent signals about the risky strategy's success prospects. Commitment to continued support is particularly important for firms where insiders need to exert substantial effort to make the investment work. In such cases, the prospect that their effort is wasted because an investor withdraws support for the risky strategy could erode insiders' effort incentives to make that strategy work. Notably, this tension can occur even if withdrawing support is ex post socially efficient. Engaging an intermediary with a reputation for acting as a trusted third party that is more willing to support the risky strategy could restore incentives.

The second result is that intermediaries acting as trusted third parties must charge positive fees even if there is perfect price competition among intermediaries. More intense competition could even lead to higher fees. Intermediation fees must always be positive because intermediaries must have an incentive to maintain their reputation. The problem is that once the decision over the continuation of the risky project has been delegated to them, intermediaries have monopoly power over that decision. Thus, unless they expect to profit from maintaining reputation, they would not be able to resist to pressure from investors (in the form of higher renegotiated fees) to force the firm to switch to the safe strategy.

When multiple intermediaries compete on prices, fees increase in the level of competition. Specifically, once competition has driven prices down to the point at which an intermediary is indifferent between maintaining and abusing its reputation, further competition reduces the likelihood that the intermediary is used again as a trusted third party in future periods. With less future fee income at stake, abusing trust becomes more attractive. This implies that future fees must increase to compensate the intermediary for the lower likelihood of obtaining such fees. That is, competition leads to higher fees because it obstructs the intertemporal link needed for developing a reputation for being a trusted intermediary. As a result, competition among intermediaries is endogenously limited by the fact that too much competition makes intermediation more expensive and unattractive for investors and firms.

Third, the paper shows that when investors develop their own in-house reputation for being trusted, their net-of-fees performance improves compared to intermediated investment. The reason is that even under perfect price competition, maintaining a reputation for being trusted, which gives investors better access to deals, is only possible if that reputation allows them to reap a positive profit in the future. Interestingly, though co-investments lie between direct and fully-intermediated investments, they will feature a lower return net of fees than intermediated investments. Such co-investments are safer for investors and, thus, require a

lower "risk premium" net of fees.[1]

The problem for investors with developing in-house reputation for being trusted is that competition among intermediaries endogenously adapts to the threat that the intermediaries are displaced by investors. Furthermore, investors find it harder to develop such a reputation, as their incentives to abuse it are stronger in a direct than in an intermediated relationship. Intuitively, in the latter case, they have to deal not only with the firm's but also the intermediary's resistance of accepting that the investor goes back on its promise to support the risky strategy.

A sufficiently larger size (than intermediaries) can help, as there are economies of scale when maintaining reputation. In particular, a large investor abusing its reputation has more future reputation income to lose from being discovered. Furthermore, abusing trust in multiple investment relationships is more likely to be detected by future market participants. Yet the effect of size on the reliance on intermediation is not monotone.

The fourth result is that there is a "wave-shaped" relation between investor size and the proportion of internally managed investments. This wave-shaped relation arises when a reputation for being trusted in one type of investment (e.g., real assets) is not transferable to other types (e.g., private equity). In particular, small investors use intermediaries, as intermediaries find it easier to maintain a reputation as a trusted party. As investors grow, they can improve investment returns by concentrating on one asset class (e.g., real assets) and developing an in-house reputation for that asset class. As they grow further and seek to make different types of investment (e.g., in private equity), they do so again initially through intermediaries who find it easier to maintain a reputation for being trusted. As investors grow yet more, they can also develop in-house reputation for the next asset class and start making this type of investment directly. Thus, the optimal proportion of internally managed investments is wave-shaped in investor size.

The paper provides support for the model's predictions using data on institutional investors' investments in alternative assets. Prior work has already shown that internally-managed investments are associated with lower investment costs and higher net-of-fees performance compared to externally managed investments (Fang et al., 2015; Andonov, 2020). However, the model cautions against interpreting such results as evidence that institutional investors should switch to internally managed investment, as the results reflect institutional investors' endogenous access to investments in alternative assets. In particular, there are two main novel empirical findings.

First, the evidence supports the model's result that investors are more likely to use inter-

[1]The lower required risk premium can help explain why co-investments yield lower returns, net of fees, than intermediated investments (Fang et al., 2015).

mediaries when intermediaries can develop a reputation for acting as trusted third parties. The effect is identified using the enactment of the Pension Protection Act of 2006. This act effectively abolished a 25% threshold for government pension plans (such as CalPERS) beyond which the assets of investment vehicles such as real estate, private equity, and hedge funds are considered as (pension) "plan assets" and, thus, subject to strict fiduciary and prohibited transactions rules. As a result, the Pension Protection Act allowed independent funds to accept more capital from public pension funds without compromising their reputation as trusted third parties that isolate firms from the strict regulations that pension funds must comply with.

The difference-in-differences results support the hypothesis that expanding the ability of intermediaries to act as trusted third parties leads to more intermediated investment. In particular, the percentage of externally managed investments in alternative assets of government pension funds significantly increases relative to the control group of private pension funds unaffected by the law. The effect is most pronounced for larger investors with enough scale to engage in in-house investments as predicted by the model.

Second, the evidence supports the prediction that the percentage of internally managed investment in alternative assets is wave-shaped in institutional investors' size. The results show that small investors invest more internally as their fund size grows. Beyond a certain point, the relationship reverses, and investor size has a negative effect on the percentage of internally managed investments in alternative assets. As fund size grows yet further, the relation inverts again, and the proportion of internally managed capital increases. These changes are mirrored in changes with the opposite sign in institutional investors' external investments in funds of funds.

Related literature. The paper contributes most broadly to the financial intermediation literature, but, unlike most of that literature, it focuses on non-bank intermediaries. The first main insight is that intermediaries are needed when institutional investors' preference for safety makes it unprofitable for firms to raise capital directly from such investors. In such cases, intermediaries maintaining a reputation as trusted third parties can isolate firms and investors from each other and allow investment capital to flow. This explanation adds to classical work on financial intermediation, arguing that intermediation helps in the resolution of pre-contract private information or post-contract moral hazard problems (Leland and Pyle, 1977; Diamond, 1984; Ramakrishnan and Thakor, 1984; Allen, 1990);[2] as well as to more-recent explanations of intermediation as a beliefs bridge between optimists and pessimists (Coval and Thakor, 2005).

[2]See Bhattacharya and Thakor (1993), Freixas and Rochet (1997), and Greenbaum et al. (2019) for comprehensive reviews.

The paper's main departure from existing work is that its explanation of intermediation is centered on why firms (rather than investors) prefer intermediated financing. This offers a novel explanation for the evidence that intermediaries may have better access to deals (Kaplan and Schoar, 2005; Hochberg et al., 2007; Sensoy et al., 2014; Lerner et al., 2020), unrelated to intermediaries having better skills.[3] Interestingly, the friction underpinning this explanation — that institutional investors may have a stronger preference for safety — echoes prior work arguing that such investors may prefer deferring responsibility in case of poor performance (Lakonishok et al., 1992).

While skill is certainly an important aspect that could give intermediaries an edge, it is not clear why institutional investors do not hire their own skilled teams. Indeed, many do, and the evidence supports the paper's prediction that net-of-fees performance of direct investments outperform intermediated investments (Fang et al., 2015; Andonov, 2020). The reason proposed in this paper for why direct investments are not more wide-spread is that intermediaries can more-easily maintain reputation for isolating firms from the differing strategic objectives of institutional investors. The presented evidence supports this explanation.

The paper also presents a novel reputation-based explanation for intermediation fees and shows that more-intense competition can lead to higher fees. These insights add to prior work, which explains fees with the need to compensate intermediaries for acquiring costly information (Admati and Pfleiderer, 1988; Garcia and Vanden, 2009; Garleanu and Pedersen, 2018). The relation between fees and reputation also differentiates the paper from Gennaioli et al. (2015). That paper argues that trust in an investment manager reduces investors' perception of investment riskiness. As a result, fees are higher for riskier investments with a higher expected return. Because of trust, fees are not competed away to zero. By contrast, fees in this paper are necessary to provide incentives not to abuse trust. Because of the necessity for such incentives, more competition, which reduces the likelihood of future intermediation fees, requires fees to be higher to be effective.[4] In line with the model, avoiding fees is one of the main reasons highlighted by prior work for why institutional investors invest directly (Fang et al., 2015).[5]

[3] Intermediaries may also sometimes avoid dealing with certain limited partners because that may lead to information leakage (Abuzov, 2020).

[4] The paper's costly reputational perspective further differentiates it from work in asset pricing that examines how fund managers' fees affect their incentives to exert effort as well as their portfolio allocation and risk-taking decisions (Admati and Pfleiderer, 1997; Palomino and Prat, 2003; Basak et al., 2007; Li and Tiwari, 2009); and how compensation contracts of asset managers affect asset prices (Cuoco and Kaniel, 2011; Buffa et al., 2019). Furthermore, the paper's reputational perspective differs from work in household finance in which firms pay fees to intermediaries to affect the financial advice intermediaries give to retail investors (Inderst and Ottaviani, 2012a,b).

[5] Avoiding agency problems is another important concern. One example of such problems is that funds

Another insight from the paper is that economies of scale related to developing reputation lead to a wave-shaped relation between investor size and the proportion of internally managed investments. The paper shows that this wave-shaped relation is strongly present in the data – a stylized fact that has previously not been documented and discussed. The model's explanation for this non-monotonic relation adds to prior theories that small investors may not have sufficient scale to make informed and sufficiently diversified investments in private markets (Admati and Pfleiderer, 1988; Allen, 2001; Ross, 2005; Garcia and Vanden, 2009).

2 Model

Consider a discrete time infinite horizon setting in which in every period t, a penniless firm, run by its owner-manager, has an investment opportunity requiring an initial cash outlay of I. To raise capital at the beginning of a period (date $\tau_t = 0$), the firm can either approach an investor directly or over a third party that acts as an intermediary between the firm and the investor. The common discount factor between periods is δ. It is assumed that, unlike investors and intermediaries, firms operate for only one period. This assumption does not imply that investors and intermediaries take a longer view about how firms should be run but that they may care about maintaining a reputation helping them in their myriad dealings with firms. While for firms, reputation in their dealings with investors is important, it is not their business.

If a firm raises capital and invests at the beginning of period t, it subsequently observes a state of the world $\theta_t = \{0, \theta_M, \theta_G\}$ at the interim date of that period. This state corresponds to the probability that the project is successful and returns x at the period's end. If the project is unsuccessful, it returns zero. The signal θ_t is observed also by the investor and the intermediary, but it is not verifiable to third parties. The ex ante probabilities of θ_M and θ_G are p_M and p_G, respectively. The firm can increase p_M to ρ_M and p_G by ρ_G by exerting effort at the beginning of the period. Effort is nonverifiable and carries a non-monetary cost c. It is assumed that investing in the project is only worth it if the firm exerts effort.

Upon observing θ_t at the interim date, the firm can abandon the risky strategy and revert to a safe strategy. The safe strategy captures the idea that the firm takes more time to explore the different options and risks to reduce the downside risk at the expense of losing

increase their fees at the expense of net returns (Kaplan and Schoar, 2005, Lopez-de-Silanes et al., 2013). Limited partners can partially curtail such incentives by threatening to walk away and dent the funds' reputation for being high-skilled (Hochberg et al., 2014). Other examples of agency problems are that funds aiming to build up reputation more quickly have incentives to exit deals prematurely (Gompers et al., 1996); and that funds may have strong incentives to invest at market peaks when expected returns are low (Axelson et al., 2013).

initiative and reducing the chance of being more successful (e.g., by being an early mover). For simplicity, it is assumed that the safe strategy yields a safe payoff y, which is the same as what the risky project generates in expectation if its success likelihood is θ_M , i.e., $y = \theta_M x$. An alternative interpretation of y is as opportunity costs — e.g., a follow-up capital injection needed to keep the risky investment going or the liquidation payoff in case the risky project is abandoned. The assumption of three state realizations θ_t is the minimum needed to generate a tension between continuation policies for the risky strategy that are optimal ex post but not ex ante. The results easily generalize to the case in whcih θ_t is continuous.

Firms and intermediaries are risk neutral. However, investors have a preference for safety. In particular, investors incur a private cost of $\kappa I > 0$ whenever they have invested capital I with risk.[6] For example, in the context of pension funds, the preference for safety can be explained by the fact that such funds must match cash flows to their pension obligations and must comply with strict fiduciary and prohibited transactions rules. Thus, unlike the firm, investors strictly prefer reverting to the safe strategy in state θ_M (as $\theta_M x - \kappa I = y - \kappa I < y$). It is this feature of the model that will create scope for intermediation. Furthermore, it is assumed that $y < \theta_G x - \kappa I$, which implies that the social surplus from continuation of the risky project is higher than from the safe project in state θ_G.

Contracting. A financing contract with an investor specifies payments $S = \{S_0, S_y, S_x\}$ where the subscripts stands for the cash flow realization and $S_0, S_x, S_y \geq 0$. If the firm uses an intermediary, the intermediary raises funding on the firm's behalf from the investor. For this service, the intermediary receives a fee of $\phi = \left\{\phi_0, \phi_x, \phi_y\right\}$ with $\phi_0, \phi_x, \phi_y \geq 0$. It is without loss of generality to assume that the investor pays all fees. However, since the investor is compensated for paying these fees through the financing contract (facilitated by the intermediary), the fees are effectively borne by the firm. All parties are protected by limited liability. Thus, if a firm raises financing and its cash flows are zero, it can pay at most zero to the investor and intermediary, i.e., $S_0 = \phi_0 = 0$.

Note that contracts can only be made contingent on cash flows and on whether the firm continues with the safe or risky strategy, as the state θ, observed at $\tau_t = 1$, is not verifiable to third parties. However, a contract can stipulate which party has the right to decide on whether the firm continues with the risky or the safe project at $\tau_t = 1$. In particular, this right can be allocated to the firm, the investor, or the intermediary. Since an intermediary only channels capital from investors to firms, it is appointed only if it is also allocated the right to decide on whether the risky project is continued at $\tau_t = 1$.

Competition, Investor Size, and Investment Types. There are multiple identical

[6] A previous working paper version derives the same qualitative results under the assumption that investors are risk averse with a quadratic utility function of the sort $u(z) = \mathrm{E}z - \frac{a}{2}\mathrm{Var}(z)$.

investors and intermediaries competing on prices that firms seeking financing can choose from. If a firm chooses among n investors with the same reputation offering the same terms, the probability that any of these investors is chosen is $q_{inv} \equiv \frac{1}{n}$. Similarly, if a firm seeks out an intermediary among m intermediaries with the same reputation and fees, the probability that any of these intermediaries is chosen is $q \equiv \frac{1}{m}$. That is, q can be thought of as a measure of market concentration (the inverse of competition). While the supply of investors and capital (captured by q_{inv}) is taken as given, the level of competition among intermediaries (captured by q) will be endogenized in the model.

Section 3.4 extends the above baseline model to develop the ideas of large and small investors making different types of investment. One asset class (also referred to as "asset class") is defined to be different from another if having a reputation for being trusted in that asset class (e.g., real estate) does not carry over to the other (e.g., private equity). For simplicity, it is assumed that there are two asset classes with two firms belonging to each type; and that there is no correlation between the states realization θ_t for different firms. All firms require an investment outlay of I (i.e., altogether $4I$). Differences in investor size are defined by whether an investor can provide funding for I, $2I$, $3I$, or $4I$ in a period.

Discussion: Skills. Work on private equity and venture capital financing typically assumes that intermediaries can contribute to value creation in a firm by improving its efficiency or helping entrepreneurs with valuable advice and their network (e.g., Schmidt, 2003; Hellmann, 2006). Similarly, the classical intermediation literature (cited in the Introduction) assumes that intermediaries might be better at selecting and monitoring investments. Skill offers a natural rationale for choosing intermediation. The reason for assuming that intermediaries have no such skills in this model is to show in a stark way that there is scope for intermediation in which intermediaries extract positive fees even when they lack skills that investors cannot acquire by hiring their own in-house investment teams.

3 The Choice Between Direct and Intermediated Financing

In what follows, Section 3.1 analyzes the investor's choice between direct and intermediated financing when only intermediaries can develop a reputation for being a trusted (third) party. For ease of exposition, it is assumed initially that only one firm seeks financing per period. Section 3.2 discusses the implications of maintaining a reputation for intermediation fees. Subsequently, Section 3.3 studies the case in which investors can also develop reputation for being trusted and avoid intermediaries. Section 3.4 discusses then the case in which

multiple firms seek financing and derives a wave-shape relation between investor size and the proportion of intermediated versus directly invested capital.

3.1 The Role of Trusted Intermediaries in Overcoming Investment Breakdown

Direct Financing.[7] Suppose that the firm raises capital directly from an investor. It is without loss of generality to assume that the decision to continue the risky project at the intermediate date $\tau_t = 1$ or revert to the safe project is delegated to the investor. Specifically, if the state is $\theta = \theta_G$, both the investor and the firm agree that social surplus is highest if the project is continued, and if $\theta = 0$, both agree that the risky investment should be abandoned in favor of the safe strategy. The only problematic state is θ_M in which case continuation is ex post socially inefficient, as $y > \theta_M x - \kappa I$. Thus, any contract leading to continuation in state θ_M will be renegotiated. However, it is shown in what follows that the prospect of not supporting the risky strategy in state θ_M could lead to investment breakdown. It is without loss of generality to consider only renegotiation-proof contracts.

Since investors compete on prices, in equilibrium they offer the contract that maximizes the firm's expected payoff

$$(1 - \rho_G)(y - S_y) + \rho_G \theta_G (x - S_x) - c \tag{1}$$

subject to $S_x, S_y \geq 0$, the investor's break even condition

$$(1 - \rho_G) S_y + \rho_G (\theta_G S_x - \kappa I) \geq I, \tag{2}$$

and the incentive constraint guaranteeing that the firm exerts effort at $\tau_t = 0$

$$(\rho_G - p_G)(\theta_G (x - S_x) - (y - S_y)) \geq c. \tag{3}$$

To ease notation, define in what follows $\Delta_G \equiv \rho_G - p_G$ and $\Delta_M \equiv \rho_M - p_M$.

The classical agency problem, captured by incentive constraint (3), limits what the firm can promise to an investor in return for providing funding for I. To see this, observe that the maximum that the firm can pledge to the investor in case the firm reverts to the safe strategy is $S_y = y$. Such an arrangement relaxes (3), as it incentivizes the owner-manager to avoid such an outcome. The maximum that can be pledged in case of continuation of the

[7] The terms "direct or intermediated financing" and "direct or intermediated investment" are used interchangeably to mean whether an investor provides capital to a firm directly or through an intermediary.

risky strategy, while satisfying the incentive constraint (3), is then $S_x = x - \frac{c}{\Delta_G \theta_G}$. Plugging this maximum pledgeable income into the investor's participation constraint, we obtain that the firm can raise financing only if

$$(1 - \rho_G)\, y + \rho_G \theta_G x - I - \rho_G \kappa I - \rho_G \frac{c}{\Delta_G} \geq 0. \tag{4}$$

The first three terms correspond to the project's net present value. The remaining terms corresponds to the additional costs arising from the investor's private benefit from safety, κI, and the agency rent $\rho_G \frac{c}{\Delta_G}$ needed to motivate the owner-manager to exert effort. If that agency rent is high, it could become impossible to raise financing, and there is a breakdown of investment.

Intermediated Financing. If the owner-manager could raise funding from the project without resorting to an intermediary, i.e., condition (4) is satisfied, it is optimal to do so. The reason is that if the owner-manager's residual stake is sufficiently high to incentivize effort, an intermediary has no value added but potentially charges an intermediation fee. However, if condition (4) is not satisfied, an intermediary can facilitate financing through its reputation. Specifically, hiring an intermediary could be beneficial if it can act as a trusted third party that can commit to continuing the risky project in sate θ_M even though, once θ_M is realized, it would be socially optimal to revert to the safe strategy. Suppose, for now, that the intermediary has such reputation.

Given that the project is continued in states θ_M and θ_G, the financing contract facilitated by intermediaries competing on prices must maximize the firm's expected payoff

$$(1 - \rho_M - \rho_G)\,(y - S_y) + (\rho_M \theta_M + \rho_G \theta_G)\,(x - S_x) - c$$

subject to $S_x, S_y \geq 0$, the investor's break even condition

$$(1 - \rho_M - \rho_G)\left(S_y - \phi_y\right) + (\rho_M \theta_M + \rho_G \theta_G)\,(S_x - \phi_x - \kappa I) \geq I,$$

and the incentive constraint guaranteeing that the firm exerts effort

$$(\Delta_M \theta_M + \Delta_G \theta_G)\,(x - S_x) - (\Delta_M + \Delta_G)\,(y - S_y) \geq c. \tag{5}$$

Intermediated financing can be preferable for the firm despite the associated fees, because it provides stronger support to the risky strategy in state θ_M. In turn, this support boosts the owner-manager's effort incentives and can make it easier to raise funding. The reason a higher likelihood of discontinuing the risky strategy can worsen the effort incentive problem

is that it makes it more likely that the owner-manager's effort is wasted. In particular, effort increases both the likelihood of state θ_M and state θ_G. However, with direct financing, that effort is wasted if the firm lands in state θ_M, as the risky project is discontinued in that state. The higher likelihood of reverting to the safe strategy (with direct financing) can also have a positive disciplining effect if the owner-manager's residual payoff with the safe strategy is low. However, the negative "wasted effort" effect attenuates this benefit and can easily dominate.

When the wasted effort effect associated with direct investment dominates, it is more difficult for the owner-manager to raise financing, because the owner-manager needs to retain a higher stake to stay incentivized — the agency rent is higher. This translates into a lower income that can be pledged to investors.

To quantify this "wasted effort" effect, observe that the rent needed to incentivize the firm to exert effort is minimal when $S_y = y$. Then, the agency rent is $\frac{\theta_G p_G + \theta_M p_M}{\theta_G \Delta_G + \theta_M \Delta_M} c$. This rent is higher than the rent, $\frac{p_G c}{\Delta_G}$, under direct financing whenever $\frac{\Delta_M}{\Delta_G} \rho_G > \rho_M$. Investment projects that fit this description are (i) risky projects that put high probability mass in the tails (i.e., ρ_G is high relative to ρ_M) so that the higher social surplus in state θ_M is less relevant; and (ii) investment projects for which putting effort is likely to reduce the project's risk profile by shifting relatively more probability mass from the left tail to the middle (i.e., Δ_M is high relative to Δ_G). In these cases, intermediated financing can facilitate investment when direct financing would lead to investment breakdown. Denoting the expected intermediation fee in any given period as

$$\mathrm{E}\phi \equiv (1 - \rho_M - \rho_G)\, \phi_y + (\rho_M \theta_M + \rho_G \theta_G)\, \phi_x,$$

we have (all proofs are in the Appendix):

Proposition 1 *Intermediated financing is feasible when direct financing is not if*

$$\mathrm{E}\phi \leq \frac{\theta_M \left(\frac{\Delta_M}{\Delta_G} \rho_G - \rho_M \right)}{\theta_G \Delta_G + \theta_M \Delta_M} c - \rho_M \theta_M \kappa I. \tag{6}$$

The cases in which direct financing is preferred are clear. This is when the investor's preference for safety κI is large, so that the benefit of long-term commitment to the risky project is less important than the investor's demand for safety. Clearly, intermediation is dominated also if the expected intermediation fees $\mathrm{E}\phi$ are too high. It is shown in what follows that these fees can, indeed, be substantial even when there is perfect competition among intermediaries.

3.2 Intermediation Fees of Trusted Third Parties

The purpose of intermediaries in this model is to create sufficient distance between firms and investors. This occurs by delegating decision power to the intermediaries about whether the risky investment should be continued. Delegation alone does not guarantee that an intermediary can credibly commit to support the project in state θ_M.

Committing to support the risky strategy in state θ_M in a one-period setting is not possible, as such continuation is not renegotiation-proof. Once the firm's effort has been sunk and state θ_M has been realized, the investor can press for renegotiation. Given that the investor's cost from investing with risk, κI, leads to a higher (ex post) surplus from reverting to the safe project, $y > \theta_M x - \kappa I$, the investor can always make an offer to the intermediary and the firm that makes everyone better off compared to the original contract in which the intermediary supports the risky project in state θ_M. The problem is that such renegotiations undermine commitment and destroy ex ante surplus. Thus, the outcome of Proposition 1, which relies on commitment, cannot be obtained in a single-period setting.

The problem of a lack of commitment can be overcome in an infinite horizon model in which the intermediary maintains reputation for supporting the risky strategy in state θ_M even if pressed to revert to the safe strategy by the investor. Maintaining such reputation is possible if future firms can detect such deviation in which case they believe that the intermediary is not trustworthy and will deviate also in the future, causing the intermediary to loose future fee income. Let π denote the probability of such detection.

Maintaining a reputation for supporting the risky strategy in state θ_M requires that the intermediary's continuation payoff from maintaining a reputation for being trustworthy be higher than the maximum payment (in the form of a renegotiated fee) the investor is willing to offer to the intermediary to discontinue the risky project in state θ_M. Recall that the additional social surplus that can be generated from renegotiating is κI. Let μ denote the intermediary's share of this surplus that it can extract (in addition to its contractual fee) if it allows for renegotiations leading to abandoning the risky strategy in state θ_M. That is, the intermediary's renegotiated fee can be stated as $\theta_M \phi_x + \mu\kappa I$. Such a renegotiation is not incentive compatible for the intermediary if

$$(1-\delta)\,\theta_M \phi_x + \delta q \mathrm{E}\phi \geq (1-\delta)\,(\theta_M \phi_x + \mu\kappa I) + (1-\pi)\,\delta q \mathrm{E}\phi. \tag{7}$$

The notable insight from this analysis is that maintaining a reputation for being a trusted third party requires that the intermediary charges a positive fee even though there is perfect price competition among intermediaries. The reason is that, once the decision to delegate the continuation control right to the intermediary has been made, the intermediary has

monopoly power over its decision to abuse its reputation for not allowing for renegotiations. In particular, as long as the intermediary can profit from abusing its reputation (i.e., $\mu > 0$), the only way to credibly commit not to do so is if that puts a strictly positive future fee income at stake.[8] It holds:

Proposition 2 *Maintaining a reputation for being a trusted third party requires that the intermediary charges a positive fee even under perfect price competition. It must hold that*

$$\mathrm{E}\phi \geq \frac{\mu\kappa I\left(1-\delta\right)}{\delta q\pi}. \tag{8}$$

It is useful to discuss the properties of the fee lower bound given by the right-hand side of expression (8), anticipating that condition (8) will be binding in equilibrium. Even though the fee structure is not uniquely pinned down, the comparative statics of this lower bound are intuitive and can be derived cleanly. The notable effects are as follows.

Perhaps surprisingly, higher competition among intermediaries leads to *higher* fees. The reason is that more intense competition reduces the likelihood of being appointed as intermediary in any given period (i.e., q is low). Thus, maintaining a reputation is worth it only if the expected future fees are high enough to compensate for the low likelihood of obtaining such fees.

That intermediation fees increase in competition does not imply that intermediaries are better off when there is more competition. Though conditional on being appointed as a trusted third party, the intermediary's expected profit increases, the likelihood of being appointed as an intermediary decreases. The net effect is neutral, as, when intermediaries compete on prices, the expected fee income is always just high enough for intermediaries not to abuse their reputation for being a trusted third party.

Proposition 3 *With $m \geq 2$ intermediaries competing on prices, an increase in the level of competition increases the minimum fees that intermediaries must charge.*

The model assumes price competition among $m \geq 2$ intermediaries. While it is not explicitly modeled how a monopolistic intermediary ($m = 1$) sets fees, it is reasonable to expect that the fees decrease if such an intermediary loses its monopoly status and faces price competition. Overall, this gives rise to a U-shaped relation between fees and competition.

Corollary 1 *Considering that an intermediary lowers its fees when losing its monopoly power, there will be a U-shaped relation between the fees charged by intermediaries acting as*

[8] As it is standard, the intermediary's bargaining power, captured by $\mu > 0$, is exogenous in the model. Assuming that $\mu = 0$ would be equivalent to assuming that the intermediary has no bargaining power in renegotiations.

trusted third parties and the level of competition among such intermediaries — i.e., $\mathrm{E}\phi$ *first decreases and then increase in* m*.*

3.3 Endogenous Limit to Competition Among Intermediaries

Intermediation fees cannot increase without bound. Although these fees are paid by investors, they are passed on to the firm in the form of more expensive financing. As a result, fees and, thus, competition among intermediaries are endogenously limited by the firm's outside options of not to raising financing or raising financing from an investor without reputation (Proposition 1). As noted, if the latter option were available, it would always be optimal. Hence, the focus in what follows is on the case in which the firm's outside option is not raising financing. The next section discusses the case in which investors can also develop reputation.

The adverse effect of competition on fees puts an upper limit to the number of intermediaries in the market even though intermediaries make positive profits and entry is free. The main effect of entry of new intermediaries is that it precludes the existence of equilibria in which the intermediaries' fees do not satisfy expression (8) with equality. Any fee structure, for which $\mathrm{E}\phi > \frac{\mu\kappa I(1-\delta)}{\delta q \pi}$ will attract entry, pushing down q until the inequality binds. Entry beyond this point forces the intermediaries to increase fees until these fees exhaust the firm's pledgeable income. More entry beyond this point is infeasible, as it will make it impossible for intermediaries to facilitate financing while maintaining a reputation for being trusted.

Proposition 4 *With free entry of intermediaries, the level of competition among intermediaries is such that the firm's pledgeable income is just exhausted and it holds that*

$$q^* = \frac{\mu\kappa I\left(1-\delta\right)}{\delta\pi\left(\mathrm{E}x - I - \left(\rho_M\theta_M + \rho_G\theta_G\right)\kappa I - \frac{\theta_G\rho_G+\theta_M\rho_M}{\theta_G\Delta_G+\theta_M\Delta_M}c\right)} \tag{9}$$

and $\mathrm{E}\phi = \frac{\mu\kappa I(1-\delta)}{\delta q^*\pi}$*.*

The remaining factors affecting intermediation fees are straightforward. A higher preference for safety, κI, pushes up intermediation fees, as it makes the investor more inclined to try to bribe the intermediary to abuse its reputation. Thus, a higher preference for safety endogenously puts a stricter limit on how intense competition among intermediaries can be. Intermediation fees decrease in the likelihood, π, that it becomes known that an intermediary has abused a firm's trust. Trivially, foregoing a higher fee from renegotiations only hurts the intermediary's reputation if future firms learn that it cannot be trusted to keep its promises

to support the risky strategy. Furthermore, more-patient intermediaries discount future fees less. This allows them to charge lower fees in any given period. Summarizing, it holds:

Corollary 2 *Intermediation fees decrease in π and δ and increase in μ and κ.*

3.4 Size, Investor Reputation, and the Choice of Intermediated or Direct Financing

In this section, we consider the full model in which there are two asset classes (as defined in Section 2) and two firms from each class. The central question is whether investors will choose direct or intermediated financing when they can also develop a reputation for being a trusted party. The latter option was implicitly assumed away in Sections 3.1 and 3.2.

We start by discussing the importance of size for maintaining a reputation as a trusted party. Recall that investor size was defined by whether an investor can invest I, $2I$, $3I$, or $4I$ each period. Since there are two firms from each asset class, a large intermediary is one that can facilitate the investment of $2I$, while a small intermediary can facilitate only I within the respective asset class.

Size is important when maintaining a reputation for being a trusted third party, as there are economies of scale when maintaining reputation. There are two complementary effects. The first is that a large player (an intermediary or investor) benefits less from abusing the trust in any given relationship with a firm. Since continuation profits from future relationships scale up with size, a large intermediary stands to lose more from being detected that he has abused his reputation.

The second effect is that abusing the trust of multiple firms makes it more likely to be discovered by market participants next period. In particular, while the likelihood that a trusted player can get away with abusing trust in one intermediated relationship is $(1-\pi)$, the likelihood of getting away with abusing the trust in two intermediated relationships is $(1-\pi)^2$.[9] This combination of having more at stake and facing a higher likelihood of discovery means that a large player has stronger incentives not to abuse trust.

Since the fees charged by intermediaries depend on their incentives to abuse trust, we obtain that small intermediaries (that do not have the capacity to facilitate multiple investments) cannot lower fees as much as large ones.

[9] It is implicitly assumed that firms discover the abuse of trust in any given relationship indepently from discovering an abuse of trust in other relationships. The argument holds strictly as long as there is no perfect correlation in discovery (otherwise it holds weakly).

Proposition 5 *There are economies of scale when maintaining a reputation as a trusted third party. Thus, when intermediaries compete on prices, intermediaries that can facilitate multiple investments can offer lower fees.*

Furthermore, since intermediaries that can facilitate more investments enjoy economies of scale when maintaining reputation:

Corollary 3 *When intermediaries competing on prices differ in how many investments they can facilitate, large intermediaries will crowd out small ones.*

Investor Reputation and Size. Investors can also try to develop in-house reputation for being a trusted party. While they are not paid intermediation fees, investors will have incentives to maintain a reputation for supporting the risky strategy in state θ_M if that helps them extract positive rents in the future. This means that, despite perfect price competition among investors, financing of projects that require reputatition for support of the risky strategy in state θ_M must be more expensive than what is needed for investors to break even. The intuition is the same as that explaining why intermediaries must extract strictly positive fees not to abuse their reputation. The corollary is that

Corollary 4 *Investment return on direct investments is higher than on intermediated investments net of fees.*

Maintaining a reputation for supporting the firm's risky strategy leads to positive profits, while intermediated financing under price competition drives the investors' profits to zero. Therefore, it seems immediate that investors should invest directly. However, this may not be possible if intermediaries can facilitate better financing terms, as they find it cheaper to develop a reputation for being a trusted party.

The first factor working in the intermediaries' favor is that they stand to gain less from abusing their reputation. In particular, renegotiations among three parties imply that the gains from renegotiations must be split three-ways, while renegotiations between the firm and the investor result in a two-way split.[10] That is, the gains from renegotiations are smaller if an intermediary is involved. This allows intermediaries to facilitate better financing terms than those of investors of equal size. Notably, the intermediaries' profits are not dissipated even with free entry among intermediaries, as the threat of being crowded out by investors

[10] To simplify exposition, it is assumed that each party can extract an equal share. This assumption can be rationalizes with the Shapley value generalization of Nash bargaining (e.g., Bolton and Scharfstein, 1996), which postulates that each player's bargaining power is related to the marginal value of the various coalitions that can be formed (see Lemma 2 in the Appendix).

sets an upper bar on the level of competition among intermediaries (Proposition 4). Investors can only outcompete intermediaries if they are prepared to invest much more than a single intermediary can facilitate.

Lemma 1 *Investors can offer better financing terms than the terms facilitated by an intermediary only if they have a size advantage — i.e., if they can invest more than the amount that a single intermediary can facilitate.*

Investors that can invest only I will invest through an intermediary. If they can invest $2I$, while an intermediary can only facilitate I, they will invest directly. Specifically, it is optimal to maintain reputation for being trusted (in that class), which allows to make positive profits. If investors can invest $3I$, they will invest $2I$ directly (on which they profit) and I through an intermediary (on which they make no profit). Finally, if investors can invest $4I$, they invest directly by building up reputation for being trusted in both asset classes.

Proposition 6 *If an intermediary can only facilitate the investment of I and $q_{inv} > \frac{3}{2(2-\pi)}$, there is a wave-shaped relationship between investor size and the proportion of direct relative to intermediated investment. Investors that can invest I do so through an intermediary. If investors can invest $2I$, they invest directly. If investors can invest $3I$, they invest $2I$ directly, and I through an intermediary. If they can invest $4I$, all capital is invested directly.*

An important difference between investors and intermediaries is that, while small intermediaries will be crowded out by large ones that can facilitate multiple investments, large investors will not crowd out small ones. The reason is that small investors will still be able to invest through intermediaries, albeit the intermediaries will be reaping all the profits.

3.5 Co-Investments

The analysis thus far considered the extreme in which an intermediary maintains reputation for always supporting the risky strategy in state θ_M. Maintaining such strict reputation helps increase the firm's pledgeable income by lowering its agency costs. However, it may not always be optimal, as it may impose too much risk on investors, making satisfying their participation constraint more difficult.

Co-investments can help attenuate this trade-off. The idea of a co-investment in this model is that the intermediary can lend its reputation to an investor without compromising it if the risky strategy is not supported in state θ_M. Consider initially the case in which there is only one firm needing an investment of I. To derive this insight in the simplest way, suppose that intermediaries facilitate φI of the investment, while investors provide $(1-\varphi)\, I$

directly. Intermediaries obtain only partial control over the continuation of the risky strategy that allows them to overcome investors' resistance to supporting that strategy in state θ_M with probability φ. With probability $1-\varphi$, investors can get their way and force the firm to switch to the safe strategy.

The main benefit of such co-investment arrangements is that they lower intermediation fees and the firm's financing costs. In particular, the intermediaries' incentive constraint to support the risky strategy in state θ_M is

$$\begin{aligned} & (1-\delta)\left(\varphi\theta_M\phi_x + (1-\varphi)\,\phi_y\right) + \delta q \mathrm{E}\phi \\ \geq\ & (1-\delta)\left(\varphi\left(\theta_M\phi_x + \mu\kappa I\right) + (1-\varphi)\,\phi_y\right) + (1-\pi)\,\delta q \mathrm{E}\phi. \end{aligned}$$

The first term in the first line of this constraint states that the intermediary can support the risky strategy in state θ_M only with probability φ. The first term in the second line stands for outcome in which the intermediary starts renegotiating with the investor to abandon the risky strategy in state θ_M. In this case, the intermediary can get its way with probability φ and extract a fraction μ from the additional social surplus κI in return for forcing the firm to abandon the risky strategy.

This incentive constraint is satisfied if intermediation fees are at least

$$\mathrm{E}\phi \geq \frac{(1-\delta)\,\varphi\mu\kappa I}{\pi\delta q}. \tag{10}$$

Hence, relinquishing control to investors (i.e., lowering φ) helps lower fees. That lowers financing costs since the lower fees are ultimately borne by the firm. In addition, partially relinquishing control further lowers financing costs by reducing the need to compensate investors for the higher risk, associated with the risky strategy.

The downside of co-investments is that they increase the firms' agency costs. In particular, the higher likelihood that the risky strategy will not be supported in state θ_M disincentivizes the owner-manager. Restoring incentives requires that the owner-manager retains a higher stake in the firm, limiting the firm's pledgeable income. There are multiple equilibria with co-inestment, in which the level of competition among intermediaries always adjusts so condition (10) holds with equality and the firm's pledgeable income is just enough that the firm can raise intermediated financing. The proof of the following proposition derives the co-investment arrangement that maximizes the firm's pledgeable income.

Proposition 7 *Co-investments lowers intermediation fees and can increase the firm's pledgeable income.*

Though investors break even, satisfying their participation constraint still requires that

they are paid a risk premium regardless of whether their investment is fully or partially intermediated. However, investors need to be paid a lower risk premium when co-investing, as their investment carries less risk (the risky strategy is continued with probability $\varphi < 1$ in state θ_M). Thus, the risk-unadjusted return, net of fees, of co-investments is lower than that of fully intermediated investment. This is worth remarking, as the risk-adjustment for co-investments and fully intermediated investments in practice is typically the same.

Corollary 5 *Co-investment allow investors to invest more safely. Thus, the risk-unadjusted return of co-investment will be lower than that of fully intermediated investments.*

Co-investment can also be an optimal way for intermediaries to leverage their reputation by lending it to investors. Similar to the analysis in Section 3.4, this can help intermediaries enjoy higher economies of scale and lower fees.

4 Empirical Implications and Evidence

Public pension funds and sovereign wealth funds invest trillions of dollars of public sector capital. For policy makers, this raises the question of whether such funds could save on billions of fees by investing more directly rather than through intermediaries. The paper shows that achieving this goals is difficult, as *firms* might be unwilling to do deal directly with investors with differing strategic objectives. For example, apart from trying to match cash inflows to pension outflows, pension funds must comply with ERISA's strict fiduciary duties provisions, which could slow down their decision process and create a preference for safety for fear of being in breach of regulation. The lighter regulatory burden intermediaries face compared to in-house investment managers, the more attractive will be intermediated financing. The next section provides direct support for this prediction.

Implication 1 *Less regulatory pressure to comply with regulation pertaining to institutional investors increases intermediaries' ability to act as trusted third parties facilitating the flow of capital between institutional investors and firms.*

The paper's main focus is on investments by institutional investors. However, the model can also be applied to the question of why large corporations sometimes directly invest in start-ups through their own corporate venture capital arms or through venture capital funds. Although both types of investments are pervasive (Ma, 2020), this question has received little attention so far.[11]

[11] For example, though the venture capital arm of Siemens has invested directly in more than 150 companies, it has also invested in over 40 venture capital funds.

The paper's second main implication is that maintaining a reputation as a trusted party requires charging positive fees. By reducing the likelihood that an intermediary is able to benefit from future intermediation, competition increases the intermediary's incentives to abuse its reputation, which can only be counteracted by raising fees. This cost puts a limit on how much competition there can be among intermediaries to act as trusted third parties. In particular, fees cannot rise without bound, as that would drive firms to raise financing directly from investors. Hence, the well-known stickiness of the 2-20 fee model could reflect that the intermediation industry has reached maturity in terms of competitiveness. Making intermediation less profitable by driving down fees would make it impossible for intermediaries to maintain reputation.

Implication 2 *Intermediaries acting as trusted third parties must charge positive fees. Higher competition among intermediaries puts an upward pressure on fees, but these fees are limited by competition from investors willing to invest directly.*

Institutional investors can hire their own in-house fund management teams. Direct investments are likely to perform better, as investor can then profit from their own reputation rather than allowing intermediaries to profit from theirs (Corollary 4). Indeed, the evidence is that direct investments outperform intermediated investments net of fees (Fang et al., 2015). Howevers, since intermediaries find it easier to maintain reputation, investors can only attract firms with better financing terms if investors are sufficiently larger than intermediaries (Proposition 5). The proportion of direct investment first increases in size, then decreases as an investor branches out into a second asset class, then increases again in size, as the investor reaches a point where it is worth developing reputation for investing also in the second asset class (Proposition 6). The next section provides empirical support for this prediction.

Implication 3 *The proportion of direct investment is wave-shaped in investor size.*

Co-investment by institutional investors with intermediaries has become increasingly common over the last decades (Fang et al., 2015). Lerner et al. (2020) estimate that over 40% of the private equity investments in their sample were over so-called alternative investment vehicles that allow investors to co-invest in deals. The main patterns in the data are that such co-investments typically yield lower excess returns net of fees compared to fully intermediated private equity investments. A potential explanation provided by this paper is that co-investments are safer for investors, which requires compensating them with a lower risk premium. Indeed, the most widely-used measures for calculating private equity excess returns do not account for differences in risk between co-investments and fully intermediated

investments. The standard approach is to calculate the so-called public market equivalent PME, which compares an investment in a private equity fund to an investment in the S&P 500 by discounting fund cash flows at the total return to the S&P 500 (Kaplan and Schoar, 2005). Summarizing all investment performance results, it holds:

Implication 4 *(i) Returns on direct investments are higher than on intermediated investments net of fees. (ii) Co-investments carry lower risks for investors and, thus, will be associated with a lower risk premium and a lower public market equivalent than intermediated investments.*

4.1 Evidence From Pension Funds' Investment in Alternative Assets

In this section, the paper provides evidence supporting the model's predictions. First, the paper shows that expanding the ability of independent fund managers to act as trusted third parties leads to more intermediated investment (Implication 1). Second, the paper documents that there is a wave-shaped relation between fund size and the percent of internally managed investments in alternative assets (3). As noted above, prior work already offers supporting Implications 4.

4.1.1 Data

Data on institutional investor characteristics and their investments in alternative assets are obtained from CEM Benchmarking Inc. for the period 1991 – 2015. Most of the data are from defined benefit pension plans, but there are also data from collective defined contribution funds, sovereign wealth funds, insurance companies, and insurance funds. The analysis is restricted to North America (i.e., the United States and Canada), which has the best data coverage. The dataset includes information about the amount of assets under management, investor type (public or private), asset allocation, and the proportion of internally relative to externally managed investment in each asset class. Furthermore, there are data on investment costs, returns, and benchmarks.

Table 1 offers descriptive statistics of the data. It shows that the average fund size is close to $11 million. About 65% of the sample consists of U.S. institutional investors, and about 25% are public U.S. institutional investors (such as CalPERS). Funds that specialize in only one broad alternative asset class represent about 32% of the sample. On average, institutional investors allocate about 10% of their investments to alternative assets. Out of these, about 57% are in real assets, 26% in private equity, and 16% in hedge funds.

Furthermore, investors allocate about 37% to international equity, and 75% of investments are managed actively. The most substantial difference between the U.S. and Canada is that about 26% of Canadian funds invest in alternative assets also internally, while only 4% of their U.S. counterparts do the same. All these statistics have substantial cross sectional and time series variation. Institutional investors' total investment in alternative assets has steadily increased from below $42 billion in 1991 assets to $1.3 trillion in 2015.

INSERT TABLE 1

The data contain comprehensive information on internal investment costs, cost of intermediated financing, and the costs of investing through funds of funds. Internal costs include compensation and benefits of employees managing internal portfolios, expenses for support staff, consulting, research, legal, trading services, and allocated overhead costs (such as rent, utilities, IT, investment accounting, financial control, HR, etc.). External investment costs capture the management fees paid to investment consultants and external asset managers. The performance fees, carried interest and rebates are subtracted from the returns and are not part of these figures. External investments costs also account for compensation, benefits, travel, and education costs for internal staff whose main responsibility is to select and monitor external managers in alternative assets.

INSERT TABLE 2

Table 2 presents evidence on the cost of intermediated financing. The dependent variable are the costs paid by institutional for investment in alternative assets. The results show that across all alternative asset classes, pension funds that invest more through intermediaries in alternative asset classes have significant higher costs. Moving from an internally to intermediated investment increases the costs by 0.34% when investing in real estate, by 3.7% when investing in private equity, and by 0.9% when investing in hedge funds. The cost increase is higher by a factor of three when investing through funds of funds. For a more detailed description of the data and cost break-downs, see Andonov (2020).

The results presented in Table 2 seem to suggest that pension funds could save on billions of dollars worth of fees if they would switch to managing their investments in alternative assets internally. However, this paper cautions against drawing such conclusions, as the counterfactual is not observed. The choice between investing directly or through intermediaries is endogenous and depends on what is cheaper. That is, funds that have chosen intermediated investment have done so, because the alternative of managing the investments internally would have either been more expensive or not possible.

Table 2 also shows that small funds are less likely to invest in alternative assets and, when they do so, they are more likely to specialize in one alternative asset class (Andonov (2020) reports more such results in detail). This is consistent with the model's prediction that investors diversify into further asset classes only once they have been able to develop and exploit the reputational economies of scale from investing in one alternative asset class.

4.1.2 Intermediaries as Trusted Third Parties: Evidence from the Pension Protection Act of 2006

To identify the role of intermediaries as trusted third parties, the paper utilizes the enactment of the Pension Protection Act of 2006. The main objective of this act was to require companies that have underfunded their pension plans to pay higher premiums to the Pension Benefit Guarantee Corporation and extend the requirement of providing extra funding to the pension systems of companies that terminate their pension plans. However, one of the less-prominent sections of the Pension Protection Act of 2006 provided for a big benefit for private equity funds and other investment vehicles. Specifically, investment vehicles raising capital from pension funds are no longer required to aggregate government pension funds (such as CalPERS) with ERISA plan funds when applying the 25% "significant participation" limit.[12] The 25%-limit defines the threshold above which all of the underlying assets of an investment fund, such as a private equity or a hedge fund, can be deemed to be "plan assets." Going beyond this threshold forces funds to comply with a number of prohibited transactions rules and with ERISA's strict fiduciary standard of conduct.

By effectively abolishing the 25% threshold for public but not for private U.S. pension plans, the Pension Protection Act of 2006 made it more attractive for funds managing alternative investments to accept public pension funds' capital without fearing subsequent meddling by these pension funds and their regulators. Thus, the Pension Protection Act of 2006 expanded the ability of fund managers of alternative assets to act as trusted third parties that create sufficient distance between pension funds and the ultimate recipients of pension funds' capital. Based on this reform, we formulate the following difference-in-differences specification for the sample of U.S. institutional investors

$$\begin{aligned} y_{i,t} &= \alpha + \beta_1 PublicFund_i \times after06 \times large06 + b_2 PublicFund_i \times after06 \\ &\quad + \beta_2 PublicFund_i \times large06 + \boldsymbol{\beta}_3 X_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \end{aligned} \tag{11}$$

where $y_{i,t}$ is one of three variables — the percentage of pension fund capital invested in

[12] The Employee Retirement Income Security Act of 1974 [ERISA] is a federal law that sets minimum standards for most voluntarily established pension plans.

alternative assets managed internally, externally (but not in funds of funds), or invested in funds of funds. Public is a dummy taking the value of one in the case of government pension funds; after06 is a dummy taking the value of one for years after the passage of the Pension Protection Act of 2006; large06 take the value of one if the size of a pension fund was larger than the median in 2006; $X_{i,t}$ is a vector of control variables that includes fund size, whether the investor specializes in one or more alternative asset classes, the percentages of international equity and actively managed investments in the investor's portfolio, and the allocations to alternative assets. All regressions are run also without these controls to avoid the problem that these variables might be affected by the reform. All specifications contain year and fund fixed effects, and standard errors are clustered at the fund level. The tests use three years before and after the enactment of the reform (2003–2009). All results are robust to alternative window specifications.

INSERT TABLE 3

The difference-in-differences specification in Table 3 support the hypotheses that expanding the ability of intermediaries to act as trusted third parties should lead to more intermediated investment. In particular, the percentage of internally managed investment in alternative assets of public pension plans significantly drops after the reform relative to the control group of pension funds unaffected by the law. The triple differences specifications show that the effect is specific to large investors. This is consistent with the model's prediction that only larger investors can afford to choose between direct and intermediated investment.

A number of placebo tests mitigate potential concerns about trends in the data that can explain the effects documented in Table 3. In particular, shifting the event year in both direction by one, two, three, four, and five years yields insignificant results.

4.1.3 Relation Between Fund Size and Percentage of Internally Managed Investment in Alternative Assets

Second, the evidence supports the prediction that the percentage of internally managed investment in alternative assets is wave-shaped in the size of institutional investors, proxied by their fund size. Specifically, following Proposition 6, the prediction is that investor size initially has a positive effect on the percent of internally managed investments in alternative assets, as it is easier for larger investors to develop a reputation for being trusted investors in one asset class. As investor size increases further and investors have exploited the investment opportunities in the asset class for which they have reputation and want to branch out in a new asset class, the percentage of internally managed investments will decrease, as

the investor makes use of intermediaries to invest in further asset classes. As investor size increases even more, so that developing reputation in other asset classes becomes easier, there will be again an increase in the percentage of internally-managed investments in alternative assets.

INSERT TABLE 4

Table 4 shows that the results are consistent with this prediction. As it is standard when testing non-linear relations, the table presents the results from a cubic spline specification. This specification allows for three different slope regions for the effect of fund size on the percent of internally or externally managed investments. Consistent with the above results, there is an initially positive effect of fund size on the level of internally managed investments in alternative assets. For intermediate levels of fund size, the effect is negative, and for very high values, we have then again a positive effect. Interestingly, the changes in the proportion of internally managed investments are mirrored in changes with the opposite sign in investments in funds of funds. All regression specifications control for fund and year fixed effects.

5 Conclusion

This paper develops a model of non-bank financial intermediaries as trusted third parties. It argues that intermediaries are needed when firms are reluctant to raise capital from certain investors, such as pension funds or insurance companies, because firms fear that the strategic objectives of such investors could be misaligned with those of the firm. In such cases, intermediaries could protect firms from such differing objectives and, thus, allow for capital to flow.

When intermediaries play the role of trusted third parties, positive fees emerge in equilibrium even when intermediaries compete on prices. These fees are explained by the fact that intermediaries must have an incentive to maintain their reputation for being trusted and not succumb to potentially profitable opportunities to betray trust. This is only possible if having a reputation goes hand in hand with a high future fee income. Only then do intermediaries stand something to lose from abusing their reputation. Perhaps surprisingly, an increase in price competition among intermediaries leads to higher fees. The reason is that higher competition reduces the value of building reputation for being a trusted third party, as it reduces the likelihood that the intermediary will be able to act as such a party also in the future. Fees must increase to compensate for this lower likelihood. Because competition

exerts an upward pressure on fees, it will be endogenously limited by the fact that fees that are too high will drive firms to seek financing directly from investors.

Investors can also develop a reputation for being trusted, but they find it harder to do so than intermediaries, as they have more to gain from abusing that reputation. Intuitively, the resistance to go back on a promise to support the firm is stronger in a three-way relationship. Being larger helps, as there economies of scale when maintaining reputation. Specifically, large investors have more future income to lose if their reputation deteriorates; abusing trust in multiple relationships is also more likely to be discovered. This insight leads to the prediction that there will be a wave-shaped relation between investor size and the proportion of internally managed investments. As small investors become larger, they find it easier to develop a reputation for being trusted when making a certain type of investment. This allows investors to make more direct investments. As investors grow even more and seek to make also other types of investments for which they have no reputation, they starts investing again through intermediaries, leading to a decrease in the proportion of internally managed investment. As investors become even larger so that developing reputation in other asset classes becomes possible, the share of in-house investment increases again. The implications for investment performance are that direct investments outperform intermediated investments net of fees. Furthermore, though co-investments lie between direct and intermediated investent, they are safer for investors. Thus, they require a lower risk premium and will feature lower public market equiavalents.

Evidence from institutional investors' investment in alternative assets supports the model's main predictions. It shows that intermediated financing is more expensive for institutional investors compared to in-house investment. However, concluding that investors should invest more in-house would be wrong. Specifically, using the Pension Protection Act of 2006, the paper shows that increasing the scope of intermediaries to protect firms from the differing strategic objectives of investors, leads to more intermediated investment. Thus, investors and firms choose intermediated financing whenever they perceive it as the cheaper option. The empirical evidence further supports the prediction that there is a wave-shaped relation between pension fund size and the proportion of internally managed investments.

Overall, the paper presents a novel empirically-supported theory of institutional investors' choice between intermediated and direct investment. The results suggest that policy measures forcing institutional investors, such as pension funds, to check various safety boxes, should balance the need for such regulation with the problem that it makes them unattractive as investors for many firms that would have otherwise benefited from these investors' long-term investment horizon. Regulation also harms investors' ability to develop in-house investment teams, curbing their ability to make more-profitable direct (in-house) invest-

ments.

References

[1] Abuzov, Rustam, 2019, The value of privacy and the choice of limited partners by venture capitalists, Working Paper, HEC Lausanne.

[2] Admati, Anat R., and Paul Pfleiderer, 1988, Selling and trading on information in financial markets, *American Economic Review* 78(2), 96–103.

[3] Admati, Anat R., and Paul Pfleiderer, 1997, Does it all add up? Benchmarks and the compensation of active portfolio managers, *Journal of Business* 70(3), 323-350.

[4] Allen, Franklin, 1990, The market for information and the origin of financial intermediation, *Journal of Financial Intermediation* 1(1), 3-30.

[5] Allen, Franklin, 2001, Presidential address: Do financial institutions matter?, *Journal of Finance* 56 (4), 1165-1175.

[6] Andonov, Aleksandar, 2020, Delegated investment management in alternative assets, Working Paper, University of Amsterdam.

[7] Axelson, Ulf, Tim Jenkinson, Per Strömberg, and Michael S. Weisbach, 2013, Borrow cheap, buy high? The determinants of leverage and pricing in buyouts, *Journal of Finance* 68(6), 2223–2267.

[8] Basak, Suleyman, Anna Pavlova, and Alexander Shapiro, 2007, Optimal asset allocation and risk shifting in money management, *Review of Financial Studies* 20(5), 1583-1621

[9] Bhattacharya, Sudipto, and Anjan V. Thakor, 1993, Contemporary banking theory, *Journal of Financial Intermediation* 3(1), 2-50.

[10] Bolton, Patrick, and David D. Scharfstein, 1996, Optimal debt structure and the number of creditors, *Journal of Political Economy* 104(1), 1–25.

[11] Buffa, Andrea M., Dimitri Vayanos, and Paul Woolley, 2019, Asset management contracts and equilibrium prices, Working paper, Boston University and LSE.

[12] Coval, Joshua D., and Anjan V. Thakor, 2005. Financial intermediation as a beliefs-bridge between optimists and pessimists, *Journal of Financial Economics* 75(3), 535-569.

[13] Cuoco, Domenico, and Ron Kaniel, 2011, Equilibrium prices in the presence of delegated portfolio management, *Journal of Financial Economics* 101(2), 264-296.

[14] Garcia, Diego, and Joel M. Vanden, 2009, Information acquisition and mutual funds, *Journal of Economic Theory* 144(5), 1965–1995.

[15] Diamond, Douglas W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51(3), 393-414.

[16] Fang, Lily, Victoria Ivashina, and Josh Lerner, 2015, The disintermediation of financial markets: direct investing in private equity, *Journal of Financial Economics* 116(1), 160–178.

[17] Freixas, Xavier, and Jean-Charles Rochet, 1997, Microeconomics of Banking, The MIT Press, Cambridge, MA.

[18] Garcia, Diego, and Joel M. Vanden, 2009, Information acquisition and mutual funds, *Journal of Economic Theory* 144(5), 1965–1995.

[19] Garleanu, Nicolae, and Lasse Heje Pedersen, 2018, Efficiently inefficient markets for assets and asset management, *Journal of Finance* 73(4), 1663-1712.

[20] Gennaioli, Nicola, Andrei Shleifer, and Robert Vishny, 2015. Money doctors, *Journal of Finance* 70 (1), 91-114.

[21] Gompers, Paul A, 1996, Grandstanding in the venture capital industry, *Journal of Financial economics* 42(1), 133–156.

[22] Greenbaum, Stuart, Anjan Thakor, and Arnoud W. A. Boot, 2019, Contemporary financial intermediation, Elsevier, fourth edition.

[23] Hellmann, Thomas, 2006, IPOs, acquisitions, and the use of convertible securities in venture capital, *Journal of Financial Economics* 81(3), 649–679.

[24] Hochberg, Yael V., Alexander Ljungqvist, and Yang Lu, 2007, Whom you know matters: venture capital networks and investment performance, *Journal of Finance* 62 (1), 251-301.

[25] Hochberg, Yael V., Alexander Ljungqvist, and Annette Vissing-Jørgensen, 2014, Informational holdup and performance persistence in venture capital, *Review of Financial Studies* 27(1), 102-152.

[26] Inderst, Roman, and Marco Ottaviani, 2012a, Competition through commissions and kickbacks, *American Economic Review* 102 (2), 780-809.

[27] Inderst, Roman, and Marco Ottaviani, 2012b, Financial advice, *Journal of Economic Literature* 50(2), 494-512.

[28] Kaplan, Steven N, and Antoinette Schoar, 2005, Private equity performance: returns, persistence, and capital flows, *Journal of Finance* 60 (4), 1791-1823.

[29] Lakonishok, Josef, Andrei Shleifer, and Robert Vishny, 1992, The structure and performance of the money management industry. Brookings Papers on Economic Activity. Microeconomics, 339-391.

[30] Leland, Hayne E., and David H. Pyle, 1977, Informational asymmetries, financial structure, and financial intermediation, *Journal of Finance* 32(2), 371-387.

[31] Lerner, Josh, Jason Mao, Antoinette Schoar, and Nan R. Zhang, 2020, Investing outside the box: evidence from alternative vehicles in private equity, Working Paper, Harvard University.

[32] Li, C. Wei, and Ashish Tiwari, 2009, Incentive contracts in delegated portfolio management, *Review of Financial Studies* 22(11), 4681-4714.

[33] Ma, Song, 2020, The life cycle of corporate venture capital, *Review of Financial Studies* 33(1), 358–394.

[34] Palomino, Frederic, and Andrea Prat, 2003, Risk taking and optimal contracts for money managers, *RAND Journal of Economics* 34(1), 113-137.

[35] Ramakrishnan, Ram T.S., Anjan V. Thakor, 1984, Information reliability and a theory of financial intermediation, *Review of Economic Studies* 51(3), 415-432.

[36] Ross, Stephen A., 2005, Markets for agents: Fund management, in Bruce N. Lehmann, eds.: The Legacy of Fischer Black (Oxford University Press, New York, NY).

[37] Schmidt, Klaus, 2003, Convertible securities in venture capital, *Journal of Finance* 58, 1139–1166.

[38] Sensoy, Berk A., Yingdi Wang, and Michael S. Weisbach, 2014, Limited partner performance and the maturing of the private equity industry, *Journal of Financial Economics* 112 (3), 320-343.

6 Appendix: Omitted Proofs

Proof of Proposition 1. Proceeding as in the case of direct financing, the firm's incentive constraint (5) is maximally relaxed for $S_y = y$ and $S_x = x - \frac{c}{(\Delta_M \theta_M + \Delta_G \theta_G)}$, giving a maximum net pledgeable income of

$$\begin{aligned} &(1 - \rho_M - \rho_G)\, y + (\rho_M \theta_M + \rho_G \theta_G)\, x - I \\ &-\mathrm{E}\phi - (\rho_M + \rho_G)\, \kappa I - \frac{\theta_G \rho_G + \theta_M \rho_M}{\theta_G \Delta_G + \theta_M \Delta_M} c. \end{aligned} \tag{12}$$

The first line of (12) is the same as the first line of (4), as $y = \theta_M x$. Hence, the difference between the pledgeable income under intermediated and direct financing is

$$\frac{\theta_M \left(\frac{\Delta_M}{\Delta_G} \rho_G - \rho_M \right)}{\theta_G \Delta_G + \theta_M \Delta_M} c - \rho_M \kappa I - \mathrm{E}\phi.$$

For this expression to be positive, a necessary condition is that $\frac{\Delta_M}{\Delta_G} p_G > p_M$. The expression further decreases in κ and $\mathrm{E}\phi$. **Q.E.D.**

Proof of Propositions 2 and 3. The proof proceeds in two steps to show that there is an equilibrium in which intermediaries compete on prices yet still set positive intermediation fees.

Step 1. *Maintaining a reputation as a trusted third party at the lowest cost requires that (7) is satisfied with equality.* If the intermediary abuses its reputation in state θ_M, the investor extracts $S_y + \kappa I$. Define the expected payoff from the financing contract in a given period as

$$\mathrm{E}S = (1 - \rho_M - \rho_G)\, S_y + (\rho_M \theta_M + \rho_G \theta_G)\, S_x \ .$$

To minimize the cost of financing and intermediation subject to the firm's and intermediary's incentive constraints, the investor's break even constraint, and the requirement that payments to the intermediary must be non-negative, we apply Kuhn Tucker's theorem and define

$$\begin{aligned} \mathcal{L} \ = \ & -\mathrm{E}\phi - \mathrm{E}S + \lambda \left(-\mu \kappa I + \frac{\delta q \pi}{1 - \delta} \mathrm{E}\phi \right) + \omega \left(\mathrm{E}S - \mathrm{E}\phi - I - \kappa I \right) \\ & + \chi \left(\left(\Delta_M \theta_M + \Delta_G \theta_G \right) (x - S_x) - \left(\Delta_G + \Delta_M \right) (y - S_y) - c \right) \\ & + \xi \phi_y + \zeta \phi_0 + \psi \phi_x + \varpi S_x + \rho S_y \end{aligned}$$

where λ, ω, χ, ζ, ξ, and ψ are the weakly positive Kuhn Tucker multipliers. Taking the

first-order conditions

$$\begin{aligned}
0 &= \frac{\partial \mathcal{L}}{\partial \phi_y} = -\left(1-\rho_M-\rho_G\right)\left(1+\omega\right)+\lambda\frac{\delta q\pi}{1-\delta}\left(1-\rho_M-\rho_G\right)+\xi \\
0 &= \frac{\partial \mathcal{L}}{\partial \phi_0} = -\left(1+\omega\right)+\lambda\frac{\delta q\pi}{1-\delta}+\zeta \\
0 &= \frac{\partial \mathcal{L}}{\partial \phi_x} = -\left(\rho_M\theta_M+\rho_G\theta_G\right)\left(1+\omega\right)+\lambda\frac{\delta q\pi}{1-\delta}\left(\rho_M\theta_M+\rho_G\theta_G\right)+\psi
\end{aligned}$$

Observe that $\lambda > 0$. Otherwise, it must be that $\zeta, \xi, \psi > 0$ (i.e., $\phi_0 = \phi_x = \phi_y = 0$), which makes it impossible to satisfy the intermediary's break even condition. Thus, condition (γ) must be binding. There is a continuum of fee contracts that satisfy this condition. Furthermore, there are multiple financing contracts that achieve this for which $S_x, S_y \geq 0$ and the owner-manager's incentive and investor's participation constraints are satisfied. The right-had side of (8) decreases in π, q, δ. Furthermore, it increases in μ and κ, which gives the comparative statics of the expected intermediation fee.

Step 2. *There is an equilibrium in which the intermediaries charge* $E\phi = \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$. *Following a deviation from this equilibirum all other intermediaries set* $E\phi = 0$ *in the following period and then revert to* $E\phi = \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$.

We show that there is no profitable deviation from the proposed equilibrium. Clearly, a deviation to $\mathrm{E}\phi > \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$ cannot be profitable, as then investors and firms prefer another intermediary with probability one. Consider a deviation to $\mathrm{E}\phi < \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$ in period t and suppose to a contradiction that thid deviation was accepted by investors and firms. Following such a deviation, all other intermediaries set zero fees in the following period $t+1$. That is, the deviating intermediary cannot make a positive profit in $t+1$, as setting a fee higher than zero will not attract investors and firms. Hence, its expected continuation stream of future fees is $\delta\frac{q\pi\mathrm{E}\phi}{(1-\delta)} < \mu\kappa I$. However, this makes it impossible to satisfy the deviating intermediary's incentive constraint of not abusing trust in period the period in which it deviates. Since this is anticipated by investors and firms, they reject the deviation in t.

Finally, observe that the proposed trigger strategy is an optimal response in the stage game for all other intermediaries. Indeed, setting a zero fee in period $t+1$ is the unique outcome of price competition of the stage game, and the fact that the intermediaries revert to $\mathrm{E}\phi = \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$ in all subsequent periods still makes it possible to satisfy the interemediaries' incentive constraint in $t+1$. **Q.E.D.**

Proof of Proposition 4. With free entry for intermediaries, the prospect of positive profits draws more intermediaries. If $\mathrm{E}\phi > \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$, this means that q will decrease (i.e., the number of intermediaries will grow) until $\mathrm{E}\phi = \frac{\mu\kappa I(1-\delta)}{\delta q\pi}$. The number of intermediaries

will continue to grow until q decreases to the level at which further entry will make it impossible for the firm to raise financing while retaining effort incentives (i.e., (12) would be negative). Assuming that ties are resolved in favor of investment, the equilibrium number of intermediaries, m, solves condition (9), where $q = \frac{1}{m}$ (and m is the highest integer for which q is at least equal to the right-hand side of (9)). **Q.E.D.**

Proof of Proposition 5. Consider an intermediary that facilitates the financing of two projects from the same asset class. If such an intermediary maintains its reputation, it can facilitate one investment in the next period with probability $2q$ and two investments with probability q^2. Thus, the intermediary's expected fee income from the following period is

$$2q\left(1-q\right)\mathrm{E}\phi + q^2 2\mathrm{E}\phi = 2q\mathrm{E}\phi$$

If in the current period one firm is in state θ_M and one in state θ_G, the intermediary does not renegotiate with the investor to stop supporting the risky strategy of the firm in state θ_M if

$$\begin{aligned} & \left(1-\delta\right)\left(\theta_M+\theta_G\right)\phi_x + \delta q 2\mathrm{E}\phi \\ \geq\ & \left(1-\delta\right)\left(\left(\theta_M+\theta_G\right)\phi_x + \mu\kappa I\right) + \left(1-\pi\right)\delta 2q\mathrm{E}\phi. \end{aligned}$$

If both firms are in state θ_M, the intermediary does not renegotiate with both firms if

$$\begin{aligned} & \left(1-\delta\right)2\theta_M\phi_x + \delta q 2\mathrm{E}\phi \\ \geq\ & \left(1-\delta\right)2\left(\theta_M\phi_x + \mu\kappa I\right) + \left(1-\pi\right)^2\delta q 2\mathrm{E}\phi. \end{aligned}$$

Finally, if both are in state θ_M, the intermediary does not renegotiate with only one firm if

$$\begin{aligned} & \left(1-\delta\right)2\theta_M\phi_x + \delta q 2\mathrm{E}\phi \\ \geq\ & \left(1-\delta\right)\left(2\theta_M\phi_x + \mu\kappa I\right) + \left(1-\pi\right)\delta q 2\mathrm{E}\phi. \end{aligned}$$

Note that the first and third condition reduce to $\mathrm{E}\phi \geq \frac{(1-\delta)\mu\kappa I}{2\pi\delta q}$, while the second condition to $\mathrm{E}\phi \geq \frac{(1-\delta)\mu\kappa I}{(2-\pi)\pi\delta q}$. The latter condition, which states that intermediaries should not have incentives to renegotiate with both firms, is the one more difficult to satisfy. In analogy to Proposition 3, we obtain $\mathrm{E}\phi = \frac{(1-\delta)\mu\kappa I}{(2-\pi)\pi\delta q}$.

The argument that charging a fee of $\mathrm{E}\phi = \frac{(1-\delta)\mu\kappa I}{(2-\pi)\pi\delta q}$ follows the same steps as Propositions 2–4. The difference between this expression and the fees that charged by a small intermediary,

given by expression (8), is

$$\frac{(1-\delta)\,\mu\kappa I}{(2-\pi)\,\delta q\pi} - \frac{\mu\kappa I\,(1-\delta)}{\delta q\pi} < 0.$$

Q.E.D.

Proof of Lemma 1 and Proposition 6. The proof starts by deriving the investors' financing terms when investing directly into the firm. Subsequently, it derives the equilibrium reaction of intermediaries and the investors' choice between direct and intermediated financing.

Step 1: *Investors' financing terms.* Denote the investor's expected payoff from offering a contract $\{S_y, S_x\}$ with

$$\mathrm{E}S \equiv (1-\rho_M-\rho_G)\,(S_y+\kappa I) + ((p_M-\Delta_M)\,\theta_M + \rho_G\theta_G)\,S_x.$$

In analogy to Proposition 2, the incentive constraint of an investor investing in one firm not to abuse its trust and attempt to renegotiate in state θ_M is

$$\mathrm{E}S \geq I + \kappa I + \frac{\eta\kappa I\,(1-\delta)}{\pi\delta q_{inv}}. \tag{13}$$

where η is the investor's share of surplus when renegotiating with the firm to stop support of the risky strategy in state θ_M.

In case of investing in two firms, the most stringent incentive constraint for the investor is

$$\mathrm{E}S \geq I + \kappa I + \frac{(1-\delta)\,\eta\kappa I}{(2-\pi)\,\pi\delta q_{inv}}. \tag{14}$$

Note that both of these incentive constraints require that the investor must obtain a financial claim for which he more than breaks even (i.e., $\mathrm{E}S > I + \kappa I$). Thus, minimizing the cost of financing boils down to minimizing $\mathrm{E}S$ subject to (13) or (14), respectively. In the equilibrium with the cheapest financing terms for the firms, these conditions will be satisfied with equality. Also in this case, the incentive constraint that the firm exerts effort

$$(\Delta_M\theta_M + \Delta_G\theta_G)\,(x-S_x) - (\Delta_G+\Delta_M)\,(y-S_y) \geq c \tag{15}$$

must be satisfied.

From Proposition 3, we now that the firms' financing costs when an intermediary facili-

tates financing are

$$\mathrm{E}S = I + \kappa I + \frac{(1-\delta)\,\mu\kappa I}{\pi\delta q} \tag{16}$$

if the investor can invest in only one firm and

$$\mathrm{E}S = I + \kappa I + \frac{(1-\delta)\,\mu\kappa I}{(2-\pi)\,\pi\delta q}. \tag{17}$$

if the investor can invest in two firms. Comparing (13), (14), (16), and (17), and using that $\mu = \frac{1}{3}$ and $\eta = \frac{1}{2}$,[13] we obtain that the investor can offer better financing terms than those facilitated by an intermediary if

$$q_{inv} > \begin{cases} q\frac{3}{2(2-\pi)} & \text{if the intermediary is smaller} \\ q\frac{3}{2} & \text{if the intermediary is equal-sized} \\ q\frac{3(2-\pi)}{2} & \text{if the intermediary is larger} \end{cases}. \tag{18}$$

Thus, the larger is the intermediary relative to the investor, the more difficult it is for the investor to offer better terms.

Step 2: *Equilibrium with free entry among intermediaries.* Observe that if there was one intermediary, i.e., $q = 1$, a large intermediary can always facilitate better financing terms than can be offered by small investors, as it always holds that $q_{inv} < \frac{3}{2}(2-\pi)$ (see condition (18)). Even with free entry (i.e., $q \leq 1$), the number of intermediaries will stay below the level at which the investor offers better financing terms and crowds out the intermediaries. The argument is nearly identical to that in Proposition 4. Assuming that ties are resolved in favor of direct financing, the equilibrium number of intermediaries, m^*, will be the largest integer for which $q_{inv} < \frac{1}{m^*}\frac{3(2-\pi)}{2}$. A similar argument applies when comparing large investors with a large intermediary, as it always holds that $q_{inv} < q\frac{3}{2}$. However, if an intermediary is small while investors are large, intermediaries can never outcompete the investors' terms if $q_{inv} > \frac{3}{2(2-\pi)}$ even if there is only one intermediary. Thus, if $q_{inv} > \frac{3}{2(2-\pi)}$, we obtain the wave-shaped relation as claimed. **Q.E.D.**

Proof of Proposition 7. The owner-manager's incentive constraint is

$$(\varphi\Delta_M\theta_M + \Delta_G\theta_G)(x - S_x) - (\Delta_M\varphi + \Delta_G)(x - S_y) \geq c.$$

[13] Since each party is equally important for renegotiations to succeed, it is assumed that they equally share the surplus from renegotiations in the stage game.

The firm's pledgeable income is maximized for $S_y = y$ and $S_x = x - \frac{c}{(\varphi\Delta_M\theta_M + \Delta_G\theta_G)}$, resulting in a pledgeable income net of investment cost I of

$$(1 - \rho_M - \rho_G)\, y + (\rho_M\theta_M + \rho_G\theta_G)\, x - \frac{(\rho_M\varphi\theta_M + \rho_G\theta_G)\, c}{(\Delta_M\varphi\theta_M + \Delta_G\theta_G)} - \mathrm{E}\phi - I - (\varphi\rho_M + \rho_G)\,\kappa I. \quad (19)$$

Following the same arguments as in Proposition 2, in equilibrium it must hold that $\mathrm{E}\phi = \frac{(1-\delta)\varphi\mu\kappa I}{\pi\delta q}$. For any given level of competition among intermediaries, taking the first order condition of (19) with respect to φ, we obtain

$$\theta_G\theta_M \frac{\Delta_M\rho_G - \Delta_G\rho_M}{(\Delta_M\varphi\theta_M + \Delta_G\theta_G)^2} c - \frac{(1-\delta)\,\mu\kappa I}{\pi\delta q} - \rho_M\kappa I = 0.$$

The proportion of intermediated financing that maximizes the firm's pledgeable income is, thus, given by

$$\varphi^* = \max\left\{0, \frac{1}{\Delta_M\theta_M}\sqrt{\frac{\theta_G\theta_M\,(\Delta_M\rho_G - \Delta_G\rho_M)\, c}{\frac{(1-\delta)\mu\kappa I}{\pi\delta q} + \rho_M\kappa I}} - \frac{\Delta_G\theta_G}{\Delta_M\theta_M}\right\}.$$

Q.E.D.

Lemma 2 *If the investor, intermediary, and the firm renegotiate their existing contract, each party extracts a share of one-third from the renegotiation surplus. In case of direct investment, the investor and the firm each extract one-half of the renegotiations surplus.*

Proof of Lemma 2. Consider a one-period formulation of the game. Suppose that the investor invests through an intermediary. The expected social surplus of the stage game in state θ_M is $y + \kappa I$ in case of renegotiations (to which all parties must agree) and $\theta_M x = y$ otherwise. That is, the value functions of the possible coalitions are

$$v(C) = \begin{cases} y + \kappa I & \text{if } C \in \{\{inv, int, firm\}\} \\ \theta_M x & otherwise \end{cases}$$

The formula for calculating the Shapley value is

$$\mu_i(v) = \frac{1}{|N|!}\sum_R \left[v\left(P_i^R \cup \{i\} - v\left(P_i^R\right)\right)\right] \text{ for } i \in \{inv, int, firm\},$$

where R is an ordering of the players and P_i^R is the set of players in N which precede i in the order R. Plugging in for all coalition payoffs, we obtain that $\mu_{inv} = \mu_{int} = \mu_{firm} = \frac{\kappa I}{3}$.

Following the same steps, we can show that if the investor invests directly, $\eta_{inv} = \eta_f = \frac{\kappa I}{2}$. **Q.E.D.**

Table 1: **Descriptive Statistics.** The table reports summary statistics of the main variables. Fund size is the size of capital under management of the institutional investor in million USD. Foreign is an indicator variable taking the value of one if the investor is based in Canada. Public is an indicator variable taking the value of one if the investor is a public sector fund (such as CalPERS). Specialized in one alt. asset is an indicator variable taking the value of one if the institutional investor specializes in one alternative asset class. % invested internally, % invested externally, and % invested through FoF are the percentages of investments in alternative assets made internally, externally, or through fund of funds. % international equity is the percentage invested in foreign equity, and % actively managed is the percentage that it actively managed. % in alternatives is the fraction of capital invested in alternative assets. % in PE, % in HF, and % in real assets represent the fraction of alternative investments made in private equity, hedge funds, and real assets.

Variable	Mean	Median	Std		Mean	Median	Std
Fund size (in million $)	10,785	2,477	26,792	% international equity	0.372	0.344	0.190
Foreign	0.354	0.000	0.478	% actively managed	0.754	0.817	0.257
Public	0.247	0.000	0.431	% in alternatives	0.100	0.073	0.111
Specialized in one alt. asset	0.320	0.000	0.467	% in PE	0.262	0.188	0.291
% invested internally	0.111	0.000	0.277	% in HF	0.167	0.000	0.276
% invested externally	0.763	1.000	0.345	% in real assets	0.571	0.564	0.353
% invested through FoF	0.125	0.000	0.255				

Table 2: **Investment Costs and Specialization.** The table reports the results from OLS regressions in which the dependent variables are the investment costs in percentage points that institutions pay when investing in real assets, private equity, or hedge funds (models (1)-(3)). In model (4), the dependent variable is an indicator variable taking the value of one if the firm invests in one broad alternative asset class. In model (5), the depednent variable is the percent invested in alternative assets. Observations are at the investor-year level. Log(Fund size) is the log of capital under management of the institutional investor in million USD. Foreign is an indicator variable taking the value of one if the investor is based in Canada. Public is an indicator variable taking the value of one if the investor is a public sector fund (such as CalPERS). Specialized in one is an indicator variable taking the value of one if the institutional investor specializes in one alternative asset class. % invested internally, % invested externally (but not over fund of funds), and % invested through FoF are the percentages of investments in alternative assets made internally, externally, or over fund of funds. % international equity is the percentage invested in foreign equity, and % actively managed is the percentage that it actively managed. % in alternatives is the fraction of capital invested in alternative assets. % in PE, % in HF, and % in real assets represent the fraction of alternative investments made in private equity, hedge funds, and real assets. All regressions include year and country fixed effects. Robust standard errors clustered at the fund level are reported in parantheses. ***,**,* represents statistical significance at the 1%, 5%, and 10% level, respectively.

	(1) Investment cost RA	(2) Investment cost PE	(3) Investment cost HF	(4) Specialized in one alt. asset	(5) % Alternatives
% External	0.768**	3.137**	1.015***		
	(0.328)	(1.574)	(0.166)		
% FoF	2.098***	5.153**	2.331***		
	(0.534)	(2.334)	(0.163)		
Log(Fund size)	-0.077*	0.049	-0.021	-0.096***	0.004**
	(0.046)	(0.300)	(0.029)	(0.008)	(0.001)
% in alternatives	-0.542	-8.072**	0.310	-1.161***	0.749***
	(0.966)	(3.473)	(0.313)	(0.122)	(0.025)
% invested internally	0.333	-1.811	0.105	-0.071	0.011***
	(0.388)	(1.458)	(0.225)	(0.048)	(0.004)
% invested through FoF	-0.424	4.826	0.361*	-0.056	-0.043***
	(0.489)	(4.954)	(0.213)	(0.060)	(0.007)
% in PE	0.853**	-6.676	0.613***	-0.317***	0.016***
	(0.340)	(4.109)	(0.227)	(0.058)	(0.005)
% in HF	1.034*	-3.133	-0.226	-0.326***	0.081***
	(0.570)	(4.110)	(0.189)	(0.054)	(0.011)
% international equity	0.058	1.705	0.053	-0.045	0.048***
	(0.283)	(1.506)	(0.205)	(0.080)	(0.017)
% actively managed	0.048	-1.647	-0.114	-0.154***	0.027***
	(0.228)	(1.251)	(0.157)	(0.049)	(0.008)
Public	0.229	1.229	0.020	-0.002	-0.007
	(0.157)	(0.901)	(0.075)	(0.027)	(0.005)
Constant	0.392	4.696	0.096	1.309***	-0.046***
	(0.517)	(6.130)	(0.351)	(0.088)	(0.013)
Country and year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	817	638	407	5,434	5,434
Adjusted R-squared	0.085	0.076	0.637	0.336	0.798

Table 3: **Internal Investment and the Pension Protection Act of 2006.** The table reports the results from the panel regression model stated in (11) in which the dependent variables are the percentage of investment in alternative assets invested internally, externally (but not funds of funds), or through funds of funds. Observations are at the investor-year level. Log(Fund size) is the log of capital under management of the institutional investor in million USD. Public is an indicator variable taking the value of one if the investor is a public sector fund (such as CalPERS). Large06 is an indicator variable taking the value of one if the fund size is above the median in 2006 when the Pension Protection Act was passed. Specialized in one alt. asset is an indicator variable taking the value of one if the institutional investor specializes in one alternative asset class. % invested internally, % invested externally, and % invested through FoF are the percentages of investments in alternative assets made internally, externally (but not over fund of funds), or over fund of funds. % international equity is the percentage invested in foreign equity, and % actively managed is the percentage that it actively managed. % in alternatives is the fraction of capital invested in alternative assets. % in PE, % in HF, and % in real assets represent the fraction of alternative investments made in private equity, hedge funds, and real assets. All regressions include fund and year fixed effects. Robust standard errors clustered at the fund level are reported in parantheses. ***,**,* represents statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	% invested internally	% invested internally	% invested externally	% invested externally	% invested through FoF	% invested through FoF
After06 x Public x Large	-0.059**	-0.056**	-0.024	-0.014	0.084*	0.07
	(0.029)	(0.027)	(0.056)	(0.053)	(0.049)	(0.046)
After06 x Public	0.028	0.031	0.062	0.062	-0.089**	-0.093**
	(0.022)	(0.022)	(0.050)	(0.048)	(0.043)	(0.042)
a2006_x_large2006		0.003		0.067		-0.069*
		(0.018)		(0.043)		(0.037)
Log(Fund size)		-0.177**		0.206		-0.028
		(0.083)		(0.257)		(0.234)
logsize_USDsq		0.011*		-0.019		0.008
		(0.005)		(0.013)		(0.011)
% in alternatives		0.042		-0.013		-0.029
		(0.059)		(0.164)		(0.149)
Specialized in one alt. asset		0.02		0.011		-0.031
		(0.016)		(0.034)		(0.032)
% international equity		-0.008		0.153*		-0.145**
		(0.056)		(0.091)		(0.065)
% actively managed		0.09		-0.061		-0.029
		(0.078)		(0.097)		(0.043)
% in PE		-0.110*		-0.308**		0.419***
		(0.067)		(0.146)		(0.112)
% in HF		-0.1		-0.12		0.220***
		(0.071)		(0.080)		(0.074)
Fund and year fixed effecs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	993	993	993	993	993	993
Adjusted R-squared	0.054	0.123	0.037	0.117	0.066	0.243

Table 4: **Internal Investment and Fund Size.** The table reports the results from spline regressions in which the dependent variables are the percentage of investment in alternative assets invested internally, externally (but not funds of funds), or through funds of funds. Observations are at the investor-year level. The spline regressions are based on the quartile cutoff points of Log(Fund size). This variable represents the log of capital under management of the institutional investor in million USD. Public is an indicator variable taking the value of one if the investor is a public sector fund (such as CalPERS). Specialized in one alt. asset is an indicator variable taking the value of one if the institutional investor specializes in one alternative asset class. % invested internally, % invested externally, and % invested through FoF are the percentages of investments in alternative assets made internally, externally (but not over fund of funds), or over fund of funds. % international equity is the percentage invested in foreign equity, and % actively managed is the percentage that it actively managed. % in alternatives is the fraction of capital invested in alternative assets. % in PE, % in HF, and % in real assets represent the fraction of alternative investments made in private equity, hedge funds, and real assets. All regressions include fund and year fixed effects. Robust standard errors clustered at the fund level are reported in parantheses. ***,**,* represents statistical significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	% invested internally	% invested internally	% invested externally	% invested externally	% invested through FoF	% invested through FoF
Log(Fund size) spline 1	0.080**	0.073*	0.021	0.001	-0.101**	-0.075*
	(0.037)	(0.038)	(0.056)	(0.054)	(0.043)	(0.038)
Log(Fund size) spline 2	-0.261***	-0.226**	-0.038	0.018	0.299***	0.209**
	(0.091)	(0.091)	(0.148)	(0.143)	(0.115)	(0.104)
Log(Fund size) spline 3	1.024***	0.900***	0.174	0.007	-1.199***	-0.907***
	(0.307)	(0.298)	(0.466)	(0.455)	(0.356)	(0.331)
% in alternatives		0.071		-0.128		0.057
		(0.074)		(0.123)		(0.091)
% international equity		-0.085		0.208***		-0.124**
		(0.063)		(0.077)		(0.050)
% actively managed		0.033		0.016		-0.049
		(0.034)		(0.048)		(0.034)
Specialized in one		-0.027		0.013		0.014
		(0.020)		(0.025)		(0.019)
% in PE		-0.068**		-0.172***		0.240***
		(0.034)		(0.062)		(0.052)
% in HF		-0.142***		-0.133**		0.275***
		(0.042)		(0.065)		(0.050)
Constant	-0.500*	-0.4	0.609	0.710*	0.891***	0.690**
	(0.276)	(0.287)	(0.415)	(0.400)	(0.303)	(0.277)
Fund and year fixed effecs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5445	5434	5445	5434	5445	5434
Adjusted R-squared	0.079	0.102	0.012	0.042	0.151	0.249