Corporate Disclosure and Investor Recognition

Per Östberg

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Dissertation for the Degree of Doctor of Philosophy
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To Brita, Torbjörn and Jackie

Contents

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Bergen, September 2005
Per Östberg

Summary of Thesis

Summary of Papers

This thesis has two distinct parts each with two papers, the first part is theoretical and concerned with firm disclosure and the second part is empirical and related to investor recognition. The first two papers focuses on disclosure regulation, illustrating the characteristics and the optimal level of regulation. The second two document the effect of market segmentation on stock returns and whether investor recognition may explain some observed phenomena surrounding corporate events. Below follows a short summary of the papers.

Paper 1: Disclosure, Investment and Regulation

There is an extensive literature in corporate governance pioneered by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997), (1998) that considers the firm to be subject to a moral hazard problem. Improving corporate governance in this setting reduces the moral hazard problem and is welfare enhancing.

This paper modifies the setting used in the traditional corporate governance literature by assuming that firms have existing claimholders and considers the effect of disclosure regulation in this setting. The model is able to corroborate a number of empirical findings concerning firm disclosure.

Concerning regulation, the model predicts that the optimal disclosure level may be less than complete and may depend on firm characteristics. Thus, more disclosure is not always better and harmonization of disclosure standards may be detrimental.

Paper 2: The Optimality of the Opt-Out

One prominent stylized fact of disclosure regulation is that firms are provided with a menu with disclosure alternatives from which they can choose a disclosure standard. Given recent evidence that stricter regulation is beneficial it is somewhat surprising that firms are given so much latitude in terms of their disclosure level.

This paper extends the setting in paper 1 to include asymmetric information. If an entrepreneur has significant existing outsiders then he prefers an as low disclosure level

as possible. Given this, providing choice to the entrepreneur is costly since he will use it for wasteful expropriation.

The first main result of the paper is that if both types of firm have significant existing claimholders so that there is a conflict of interest then providing a single mandatory standard (i.e. leaving the entrepreneur with no choice) always dominates providing a menu consisting of multiple alternatives. The second result is that when some firms have significant existing claimholders and others do not then implementing a menu consisting of two standards may be optimal. Thus, this paper endogenizes the choice that is so prevalent in practice.

Paper 3: Does Investor Recognition Predict Excess Returns? (Joint with Andriy Bodnaruk)

Large parts of the asset pricing literature tries to explain the divergence between the portfolios held by individuals and the portfolios that economic theory predicts that they should hold. It is well documented that individuals have a puzzling preference for stocks from their own country and stocks of firms that located in their geographic proximity. Early explanations for this phenomenon included physical barriers to foreign investment and currency risk, but these fail to account for the recent evidence of local bias. Merton (1987) considers an asset pricing setting in which not all investors have information about all securities and predicts that firms that have large investor recognition yield lower returns.

Using Swedish data on stock holdings we examine the effect of investor recognition on stock returns. We find that firms that have lower investor recognition provide investors with higher future returns than firms with low investor recognition. A positive (negative) change in investor recognition is followed by lower (higher) excess returns. Additionally, we find some evidence that investors require compensation for holding stocks that are very volatile in terms of investor recognition.

Paper 4: Investor Recognition and the Long-Run Performance of Repurchases (Joint with Andriy Bodnaruk)

A puzzle in corporate finance is the significant abnormal returns that firms undertaking a repurchase earn in the three years subsequent the repurchase (Ikenberry et. al (1995), (2000)). We document that firms that undertake a repurchase significantly reduce their investor recognition. Therefore, by Merton's (1987) theory they should experience an increase in returns. Accounting for changes in investor recognition allows

us to explain a significant part of the abnormal returns earned by firms undertaking a repurchase.

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Papers

PAPER 1

Disclosure, Investment and Regulation

ABSTRACT. This paper provides a framework to analyze voluntary and mandatory disclosure. Since improved disclosure reduces the entrepreneur's ability to extract private benefits, it secures funding for new investments, but also provides existing claimholders with a windfall gain. As a result, the entrepreneur may choose to forgo investment in favor of extracting more private benefits. A mandatory disclosure standard reduces inefficient extraction and increases investment efficiency. Although the optimal standard is higher than the entrepreneur's optimal choice, it can be less than complete in order not to deter investment. The model also shows that better legal shareholder protection goes together with higher disclosure standards and that harmonization of disclosure standards may be detrimental.

1. Introduction

A prerequisite for a functioning capital market is that investors can protect themselves from expropriation. La Porta et al. (1997, 1998) document that countries with weak legal protection of minority shareholders have less developed and narrower capital markets. Firms in weak legal environments find it harder to raise financing since they cannot commit not to expropriate outside shareholders.

Coffee (1999) and Stulz (1999) argue that firms can use bonding mechanisms to commit not to expropriate investors. One such mechanism is disclosure rules which are found in company laws, security laws and stock exchange regulations. So firms in weak legal environments may leapfrog their weak institutions by for example cross-listing their shares on an exchange with stricter disclosure requirements.

In support of this view, Reese and Weisbach (2002) find that firms from countries with weaker legal protection are more likely to issue equity in their home country after a U.S. listing, suggesting that the U.S. listing is a commitment not to expropriate

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investors[1]. Complying to stricter disclosure rules has also been found to be associated with significant stock price increases[2]. For instance, Miller (1999) finds an abnormal return of 1.15% to the announcement of a U.S. listing. Doidge, Karolyi and Stulz (2004) find that exchange-listed firms that choose to cross-list their shares are worth up to 37% more than firms that choose not to cross-list. Given these significant returns it is puzzling that so few firms choose to cross-list their shares. Indeed, Doidge et. al (2004) report that only one in ten large firms choose to cross-list their shares on a U.S. market.

This paper provides a general model of voluntary and mandatory disclosure that is applicable to various disclosure decisions, such as going public, cross-listing on a foreign exchange, or imposing a minimum disclosure requirement. While the literature traditionally models disclosure as information transmission (e.g., Verrecchia (1983)), the present incomplete contract model emphasizes the impact of disclosure on the verifiability (as in the sense of Hart, 1995) of the firms' revenues.[3] More precisely, we assume that the disclosure level determines the probability that the realized cash flow is verifiable, thereby limiting the extent to which investors can be expropriated. Intuitively, when a firm discloses the existence of a certain asset (or the value of that asset) this asset becomes verifiable in a court of law. The asymmetric information literature on disclosure implicitly assumes that cash flows are verifiable while we relax that assumption in a setting with symmetric information.

One difference between the two major accounting systems, code law and common law, is the treatment of hidden reserves. Code law allows firms to keep some hidden reserves which effectively implies that this cash is not verifiable in a court of law[4].

We consider a cash constrained entrepreneur who has an investment opportunity with a positive NPV. In order to attract funding from new investors, the entrepreneur has to increase the firm's disclosure level. Due to the presence of existing claimholders, adhering to a higher disclosure level also comes with a cost: it reduces the insider's ability to expropriate all investors, and thereby grants existing claimholders with a windfall gain. In effect existing claimholders act like a debt overhang on investment. Consequently, the optimal voluntary disclosure level solves the following trade-off: a higher disclosure level implies a better price for newly issued claims but reduces the

[1] Siegel (2004) finds that reputational bonding better explains the growth of cross-listing than legal bonding.

[2] See Karolyi (1998) for a survey of the literature.

[3] Common to both approaches is that disclosure helps investors to avoid losing money.

[4] When Daimler Chrysler listed on the NYSE a profit under German code-law was turned into a sizeable loss due to common law treatment of hidden reserves.

entrepreneur's expropriation rents. The entrepreneur selects less than complete disclosure when the deadweight cost of expropriation is smaller than the transfer to existing claimants. Furthermore, some positive NPV investments may not be undertaken because of the debt overhang problem. Thus, the model can explain why firms abstain from cross-listing even though it would increase share value.

In practice some disclosure decisions are mandatory, such as publishing accounts while others are at the firm's discretion such as cross-listing shares on a foreign exchange. It is important to understand why regulators feel that they can improve the private contracting outcome by legislation. The model predicts that if there are significant residual claimholders the entrepreneur expropriates as much as possible. If expropriation is costly then a social planner selects a higher disclosure level than the entrepreneur and thereby reduce the amount of costly expropriation.

An important effect of a mandatory disclosure standard is that it reduces the entrepreneur's expropriation rents, irrespective of the investment decision. As a result, a mandatory disclosure standard may induce the entrepreneur to undertake investments that would not be undertaken in the absence of the standard. Greenstone, Oyer and Vissing-Jorgensen (2004) document positive and significant returns from increasing mandatory disclosure requirements through the 1964 Securities Acts Amendments. The importance of disclosure for capital markets is highlighted in a recent study by La Porta, Lopez-de-Silanez and Shleifer (2003) that finds that disclosure and liability rules are more important than public enforcement.

In the model there is an upper bound on the mandatory standard compatible with investment because the entrepreneur is not the sole residual claimant. This upper bound implies that the social planner faces a trade-off when deciding whether to increase the disclosure level. A higher disclosure level reduces the amount of costly expropriation, but may prevent investment. This implies that although the social planner selects a higher disclosure level than the entrepreneur, he may select partial rather than complete disclosure to maintain investment efficiency.

Bushee and Leuz (2004) find that imposition of additional disclosure requirements on firms listed on the OTCBB (Over the Counter Bulletin Board) implied that many firms delisted corroborating that disclosure is associated with significant costs.

Holmström and Kaplan (2003) argue that the greatest risk now facing the U.S. corporate governance system is the possibility of overregulation. This is very much in line with the conclusions of this paper, since some regulation is beneficial since it reduces wasteful expropriation and increases investment efficiency, but excessive regulation may have detrimental effects on investment efficiency.

If the social planner selects less than complete disclosure this disclosure level will depend on the characteristics of the investment which implies the optimal disclosure level will differ from investment to investment. Therefore, a "one size fits all" regulation may not be optimal. This implies that convergence of disclosure standards may be harmful.

An implication of the social planner's trade-off is that the greater the shareholder protection the more likely the social planner is to implement complete disclosure. Intuitively, stronger shareholder protection increases - by assumption - the deadweight loss of extraction which increases the social planner's returns from increasing the disclosure level. This implies that economies with better shareholder protection also have higher mandatory disclosure standards.

The crucial assumption of the model is the existence of claimholders at the time the disclosure level is chosen. There is ample empirical motivation for this assumption. According to Casares, Field and Sheehan (2004) 83% of all firms going public have an outside blockholder. In addition, most firms have other significant stakeholders who have relative to new investors senior claims, such as wages, trade credits and other creditor liabilities. Additionally, Dyck and Zingales (2004) point out that the government has a residual claim in all firms through the firm's corporate tax liabilities. These tax claims exist before any contract is written with the firm and cannot be renegotiated.

It is also well known that venture capitalists use other mechanisms to motivate entrepreneurs and protect themselves from expropriation. They require seats on the board, the ability to veto decisions within the firm and they give financing in stages to ensure that the entrepreneur fulfills his obligations. When a venture capitalist exits his investment the mechanisms employed by the venture capitalist needs to be replaced. For many firms stock market disclosure rules serve this purpose.

There are at least three alternative explanations for the premium that firms earn from cross-listing their shares on other exchanges. First, if capital markets are segmented, the asset pricing models of Black (1974) and Solnik (1974) predict cross-listing increases the shareholder base and thereby reduces the cost of capital through more effective risk-sharing. In a recent examination of this hypothesis Sarkissian and Schill (2004) find that firms that cross-list do so on exchanges which have a high correlation with the firm, thereby severely limiting the gains in diversification. Another problem with this explanation is that it cannot explain why firms are reluctant to cross-list their shares. Additionally, it cannot explain why the number of cross-listings has increased during the 1990s even though capital markets have become more integrated. Second, firms might signal their quality by cross-listing shares in a high disclosure environment

(see Cantale (1996) and Fuerst (1998)). Third, Lins, Strickland and Zenner (2005) argue that a U.S. listing leads to greater liquidity and hence eases the firm's credit constraint.

This paper relates to Shleifer and Wolfenzon (2002) who consider the effect of the legal environment on the size of the capital markets and the decision to go public by entrepreneurs. We focus on the firm's and the social planner's disclosure choice, so the model in this paper gives the entrepreneur the opportunity to eliminate the possibility to expropriate. Additionally, many of the results of this paper depend on the fact that the entrepreneur is not the sole residual claimant at the disclosure date which is not present in their model. A related paper is that of Durnev and Kim (2003) who also consider the governance choices of firms, but unlike this paper they do not allow the entrepreneur to limit the possibility to expropriate.

The most closely related paper to this paper is that of Doidge, Karolyi and Stulz (2004) which illustrates an insider's decision to cross-list the firm's shares. In their model the entrepreneur faces a trade-off between the ability to extract private benefits of control and the ability to fund future growth opportunities. Their model does not consider a social planner. Introducing a social planner in their setting results in a trivial outcome because imposing a higher level of corporate governance never has any downside. Additionally, their model considers exclusively cross-listing while this paper is more general in the sense that it is applicable to other increases in verifiability such as IPOs.

Other related theoretical literature includes Modigliani and Perotti (2000), but in our model the entrepreneur is given the option to commit not to expropriate the investors by complying with disclosure rules. Bergman and Nicolaievsky (2002) examine charters of Mexican firms and find that private firms more often enhance the protection of minority shareholders than public firms. They explain this result in a theoretical model in which providing extensive legal protection may lead to "overinclusion" which requires renegotiation. Publicly held firms have higher renegotiation costs and hence insiders in a public firm provides lower minority protection than private firms with low renegotiation costs.

The paper is organized as follows. Section 2 outlines the model. Section 3 examines the entrepreneur's choice of disclosure level. Section 4 analyses the disclosure choice of a social planner. Section 5 discusses robustness issues such as renegotiation, incentive contracts and seniority. Section 6 concludes.

2. Model

Consider a firm run by an entrepreneur that has assets in place that generate a random cash flow. With probability θ the firm succeeds and is worth X. With probability $(1-\theta)$ the firm fails and is worth zero. Besides the entrepreneur, there are existing outside investors who hold a claim $\beta \in (0,1)$ on the expected cash flow. Importantly, we assume that their claim is senior, i.e., they hold debt[5]. The model has three dates, there is no discounting, and all agents are risk-neutral.

At date $t = 1$ the entrepreneur can choose a voluntary disclosure level $\lambda \in [0,1]$ to which the firm will adhere. The disclosure level λ determines the probability with which the entire cash flow X is verifiable. The lack of disclosure prior to $t = 1$ is merely a normalization. For our results it suffices to assume that disclosure prior to $t = 1$ is less than complete.

At date $t = 2$ the entrepreneur has the possibility to undertake an investment at financial cost F. The investment increases the success probability from θ to $\theta + \Delta$. The important implication of this formalization is that the investment return cannot be separated from the return generated by the assets in place. The entrepreneur is cash-constrained and has to raise F on the competitive capital market. Additionally, the entrepreneur may only issue claims that are junior to the existing outsiders' claim. As a result, the entrepreneur has to raise F by selling a part of his stake. Thus, the new investors purchase a claim $\alpha \in [0, 1-\beta]$. The entrepreneur retains control over the firm, irrespective of the fraction of cash flow rights that he retains. We denote his stake by $\gamma \in [0, \beta]$. The sum of all stakeholders' claims must sum up to unity which implies $\beta + \alpha + \gamma = 1$.

At date $t = 3$ the cash flow X realizes with probability θ or probability $\theta + \Delta$ (depending on whether the investment was undertaken). The cash flow is not verifiable with probability $(1-\lambda)$ in which case the entrepreneur decides how much of the cash flow to expropriate. Otherwise, X is paid out to investors and entrepreneur in accordance with the size of their respective stakes β, α and γ. We assume that diversion involves a constant marginal deadweight loss. For each dollar the entrepreneur diverts, he receives $(1-\phi)$ dollars in private benefits where $\phi \in [0,1]$ denotes the expropriation cost. Moreover, the entrepreneur cannot target specific claims when extracting private benefits. That is, expropriation dilutes his and all investors' claims equally. Private benefit extraction should be broadly interpreted as any action that does not maximize the outside investors claim, such as underprovision of effort or consumption of various perquisites (Jensen and Meckling, 1976).

[5] Since we have a binary outcome we can assume that β represents a debt claim.

The model explores the interaction between two agency problems, the possibility to divert corporate resources and the debt overhang. Obviously, the latter relies on the assumption that existing outsiders hold a senior claim. The seniority of the existing outsiders' claim should be interpreted as a composite claim (of all senior claims) that existed or that the entrepreneur entered prior to choosing the disclosure level and that is difficult or impossible to renegotiate. As mentioned in the introduction, there are various examples of such claims. In the section Seniority we explore the robustness of our results with respect to the seniority assumption.

3. Voluntary Disclosure

To determine the entrepreneur's optimal disclosure choice, we solve the model backwards. We derive the conditions under which the entrepreneur diverts revenues and then the conditions under which he undertakes the investment. Finally, we determine the disclosure choice.

Suppose some disclosure level λ has been chosen at $t = 1$ and the firm succeeds. This outcome is feasible irrespective of whether or not the investment is undertaken, as the investment merely increases the success probability from θ to $\theta + \Delta$. With probability λ the revenues are verifiable, preventing any diversion. With the complementary probability $(1 - \lambda)$ the cash flow is not verifiable, and the entrepreneur has full discretion over the resource allocation. When diverting a fraction $d \in [0, 1]$ his payoff is

$$\Pi = [(1 - d)\gamma + d(1 - \phi)]\, X \tag{3.1}$$

Since his marginal cost γ and his marginal benefit $(1-\phi)$ of diversion are both constant, the entrepreneur expropriates the entire cash flow if $(1 - \phi) > \gamma$, and nothing if $(1 - \phi) < \gamma$.[6]

The entrepreneur's incentives to expropriate ex post depend on the chosen disclosure level. A higher disclosure level reduces the size of the stake that the new investors require to fund the investment. While the disclosure level affects the entrepreneur's remaining stake, it has no impact on the size of the existing claims β.

When investing the reduction in the entrepreneur's stake can create a time consistency problem because the expropriation cost borne by the entrepreneur decreases with the issue. Since the new investors anticipate the entrepreneur's diversion decision, they require a compensation, i.e., a larger stake, if the entrepreneur has incentives to

[6] This is a result of the constant cost of diversion. An increasing marginal cost could yield an interior solution, as in Burkart, Gromb and Panunzi (1998), but would not affect the qualitative results.

expropriate at $t = 3$. Thus, the entrepreneur does not gain from expropriating the new investors. By contrast, the possibility to divert the existing outsiders may be valuable.

LEMMA 1. *For $\beta \leq \phi$ the entrepreneur never diverts any revenues in equilibrium.*

Intuitively, if the expropriation cost exceeds the fraction owned by existing outsiders, the entrepreneur never wants to divert ex ante. This also holds ex post, if his stake after the issue still exceeds the marginal benefit of diversion ($1-\phi < \gamma = 1-\alpha-\beta$). Conversely, if the issue is large, the entrepreneur prefers to expropriate ex post, even though he would gain ex ante from forgoing the opportunity to divert. Disclosure allows the entrepreneur to resolve the time consistency problem: By choosing full disclosure ($\lambda = 1$) the entrepreneur commits himself not to divert.

By contrast, if the fraction held by the existing outsiders exceeds the expropriation cost ($\beta > \phi$) there is always a conflict of interest between existing outsiders and the entrepreneur. Moreover, the entrepreneur does not want to avoid this conflict by choosing full disclosure. Subsequently, we restrict attention to this constellation.

ASSUMPTION 1. $\beta > \phi$

This assumption ensures that the entrepreneur prefers to divert even though he has to compensate the new investors.

Consider the entrepreneur's issue and invest decision at date $t = 2$ for some given disclosure level λ. Since the project has a positive NPV, the entrepreneur always invests if he has raised the financing. He prefers to invest if

$$(\Delta + \theta)\left[\lambda(1-\alpha-\beta) + (1-\lambda)(1-\phi)\right] X > \theta\left[\lambda(1-\beta) + (1-\lambda)(1-\phi)\right] X$$

Rearranging this inequality yields

$$\Delta\left[\lambda(1-\beta) + (1-\lambda)(1-\phi)\right] X > (\Delta + \theta)\lambda\alpha X \tag{3.2}$$

This condition compares the entrepreneur's benefit and cost from undertaking the investment. The benefit depends on the disclosure level. When the revenues are verifiable, the entrepreneur has to share the expected investment return with the existing outsiders. Otherwise, he can extract the entire expected investment return as private benefits. The cost is simply that new investors receive a share of the entire firm in return for financing the investment. As will become clear later the condition (3.2) is not a binding constraint in equilibrium.

Given that markets are competitive, the new investor's participation constraint is

$$\alpha = \frac{F}{\lambda(\Delta + \theta)X} \tag{3.3}$$

In addition, the entrepreneur can at most sell his entire stake $(1-\beta)$. Hence, the investment is only feasible if $(1-\beta) \geqslant \alpha = F/(\lambda(\Delta+\theta)X)$. Rearranging this condition allows us to express the participation constraint in terms of a lower bound on the disclosure level

$$\lambda \geq \lambda_{\min} \equiv \frac{F}{(1-\beta)(\Delta+\theta)X} \tag{3.4}$$

Thus, unless the entrepreneur chooses $\lambda > \lambda_{\min}$, the investment is not feasible because the new investors cannot break even.

Which disclosure level $\lambda \geq \lambda_{\min}$ does the entrepreneur choose at $t = 1$, given he intends to issue and invest at $t = 2$? His expected payoff from doing so is

$$\Pi = (\Delta+\theta)\left[\lambda(1-\alpha-\beta)+(1-\lambda)(1-\phi)\right]X$$

Taking the new investors' participation constraint into account, the entrepreneur maximizes

$$\Pi = (\Delta+\theta)\left[\lambda(\phi-\beta)+(1-\phi)\right]X - F$$

subject to the constraint

$$\lambda \geq \lambda_{\min}$$

Since $\beta > \phi$ (Assumption 1) the entrepreneur's payoff decreases with the disclosure level and the constraint binds. Note that as long as the investment is of positive NPV the entrepreneur always invests after issuing equity. The intuition for this is that once a disclosure level is set the entrepreneur has already borne the cost of undertaking the investment (the reduction in expropriation) and since the entrepreneur's expropriation income depends on the final cash flow he gains from undertaking the investment[7].

Selecting the minimum possible disclosure level implies that the entrepreneur sells his entire stake to the new investors ($(1-\beta) = \alpha$). This extreme result is due to the assumption that the entrepreneur retains control irrespective of the size of his stake. Below we discuss how the entrepreneur's choice is affected if control requires some minimum stake.

Intuitively, the choice of the disclosure level involves a trade-off between granting existing outsiders a windfall gain and expropriation cost. On the one hand, a higher disclosure level increases the transfer to existing outside claimholders, thereby aggravating the debt overhang problem. On the other hand, it reduces the likelihood that revenues are not verifiable and hence the expected expropriation cost. Since the fraction held by the existing outsiders exceeds the expropriation cost, the trade-off has

[7] Formally, the payoff from investing once equity has been issued is $(\Delta+\theta)[\lambda\gamma+(1-\lambda)(1-\phi)]X$ while the payoff from not investing is $(\theta X+F)[\lambda\gamma+(1-\lambda)(1-\phi)]$. Hence, the entrepreneur invests as long as $\Delta X > F$.

a corner solution. That is, the entrepreneur minimizes the transfer to the existing outsiders by choosing the minimum feasible disclosure level $\lambda_{\min}$.

Clearly, if the entrepreneur does not plan to invest, he does not have to satisfy the participation constraint. In this case, his objective function is given by

$$\Pi = \theta\left[\lambda(\phi - \beta) + (1 - \phi)\right] X$$

which also strictly decreases with λ. Thus, the entrepreneur chooses not to disclose at all ($\lambda = 0$) when he does not undertake the investment.

Recall that the zero disclosure level prior to date $t = 1$ is a normalization. Thus, the result that the entrepreneur chooses $\lambda = 0$ when abstaining from investing should be interpreted as no increase in the disclosure level.

Comparing the payoffs associated with $\lambda = \lambda_{\min}$ and with $\lambda = 0$ yields that the entrepreneur chooses to issue and invests if

$$(\Delta + \theta)\left[\lambda_{\min}(\phi - \beta) + (1 - \phi)\right] X - F \geq \theta\left[(1 - \phi)\right] X$$

or equivalently, if

$$\Delta X \geq \Delta\beta X + F \tag{3.5}$$

The entrepreneur undertakes the investment if the expected total return exceeds the sum of the transfer to existing outsiders and the investment cost. Clearly, the investment decision is always efficient in the absence of the debt overhang problem ($\beta = 0$). For future reference, we denote by C_1 the total expected return ΔX for which the above condition holds with strict equality. This lower bound on the investment return is equal to

$$C_1 = \frac{F}{(1 - \beta)} \tag{3.6}$$

PROPOSITION 1. *For $\Delta(1 - \beta)X \geq F$ the entrepreneur selects $\lambda^E = \lambda_{\min}$ and undertakes the investment. Otherwise, the entrepreneur does not invest and selects $\lambda^E = 0$.*

The Proposition predicts that firms with a significant amount of existing outside claimholders choose not to increase their disclosure levels. That is, efficient investments may be forgone because the existing outsiders' claim is too large, just like in Myers (1977). Doidge et al. (2005) find that the probability of a firm cross-listing is inversely related to the difference between control and cash flow rights. In our context, a high β implies control with little cash flow rights and all other things equal, more likely that the firm does not cross-list.

The value of the existing claimholders stake is increased by $\beta\lambda_{\min}(\Delta + \theta)X$. We have given existing claimholders seniority to avoid their claim being diluted, but we could relax the assumption of seniority (i.e. assume that they hold equity) and assume that their interest is protected by an anti-dilution provision. In which case stock prices would increase with an increase in the disclosure level (as documented by Miller (1999) and others).

For all firms that satisfy the above condition (3.6), the optimal disclosure level λ^E increases with investment cost F and the size of the existing outsiders's stake β, but decreases with the profitability of the investment ΔX and of the assets in place θX. Another implication of the result $\lambda^E = \lambda_{\min}$ is that the entrepreneur prefers to use internal funds to finance the investment. Intuitively, the less funds the new investors have to contribute the lower the necessary disclosure level, which in turn allows the entrepreneur to divert the revenues more often. (A formal proof is given in Appendix A.)

Taken together, these results imply that the relationship between firm size and disclosure level is ambiguous due to opposing effects. On the one hand, less profitable firms choose higher disclosure levels. So, if economic growth implies ceteris paribus a decrease in return to capital, the model predicts that voluntary disclosure levels increase with the maturity of the economy (firms). On the other hand, larger and older firms typically have more retained earnings which eases the financing constraint, thereby reducing the required disclosure level. Another prediction is that larger firms tend to have more existing claimholders (β) and therefore have to opt for higher disclosure levels. While the relation between size and disclosure level is in general indeterminate, the implication for cash-constrained growth firms is clear cut: Growing firms without cash have to increase their disclosure level to finance their investments. Hence, a prediction of the model is that finance junkies need to select higher disclosure levels than cash cows.

As mentioned above, the entrepreneur sells his entire stake when he sets $\lambda^E = \lambda_{\min}$. If control would require some minimum stake $\underline{\gamma}$, the entrepreneur has to choose a higher disclosure level to simultaneously satisfy the new investors' participation constraint and the control constraint. Clearly, this renders the investment option less attractive, and ceteris paribus less entrepreneurs would find it profitable to invest.

The above analysis assumes that the entrepreneur can choose any disclosure level in the unit interval. This can be interpreted as a legal system allowing the entrepreneur numerous (infinite) choices with respect to the amount of revenues that he can pledge to outside investors. Such an abundant menu of options is only available in a sophisticated legal system characterized by highly developed institutions, functioning courts, liability

standards and various opt-out provisions. Arguably, lesser developed institutions do not provide such rich menus. In particular, the amount of returns that corporate insiders can credibly pledge to outside investors is limited in countries with a weak legal system.

In our framework, a weak legal system can be modelled as an upper bound λ^D on the disclosure level available to an entrepreneur. Given this restrictions, only entrepreneurs with very profitable investments and consequent $\lambda^E < \lambda^D$ are able to fund their investment. Consider now the possibility of overcoming the weak domestic institutions by means of cross-listing on a foreign stock exchange with $\lambda^F > \lambda^D$. The preceding analysis implies that entrepreneurs with $\lambda^E \in (\lambda^D, \lambda^F)$ prefer to use the option to cross-list in order to raise the funds to undertake the investment.

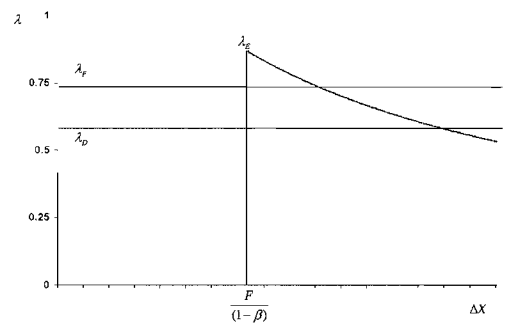

Figure 1: The graph is plotted for parameter values $\theta = 0.1$, $F = 5$ and $\beta = 0.5$.

Figure 1 illustrates the entrepreneur's choice λ^E as a function of the expected investment return. For all returns $\Delta X < C_1$, the entrepreneur forgoes the investment due to the debt overhang problem and sets $\lambda^E = 0$. At $\Delta X = C_1$, the voluntary disclosure level λ^E jumps and then decreases thereafter in ΔX. If given the entire unit interval to choose from, the entrepreneur picks $\lambda_{\min}$ and invests for $\Delta X \geq C_1$. The two horizontal lines in Figure 1 depict the maximum domestic disclosure standard λ^D, and the standard required by the foreign stock exchange λ^F. If the entrepreneur is restricted in his disclosure choice to $\lambda \leq \lambda^D$ and/or $\lambda = \lambda^F$, we obtain the following disclosure and cross-listing decisions: Entrepreneurs with low investment returns ($\lambda^E > \lambda^F$) do not disclose, entrepreneurs with intermediate investment returns ($\lambda^E \in (\lambda^D, \lambda^F)$) cross-list and invest, while entrepreneurs with high investment returns ($\lambda^E < \lambda^D$) raise funds in their home country.

A number of predictions emerge from this analysis of the entrepreneur's decision to cross-list. First, among the firms that undertake the investment, those with a lower return, or equivalently higher funding requirement, cross-list. Second, the value of the

outsiders' stake increases with the disclosure level. Third, a lower domestic disclosure level induces more firms to cross-list. Fourth, in countries with weak shareholder protection (low ϕ) more firms are likely to face a conflict of interest between insiders and outsiders, and therefore require disclosure to fund their investment. Hence, we expect an inverse relationship between shareholder protection and the number of firms that cross-list.

Several recent empirical studies analyze the decision to cross-list. Blass and Yafeh (2001) find that Israeli firms choosing to go public on NASDAQ as opposed to the Tel Aviv Stock Exchange are in general more R&D intensive. This fits well with the model's first prediction that firms with ample investment opportunities, but little funds choose to cross-list their shares. Doidge, Karolyi and Stulz (2004) report that firms which cross-list have a 16.5 percent higher Tobin's Q than those which do not cross-list. Reese and Weisbach (2002) document that firms from French Civil Law countries are more likely to cross-list on an exchange than firms from English Common Law countries. This finding corroborates the prediction that firms from weak legal environments are more likely to cross-list.

4. Disclosure Regulation

In this section we introduce a social planner who has the opportunity to impose a mandatory disclosure standard λ^M, say through the choice of disclosure requirements in company law. Within our framework such a mandatory standard prevents the entrepreneur from selecting any disclosure level $\lambda^E < \lambda^M$. Other than choosing λ^M, the social planner (regulator) has by assumption no influence over private party contracting, notably he cannot affect the claims of the existing outsiders nor the expropriation cost. We further assume that Assumption 1 ($\beta > \phi$) continues to hold.

The regulator sets the disclosure level such as to maximize total expected revenues net of any expropriation cost. From the analysis above, it follows that the socially optimal disclosure level entails a trade-off between investment efficiency and expropriation cost. While a higher disclosure level reduces the expected expropriation cost, the social planner may not want to require full disclosure because this may discourage investment.

To derive the socially optimal disclosure standard we need to compare the social welfare for two different outcomes; the social welfare obtained when disclosure is compatible with investment and the social welfare obtained when disclosure discourages investment. To this end we repeat the analytical steps of the previous section and determine how the entrepreneur reacts to the minimum standard. Thereafter we derive the socially optimal disclosure choice for a given investment behavior.

The entrepreneur's resource allocation decision at $t = 3$ is independent of the disclosure level. For any imposed λ^M, he expropriates the entire cash flow when cash flow is not verifiable because of Assumption 1. At $t = 2$ the entrepreneur issues and invests for a given disclosure level if condition (3.2)

$$\Delta\left[\lambda(1-\beta)+(1-\lambda)(1-\phi)\right]X > (\Delta+\theta)\lambda\alpha X$$

is satisfied. As before, he invests if his additional payoff exceeds the expected return accruing to the new investors. Competitive markets imply that the new investors' return is equal to the investment cost F.

From the regulator's perspective this condition is the crucial constraint, to simultaneously induce investment and minimize expropriation cost. Replacing the investor participation constraint (3.3) in condition (3.2) yields the upper bound on the disclosure level

$$\lambda_{\max} = \frac{\Delta(1-\phi)X - F}{\Delta(\beta-\phi)X} \tag{4.1}$$

that is compatible with investment. Intuitively, higher disclosure levels increase the likelihood that the cash flow is verifiable and thereby the transfer to existing outsiders. For $\lambda > \lambda_{\max}$ the debt overhang is so severe that the entrepreneur prefers not to issue and invest.

Given that the regulator wants to preserve the entrepreneur's incentives to invest, maximizing social welfare solves

$$\max_{\lambda}(\Delta+\theta)\left[\lambda\gamma+(1-\lambda)(1-\phi)+\lambda\beta+\lambda\alpha\right]X - F$$

subject to the constraints

$$\lambda \leq \lambda_{\max}$$
$$\lambda \geq \lambda_{\min}$$

Clearly, the social objective function increases with λ and the social planner selects $\lambda^* = \lambda_{\max}$.

Consider now the outcome in which mandatory disclosure discourages investment. In this case, the regulator obviously wants to minimize the expropriation cost and maximizes

$$\theta\left[\lambda(1-\beta)+(1-\lambda)(1-\phi)+\lambda\beta\right]X$$

by setting $\lambda^* = 1$. That is, if the social planner abstracts from the impact that the mandatory disclosure standard may have on investment efficiency, his only concern is the expropriation cost.

Having derived the socially optimal disclosure standard for the outcome with and without investment, we now examine in more detail the different effects that the introduction of a mandatory disclosure standard has on investment efficiency and social welfare. The upper bound on the disclosure level (condition 4.1) implies that full disclosure may not be compatible with investment. Nonetheless, full disclosure per se does not distort the entrepreneur's investment incentives.

PROPOSITION 2. *The entrepreneur has the same investment incentives under a complete disclosure requirement ($\lambda^M = 1$) as in absence of a mandatory standard ($\lambda^M = 0$).*

In the absence of a mandatory standard, the entrepreneur always has the option to divert the revenues generated by the assets in place. To finance investment, he must, however, limit his ability to expropriate investors. As shown above, the entrepreneur prefers to constrain his diversion ability as long as the investment return net of the transfer to existing outsiders exceeds the investment costs, i.e., $\Delta(1-\beta)X > F$. In a regime with complete disclosure, the entire cash flow is always verifiable, and hence the investment is undertaken if its NPV exceeds the transfer to the existing outsiders, i.e., $\Delta(1-\beta)X > F$. Complete disclosure does not reduce investment efficiency because it lowers the entrepreneur's payoff from abstaining.

Although complete disclosure entails no loss in investment efficiency relative to the absence of a mandatory standard, a lower mandatory standard can improve investment efficiency. In a regime with mandatory disclosure, investment is feasible if the new investor's participation constraint (condition 3.4) and the entrepreneur's incentive constraint (condition 4.1) are simultaneously satisfied, i.e., $\lambda_{\min} \leq \lambda^M \leq \lambda_{\max}$. Inserting the definitions for $\lambda_{\min}$ and $\lambda_{\max}$ and rearranging yields

$$\Delta X > F\left[\frac{\Delta}{\theta+\Delta}\frac{1}{1-\beta} + \frac{\theta}{\theta+\Delta}\frac{1}{1-\phi}\right] \tag{4.2}$$

Investment is feasible if its expected return exceeds the sum of investment cost, transfer to existing outsiders and forgone diversion benefits. Besides letting existing outsiders participate in the investment returns, mandatory disclosure also limits diversion of assets in place. This latter effect reduces the opportunity costs of investing, i.e., of pledging part of these assets to new investors. Therefore, the investment feasibility condition depends on the assets in place and is less stringent than in the absence of a mandatory standard (condition 3.5) where the entrepreneur always has the option to divert the entire return by abstaining from voluntary disclosure (and investment).[8]

[8] From $1 > \beta > \phi$ it follows that $1 < \left[\frac{\Delta}{\theta+\Delta}\frac{1}{1-\beta} + \frac{\theta}{\theta+\Delta}\frac{1}{1-\phi}\right] < \left[\frac{\theta+\Delta}{\theta+\Delta}\frac{1}{1-\beta}\right]$.

The two conditions coincide when there are no assets in place ($\theta = 0$). Assets in place have two opposing effects on the investment efficiency. Firstly, they can be pledged to new investors which implies that the minimum disclosure required to satisfy investors is reduced and therefore investment efficiency is increased. Secondly, without assets in place there is no value to the entrepreneur from abstaining and hence reduces the entrepreneur's incentives to undertake the investment. In fact the optimal mandatory disclosure level reduces the value from abstaining from the investment completely so only the first effect remains which implies that the presence of assets in place increases investment efficiency under a mandatory standard[9]. This also holds for the special case when $\phi = \beta$ since forgone diversion gains and the transfer of investment return to existing outsiders cancel.

For future reference, we denote by C_2 the total expected investment return for which condition (4.2) holds with equality. This lower bound on the investment return is equal to

$$C_2 = \frac{F}{(\theta + \Delta)} \left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi} \right] \tag{4.3}$$

and smaller than C_1. In a regime with mandatory disclosure, assets in place mitigate the debt overhang problem because diverting all returns is not an option. Indeed, a mandatory standard lowers the investment threshold of the entrepreneur given that Assumption 1 holds.

PROPOSITION 3. *For $\Delta X \in (C_2, C_1)$, the introduction of the mandatory disclosure standard ($\lambda^{M*} = \lambda_{\max} < 1$) increases investment efficiency. Otherwise ($\Delta X \notin (C_2, C_1)$), mandatory disclosure does not affect investment.*

Disclosure standards that satisfy the entrepreneur's incentive constraint (condition 4.1) ensure that all investments in the interval (C_2, C_1) are undertaken that are passed up in the absence of a mandatory standard. To ensure investment, the mandatory standard must, however, be less than complete. That is, condition (4.1) binds for λ values smaller than 1. For more profitable investments ($\Delta X > C_1$), the entrepreneur prefers to invest under complete disclosure as well as under any lower standard. For investments with low profitability ($\Delta X < C_2$), the debt overhang always prevents investment. Although a mandatory standard $\lambda^{M*} = \lambda_{\max}$ increases investment efficiency, the regulator may nonetheless prefer complete disclosure due to the expropriation cost. More precisely, for $\Delta X \in (C_2, C_1)$ the social planner faces a trade-off: Setting $\lambda^M = \lambda_{\max} < 1$ ensures investment but leads to expropriation costs, whereas

[9] Investment efficiency is unaffected by assets in place in the absence of a mandatory standard since the outside option is always at maximum value. Formally, condition (3.5) does not contain θ.

setting $\lambda^M = 1$ eliminates any deadweight loss but prevents investment. To establish the optimal disclosure level when ΔX is in the range (C_2, C_1), we compare the social welfare of the two options[10].

When preserving the entrepreneur's investment incentives ($\lambda^M \leq \lambda_{\max}$), the highest possible social welfare is

$$(\Delta + \theta)\left[(1 - \phi) + \lambda_{\max}\phi\right] X - F$$

For $\Delta X \in (C_2, C_1)$, full disclosure discourages investment and social welfare simplifies to θX. Thus, the regulator prefers partial disclosure ($\lambda_{\max} < 1$) to complete disclosure if

$$\Delta X - F > (\Delta + \theta)(1 - \lambda_{\max})\phi X \tag{4.4}$$

Comparing the NPV of the investment ($\Delta X - F$) with the expected expropriation cost ($(\Delta + \theta)(1 - \lambda_{\max})\phi X$), the social planner is more likely to choose partial disclosure when the investment is more profitable. Additionally, when $\lambda_{\max}$ is closer to complete disclosure, the expropriation cost is smaller, and hence the social planner is more likely to select partial disclosure.

Replacing $\lambda_{\max}$ (equation 4.1) in the above condition yields a lower bound on the expected investment return for which the regulator prefers partial to complete disclosure. This minimum return is

$$\Delta X > C_3 \equiv \frac{(\Delta + \theta)\phi + \Delta(\beta - \phi)}{(\Delta + \theta)(1 - \beta)\phi + \Delta(\beta - \phi)} F \tag{4.5}$$

Given Assumption 1 ($\beta > \phi$) it is easy to verify that $C_3 < C_1$ holds. Whether C_3 exceeds C_2 or not depends on the the parameters ϕ, Δ, and θ. Given $\Delta X \in (C_2, C_1)$, the regulator prefers partial disclosure when $C_2 > C_3$ holds. All investments that are feasible, i.e., satisfy simultaneously the entrepreneur's incentive constraint and the new investors' participation constraint (condition 4.2) are also socially desirable. By contrast, when $C_3 > C_2$ holds, the regulator wants to curtail investment in order to reduce the expropriation cost.

Obviously, the regulator favours investment when its return is relatively large compared to the return from the assets in place. That is, C_2 always exceeds C_3 when $\Delta > \theta$. By contrast, the ranking of C_2 and C_3 depends on the expropriation cost ϕ when the assets in place are more relevant for the payoff than the investment ($\Delta < \theta$).

LEMMA 2. *For $\Delta < \theta$ and $\phi \in \left(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta\right)$, it always holds that $C_3 > C_2$.*

PROOF. See Appendix B □

[10] We are grateful to an anonymous referee for suggesting this.

In this constellation, there are feasible investments that the regulator prevents by imposing complete disclosure. More precisely, for $\Delta X \in (C_3, C_1)$ the regulator chooses $\lambda^{M*} = \lambda_{\max} < 1$ and investment is undertaken, while for $\Delta X \in (C_2, C_3)$, he selects $\lambda^{M*} = 1$ and no investment takes place even if the investment is feasible.

When the expropriation cost is relatively small, i.e., $\phi \in [0, \beta\Delta^2/[\theta^2(1-\beta)+\beta\Delta^2])$, $C_2 > C_3$ and the social planner always prefers the entrepreneur to undertake the investment if feasible.

Figure 2 illustrates the optimal disclosure standard as a function of the investment return for $\Delta < \theta$.

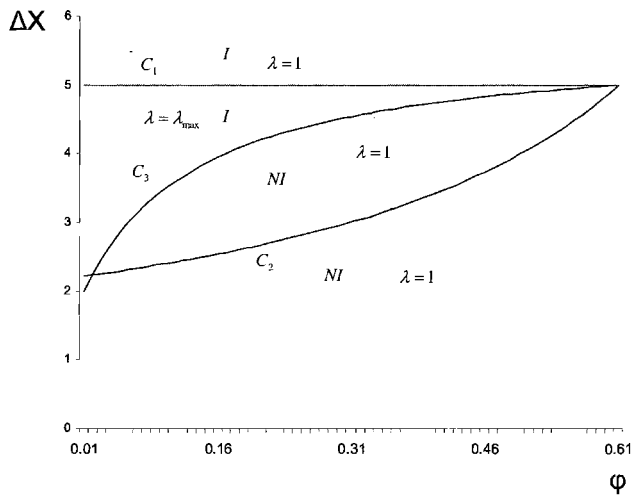

Figure 2: Regions for which there is investment are denoted by I and regions with no investment are dentoed by NI. The graph is plotted for parameter values $\beta = 0.6$. $\Delta = 0.05$, $\theta = 0.65$ and $F = 2$.

There are five different cases depending on the relative size of C_1, C_2 and C_3. From Proposition 3, we know that the disclosure standard does not affect investment when projects are have a high or low profitability. For $\Delta X > C_1$, the social planner does not face a trade off since the entrepreneur undertakes the investment even if $\lambda^{M*} = 1$. For $\Delta X < C_2$ there is no disclosure level such that the investment is feasible. Again, social welfare is maximized by eliminating all expropriation cost by setting $\lambda^{M*} = 1$. When investment is of intermediate profitability, the regulator faces a trade-off between investment and expropriation cost. For $C_3 > \Delta X > C_2$, investment is feasible for $\lambda \leq \lambda_{\max}$, but the return does not offset the expected expropriation cost. Hence, the social

planner prefers $\lambda^{M*} = 1$. The graph illustrates that the size of the interval (C_2, C_3) is increasing expropriation cost ϕ which is intuitive. For $\Delta X > C_3 > C_2$ the expropriation cost associated with $\lambda_{\max} < 1$ is outweighed by the investment return. This also holds for $\Delta X > C_2 > C_3$ where the binding constraint on investment is condition (4.2), rather than the regulator's trade-off between investment and expropriation cost. For $\Delta > \theta$ the regulator never wants to prevent feasible investments. That is, he always picks $\lambda_{\max} < 1$ for $\Delta X \in (C_2, C_1)$ as $C_2 > C_3$ always holds.

PROPOSITION 4. *The optimal mandatory disclosure standard λ^{M*} may be complete or partial, but always exceeds the voluntary disclosure level λ^E.*

The above discussion shows that regulation provides an improvement over voluntary disclosure (private contracting) for two reasons. Firstly, the social planner reduces the expropriation cost by selecting a higher disclosure level (in all cases). Secondly, a mandatory standard increases investment efficiency because it reduces the value of abstaining from investment. Despite the efficiency gain, this is, however, not a Pareto improvement since the entrepreneur is worse off than in the absence of a mandatory standard. His share of the investment return is smaller than his forgone expropriation benefits. So the introduction of a mandatory standard provides existing claimholders with a windfall and all their claims increase in value which is corroborated by Greenstone, Oyer and Vissing-Jorgensen (2004) that document positive and significant returns from an increase in the mandatory disclosure requirements.

Moreover, too stringent disclosure requirements may be undesirable. The reason is that complete disclosure solves the expropriation problem but aggravates the debt overhang problem. Hence, some socially desirable investments are not undertaken unless disclosure is partial ($C_3 < \Delta X < C_1$). This is a statement about the second best outcomes: In the presence of two agency problems, solving one completely is typically not optimal from a social point of view. The regulator has to take a systems view when implementing disclosure regulation.

Following the suggestion of La Porta et al. (2000) to interpret expropriation cost as an inverse measure of legal shareholder protection, we can relate optimal disclosure levels to the quality of investor protection.

PROPOSITION 5. *Ceteris paribus, weak shareholder protection (small ϕ values) implies a lower mandatory disclosure standard.*

As shown above, the social planner faces a trade-off between investment and expropriation cost when investment profitability is intermediate ($\Delta X \in (C_2, C_1)$). As C_3

is increasing in the expropriation cost ϕ (condition 4.5), the region in which the social planner selects $\lambda_{\max} < 1$ is decreasing in ϕ. Intuitively, better shareholder protection (higher ϕ values) renders expropriation more costly and therefore complete disclosure more attractive. Strong legal protection goes together with high mandatory disclosure standards which is consistent with the observation that developed economies have better shareholder protection and higher mandatory disclosure levels.

Proposition 4 also has implications for the harmonization of disclosure standards. The convergence of disclosure rules may be undesirable when (the representative) firms are heterogeneous across economies. More precisely, consider two economies A and B, each populated by many identical firms. In both countries, firms have an investment return such that the optimal disclosure standard is partial ($\lambda_{\max} < 1$), but $\lambda^A_{\max} < \lambda^B_{\max}$ (as $\Delta X^A < \Delta X^B$).

From Lemma 2 it follows that social welfare in country A (B) is maximized by setting $\lambda^{M*A} = \lambda^A_{\max}$ ($\lambda^{M*B} = \lambda^B_{\max}$). On the one hand, if country A adopts $\lambda^B_{\max}$, socially desirable investments are prevented due to a too stringent disclosure requirement. On the other hand, if the social planner in country B implements $\lambda^A_{\max}$ there is an inefficiently high level of expropriation. Thus convergence can be sub-optimal unless economies have a comparable composition of firms.

5. Robustness

5.0.1. *Renegotiation.* In this model, the entrepreneur selects an inefficiently low disclosure level due to the existing outsiders' claim. Clearly, this inefficiency could be alleviated if the existing outside claimholders were willing to reduce the size of their stake. Nonetheless, the possibility of renegotiation does not always eliminate costly expropriation as it may require too much "debt forgiveness."

Since, the entrepreneur selects an inefficient disclosure level as long as $\beta > \phi$, the outsiders have to reduce their claim from β to β' where $\beta' \leq \phi$ to induce the entrepreneur to select $\lambda = 1$. In what circumstances would they have the incentives to accept such a β'? As the entrepreneur selects $\lambda_{\min}$ if the existing outsiders do not reduce the size of their claim, the expected value of their claim is $\beta\lambda_{\min}(\theta + \Delta)X$. The highest stake the outsiders can retain without triggering expropriation is ϕ. So if $\lambda_{\min}\beta > 1 \times \phi$, the existing claimholders have no incentive to reduce their stake in order to achieve congruency. This is equivalent to

$$\lambda_{\min}\beta > \phi \Rightarrow \frac{F}{(\Delta + \theta)} \frac{\beta}{(1-\beta)\phi} > X$$

The condition implies an upper bound on the profitability of the firm (investment and assets in place) such that the existing outsiders prefer not to reduce their claim. In section 4, it was shown that the investment is feasible provided that condition (4.2) is satisfied ($\lambda_{\max} > \lambda_{\min}$). The above upper bound is compatible with the condition (4.2) if

$$\frac{\beta}{\phi} > 1 + \frac{(1-\beta)}{(1-\phi)}\frac{\theta}{\Delta}$$

The above inequality always holds if ϕ is sufficiently small relative to β. Intuitively, if the expropriation cost ϕ is small compared to β, it is very costly for the existing outsiders to achieve congruent interest.

5.0.2. *Incentive Contracts.* In this section we show by example that a wage/ incentive contract is not a perfect substitute for a disclosure level. Irrespective of whether the disclosure decision is made by a regulator or the entrepreneur the fact that the disclosure device can finance investments for which interests are not aligned implies that some investments that would not be undertaken under a wage contract may be undertaken by the use of disclosure. We assume that a regulator has the possibility give the entrepreneur a wage contract that is paid out of the firm's returns.

Clearly, a wage is a more efficient instrument to provide incentives than allowing expropriation as wages do not involve a deadweight loss. However, if the investment requires relative much funding, it may not be possible to simultaneously align the entrepreneur's interest with those of the existing outsiders and to satisfy the new investors' participation constraint. Since the disclosure device does not require congruent interests, investments may be feasible that cannot be financed under an incentive contract. Subsequently, we provide such an example and abstract for simplicity from the possibility of using both devices simultaneously. The main difference between the incentive contract and renegotiation is that incentive contract is implemented irrespective of if existing claimholders are in favor of it and therefore it is a harder robustness test.

The most effective wage scheme is to pay nothing unless the entrepreneur abstains from expropriation. Since the payoff of the project is binary, the optimal contract is to pay the entrepreneur δX (in addition to his remaining equity stake γ) if the cash flow is X. In addition, we assume that the entrepreneur's wage is senior to all other claims. This implies that the wage dilutes the claims of old and new investors alike. Furthermore, the wage is agreed upon before equity is issued to new outsiders.

To ensure that the investment is undertaken an incentive contract has to make sure that the new investors' participation constraint is satisfied and that the entrepreneur's interests are congruent with those of the investors. Otherwise, the entrepreneur would steal all the cash flow. The entrepreneur prefers not to divert at date $t = 3$ if the wage

δ satisfies the condition

$$\delta X + (1 - \alpha - \beta)(1 - \delta)X > (1 - \phi)X$$
$$\phi > (1 - \delta)(\alpha + \beta)$$

Since ϕ is positive, this condition always holds if $\delta = 1$. Intuitively, alignment of interest can always be achieved if all other stakeholders reduce their claims in favour of the entrepreneur. However, this may not be compatible with the new investors' participation constraint. Replacing $\alpha = F/((1 - \delta)(\Delta + \theta)X)$ in the above condition $\phi > (1 - \delta)(\alpha + \beta)$ and rearranging yields

$$(\Delta + \theta)\left(\phi - (1 - \delta)\beta\right) > \frac{F}{X}$$

Thus, if $F/X \geq (\Delta + \theta)\phi$ there exists no wage such that both conditions are satisfied. Consider the example where $\phi = F/((\Delta + \theta)X)$. In this case, we know that an incentive contract cannot ensure investment, but is investment feasible with the disclosure device?

Using $\phi = F/((\theta + \Delta)X)$ and assumption $1(\beta > \phi)$ implies

$$\beta > \phi = \frac{F}{(\theta + \Delta)X}$$

Combining the above condition with the entrepreneur's investment condition (3.5) implies that the disclosure device can finance investments that a wage contract cannot if

$$\Delta X > \Delta(\beta - \phi)X + \frac{\Delta}{\theta + \Delta}F + F$$

If a regulator selects the disclosure level then the investment decision may be different. From Proposition 2 we know that the investment condition is unaltered if a complete standard is implemented which means the above condition applies.

If on the other hand a partial standard is implemented then the appropriate investment condition is (4.2). Appendix C shows that condition (4.2) may be satisfied for $\phi = F/((\Delta + \theta)X)$.

The above examples implies that an incentive contract is not a perfect substitute for disclosure rules. The intuition is that although an incentive contract may solve the debt overhang problem, it may not be compatible with investment due to the entrepreneur's time consistency problem.

5.0.3. *Seniority.* This section discusses the robustness of the results when the assumption that existing outsiders hold a senior claim, i.e., debt, is relaxed. Everything remains the same as in the basic model, except that the existing outsiders are now assumed to hold equity (β is an equity claim). This implies that entrepreneur and

existing outsiders have their stakes diluted if the investment is undertaken. So after issuing α shares to new investors, the entrepreneur owns $(1-\beta)(1-\alpha)$ of shares and the existing outsiders hold $\beta(1-\alpha)$.

Repeating the above solution procedure we solve the model backwards. When the revenues are not verifiable, the entrepreneur continues to divert all revenues. The entrepreneur also continues to select the minimum disclosure level possible. The removal of seniority implies that the entrepreneur can sell claims on the entire cash flow. So α is now bounded by 1 rather than $(1-\beta)$. This makes it easier to satisfy the new investors' participation constraint and the entrepreneur's incentive constraint. The lower bound on the disclosure level is

$$\lambda_{\min} = \frac{F}{(\theta+\Delta)X}$$

and the upper bound is

$$\lambda_{\max} = \frac{\Delta(1-\phi)X - (1-\beta)F}{\Delta(\beta-\phi)X}$$

Thus, investment is feasible if $(\lambda_{\max} > \lambda_{\min})$

$$\Delta X > \frac{F}{(1-\phi)(\theta+\Delta)}\left[\Delta(1-\phi)+\theta(1-\beta)\right]$$

The above inequality is less stringent than C_2 (equation 4.3) because the debt overhang is eliminated. Just like in section 3, we have to compare the entrepreneur's best possible payoff from abstaining with his best possible payoff if he invests. We find that the entrepreneur undertakes the investment if $\Delta X > F$ which implies that there is no debt overhang and no investment distortion. Additionally, the possibility to issue securities of equal seniority implies that the maximum disclosure level compatible with investment $(\lambda_{\max})$ is never less than 1 for all investments with a positive NPV $(\Delta X \geq F)$. Hence, the social planner never faces a trade-off and always selects complete disclosure.

Replacing the existing outsiders' debt claim with an equity stake does not alter the result that there is a divergence between the voluntary disclosure level and the socially optimal disclosure standard. However, the debt overhang problem never binds in this setting since the existing outsiders' equity claim can always be diluted. Furthermore, the minimum possible disclosure level now implies that the new investors own the entire firm $(\alpha = 1)$. Obviously, this implies that the existing outsider's equity stake has no value. (The assumption that existing outsiders hold senior claims avoids this degenerate outcome.) Given the debt overhang problem ceases to exist, the introduction of a mandatory disclosure standard does not increase investment efficiency nor does the regulator face a trade-off between investment and expropriation cost.

6. Conclusion

This paper analyzes voluntary and mandatory disclosure. The disclosure level is assumed to determine the probability that the firm's returns are verifiable. The model developed in the paper shows that if the entrepreneur has issued debt (or other senior claims) prior to his disclosure choice he may not want to increase disclosure even though it is social welfare enhancing.

Specifically the debt claim and the possibility to expropriate outsiders results in a trade-off. Increasing the disclosure level aggravates the debt overhang while alleviating the agency problem caused by expropriation. If the debt overhang dominates then the entrepreneur has incentives to set an as low disclosure level as possible. Hence, the model is able to explain why so relatively few firms cross-list given the positive stock price reaction.

The social planner selects a higher disclosure level than the entrepreneur since this reduces the amount of wasteful expropriation. Additionally, a mandatory standard may improve investment efficiency by reducing the entrepreneur's possibility to expropriate and hence the benefit of abstaining from investment. He may implement partial or complete disclosure. Partial disclosure is implemented when the investment is relatively valuable. Thus, the model provides a rational for disclosure regulation and even though the social planner implements higher disclosure than the entrepreneur it may be less than complete. Partial disclosure implies that the optimal disclosure depends on firm characteristics and if there is firm heterogeneity then disclosure harmonization is detrimental.

The social planner may curtail feasible investments if they entail significant expropriation costs. So, economies with stronger shareholder protection (higher expropriation costs) should have higher mandatory disclosure requirements.

Appendix A

A.0.4. *With Assets in Place.* Assume the firm has liquid assets in place that can be diverted at $t = 3$ in the same way as the investment return, provided the project succeeded. Given Assumption 1, the entrepreneur selects the lowest feasible disclosure level. Given the liquid assets are distributed with probability λ, the new investors' participation constraint implies the following lower bound on disclosure

$$\lambda^D_{\min} \geq \frac{F}{(1-\beta)\left[(\Delta+\theta)X + A\right]}$$

Relative to the case without liquid assets in place, the minimum disclosure level is lower as the new investors also get part of these assets.

Suppose now that these liquid assets can be used to fund part of the investment. Again, the entrepreneur selects the minimum disclosure level that satisfy the new investors' participation constraint. Given that the liquid assets (retained earnings) are used to finance the investment, the entrepreneur needs to raise on the market $\max(F - A, 0)$. The disclosure level that satisfy the new investors' participation constraint when they invest $\max(F - A, 0)$ is

$$\lambda^R_{\min} \geq \frac{\max(F-A,0)}{(1-\beta)(\theta+\Delta)X}$$

To assess whether the entrepreneur wants to invest retained earnings, we compare the payoffs under the two alternative modes of financing. Assuming that $F > A$, the entrepreneur prefers to invest A if

$$\Pi(\lambda^R_{\min}) = (\theta+\Delta)\left[\lambda^R_{\min}(\phi-\beta) + (1-\phi)\right]X - (F-A) \geq$$
$$\lambda^D_{\min}(\phi-\beta)\left[(\theta+\Delta)X + A\right] + (1-\phi)\left[(\theta+\Delta)X + A\right] - F = \Pi(\lambda^D_{\min})$$

Substituting the above definition of the minimum disclosure levels and rearranging yields

$$A\beta\frac{(1-\phi)}{(1-\beta)} \geq 0$$

Hence, the entrepreneur strictly prefers to invest all retained earnings. Clearly, this also applies for $F \leq A$, as investment does not require disclosure.

Appendix B

First we will show that $C_1 > C_3 > C_2$ in the range $\phi \in (\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$.

Recall that $C_3 = \frac{(\Delta+\theta)\phi+\Delta(\beta-\phi)}{(\Delta+\theta)(1-\beta)\phi+\Delta(\beta-\phi)}F$, $C_2 = \frac{F}{(\theta+\Delta)}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right]$ and $C_1 = \frac{F}{(1-\beta)}$. Note that $\frac{\partial C_2}{\partial\phi} > 0$, $\frac{\partial C_3}{\partial\phi} > 0$ and $C_3(\phi=\beta) = C_2(\phi=\beta) = C_1$ therefore $C_1 > C_2$ and

$C_1 > C_3$, $\forall \phi \in [0, \beta)$. Define $A = C_3 - C_2 = \frac{(\Delta+\theta)\phi+\Delta(\beta-\phi)}{(\Delta+\theta)(1-\beta)\phi+\Delta(\beta-\phi)}F - \frac{F}{(\theta+\Delta)}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right]$. Rearranging and setting $A = 0$ yields $(\beta-\phi)(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2} - \phi) = 0$ which is quadratic in ϕ. This means that $C_2 = C_3$ if $\phi = \beta$ or $\phi = \frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}$. Notice that $\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2} < \beta$ as long as $\theta > \Delta$. Since $\frac{\partial^2 A}{\partial\phi^2} = 2 > 0$ we know that A has a maximum. Additionally, since A has two solutions, one on each side of the interval $(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$ we know that A is positive on the interval. Hence, $C_1 > C_3 > C_2$, $\forall \phi \in (\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$.

Appendix C

For $\lambda_{\max} > \lambda_{\min}$ when $\phi = \frac{F}{(\Delta+\theta)X}$ requires that

$$(\theta + \Delta)\Delta X^2 - (\Delta + \frac{\Delta}{1-\beta} + \theta)FX + \frac{\Delta F^2}{(\Delta+\theta)(1-\beta)} > 0$$

The roots are given by $c_{1,2} = \frac{-b\pm\sqrt{D}}{2a}$ and in our case $a = (\theta+\Delta)\Delta$, $b = -(\Delta+\frac{\Delta}{1-\beta}+\theta)F$, $c = \frac{\Delta F^2}{(\Delta+\theta)(1-\beta)}$. Simple calculations shows that $D = F^2\left[\Delta^2\frac{\beta^2}{(1-\beta)^2} + \theta(2\Delta + \frac{2\Delta}{1-\beta} + \theta)\right] > 0$ which implies that $c_{1,2}$ are both real roots. Since $-b > 0$, $2a > 0$ and $4ac > 0$ both roots are positive.

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PAPER 2

The Optimality of the Opt-Out

ABSTRACT. This paper determines conditions under which providing firms with a menu of disclosure alternatives is desirable. If all types of firms have a conflict of interest with existing stakeholders concerning the resource allocation decision then providing firms with a single mandatory standard is optimal. When some firms do not have a conflict of interest then the optimal mandatory standard may allow firms to choose from multiple disclosure standards. Diversity in assets favours a single standard while diversity in liabilities favours multiple standards.

1. Introduction

Many decisions that firms take affect what information they have to disclose to investors. In general the amount of information that the firm has to disclose grows as the firm grows. Partnerships and small private firms only have to disclose very limited amounts stipulated by company law. Later the firm may go public or even cross-list their shares on a foreign exchange and both these decisions greatly increases the amount of information the firm has to disclose.

In effect, firms face a menu consisting of numerous possible disclosure alternatives. They can choose to merely comply with the minimum disclosure requirements stipulated by company law or the firm can choose from several higher alternatives by undertaking an IPO or cross-listing its shares. Thus, firms are presented with the opportunity to opt-out of the minimum mandatory standard into a higher standard.

The return to the firm's shareholders of increasing firm disclosure has been documented to be positive and significant (see Miller (1999)). At the same time there is an extensive corporate governance literature whose premise is that firms suffer from a moral hazard problem that is mitigated by improvements corporate governance standards. La Porta, Lopez-de-Silanes, Shleifer and Vishny (LLSV) (1997), (1998) and a host of other papers document that countries with better shareholder protection have more developed and broader capital markets. In fact Greenstone, Oyer and Vissing-Jorgensen (2004) find that the introduction of a mandatory disclosure standard leads

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to an increase in stock prices. So the empirical evidence seems to suggest that a reduction in choice implemented through tougher mandatory standards is beneficial for the stock price.

It is puzzling that firms are given so much latitude in terms of their disclosure choice in the presence of the empirical evidence of the benefits of limiting choice. This paper derives conditions under which providing firms with a menu of disclosure alternatives dominates imposing a single mandatory standard.

This paper determines that one potential cost of implementing a menu of disclosure alternatives is that if firms in the economy face a debt overhang then the added flexibility that a menu with multiple alternatives results in underinvestment. The reason for this is that disclosure regulation reduces flexibility and thereby alleviates the debt overhang. Hence, providing choice may be sub-optimal. In fact, it is shown that it is always optimal to implement a menu consisting of a single disclosure standard (no choice) if both types of firm face a significant debt overhang. This is because the rents that have to be given to the good type in order to induce him to select the higher disclosure level always exceed the benefit of having two levels. Only in situations when the debt overhang is significant for some firms and not significant for others will having a menu consisting of multiple disclosure standards be optimal. The intuition for this is that implementing a pooling standard implies that the good firm has to select an inefficiently low disclosure level in order to provide the bad firm with incentives to undertake the investment. In this case providing a menu consisting of two disclosure levels so that the good type selects a higher disclosure level and the bad firms selects a lower disclosure level is optimal. In other words, if the there is heterogeneity in terms of whether the debt overhang binds among firms then providing firms with flexibility may be optimal.

We analyze the regulator's optimal disclosure menu in the setting of Östberg (2005) with the added assumption of asymmetric information. In our setting the disclosure level determines the probability that the firm's assets are verifiable. Firms may have senior claimholders which means that they may face a binding debt overhang. Additionally, the entrepreneur has the possibility to expropriate resources from the firm so there is an ex-post moral hazard problem. Lastly, there are multiple types of firm and the entrepreneur has more information concerning the value of the firm than outsiders and the regulator. In this setting both the entrepreneur and the regulator faces a trade-off with respect to the disclosure level. A higher disclosure allows the entrepreneur to secure financing at the cost of reducing his benefits from expropriation. The regulator prefers higher disclosure since it reduces the amount of costly expropriation, but may

still implement less than complete disclosure in order to maintain the entrepreneur's incentives to undertake the investment.

This paper is related both to the corporate governance literature and the literature on disclosure. In general the corporate governance literature examines a moral hazard problem while the disclosure literature considers an asymmetric information perspective. In this paper we have both moral hazard and asymmetric information. Unlike the literature on asymmetric information this paper assumes that the disclosure limits the entrepreneur's possibility to expropriate funds from the firm. In this paper the disclosure level determines the probability that the firm's assets are verifiable. The motivation for this assumption is that the more a firm discloses about certain assets the more likely it is that these assets are verifiable in a court of law.

The corporate governance literature focuses on entrepreneurial moral hazard. La Porta, Lopez-de-Silanes, Shleifer and Vishny (2002) establish a theoretical and empirical link between minority protection and corporate valuation. In their framework, an increase in minority protection reduces the moral hazard problem and thereby also increases the value of firms. Shleifer and Wolfenzon (2002) models the relationship between shareholder protection and the size of the capital market. A related paper is that of Durnev and Kim (2003) who also consider the governance choices of firms. Doidge, Karolyi and Stulz (2004) argue that cross-listing is one mechanism whereby a firm can limit the firms moral hazard problem and that the reason that so few firms cross-list is that they enjoy significant private benefits. These results begs the question that given the significant moral hazard problem in the firm it is surprising that regulators just do not impose sufficiently strict mandatory standards to eliminate the moral hazard problem. All of the above papers consider the firm to be subject to a single moral hazard problem. Östberg (2005) examines a situation in which the firm is subject to several agency problems and argues that if the firm faces a significant debt overhang then imposing a strict mandatory standard may have averse consequences on investment efficiency. In this setting eve though less than complete disclosure may be implemented the firm will never be given any choice.

There has been extensive work on the effect on asymmetric information on capital markets and although disclosure is related to the moral hazard problem and not the degree of asymmetric information in this paper there are several related contributions.

Verrechia (1983) shows that disclosure costs may lead to managers not disclosing information in the presence of asymmetric information and market participants that have rational expectations. Admati and Pfleiderer (2000) provide a model in which mandatory disclosure is desirable from a social perspective. They assume that firm

values are correlated and that asymmetric information is harmful. In this setting individual firms will not take into account the positive externality that their disclosure has on other firms and therefore some mandatory disclosure is beneficial. Fishman and Hagerty (1990) illustrates that under certain circumstances limiting the amount of discretion given to firms may increase informativeness and therefore be optimal. If there is a limit to how many signals a firm can disclose then introducing a mandatory standard will result in the average signal becoming more informative. Dye and Verrechia (1995) consider the relative advantages of discretion and uniformity. Uniformity in their setting implies forcing the firm to report a discount factor irrespective of its true value. The basic trade off is between being able to report the firms position accurately versus the possibility of misreporting to prospective shareholders.

The paper is organized as follows. Section 2 describes the model. Section 3 determines equilibrium when both types of firm have significant debt claims. Section 4 illustrates the case in which only one type of firm faces a significant debt claim and section 5 concludes.

2. Model

Consider an economy populated by many firms that can be one of two types (one good and one bad). Each firm has assets in place consisting of a project whose cashflows realize at the end of the model. With probability θ_i the project will be successful and worth X where i refers to firm type. With probability $(1-\theta_i)$ the project will fail in which case it will be worth 0. Additionally, each firm has an investment that if taken increases the success probability of the project by Δ_i. The good firm (type 1) has assets in place of θ_1 and an investment of Δ_1 while the bad (type 2) firm has correspondingly θ_2 and Δ_2 (where $\Delta_1 > \Delta_2$ and $\theta_1 > \theta_2$). The assumed structure implies that there is perfect correlation between the value of assets in place and the investment opportunity (firms with good assets in place also have good investment opportunities)[1]. The proportion of firms in the economy that are good is denoted by ρ.

All firms are run by a risk neutral entrepreneur. The firm has existing claimholders that hold a senior claim amounting to $\beta \in [0,1]$ of future cashflows. These investors will be referred to as existing outsiders. The entrepreneur is cash constrained which implies that if the entrepreneur wishes to undertake the investment he has to raise the financial cost F by issuing junior equity on the capital market. Thus, a proportion $\alpha \in [0, 1-\beta]$ of the entrepreneur's equity is sold to new outsiders if the investment is undertaken.

[1] This is done for simplicity, less than perfect correlation would yield the same qualitative results.

The proportion of the cash flow rights that is still held by the entrepreneur after the sale is denoted by $\gamma \in [0, 1)$. Now we have β, α and γ which means that $\beta + \alpha + \gamma = 1$.

The model has three dates. At date $t = 1$ the regulator provides the entrepreneur with either one or two disclosure standards from which the entrepreneur has to select one[2]. The disclosure level ($\lambda \in [0, 1]$) determines the probability that the firms assets are verifiable. At date $t = 2$ the entrepreneur decides whether to undertake the investment and hence raise funds from the capital market. At date $t = 3$, if the project is successful then a cash flow of X is realized. Additionally, if the cashflow is not verifiable then the entrepreneur decides how much of the cash flow to expropriate. We follow Burkart et al. (1998) in assuming that expropriation is wasteful. If the entrepreneur decides to expropriate some part of the unverifiable cash flow then a deadweight cost of $\phi \in [0, 1]$ is incurred on the amount of cash that he diverts.

Given the set up of the problem we can limit the possible menus that the regulator find it optimal to provide entrepreneurs with. Since the regulator knows what types of firms are present in the economy it is never optimal to implement a menu consisting of more standards than there are types. In other words, the entrepreneurs incentive compatibility can be satisfied by one disclosure level and therefore providing more levels than there are types is either redundant or harmful (leads to excessive expropriation).

3. The Investment Decision

In order to derive the regulator's optimal disclosure policy, we need to first determine how the entrepreneurs and new investors respond to possible disclosure levels. To this end, we derive the conditions when the entrepreneur expropriates funds and when he undertakes the investment.

Assume that the project has been successful and X has realized at date $t = 3$. Since the investment merely increases the success probability, this outcome may obtain with or without investment. Suppose the entrepreneur has adopted some disclosure level λ which was part of the regulator's menu. Consequently, the cash flow is verifiable with probability λ in which case the entrepreneur cannot divert. With the complementary probability $(1 - \lambda)$ the cash flow is not verifiable, leaving the entrepreneur the choice how much to divert. If the entrepreneur diverts a fraction d of the cash flow his payoff is

$$\Pi = [(1 - d)\gamma + d(1 - \phi)]\, X \tag{3.1}$$

[2] Since we have two types the optimal menu will at most contain two standards (this will be discussed later).

Since the marginal cost γ and the marginal benefit $(1-\phi)$ of diversion are both constant, the entrepreneur expropriates everything if $(1-\phi) > \gamma$ and nothing if $(1-\phi) < \gamma$[3]. Since the issue of equity reduces the entrepreneur's stake from $1-\beta$ to $\gamma = 1-\alpha-\beta$, there are three possible cases. First, if the entrepreneur does not have any incentives to expropriate either ex-ante or ex-post in which the disclosure level is irrelevant. Second, if the entrepreneur does not have any incentives to expropriate ex-ante, but the issue creates incentives to expropriate. In effect the entrepreneur faces a time-consistency problem and he prefers (if possible) to limit his possibilities to expropriate ex-post by selecting an as high disclosure level as possible. Third, the entrepreneur has an incentive to expropriate both ex-ante and ex-post.

The entrepreneur's incentives to expropriate ex post depend on the disclosure. A higher disclosure level reduces the size of the stake that the new investors require to fund the investment. While the disclosure level affects the entrepreneur's remaining stake, it has no impact on the size of the existing claims β.

When investing the reduction in the entrepreneur's stake can create a time consistency problem because the expropriation cost borne by the entrepreneur decreases with the issue. Since the new investors anticipate the entrepreneur's diversion decision, they require a compensation, i.e., a larger stake, if the entrepreneur has incentives to expropriate at $t = 3$. Thus, the entrepreneur does not gain from expropriating the new investors. By contrast, the possibility to divert the existing outsiders may be valuable.

Intuitively, if the expropriation cost exceeds the fraction owned by existing outsiders, the entrepreneur never wants to divert ex ante. This also holds ex post, if his stake after the issue still exceeds the marginal benefit of diversion $(1-\phi < \gamma = 1-\alpha-\beta)$. Conversely, if the issue is large, the entrepreneur prefers to expropriate ex post, even though he would gain ex ante from forgoing the opportunity to divert. High disclosure levels may allow the entrepreneur to resolve the time consistency problem: A high disclosure level implies that the entrepreneur cannot divert.

By contrast, if the fraction held by the existing outsiders exceeds the expropriation cost $(\beta > \phi)$ there is always a conflict of interest between existing outsiders and the entrepreneur. Moreover, the entrepreneur does not want to avoid this conflict by choosing full disclosure. Subsequently, we restrict attention to this constellation.

ASSUMPTION 1. $\beta > \phi$

This assumption implies that if the project succeeds and the cash flow is not verifiable then the entrepreneur diverts the entire cash flow (i.e. set $d = 1$). We refer to

[3] This is a result of the constant cost of diversion. Assuming that the cost function is convex in the fraction diverted would yield an interior solution as in for example Burkart, Gromb and Panunzi (1998).

situations in which Assumption 1 holds as the firm having a significant debt overhang or that the entrepreneur has a conflict of interest with existing claimholders. Later we are also considering the case where the reverse inequality holds for some firms which implies that these firms prefer as much disclosure as possible.

Consider entrepreneur i's issue and invest decision at date $t = 2$ for some chosen disclosure level λ. Since the project has a positive NPV, the entrepreneur always invests if he has raised the financing. He prefers to invest if

$$(\Delta_i + \theta_i)\left[\lambda(1-\alpha-\beta) + (1-\lambda)(1-\phi)\right]X > \theta_i\left[\lambda(1-\beta) + (1-\lambda)(1-\phi)\right]X$$

Rearranging this inequality yields

$$(\Delta_i + \theta_i)\left[\lambda(\phi-\alpha-\beta) + (1-\phi)\right]X > \theta_i\left[\lambda(\phi-\beta) + (1-\phi)\right]X \tag{3.2}$$

The entrepreneur issues and invests for a given disclosure level only if the benefit of the higher success probability outweighs the cost of owning a smaller stake in the firm.

In order to invest the firm has to issue equity at date $t = 2$. Given that markets are competitive, the new outsiders' participation constraint is

$$\alpha = \frac{F}{\lambda E(\Delta+\theta)X} \tag{3.3}$$

Where $E(\Delta + \theta)$ denotes the market's expectation of the success probability. The firm's success probability $(\Delta_i + \theta_i)$ remains unknown to them in a pooling equilibrium. In this case the new outsiders require a stake $\alpha^P = F/\lambda[E^P(\Delta+\theta)X]$ where $E^P = \rho(\theta_1 + \Delta_1) + (1-\rho)(\theta_2 + \Delta_2)$. In a separating equilibrium, entrepreneur i has to offer the investors a stake $\alpha_i^S = F/\lambda(\Delta_i + \theta_i)X$.

Since the entrepreneur can at most sell $(1-\beta)$ of the cash flows, the investment is only feasible if $(1-\beta) \geqslant \alpha = \frac{F}{\lambda E(\Delta+\theta)X}$ which can be expressed as

$$\lambda \geq \lambda_i^{IR} = \frac{F}{(1-\beta)E(\Delta+\theta)X} \tag{3.4}$$

Thus, new investors are only willing to finance the investment if the disclosure level is above the lower limit λ_i^{IR}. Since the regulator aims to minimize expropriation costs, he typically selects higher disclosure levels than those satisfying the new outsiders' participation constraint.

Equation (3.2) describes the condition under which the entrepreneur issues equity and invests. Replacing the investor participation constraint (3.3) into (3.2) and rearranging implies that entrepreneur i undertakes the investment only if

$$\lambda \leq \lambda_i^{\max} = \frac{\Delta_i(1-\phi)X - \frac{(\Delta_i+\theta_i)}{E(\Delta+\theta)}F}{\Delta_i(\beta-\phi)X} \tag{3.5}$$

Asymmetric information affects the entrepreneur's investment decision through its impact on the cost of financing. i.e., the ratio $\frac{(\Delta_i+\theta_i)}{E(\Delta+\theta)}$. In a separating equilibrium this ratio is 1, while in a pooling equilibrium type 1 subsidizes type 2. We refer to the maximum disclosure level consistent with investment in a separating equilibrium as $\lambda_i^{\max S}$ while the maximum associated with a pooling equilibrium is denoted by $\lambda_i^{\max P}$.

There are a number relationships concerning across types and types and type of equilibrium. First, it is clear that $\lambda_1^{\max S} > \lambda_2^{\max S}$ and the intuition for this is that the more profitable the investment is the higher a disclosure level is the entrepreneur willing to sustain in order to undertake the investment. Second, $\lambda_1^{\max S} > \lambda_1^{\max P}$, if investing implies that the entrepreneur of the good firm is pooled with bad firms then the disclosure level for which the good type invests is decreased. Conversely, $\lambda_2^{\max P} > \lambda_2^{\max S}$, if the bad type is cross-subsidized by the good type in a pooling equilibrium then the disclosure threshold for which the entrepreneur undertakes the investment is increased.

For our further analysis it is going to be important to know whether $\lambda_i^{\max}$ is less than 1 since then a partial standard is required for investment. A complete standard ($\lambda = 1$) is not consistent with investment if ($\lambda_i^{\max} \leq 1$) and using (3.5) this means

$$\Delta_i X \leq \frac{(\Delta_i + \theta_i)}{(1-\beta)E(\Delta+\theta)} F \tag{3.6}$$

The investment is only feasible if the new investor's participation constraint and the entrepreneur's incentive compatibility constraint are jointly satisfied. Using equations (3.4) and (3.5) it is the case that $\lambda_i^{\max} \geq \lambda_i^{IR}$ as long as

$$\Delta_i X \geq \frac{F}{E(\theta+\Delta)} \left[\frac{\Delta_i}{1-\beta} + \frac{\theta_i}{1-\phi} \right] \tag{3.7}$$

Thus, the investment is undertaken if the expected returns exceed the investment cost scaled with the agency costs of the debt overhang and expropriation possibility. If condition (3.7) does not hold then there is no disclosure such that investors are willing to commit funds and the entrepreneur undertakes the investment.

It is worth noting that (3.6) is jointly feasible with (3.7) as long as Assumption 1 holds. Another implication of Assumption 1 is that the entrepreneur prefers to expropriate as much as possible. Even though the entrepreneur ends up paying for all of the expropriation of new investors, the possibility of expropriating existing outsiders is valuable to him. So if the entrepreneur could choose the disclosure level, he would select $\lambda = \lambda^{IR}$ if he plans to invest and $\lambda = 0$ if he plans to abstain (effectively always selecting the minimum possible).

4. Optimal Disclosure Policy

In this section we examine the optimal disclosure policy. We are going to analyze the solution to the regulators problem of maximizing proceeds from investment while minimizing expropriation costs in the presence of asymmetric information. There are two ways in which the disclosure level affects welfare. Firstly, the disclosure level affects the entrepreneurs investment decision, a too high disclosure level may result in profitable investments not being undertaken. Secondly, the disclosure level affects the amount of costly expropriation. So from a welfare perspective the optimal disclosure level is not clear. Especially when we add asymmetric information then the effect of the disclosure level on the information game also has to be considered. However, it is clear that keeping the investment decision constant more disclosure is preferred to less as this reduces the amount of costly expropriation.

For our purpose only cases in which the regulator faces a trade-off between the NPV of the investment and expropriation cost are of interest as otherwise the regulator implements complete disclosure. There are two cases in which the regulator does not face a trade-off. First, if the investment is not feasible for any disclosure level (equation (3.7) is violated) then clearly it is optimal for the regulator to implement complete disclosure to eliminate all expropriation cost. In order to eliminate this from consider we make the following assumption:

ASSUMPTION 2.

$$\begin{aligned}\Delta_1 X &\geq \frac{F}{E_P(\theta+\Delta)}\left[\frac{\Delta_1}{1-\beta}+\frac{\theta_1}{1-\phi}\right]\\ \Delta_2 X &\geq \frac{F}{(\theta_2+\Delta_2)}\left[\frac{\Delta_2}{1-\beta}+\frac{\theta_2}{1-\phi}\right]\end{aligned}$$

The above assumption implies that for all firms and investor expectations the firm is feasible for some λ. Clearly above we have made the most restrictive assumption concerning investor expectations above and therefore the investments are also feasible under less restrictive assumptions.

The other case in which disclosure policy does not affect investment is when both types of firm invest irrespective of the disclosure level (that is $\lambda_i^{\max} \geq 1$). In which case implementing complete disclosure eliminates expropriation cost and is optimal. As long as (3.6) holds for both types of firm complete disclosure cannot be implemented without affecting investment[4].

We know that the optimal menu from the regulator's perspective is going to consist of one or two disclosure levels. Additionally, we know that the entrepreneur's response

[4] We do not make this assumption explicitly since we will have situations in Section 4 in which this will not hold for one of the firms.

is going to be to either invest or not invest. These two facts implies that we have eight possible outcomes: $\{NI, NI\}^{one}$, $\{I, NI\}^{one}$, $\{NI, I\}^{one}$, $\{I, I\}^{one}$, $\{NI, NI\}^{two}$, $\{NI, I\}^{two}$, $\{I, NI\}^{two}$, $\{I, I\}^{two}$. Where the first element denotes whether entrepreneurs of type 1 invest (I denotes investment while NI indicates that the entrepreneur does not invest) and the second element denotes the investment decision of type 2 firms. The superscript denotes the number of disclosure standards that the regulator provides.

Although we have many outcomes some of them can be discarded as they are suboptimal from the regulators point of view. In an equilibrium where the two types select different investment decisions the true type is revealed to investors. Given that under separation firms of type 1 are willing to select a higher disclosure and invest ($\lambda_1^{\max S} > \lambda_2^{\max S}$) and that it is more valuable to have firms of type 1 select a higher disclosure level (since $\Delta_1 > \Delta_2$ and $\theta_1 > \theta_2$) then the regulator clearly prefers type 1 as the investing firm if there is separation. That is outcomes $\{NI, I\}^{one}$ and $\{NI, I\}^{two}$ are dominated by $\{I, NI\}^{one}$ and $\{I, NI\}^{two}$.

Providing disclosure levels which are not used to satisfy an incentive compatibility constraint are at best redundant. So outcomes $\{NI, NI\}^{two}$and $\{NI, I\}^{two}$ are inferior to $\{NI, NI\}^{one}$and $\{I, NI\}^{one}$. In the case of $\{NI, NI\}^{two}$, if the regulator does not want to encourage any type to undertake the investment then implementing complete disclosure is optimal since it eliminates expropriation cost. Clearly, providing a second lower disclosure level implies some expropriation cost (since the entrepreneur prefers a lower level) and there is still no investment. Hence, a single disclosure level is preferred and $\{NI, NI\}^{one}$ dominates $\{NI, NI\}^{two}$. In the case of $\{NI, I\}^{two}$, one level is needed guarantee investment from type 1 firms ($\lambda_1^{\max S}$). Providing a second higher level is redundant as no firm selects it and providing a second lower level implies a welfare loss since this results in firm 2 expropriating more.

This elimination leaves us with four equilibria: $\{NI, NI\}^{one}$, $\{I, NI\}^{one}$, $\{I, I\}^{one}$ and $\{I, I\}^{two}$. We first analyze under what conditions the regulator prefers $\{I, I\}^{one}$ to $\{I, I\}^{two}$. Thereafter we consider under what conditions it is superior to have two firms invest to one or none.

We consider an outcome in which there are multiple levels, but the same level is selected by both types to be an outcome of the type $\{I, I\}^{one}$. Henceforth, we refer to the equilibrium in which both firms invest and choose the same disclosure as the pooling equilibrium and the equilibrium in which both firms invest but choose different disclosure levels as a separating equilibrium.

4.1. Pooling Equilibrium. The regulator prefers the highest disclosure level for which both firms invest since this minimizes the expropriation cost. For this equilibrium to be implemented the new outsiders participation constraint and the incentive compatibility constraints of both types of entrepreneur have to be satisfied. Each entrepreneur undertakes the investment as long as $\lambda \leq \lambda_i^{\max P}$ (condition (3.5)) which implies that highest disclosure that implies investment by both types is given by $\min\left(\lambda_1^{\max P}, \lambda_2^{\max P}\right)$.

The two incentive compatibility conditions are found by replacing firm type and pooling expectation into (3.5) and this yields

$$\lambda_1^{\max P} = \frac{\Delta_1(1-\phi)X - \frac{(\Delta_1+\theta_1)}{E^P(\Delta+\theta)}F}{\Delta_1(\beta-\phi)X}, \quad \lambda_2^{\max P} = \frac{\Delta_2(1-\phi)X - \frac{(\Delta_2+\theta_2)}{E^P(\Delta+\theta)}F}{\Delta_2(\beta-\phi)X} \tag{4.1}$$

It turns out that if the ratio of asset profitabilities is greater than the ratio of investment profitabilities ($\theta_1/\theta_2 > \Delta_1/\Delta_2$) then $\lambda_2^{\max P} > \lambda_1^{\max P}$ (Appendix A verifies this). We will from now on consider this constellation.

ASSUMPTION 3. $\theta_1/\theta_2 > \Delta_1/\Delta_2$

As will become clear later, this assumption is made to guarantee the existence of a separating equilibrium. This assumptions implies that firms are more heterogenous in terms of assets in place than in terms of investment opportunities.

4.2. Separating Equilibrium. In a separating equilibrium the social planner provides two disclosure levels ($\lambda^H > \lambda^L$) and firms of type 1 self-select into the higher disclosure level while firms of type 2 self-select into the lower disclosure level. In case of separation we know that good firms can sustain a higher disclosure level since $\Delta_1 > \Delta_2$. As mentioned before, once we are in a separating equilibrium we know that $\lambda_1^{\max S} > \lambda_2^{\max S}$.

To support the separating equilibrium in which both firms invest, the disclosure levels (λ^H, λ^L) must be chosen such that none of the firms deviate in any of three possible ways. First, firms do not abstain from the investment. Second, none of the two types has an incentive to mimic the other firm and invest. Third, none of the two types has an incentive to select the disclosure level meant for the other type and abstain from investing.

The first deviation does not occur if the regulator selects disclosure levels such that $\lambda^H \leq \lambda_1^{\max S}$ and $\lambda^L \leq \lambda_2^{\max S}$ which are the relevant conditions in case of separation. In order to ensure that neither type does not want to mimic the other and invest we have two non-mimicking conditions that have to be satisfied. Type 1 firms do not want

to mimic the type 2 firm and invest if

(4.2)

$$(\theta_1+\Delta_1)(\lambda^H(\phi-\beta)+(1-\phi))X-F \geq (\theta_1+\Delta_1)(\lambda^L(\phi-\beta)+(1-\phi))X-\left(\frac{\theta_1+\Delta_1}{\theta_2+\Delta_2}\right)F$$

Rearranging yields,

$$\lambda^H \leq \lambda^L + \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\beta-\phi)X}F \tag{4.3}$$

Intuitively, the good type is only willing to select the higher disclosure level as long as the cost of higher disclosure level outweighs the loss cost in terms of being assumed to be of bad quality.

Similarly, the bad firm does not want to mimic the good firm if

(4.4)

$$(\theta_2+\Delta_2)(\lambda^L(\phi-\beta)+(1-\phi))X-F \geq (\theta_2+\Delta_2)(\lambda^H(\phi-\beta)+(1-\phi))X-\left(\frac{\theta_2+\Delta_2}{\theta_1+\Delta_1}\right)F$$

This is just the reverse condition as the good firm. Unless the cost of the higher disclosure outweighs the benefits of a higher issue price, the bad firm mimics the good type. Rearranging yields

$$\lambda^L \leq \lambda^H - \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\beta-\phi)X}F \tag{4.5}$$

Combining that equations (4.3) and (4.5) implies that there is a unique difference between λ^H and λ^L that is compatible with a separating equilibrium defined by

$$\lambda^H - \lambda^L = \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\beta-\phi)X}F \tag{4.6}$$

Notice that the above condition does not determine the absolute values of the optimal disclosure levels, but states that non-mimicking implies that the distance between the two levels is determined by the model parameters. In fact combining this constraint with the third deviation constraint is going to determine the optimal menu of disclosure alternatives.

To eliminate the third type of deviation we need to ensure that no type has an incentive to mimic the other and abstain. Clearly, this is not a concern with type 2 since selecting the higher disclosure level and abstaining leads to less expropriation benefits and no cross-subsidization. However, the good type increases his expropriation benefits and avoids cross-subsidizing the bad type by selecting the lower disclosure level and abstaining at cost of forgoing the investment.

The type 1 entrepreneur does not select λ^L and abstain if

$$(\theta_1+\Delta_1)(\lambda^H(\phi-\beta)+(1-\phi))X-F \geq \theta_1(\lambda^L(\phi-\beta)+(1-\phi))X \tag{4.7}$$

Rearranging yields,

$$\lambda^H \leq \left(\frac{\theta_1}{\theta_1 + \Delta_1}\right)\lambda^L + \frac{\Delta_1(1-\phi)X - F}{(\theta_1 + \Delta_1)(\beta - \phi)X} \tag{4.8}$$

So we have now specified the necessary conditions for a separating equilibrium to be defined. The maximization program of the regulator is to maximize the sum of the weighted value of the two types subject to the constraints that ensure that a separating equilibrium is feasible.

$$\max_{\lambda^H,\lambda^L} \rho(\theta_1 + \Delta_1)(\lambda^H\phi + (1-\phi))X + (1-\rho)(\theta_2 + \Delta_2)(\lambda^L\phi + (1-\phi))X - F$$

Subject to,

$$\lambda^H \leq \left(\frac{\theta_1}{\theta_1 + \Delta_1}\right)\lambda^L + \frac{\Delta_1(1-\phi)X - F}{(\theta_1 + \Delta_1)(\beta - \phi)X} \tag{4.9}$$

$$\lambda^H - \lambda^L = \frac{(\theta_1 + \Delta_1) - (\theta_2 + \Delta_2)}{(\theta_1 + \Delta_1)(\theta_2 + \Delta_2)(\beta - \phi)X}F \tag{4.10}$$

$$\lambda^H \leq \lambda_1^{\max S} = \frac{\Delta_1(1-\phi)X - F}{\Delta_1(\beta - \phi)X} \tag{4.11}$$

$$\lambda^L \leq \lambda_2^{\max S} = \frac{\Delta_2(1-\phi)X - F}{\Delta_2(\beta - \phi)X} \tag{4.12}$$

$$0 \leq \lambda^i \leq 1 \tag{4.13}$$

The objective function is clearly increasing in the disclosure level. The first two constraints state there has to be a minimum distance between the two disclosure levels and that the distance cannot be too large since then good firms will the lower disclosure level and abstain. Given these observations it is clear that the higher the high disclosure level is the higher the low disclosure level is and therefore the objective function is maximized when the first constraint holds with equality.

The conditions (4.9) and (4.10) reflect the presence of asymmetric information and bind. The constraints (4.11) and (4.12) describe the maximum disclosure level for each type that is consistent with investment given no other disclosure level is available. As these constraints abstract from the possibility of choosing between two disclosure levels which is a feature of the separating equilibrium, they cannot be binding. As we will show, they nonetheless impose restrictions on the relative profitability of the firms' assets in place and investments.

Constraints (4.9) and (4.10) imply

$$\lambda^{*H} \leq \frac{\Delta_1(1-\phi)X - F}{\Delta_1(\beta-\phi)X} - \frac{\theta_1}{\Delta_1}\frac{[(\theta_1+\Delta_1)-(\theta_2+\Delta_2)]F}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\beta-\phi)X} \tag{4.14}$$

and therefore

$$\lambda^{*L} \geq \frac{\Delta_1(1-\phi)X - F}{\Delta_1(\beta-\phi)X} - \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{\Delta_1(\theta_2+\Delta_2)(\beta-\phi)X}F \tag{4.15}$$

Given that the regulator's objective function is increasing in the disclosure level, the above conditions hold with equality. To ensure that debt overhang problem does not bind, we need to verify that conditions (4.11) and (4.12) are satisfied. It is straightforward that $\lambda_1^{\max S} > \lambda^{*H}$ holds. Condition (4.12) also holds ($\lambda_2^{\max S} > \lambda^{*L}$) if

$$\begin{aligned} \frac{\Delta_2\theta_1 - \Delta_1\theta_2}{\Delta_1\Delta_2(\theta_2+\Delta_2)(\beta-\phi)X}F &\geq 0 \\ \frac{\theta_1}{\theta_2} &\geq \frac{\Delta_1}{\Delta_2} \end{aligned}$$

The above condition holds by Assumption 3. If the inequality is reversed, the non-mimicking constraint of the good type and the investment compatibility condition of the bad type ($\lambda_2^{\max S} < \lambda^{*L}$) cannot be simultaneously satisfied, and no separating equilibrium can exist. We are now able to compare the social welfare of a single disclosure level vis-a-vis having two levels.

4.3. Optimality. The social welfare of the best possible pooling equilibrium is given by

$$\rho(\theta_1+\Delta_1)(\lambda_1^{\max P}\phi + (1-\phi))X + (1-\rho)(\theta_2+\Delta_2)(\lambda_1^{\max P}\phi + (1-\phi))X - F \tag{4.16}$$

The best possible separating equilibrium is given by λ^{*H} and λ^{*L}. Social welfare in case of a separating equilibrium is given by

$$\rho(\theta_1+\Delta_1)(\lambda^{*H}\phi + (1-\phi))X + (1-\rho)(\theta_2+\Delta_2)(\lambda^{*L}\phi + (1-\phi))X - F \tag{4.17}$$

So the social planner will prefer a separating equilibrium if,

$$\rho(\theta_1+\Delta_2)(\lambda^{*H} - \lambda_1^{\max P})\phi X + (1-\rho)(\theta_2+\Delta_2)(\lambda^{*L} - \lambda_1^{\max P})\phi X \geq 0 \tag{4.18}$$

After replacing for λ^{*H} and λ^{*L} we obtain

$$-\rho\left(\frac{\theta_1}{\theta_2+\Delta_2}\right)\left[\frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{\Delta_1(\beta-\phi)X}\right]\phi F \geq 0 \tag{4.19}$$

Which is always negative implying that the social planner will always prefer to implement a sole disclosure instead of a menu consisting of two disclosure levels.

PROPOSITION 1. *When firms are highly leveraged ($\beta > \phi$), a single disclosure standard is optimal.*

Providing flexibility is expensive since firms of type 1 need to be compensated for not selecting the lower disclosure level and abstaining. Without assets in place there would be no value to abstaining and hence the regulator does not have to give any rents to the good type to induce him to undertake the investment and the regulator would be indifferent between the menu and the single mandatory standard. In essence assets in place provide the entrepreneur with a reservation utility and once he is given any kind of flexibility he needs to be compensated for any reduction in his utility. By selecting a higher disclosure he reduces his expropriation and he needs to be compensated for this or else he selects the lower disclosure level and abstains from investment. This is illustrated by the binding condition (4.8) collapsing to condition (4.11) when $\theta_1 = 0$.

The reasoning above implicitly assumes that encouraging both type of firm to invest is preferable. There are two other possible equilibria, the regulator may choose to discourage both firms from undertaking the investment and thereby reduce the amount of expropriation. While the above proposition does not depend on the ranking of $\{NI, NI\}^{one}$, $\{I, NI\}^{one}$ and $\{I, I\}^{one}$, this result is qualified in Appendix B. In essence if the project has sufficiently large NPV in relation to the amount of expropriation cost that it implies then the project should not be discouraged.

However, it should be noted that all three possible equilibria $\{NI, NI\}^{one}$, $\{I, NI\}^{one}$ and $\{I, I\}^{one}$ imply that proposition 1 holds since it is never optimal to provide firms with two standards.

5. Firms with Low and High Leverage

We now relax Assumption 1 and consider what effect this has on the social planner's disclosure choice. Unlike like in section 3 we now assume that firms of type one are aligned with outsiders whereas there is still a conflict of interest for type two firms (i.e. $\beta_2 > \phi > \beta_1$). Or alternatively only type 2 firms face a significant debt overhang. Given that $\phi > \beta_1$ the extraction decision is altered for firms of type 1. Ex-ante the firm does not have incentives to expropriate, but once equity is issued the reduction in the ownership stake of the entrepreneur may result in ex-post incentives to expropriate. So if $\beta_1 < \phi < \alpha_1 + \beta_1$ then the entrepreneur wants to commit ex-ante not to expropriate, but after the equity issue will have incentives to expropriate.

ASSUMPTION 4. $\beta_1 < \phi < \alpha_1 + \beta_1$

The above assumption is made to ensure firms of type 1 face a time consistency problem and may actually expropriate. Without this assumption regulation has no

impact on type 1's investment decision and the regulator's problem reduces to determining the optimal disclosure level for the bad type. The solution to this is to implement either $\lambda_2^{\max}$ or complete disclosure and is trivial.

Since the firm's expropriation is reflected in the equity price, firms of type 1 prefer to limit this expropriation. When complete disclosure is not possible this leads to a trade-off: a lower equity price due to the time consistency problem against the return of the investment. In fact firms of type 1 do not invest unless the disclosure is above a certain threshold. The investment decision (denoted by equation (3.2)) of firm 1 becomes

$$\begin{aligned} (\Delta_1 + \theta_1)\left[\lambda(\phi - \alpha - \beta_1) + (1-\phi)\right] X &> \theta_1\left[\lambda(\phi - \beta_1) + (1-\phi)\right] X \\ \lambda &> \lambda_1^{\min} = \frac{\Delta_1(1-\phi)X - \frac{(\Delta_1+\theta_1)}{E(\Delta+\theta)}F}{\Delta_1(\beta_1 - \phi)X} \end{aligned} \tag{5.1}$$

The intuition for the minimum threshold is that if the entrepreneur invests then he will expropriate ex-post and ax-ante he will pay for this expropriation. So, unless a sufficiently large disclosure level is available the entrepreneur may prefer to abstain. Notice that the RHS of the above constraint is definitely negative when there is separation which means that as long as there exists a positive disclosure level and there is separation type 1 firms undertake the investment. Since firms of type 2 have a conflict of interest they still have incentives to expropriate and their conditions remain unchanged (the only change being that β is replaced by β_2).

Note that another effect of removing the conflict of interest of type 1 firms is that they are the most likely to undertake the investment under complete disclosure (since this implies no agency costs to bear). So to make sure that type 1 entrepreneurs may undertake the investment we require that

$$\Delta_1 X > \frac{F}{(1-\beta_1)}$$

Notice that the above inequality is the reverse of (3.6) (which guarantees we are in the interesting constellation when $\beta > \phi$), but does not violate it since $\phi > \beta_1$. Additionally, in order to ensure that the regulator cannot implement complete disclosure and achieve investment by both types we require that condition (3.6) is not violated for type 2 firms. Explicitly this implies

$$\Delta_2 X \leq \frac{(\Delta_2 + \theta_2)}{(1-\beta_2)E(\Delta+\theta)}F \tag{5.2}$$

This ensures that firms of type 2 do not invest under complete disclosure and the regulator faces a trade-off.

Essentially we have the same eight possible outcomes as in the last section. As before we can eliminate outcomes with two disclosure levels and only one type investing. That leaves us with the same four possible equilibria as in the last section ($\{NI, NI\}^{one}$, $\{I, NI\}^{one}$, $\{I, I\}^{one}$ and $\{I, I\}^{two}$). Additionally we can eliminate $\{NI, NI\}^{one}$ since we know that type 1 will invest under complete disclosure and that is the optimal disclosure standard in case the regulator does not want to give type 2 incentives to invest. We first compare $\{I, I\}^{one}$ to $\{I, I\}^{two}$ and then after that we qualify that in terms of the desirability of investment.

5.1. Pooling. The objective of this section is to determine the best feasible pooling equilibrium. The only difference from the previous section is that the incentive compatibility constraint of type 1 firms implies a lower bound on the disclosure level instead of an upper bound.

Entrepreneurs of type 1 undertake the investment as long as $\lambda \geq \lambda_1^{\min P}$ and entrepreneurs of type 2 invest if $\lambda \leq \lambda_2^{\max P}$. The two incentive compatibility conditions are found by replacing firm type and the investor's expectation when firm type is not revealed into (3.5) and this yields

$$\lambda \geq \lambda_1^{\min P} = \frac{\Delta_1(1-\phi)X - \frac{(\Delta_1+\theta_1)}{E^P(\Delta+\theta)}F}{\Delta_1(\beta_1-\phi)X}, \quad \lambda \leq \lambda_2^{\max P} = \frac{\Delta_2(1-\phi)X - \frac{(\theta_2+\Delta_2)}{E^P(\theta+\Delta)}F}{\Delta_2(\beta_2-\phi)X}$$

Given the opposite incentive compatibility constraint of firm 1 we require $\lambda_2^{\max P} \geq \lambda_1^{\min P}$ for a pooling equilibrium to be feasible .

ASSUMPTION 5. $\phi - \beta_1 = \beta_2 - \phi$

This assumption is made solely for tractability reasons and implies that the absolute distance to the moral hazard break point ($\beta_i = \phi$) is equal for both types. The relationship $\lambda_2^{\max P} \geq \lambda_1^{\min P}$ definitely holds if $\lambda_1^{\min P} < 0$ since $\lambda_2^{\max P} \geq 0$. Due to the lack of a binding debt overhang for entrepreneurs of type 1, as long as $\Delta_1(1-\phi)X - \frac{(\Delta_1+\theta_1)}{E(\Delta+\theta)}F > 0$ then $\lambda_1^{\min P} < 0$. So the best possible pooling equilibrium is to provide a firms with a single mandatory standard consisting of $\lambda_2^{\max P}$.

One of the effects of having firms of type 1 being aligned is that the pooling disclosure level is increased. In the previous section the incentive compatibility constraint of type 1 was binding, but now since the incentive compatibility constraint of type 2 binds the welfare of the pooling equilibrium is significantly increased, but it is still less than one as long as (5.2) is satisfied.

Even though alignment implies that firms of type 1 are willing to invest under complete disclosure (in fact they prefer it) this does not mean that the pooling disclosure

level is greater than one. As long as (5.2) holds we know that type 2 entrepreneurs do not invest under complete disclosure even if they are pooled with type 1 firms.

5.2. Separating Equilibrium. As before there are a number of deviations that we need conditions for in order to ensure that we have a separating equilibrium in which both types of firm invests. Both firm have to prefer to invest rather than abstain. We need to make sure that none of the firms want to mimic the other and invest. In this case none of the two types would want to select the disclosure level meant for the other type and abstain from investment. Type 1 firms prefer higher to lower disclosure so they will never want to select a lower disclosure level and abstain since there is no positive side to selecting a lower disclosure level. As before, type 2 firms prefer a lower level and will therefore never select a higher level to abstain.

The investment condition for type 2 under separation is found by replacing for type and separating expectations into (3.2). The bad type invests if

$$\lambda \leq \lambda_2^{\max S} = \frac{\Delta_2(1-\phi)X - F}{\Delta_2(\beta_2 - \phi)X}$$

The investment condition for the good type is found by replacing separating expectations into equation (5.1). The good firm invest if

$$\lambda > \lambda_1^{\min S} = \frac{\Delta_1(1-\phi)X - F}{\Delta_1(\beta_1 - \phi)X}$$

Additionally, we have to ensure that the good firm does not want to mimic the bad firm and invest. From an intuitive point of view the good firm loses from two perspectives by mimicking the bad firm. First of all this implies a lower disclosure level and second he gets pooled with the bad firm. Setting up a similar condition to (4.2) and rearranging implies that type 1 firms will not mimic type 2 firms if

$$\lambda^L \leq \lambda^H + \frac{(\theta_1 + \Delta_1) - (\theta_2 + \Delta_2)}{(\theta_1 + \Delta_1)(\theta_2 + \Delta_2)(\phi - \beta_1)X} F \tag{5.3}$$

Clearly, the above condition will never bind. Just replacing β_2 for β in condition (4.5) illustrates that type 2 firms do not want to mimic type 1 firms as long as

$$\lambda^L \leq \lambda^H - \frac{(\theta_1 + \Delta_1) - (\theta_2 + \Delta_2)}{(\theta_1 + \Delta_1)\,(\theta_2 + \Delta_2)\,(\beta_2 - \phi)X} F \tag{5.4}$$

The above condition shows that the disclosure level that is compatible with type 2 not mimicking is increasing in the disclosure level that type 1 selects. From inspection it is obvious that conditions (5.4) and (5.3) are compatible, but unlike in the previous section they do not provide us with a minimum distance between the two levels.

With the good type not facing a significant debt overhang problem, it is always possible to get the good type to invest under complete disclosure. Formally the regulator's maximization program is given by

$$\max_{\lambda^H,\lambda^L} \rho(\theta_1+\Delta_1)(\lambda^H\phi+(1-\phi))X+(1-\rho)(\theta_2+\Delta_2)(\lambda^L\phi+(1-\phi))X-F$$

Subject to,

$$\lambda^L \leq \lambda^H + \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\phi-\beta_1)X}F \tag{5.5}$$

$$\lambda^L \leq \lambda^H - \frac{(\theta_1+\Delta_1)-(\theta_2+\Delta_2)}{(\theta_1+\Delta_1)\,(\theta_2+\Delta_2)\,(\beta_2-\phi)X}F \tag{5.6}$$

$$\lambda^H \geq \lambda_1^{\min S} = \frac{\Delta_1(1-\phi)X-F}{\Delta_1(\beta_1-\phi)X} \tag{5.7}$$

$$\lambda^L \leq \lambda_2^{\max S} = \frac{\Delta_2(1-\phi)X-F}{\Delta_2(\beta_2-\phi)X} \tag{5.8}$$

$$0 \leq \lambda^i \leq 1 \tag{5.9}$$

Examining the objective function it is clear that social welfare is increasing in λ^H and λ^L. From inspection it is clear that (5.6) is harder to satisfy than (5.5) so we can disregard (5.5) from the analysis. Also, since constraint (5.7) is negative it is trivially satisfied as long as constraint (5.9) is satisfied.

This leaves us with three constraints (5.9), (5.6) and (5.8). Examining (5.6) it is clear that this constraint implies that there has to be a minimum distance between the high and the low disclosure level. Therefore implementing a higher high disclosure level also implies a higher low disclosure level. Therefore a candidate solution to the problem is to set $\lambda^H = 1$ and then by rearranging (5.6) the lower disclosure is given by

$$\lambda^{AL} = 1 - \frac{((\theta_1+\Delta_1)-(\theta_2+\Delta_2))F}{(\theta_1+\Delta_1)(\theta_2+\Delta_2)(\beta_2-\phi)X}$$

In effect we have two conditions that have to be satisfied for the bad firm to invest, the non-mimicking constraint and the incentive compatibility constraint. Hence, the minimum of these two constraints $(\min(\lambda^{AL}, \lambda_2^{\max S}))$ is going to be the lower disclosure level of the menu. Comparing the two, it becomes clear that $\lambda_2^{\max S} \geq \lambda^{AL}$ as long as

$$\Delta_2 X \geq \frac{F}{(1-\beta_2)}\left[\frac{\Delta_2}{\theta_1+\Delta_1}+\frac{\theta_2}{\theta_2+\Delta_2}\right] \tag{5.10}$$

and clearly this violates equation (5.2). Intuitively, equation (5.2) assumes that the that entrepreneurs of type 2 never want to invest under complete disclosure irrespective

of investor expectations and therefore it is hardly surprising that entrepreneurs of type 2 do not want to mimic type 1 firms under complete disclosure. This means that $\lambda^{AL} \geq \lambda_2^{\max S}$ and the best possible separating equilibrium is given by $\lambda^* = \{1, \lambda_2^{\max S}\}$. Since we have now determined both the optimal pooling menu and the optimal separating menu we can now compare the welfare implied by the two alternatives.

5.3. Optimality. Just as in the case in which both types of firm faced a binding moral hazard problem we compare the social welfare of the best pooling to the social welfare of the best separating equilibrium. Therefore social welfare of providing a menu consisting only of $\lambda_{\max}^{2P}$ is given by

$$\rho(\theta_1 + \Delta_1)(\lambda_2^{\max P}\phi + (1-\phi))X + (1-\rho)(\theta_2 + \Delta_2)(\lambda_2^{\max P}\phi + (1-\phi))X - F \tag{5.11}$$

The welfare of a separating equilibrium is given by

$$\rho(\theta_1 + \Delta_1)(\phi + (1-\phi))X + (1-\rho)(\theta_2 + \Delta_2)(\lambda_2^{\max S}\phi + (1-\phi))X - F \tag{5.12}$$

Separation is beneficial from a welfare perspective in this situation if

$$\rho(\theta_1 + \Delta_1)(1 - \lambda_2^{\max P})\phi X + (1-\rho)(\theta_2 + \Delta_2)(\lambda_2^{\max S} - \lambda_2^{\max P})\phi X \geq 0$$

After some simplification this can be expressed as

$$\frac{\rho\phi}{\Delta_2(\beta_2 - \phi)}\left[F - \frac{\theta_1 + \Delta_1}{\Delta_2 + \theta_2}\Delta_2(1-\beta_2)X\right] \geq 0 \tag{5.13}$$

This condition is satisfied as long as

$$\Delta_2 X \leq \frac{(\theta_2 + \Delta_2)}{(1-\beta_2)(\theta_1 + \Delta_1)}F \tag{5.14}$$

Hence, the overall menu can be described as follows

$$m^* \begin{cases} \Delta_2 X \geq \frac{(\theta_2+\Delta_2)}{(1-\beta_2)(\theta_1+\Delta_1)}F & \Rightarrow \quad \lambda^* = \{\lambda_2^{\max P}\} \\ \Delta_2 X < \frac{(\theta_2+\Delta_2)}{(1-\beta_2)(\theta_1+\Delta_1)}F & \Rightarrow \quad \lambda^* = \{1, \lambda_2^{\max S}\} \end{cases}$$

As in the previous section the regulator may prefer to implement complete disclosure rather than allow a certain amount of costly expropriation. Since the good type implements complete disclosure it does not occur any expropriation and it is only the costly expropriation of the bad type that has to be considered. Appendix B considers under what circumstances the regulator wishes to discourage the bad firm from investing. Since (5.14) does not explicitly contain the expropriation cost it is sufficient to assume that the cost is small to ensure that curtailing investment is never optimal.

PROPOSITION 2. *When expropriation costs are relatively low, and only some firms are highly leveraged ($\beta_2 > \phi > \beta_1$) then multiple standards may be optimal.*

So in weak legal environments with diverse firms multiple standards may be beneficial, but in strong legal environments extraction is the primary concern. This indicates that emerging economies should select a mandatory standard, but allow firms to opt-out into a higher disclosure level. A necessary condition for achieving separation is that providing flexibility to the good type is not costly. If the type 1 firm is not aligned then inducing him to select the higher disclosure is very expensive and this would imply that a pooling equilibrium would always be beneficial (like in the previous section).

Condition (5.14) is crucial in determining whether a menu should be provided. Notice that the condition is less likely to hold the more diversity we have in terms of θ and Δ. The reason for this is that a positive effect of a pooling equilibrium is to pull up the disclosure level of type 2 firms. This effect is also illustrated by the pooling disclosure level being higher once we have aligned the interests of type 1 firms with outsiders. Diversity among liabilities (β) has the opposite effect on this condition. The greater β_2 is the more likely condition (5.14) is to hold. The intuition for this is that if the debt overhang of type 2 is particularly severe then the pooling standard is so low that the added agency cost that type 1 firms would bear are so large that a separating equilibrium is preferred.

COROLLARY 1. *Diversity in assets (θ) and investments (Δ) both favor a pooling standard while diversity in liabilities (β) favors a separating equilibrium.*

Whenever it is optimal to implement a separating equilibrium it is also imperative that the there is considerable distance between the two standards.

6. Conclusion

Even though recent evidence in corporate governance seems to argue that providing less choice to firms in terms of legal standards most economies provide firms with significant choice in terms of disclosure standards. This paper has analyzed under what circumstances providing a certain amount of choice to firms regarding their disclosure level is beneficial. If all types of firm have a significant debt overhang then they have incentives to expropriate existing outsiders. This incentive to expropriate coupled with the firms assets in place implies that providing any choice to the entrepreneur is very expensive. The reason being that the ability to expropriate the firms assets in place acts as a reservation utility for which the entrepreneur requires compensation for if it is reduced. So as long as all types of firm have a significant debt claim that leads to an incentive to expropriate then providing a menu consisting of a single standard is always optimal.

When some firms do not face a significant debt claim so they do not have incentives to expropriate then providing flexibility to them is not costly from a welfare perspective. In such a setting, given that there is sufficient heterogeneity in terms of the size of the debt claim a menu with multiple standards may be optimal.

Appendix A

We show in this section that $\lambda_2^{\max P} \geq \lambda_1^{\max P}$ when $\theta_1/\theta_2 \geq \Delta_1/\Delta_2$

$$\lambda_2^{\max P} = \frac{\Delta_2(1-\phi)X - \frac{(\Delta_2+\theta_2)}{E_P(\Delta+\theta)}F}{\Delta_2(\beta-\phi)X} \geq \frac{\Delta_1(1-\phi)X - \frac{(\Delta_1+\theta_1)}{E_P(\Delta+\theta)}F}{\Delta_1(\beta-\phi)X} = \lambda_1^{\max P}$$

Rearranging yields

$$\Delta_1\Delta_2(1-\phi)X - \Delta_1\frac{(\Delta_2+\theta_2)}{E_P(\Delta+\theta)}F \geq \Delta_2\Delta_1(1-\phi)X - \Delta_2\frac{(\Delta_1+\theta_1)}{E_P(\Delta+\theta)}F$$

Further rearrangement yields

$$\theta_1/\theta_2 \geq \Delta_1/\Delta_2$$

This is the desired result.

Appendix B

First, we consider under what circumstances having a single mandatory standard such that both firms invest dominates having a mandatory standard that implies that none of the firms invests. If the regulator decides to discourage both types of firm from investing then he provides a single mandatory standard since this minimizes the deadweight cost of expropriation.

The welfare from implementing complete disclosure is given by (just replacing $\lambda = 1$ into the social welfare function)

$$\rho\theta_1(\phi + (1-\phi))X + (1-\rho)\theta_2(\phi + (1-\phi))X \tag{B.1}$$

The welfare of implementing a partial mandatory standard to get both types to invest is given by (4.16). Comparing (B.1) and (4.16) implies that the regulator favours investment and a lower disclosure level if

$$\rho(\Delta_1 X - F) + (1-\rho)(\Delta_2 X - F) + [\rho\theta_1 + (1-\rho)\theta_2]\left(\frac{\Delta_1(1-\phi)X - \frac{(\theta_1+\Delta_1)}{E_P(\theta+\Delta)}F}{\Delta_1(\beta-\phi)}\right)\phi$$
$$-\rho\Delta_1 X\phi - (1-\rho)\Delta_2 X\phi \geq 0$$

The first two terms of the expression are the NPV of the respective projects. The second two terms are related to the additional expropriation cost that a lower disclosure level

entails. Clearly, if the NPV of the projects are sufficiently large then the regulator prefers to implement a partial standard.

Another possible equilibrium is that the regulator may discourage one firm from investing and induce the other firm to invest. As long as Assumption 2 holds

we have the following relationship between the different disclosure levels $\lambda_1^{\max S} > \lambda_2^{\max P} > \lambda_1^{\max P} > \lambda_2^{\max S}$. This means that the best equilibrium in which only one firm invests is providing firms with a menu consisting solely of $\lambda_1^{\max S}$. The social welfare of such a standard is given by

$$\text{(B.2)} \qquad \rho(\theta_1 + \Delta_1)(\lambda_1^{\max S}\phi + (1-\phi))X + (1-\rho)\theta_2(\lambda_1^{\max S}\phi + (1-\phi))X - \rho F$$

The expression illustrates that firms of type 2 do not invest if the disclosure level is set to $\lambda^1_{\max}$. So comparing the welfare of (B.2) to (4.16) implies that the pooling outcome in which both firms invests is preferred if

$$(1-\rho)\left[\frac{\Delta_2(\theta_1+\Delta_1) - [\rho(\theta_1+\Delta_1) + (1-\rho)\theta_2]\left((\theta_1+\Delta_1) - (\theta_2+\Delta_2)\right)}{E_P(\theta+\Delta)\Delta_1(\beta-\phi)}\right]\phi F$$
$$-(1-\rho)\,\Delta_2 X\frac{(1-\beta)}{(\beta-\phi)}\phi + (1-\rho)(\Delta_2 X - F) \geq 0$$

As in the previous case the first two terms that describe the added expropriation cost that a lower disclosure level implies is weighed against the added NPV of the investment (the third term). In general to exclude the possibility that the regulator wants to curtail investment it is sufficient to assume that the value of the investment (Δ_i) is large in relation to the expropriation cost (ϕ).

Appendix C

Implementing complete disclosure eliminates all expropriation cost at the cost of the bad firm not investing. The social welfare of forcing complete disclosure on all firms is given by,

$$\text{(C.3)} \qquad \rho(\theta_1 + \Delta_1)(\phi + (1-\phi))X + (1-\rho)\theta_2(\phi + (1-\phi))X - \rho F$$

The above expression illustrates that the bad firm does not invest. If both types of firm are encouraged to undertake the investment and $\Delta_2 X < C$ then the payoff to implementing a separating equilibrium is given by (5.12). So having both types invest is beneficial if (5.12) is greater than (C.3) if

$$(1-\rho)\left[\Delta_2(1-\phi)X - F + \frac{\phi}{\Delta_2(\beta_2-\phi)}\left[\Delta_2(\Delta_2(1-\phi)X - F) + \theta_2(\Delta_2(1-\beta_2) - F)\right]\right] \geq 0$$

Again the issue of curtailing investment is one of the expected expropriation cost. If the expropriation cost (ϕ) is low then curtailing investment is never optimal. The

above condition does not conflict with $\Delta_2 X < C$ since C does not contain ϕ, so for a sufficiently small ϕ a separating equilibrium in which both types invest is both feasible and optimal.

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PAPER 3

Does Investor Recognition Predict Excess Returns?

with Andriy Bodnaruk

ABSTRACT. We test Merton's (1987) hypothesis using individual level stockholdings of Swedish investors. Controlling for size and other factors, we find that lower levels of investor recognition lead to greater future excess returns. Positive (negative) changes in investor recognition are followed by lower (higher) excess returns. The effect of investor recognition is more pronounced for young firms. We demonstrate that investor recognition risk is conditionally priced.

1. Introduction

One of the biggest challenges in asset pricing is to explain the apparent divergence between the portfolios held by investors and the portfolios that theory predicts that investors should hold. For example, Solnik's (1974) seminal work shows that the gains from international diversification are significant, but yet investors hold predominantly assets from their home country[1]. Even though stock markets have become more integrated over the last three decades the benefits from investing internationally are still substantial.

A number of explanations have been put forward for this puzzle, some arguments rely on the effect of national boundaries, but these have decreased significantly in importance over time while the preference for domestic stocks has remained. Other explanations rely on informational differences between foreign and domestic investors. Coval and Moskowitz (2001) find that fund managers earn substantial abnormal returns when investing in local stocks[2]. These findings suggest that investors trade local

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[1] Grubel (1968) and DeSantis and Gerard (1997) document the benfits from diversifying internationally. A number of authors (see Huberman (2001) and Coval and Moskowitz (1999, 2001)) document that investors exhibit a strong preference for proximate domestic stocks implying that there is a domestic "home bias."

[2] Bodnaruk (2004), Ivkovich and Weisbenner (2004) and Massa and Simonov (2004) find that individual inestors also earn abnormal returns when trading in local stocks.

securities at an informational advantage and highlight the importance of asymmetric information even in domestic markets.

Merton (1987) theoretically examines the effect of relaxing the assumption of equal information across investors in the Sharpe-Lintner-Mossin Capital Asset Pricing Model (CAPM). In his model investors only have information about a subset of the available securities and optimize their portfolio holdings given the limited set of securities that they have information about. If capital markets are divided into information sets, then even if each set is mean variance efficient two equal securities from different sets may have different required returns. Even though the securities are identical, assets of companies with a larger shareholder base (denoted by Merton as investor recognition) would be valued at a higher price and yield lower stock returns[3].

In a similar paper Errunza and Losq (1985) examine the effect of investment barriers/ market segmentation on stock returns. The implications of market segmentation in their model are almost identical to the predictions Merton's (1987) model since the lack of information about a stock is in effect an investment barrier.

The economic mechanism behind Merton (1987) and Errunza and Losq (1985) is that the restriction on the investment opportunity set (be it lack of information or barriers to investment) leads to inadequate diversification of investors. The restriction on investment implies that they hold fewer assets, but allocate more of their wealth to each asset that they do invest into. Consequently, investors have a greater exposure to idiosyncratic risk[4] and they will require compensation for it. Firms with a fewer number of investors (investor recognition) provide less risk-sharing for their shareholders, but yield higher returns.

This paper tests Merton's (1987) investor recognition hypothesis using data on individual equity holdings of Swedish investors. We consider all stocks traded on the Stockholm Stock Exchange (SSE) between June 1995 and June 2001. We use ownership of a stock as a proxy for being informed about the stock. We then use data on almost all Swedish individual and institutional equity holdings to determine the degree of investor recognition of the stock. We demonstrate that there is a negative and significant relationship between investor recognition and stock returns: a one standard deviation difference in investor recognition is associated with 1.46 to 30.14% lower annualized excess return. The effect is more pronounced for young firms than for seasoned firms. The effect is statistically and economically significant even for seasoned firms.

[3] Merton's (1987) model assumes all investors in the economy have equal wealth. Relaxing this assumption it is possible to demonstrate that investor recognition of a particular company will be defined as the total wealth of shareholders of the company relative to the economy wealth.

[4] Goyal and Santa-Clara (2003) documents a relation between average stock variance and the return on the market implying that idiosyncratic risk matters.

We then analyze the relationship between the changes in the degree of investor recognition and subsequent stock returns. We find that a negative change in investor recognition leads to a significant increase in future returns: a decrease in investor recognition by one standard deviation of change in investor recognition leads to an increase in annualized stock returns by 5.43 to 22.99%. Positive changes in investor recognition affect returns more significantly than negative changes.

Finally, we utilize the methodology of Dumas and Solnik (1995) to test whether investor recognition risk is conditionally priced. Our results indicate that investor recognition represents components of the risk premium that are different from the fundamental ones.

A number of papers have tested Merton's (1987) hypothesis using even-study methodology. Amihud, Mendelson and Uno (1999) find that a reduction in the minimum trading unit of a stock facilitates liquidity, increases firm's investors base and is associated with a significant increase in the stock price. Kadlec and McConnell (1994) find that stocks that announce a listing on the New York Stock Exchange (NYSE) earn abnormal returns of 5 percent in response to the listing announcement and that is associated with an increase in the number of shareholders and a decrease in bid-ask spreads. Additionally, Foerster and Karolyi (1999) find that non-U.S. firms cross-listing on U.S. exchanges earn cumulative abnormal returns of 19 percent during the year before listing, but incur a loss of 14 percent during the year following listing. The listing decision is associated with an increase in the shareholder base (the number of shareholders). Foerster and Karolyi conclude that there is evidence in favour of the market segmentation and investor recognition hypothesis.

There are a number of advantages with our methodology compared to previous studies such as Kadlec and McConnell (1994) and Foerster and Karolyi (1999). First, they consider a listing decision which imply markets become less segmented which yields the same predictions as an increase in investor recognition so separating Errunza and Losq segmentation hypothesis from Merton's investor recognition hypothesis becomes problematic. Segmentation may still drive our results, but it is less likely when we are considering one exchange and a period in which institutional details are fairly constant. Chen, Noronha and Singal (2004) find that inclusion into the S&P 500 index leads to a permanent positive price increase. Since market segmentation is unaffected by inclusion (all stocks are still traded on the same exchange) their results favour Merton's hypothesis.

Second, previous work only considers the number of shareholders which is only an appropriate measure of investor recognition if all investors in the economy are equally

wealthy. We consider seven measures of investor recognition and since we have individual level data we are able to construct a wealth weighted measure of investor recognition.

Third, they only analyze corporate events which implies that they have a very limited sample size which does not allow them to do robustness tests.

There are several other possible explanations for our results. First, if fund managers face significant constraints concerning what investments they can undertake then markets are expected to be segmented. Most Swedish funds do have limitations concerning their investments especially those funds investing pension money. However, these constraints have been more or less fixed during our sample period while we do find the level of investor recognition changing indicating that it is not investment constraints driving changes in investor recognition. Additionally, when splitting our sample into institutional and private investors we find that changes in the level of investor recognition predict future returns for both institutional and private investors.

Second, if search costs are significant then perhaps it is too costly for investors to be informed about all stocks in which case the stocks in the investor's set would be determined by news coverage, word of mouth and advertising. Barber and Odean (2003) find that individual investors tend to be net purchasers on high attention days–days that those stocks experience high abnormal trading volume, days following extreme price moves and days in which the stocks are in the news. Additionally, they find that stocks bought on high attention days by individual investors subsequently underperform. So our proxy for investor recognition may be capturing the attention effect. Grullon, Kanatas and Weston (2004) show that firms with greater advertising expenditures have a larger number of both individual and institutional investors and better liquidity. So combining their results with ours implies that a higher a level of advertising leads to a higher breadth which in turn leads to a lower required return. Gervais, Kaniel and Mingelgrin (2001) argue that shocks in the trading activity of a stock affect its visibility, and in turn the subsequent demand and price for that stock leading to a high volume return premium. So perhaps a change in visibility leads to a change in investor recognition and a subsequent change in return.

Another related paper is Chen, Hong and Stein (2002) which develops a stock market model with differences of opinion and short sales-constraints. When breadth is low that means there is a large difference in opinion of investors and since short-sales constraints bind the stock will be overvalued. This is in contrast to Merton (1987) which hypothesizes that a decrease in breadth (all other things being equal) will decrease the level of investor recognition and therefore increase the required return on that stock. We also consider institutional breadth like Chen et. al (2002) and we

find that in our data set an increase in breadth leads to a decrease in future return. Even though the Stockholm Stock Exchange has less short selling constraints than US markets (see Nilsson (2004)) we would expect the opposite sign if Chen et. al (2002) are correct. Our findings are more in line with Diamond and Verrecchia (1987) that show that short-sale constraints will not lead to an upward pressure of stock prices, but rather only affect the speed of convergence to the equilibrium price.

1.1. Investor recognition tests. We analyze how investor recognition and changes in investor recognition affect stock returns. Standard financial theory predicts that all investor should hold the same well-diversified portfolio of risky assets, each firm should be valued at its intrinsic value, and each companies return should only depend on the current level of interest rate and the beta of the firm's assets. One underlying assumption of this framework is that all investors have equal information concerning the available investment opportunities.

Merton (1987) relaxes the assumption of equal information among investors and shows that the prediction that the firm should be valued at its intrinsic value does not hold any more. He demonstrates that if investors only know about a sub-set of the available securities and hence only invest in this sub-set, risky assets will be valued below their full-information equilibrium price. Stock returns will be negatively related to the number of investors that have information about the stock (i.e. investor recognition). This provides our first testable hypothesis:

H1: Future stock returns are negatively related to the degree of investor recognition of the company.

Since the framework of Merton (1987) describes a single-period model the sub-set of investors informed about a company remains fixed. In a multi-period setting a more realistic assumption would be that investors learn about firms over time and thereby become aware of the diversification opportunities that these firms present[5]. It is plausible that investor recognition grows gradually through channels like word of mouth and newsletters and it takes time for some companies to reach their equilibrium level of investor recognition.

H2: For seasoned companies the effect of investor recognition on excess returns is lower.

[5] Shapiro (2002) presents a model in which the number of informed investors may change.

We think that investor recognition is particularly important for young firms that have not established an analyst and investor following and so we expect the effect of investor recognition to be larger for young firms.

Several recent papers have documented a high volume return premium (Gervais, Kaniel and Mingelgrin (2001); Kaniel, Li and Starks (2003). They find that companies whose "visibility" becomes temporarily abnormally low experience abnormally high returns in subsequent periods. Their findings could perhaps be attributed to changes in investor recognition. In which case it would not be surprising if future stock returns are negatively related to investor recognition. In Merton's model an exogenous increase in investor recognition leads to a fall in required return of the firm and vice versa for a decrease.

H3: An increase/ decrease in investor recognition leads to a decrease/ increase in future returns.

In a multi-period version of Merton's (1987) model in which investor recognition changes over time, firms with high volatility in investor recognition will also experience high price volatility. Hence, investors will require a premium for holding stocks of firms with highly variable shareholder bases. So controlling for other risk factors we expect that investor recognition risk is priced in asset returns.

H4: Investor recognition is conditionally priced.

We now proceed to describe our dataset and the construction our measures of investor recognition.

2. The data and measures of investor recognition

2.1. Individual stockholdings. We use data on individual stockholdings collected by the Swedish Security Registry (Värdepapperscentralen (VPC)). The data includes direct stockholdings and holdings through brokerage accounts. We complement this information with the SIS Ägarservice AB database that contains information on ultimate owners of shares held via trusts and foreign holding companies.

These data sources give us information about 98% of the owners of publicly traded Swedish companies. We have information about 97.9% of the equity of the median company, and in the worst case we have information about 81.6% of the market capitalization. We also have information about the owners of most private companies. For each investor we can identify individual stockholdings and whether the investor is a private individual or an institution. The average (median) number of investors

per period in our sample is 488216 (460297). Of those 457016 (432809) are private investors and 31200 (27665) institutional investors

2.2. Firm-level information and other data. The SIX Trust Database contains stock prices and dividend payments which we use to calculate individual security returns and the overall market return (SIX Index). Additionally, we use the Market Manager Partners Database for various firm-level characteristics. These databases are the Swedish equivalents of CRSP and COMPUSTAT.

We exclude from our sample companies with instances of suspended trading, missing trading day close prices, or unavailable data on the number of shares outstanding. For companies with missing or negative book-to-market ratios we use corresponding industry averages. We also eliminate from our analysis companies with extreme values (top and bottom 1%) of our measures of investor recognition, which we describe in detail in the next section. Our final sample consists of 152(347) listed and 280(638) non-listed[6] companies at the beginning(end) of the period. On average we have 243 publicly traded firms and 387 privately held companies per period.

2.3. Measures of investor recognition. Merton (1987) defines the shareholder base or the degree of investor recognition of the company as the proportion of shareholders in the economy that know about the firm. Using ownership as a proxy for having information about the stock investor recognition can be defined as

$$IR_i = \frac{\sum_{j=1}^{N} I_i^j}{N} \tag{2.1}$$

where I_i^j is an indicator function which takes value of 1 if investor j invests in company i and 0 otherwise. If we relax Merton's assumption of equal wealth then (2.1) to derive the wealth weighted investor recognition ($WWIR$):

$$WWIR_i = \frac{\sum_{j=1}^{N} W^j I_i^j}{\sum_{j=1}^{N} W^j} \tag{2.2}$$

where W^j denotes wealth of individual j. This leads to our measures of investor recognition.

$M1$: The logarithm of the number of shareholders.

[6] Although we do not analyze the relationship between the returns on private equity and investor recognition we use information about private firms to calculate estimates of investor wealth.

$M2$: The logarithm of the number of institutional investors.

These two measures are related to investor recognition and are used frequently in the literature[7]. We separate institutional investors to see if institutional investors are driving our results. Additionally, separation allows us to compare our results with Chen et. al (2002). We suspect that institutional investors are more reliable in reporting changes in ownership so considering them separately reduces measurement error.

$M3$: IR (equation (2.1)). The number of shareholders that own the stock divided by the total number of shareholders in the market.
$M4$: We consider the IR of institutional investors. This measure is identical to $M3$ except that we only consider institutional investors.
$M5$:$WWIR$ wealth weighted investor recognition given by (equation (2.2)).

Since we have information concerning individual shareholdings we can determine the value of individual equity portfolios. This in turn allows us to determine the total wealth of all investors informed of the stock. Dividing this with the total equity wealth (both public and private firms) gives us the *WWIR*. However, we do not possess information about cash, non-financial (real estate, durables, etc.) and non-equity holdings of market participants. The value of public equity is evaluated at the market close on the first trading day at the beginning of each period.

Merton (1987) proceeds to determine the cost of not all investors in the economy being informed in the economy. When investors invest only in the stocks known to them factors other than market risk are also priced in the equilibrium. Specifically, the expected returns will bear a premium for the cost of incomplete information

$$E(R_i) = E(R_i^*) + \lambda_i \frac{E(R_i^*)}{R_0}$$

where for the company i, R_i^* is the return on an asset in case its shareholder base coincides with the universe of investors, R_0 is the return on zero-beta asset, and λ_i is the shadow cost of incomplete information which can be expressed as

$$\lambda_i = \delta \sigma_i^2 x_i \frac{1 - q_i}{q_i} \tag{2.3}$$

where δ is the coefficient of aggregate risk aversion, σ_i^2 is the stock's idiosyncratic variance, x_i is the relative market value of the firm, and q_i is the shareholder base

[7] Foerster and Karolyi (1999) and Kadlec and McConnel (1994) use the inverse of the number of shareholders as a measure of investor recognition.

of the company. Since q is defined as shareholder base it has to belong to the unit interval.

This allows us to estimate the shadow cost of incomplete information dissemination explicitly.

$M6$: We estimate the negative of shadow cost of incomplete information equation (2.3) using $M3$ as the shareholder base (q).

$M7$: We estimate the negative of shadow cost of incomplete information using $M4$ as the shareholder base.

Intuitively, the shadow cost of information decreases with investor recognition so in order to facilitate interpretation of the results we multiply the shadow cost of incomplete information by minus one to get the same prediction for $M6$ and $M7$ as for our other measures for all our hypothesis.

3. Empirical Findings

3.1. Descriptive Statistics. In Table 1 we report the main statistics for our sample companies. We report mean, median, standard deviation, and interquartile range of the main variables.

We describe our measures of investor recognition in Panel A. Interpreting $M3$ and $M4$ illustrates that 0.7% of all investors and 1.5% of all institutional investors invest in the average firm. This supports the stylized fact that institutionals invest into more securities on average (this holds throughout our dataset). The maximum fraction of investors that hold a firm is 31.7%, almost a third of all investors in our dataset have a position in Ericsson. Not surprisingly this was at the height of the Telecom boom in 2000.

Descriptive statistics for changes in investor recognition are presented in Panel B. It is clear that the mean change in investor recognition is positive and small, but there is significant variability in investor recognition over time. We report the descriptive statistics of the main financial and accounting variables of the companies in our sample in Panel C.

In Table 3 we report correlations between the levels and changes in IR and key financial variables. It should be noted that IR has a low correlation with all variables except market capitalization. In general, larger companies have a larger shareholder base than smaller companies. To make sure that we are not measuring the effect of size we orthogonalize IR against size and use the residuals for all of our estimations.

Additionally, levels of IR are not correlated to changes in IR which ensures that we are not examining the same hypothesis when considering changes in investor recognition.

Examining excess returns in table 1, Panel C illustrates that our sample period is very volatile. The SIX stock market index which is comprised of firms in our sample starts at 95 in July 1995, reaches a high of 443 in March 2000 and ends at 273 in June 2001. The average variance of stock returns during this period is approximately 70.1% annualized, which is almost twice as under usual market conditions.

First we establish descriptive evidence of the relationship between investor recognition and future excess returns. For each six month period, we divide all firms into 4 groups by market capitalization and then within each group we form 4 portfolios on the basis of investor recognition. Quartile breakpoints are re-evaluated every period. Average excess returns are calculated for each portfolio and aggregated over different time periods. The average and median excess returns for each portfolio are reported in Table 4. Additionally, we report test statistics of the difference between mean and median excess returns for extreme quartiles. For all of our measures, a low level of investor recognition is related to higher future excess returns. This is true for all size quartiles and is statistically and economically meaningful. The difference in average excess return between extreme quartiles of investor recognition ranges from 10.20% to 30.05% semi-annually across different size quartiles. The mean and median test statistics for a difference between the highest and lowest quartiles are significant for a vast majority of measures and size groups considered. Since median tests are statistically significant across size quartiles we can be certain that our results are not driven by outliers.

3.2. Levels of Investor Recognition and Excess Returns. We analyze the relationship between current levels of investor recognition and future excess returns. More specifically we estimate

$$R_{i,t+1} = \alpha + \beta IR_{it} + \gamma D_{it} \ (1) \tag{3.1}$$

where i is the company index and t is the time index. The next period $(t+1)$ excess return is denoted by R_{it+1} and IR_{it} is one of our measures of investor recognition at time t, D_{it} is a vector of controls[8]. We control for size, book to market, momentum and firm idiosyncratic risk by including logarithm of market capitalization, logarithm

[8] All our measures of investor recognition are orthogonalized against size.

of book to market ratio, previous period return and residual variance[9]. The residual variance is firm volatility not associated with market movements.

From *Hypothesis 1* we expect β to be negative. The results are presented in Panel A of Table 5. The degree of investor recognition is strongly and negatively related to next period returns. The results are economically meaningful. An increase in investor recognition by one standard deviation leads to a decrease in future excess returns by -7.12% for $M1$, -14.08% for $M2$, -3% for $M3$, -5.76% for $M4$, -10.76% for $M5$, 0.03% for $M6$ and 0.42% for $M7$.

One implication of these results is that firms that are concerned about their cost of capital should try to increase their investor base. Since Grullon et al. (2004) show that advertising spending leads to a wider shareholder base we would expect firms to increase spending on advertising and analyst coverage prior to raising new capital.

Increasing advertising expenditure and analyst coverage are both demand side measures for increasing the shareholder base. Increasing the free float or performing a stock split are supply side mechanisms that increase investor recognition. In fact, Mukherji, Kim and Walker (1997) show that the shareholder base increases following a stock split.

A characteristic of our result is that investor recognition affects firms of all sizes. Examining the descriptive evidence presented in Table 4 it can be observed that the effect of investor recognition on excess returns is persistent across size.

3.3. Seasoned Firms versus Young Firms. Since our sample period is volatile and we observe significant entry during the bull market surrounding the IT boom we split our sample of companies into seasoned and young companies. We define a company as seasoned if it is present in our sample at the start date. All firms that enter during our sample period we define as young. Since there were few IPOs in 1992 to 1995 we know that the majority of our seasoned companies have at least 3 years of data, which is required for estimating measures $M6$ and $M7$.

It is also reasonable to expect new firms to grow in terms of investor recognition until they reach their equilibrium level of recognition. Thus, new firms should have less investor recognition and be more responsive to changes in investor recognition.

From the descriptive statistics in Table 2 one can observe that seasoned firms have on average 1.90 times more common shareholders, 2.06 times more institutional investors, are 3.54 times larger in terms of market capitalization and they have a book to market ratio that is 1.29 times greater.

[9] We used the same regression specification as in (3.1), but included industry fixed effects. The results are qualitatively the same and are omitted for brevity.

Splitting the sample and estimating (3.1) separately for seasoned and young firms we find that investor recognition affects both types of firm in a statistically and economically significant way. At the same time we find support for *Hypothesis 2* that seasoned firms are less sensitive to investor recognition. Even though the effect of investor recognition is less for seasoned firms it is still highly significant even after controlling for a number of variables. Additionally, as hypothesized the effect of investor recognition is significantly more pronounced for young firms. The results are reported in Table 6.

3.4. Changes Investor Recognition and Excess Returns. We estimate the effect of a change of investor recognition on future excess returns. Specifically we estimate the following regression

$$R_{it+1} = \alpha + \beta \Delta IR_{i(t-1)} + \gamma D_{it}(2) \tag{3.2}$$

where for the company i at time t, R_{it+1} is excess return between periods t and $t+1$, $\Delta IR_{i(t-1)}$ is the change in investor recognition between $t-1$ and t, D_{it} is a vector of controls which in some specification includes IR_{it}. Hypothesis 3 states that an increase in investor recognition should lead to negative excess return and a decrease in investor recognition should lead to positive excess returns. As in the previous section we control for a number of factors. The results are reported in Panel A of Table 7.

The results support our hypothesis of a negative relationship between changes in investor recognition and future excess returns. Test statistics for β are significant across all specifications.

Changes in investor recognition are also economically significant: a decrease in the level of investor recognition by one standard deviation of change in IR leads to an increase in the next period excess returns by 5.49 for M1, 6.87 for M2, 2.73 for M3, 3.59 for M4, 2.68 for M5, 9.42 for M6 and 10.90 for M7. The results are robust to controlling for levels of investor recognition. Both levels and changes of investor recognition remain statistically and economically significant when both are included.

Chen, Hong and Stein (2002) demonstrate that a reduction in breadth as measured by the number of institutional shareholders should forecast a decrease in future returns. They attribute their results to short-selling constraints. Our results demonstrate that a reduction in the number of institutional shareholders is associated with higher future returns, supporting the findings of Amihud et. al (1999). Anecdotal evidence suggest that short-selling constraints are not as binding in Sweden which might explain the apparent contradiction.

We also investigate whether changes in IR of different sign have different effect on expected excess returns. Including a dummy for a positive change in our specification we find that it is negative and significant (these results are presented in Table 8). So increases in investor recognition have a larger impact on future excess returns than decreases do.

3.5. Is Investor Recognition Priced? In estimating the conditional asset pricing model we rely in the methodology outlined in Dumas and Solnik (1995). We assume that there are M portfolios of stocks with $j = 1, ..., M$. There are N factors (F_n) with $n = 1, ..., N$. The factors contain the standard ones and our measures of investor recognition. The conditional expected returns in an asset pricing model are given by:

$$E[R_{jt}|\Omega_{t-1}] = \sum_{i=1}^{N} \lambda_{n,t-1} cov[R_{j,t}, F_{n,t}|\Omega_{t-1}] \tag{3.3}$$

where $R_{j,t}$ is the excess return on the jth portfolio. The price of risk of the nth factor is given by $\lambda_{n,t-1}$ and Ω_{t-1} represents the information set available to investors. Define m_t as the intertemporal marginal rate of substitution between returns. The first order-conditions of the portfolio choice problem is given by

$$\begin{aligned} E[m_t(1 + R_{f,t-1})|\Omega_{t-1}] &= 1 \\ E[m_t R_{j,t}|\Omega_{t-1}] &= 0 \end{aligned} \tag{3.4}$$

where $R_{f,t}$ is the risk free rate. Dumas and Solnik (1995) show that

$$m_t = [1 - \lambda_{o,t-1} - \sum_{i=1}^{N} \lambda_{n,t-1} F_{n,t}]/(1 + R_{f,t-1}) \tag{3.5}$$

where the time-varying term $\lambda_{o,t-1}$ ensures that (3.4) is satisfied.

We assume that Ω_{t-1} is generated by a vector of instrumental variables $\mathbf{Z}_{t-1}$. To get relevant instruments for the Swedish setting we consider the variables used by Robertsson (2000). They include, *(bond yield)* the yield to maturity on a 5-year government benchmark bond minus its previous 13-week moving average, the difference between the yield to maturity of a 5-year government bond and 3-month Treasury bills (*maturity spread*), the monthly percentage change in the exchange rate against a trade-weighted currency index (*exchange rate*), the monthly change in the rate on 3-month Treasury bills *(bill rate)* and the reciprocal of stock market wealth times its 13-week moving average (*inverse relative wealth*).

We additionally assume that there is a linear relationship between the state prices (λ) and the variables $\mathbf{Z}$. So $\lambda_{o,t-1} = -\mathbf{Z}_{t-1}\boldsymbol{\delta}$ and $\lambda_{n,t-1} = -\mathbf{Z}_{t-1}\boldsymbol{\phi}_n$ where δ and ϕ are

time-invariant vectors of weights. The innovation in the marginal rate of substitution is defined as

$$u_t = 1 - m_t(1 + R_{f,t-1}) \tag{3.6}$$

Then given (3.5) u_t becomes

$$u_t = -\mathbf{Z}_{t-1}\boldsymbol{\delta} + \sum_{i=1}^{N} \mathbf{Z}_{t-1}\phi_n F_{n,t} \tag{3.7}$$

Define $h_{j,t} = R_{j,t} - R_{j,t}u_t$. The first-order conditions (3.4) imply the following orthogonality conditions

$$\begin{aligned} E[u_t|\Omega_{t-1}] &= 0 \\ E[\mathbf{h}_t|\Omega_{t-1}] &= 0 \end{aligned} \tag{3.8}$$

where $\mathbf{h}_t$ is the vector that contains the $h_{j,t}$ stacked for all considered portfolios. Combining the orthogonality conditions with the vector of residuals $\varepsilon_t = (u_t, \mathbf{h}_t)$ we obtain

$$E[\varepsilon_t|\mathbf{Z}_{t-1}] = 0 \tag{3.9}$$

which implies the restriction $E[\varepsilon_t'\mathbf{Z}_{t-1}] = 0$ and the sample version

$$\mathbf{Z}'\varepsilon = 0 \tag{3.10}$$

Here $\mathbf{Z}$ is a $T \times Q$ matrix, where Q are the number of instruments used and T is the number of time periods. The estimate of ε is a $T \times (1 + M)$ matrix where M is the number of portfolios used . We sort firms on size, book-to-market and industry. We consider 16 size and book to market portfolios and 11 industry portfolios (we exclude agriculture). The moment conditions in (3.10) represents our testable restrictions. The λs have been replaced by combinations of instruments such that $\lambda_{o,t-1} = -\mathbf{Z}_{t-1}\boldsymbol{\delta}$ and $\lambda_{n,t-1} = \mathbf{Z}_{t-1}\phi_n$. So we estimate the moment conditions in (3.10) using GMM and by minimizing the average deviation from these conditions we find the best estimates of δ and ϕ.

We test whether investor recognition is priced by testing for overidentifying restrictions of the system (3.8). Under the null hypothesis that (3.8) holds then the quadratic form of (3.10) is χ^2 distributed with degrees of freedom equal to the number of orthogonality conditions minus the number of parameters.

We construct the investor recognition factor in the following way: each period we split all companies into two groups by investor recognition (high and low) and calculate the value-weighted returns on the portfolios for the next six months. The investor recognition factor (IRF) is defined as the difference between low and high investor recognition groups. The basic factors are the Fama French factors (Market, HML and SMB) which we orthogonalize our measures of investor recognition against.

We assess the incremental explanatory power of investor recognition by comparing the explanatory power of the unrestricted model (including investor recognition) to the explanatory power of the restricted model (excluding investor recognition). This corresponds to testing

$$H_0 : \phi_{IRF} = 0 \text{ and } H_A : \phi_{IRF} \neq 0 \tag{3.11}$$

We calculate the χ^2 of the unrestricted model and then we drop investor recognition (impose $\phi_{IRF} = 0$) and we re-estimate the model with the same weighting matrix W. If the χ^2 in the restricted model is significantly higher than the χ^2 in the unrestricted one, the null of no pricing of investor recognition can be rejected.

The tests for the above hypothesis is reported in Table 9. For four out of seven measures of investor recognition we can reject the null and conclude that investor recognition is priced. These results are encouraging given that we only have 72 data points.

4. Conclusion

We have used individual level data to test Merton's (1987) investor recognition hypothesis. We construct several measures of investor recognition and find that firms that have a low levels of investor recognition offer positive and significant future excess returns. The effect of investor recognition is more pronounced for young firms and less pronounced for seasoned firms. We also find that an increase in investor recognition leads to a decline in future returns and vice versa for a decrease. The effect of an increase has a larger impact on returns than an equal decrease in investor recognition. The majority of our measures of investor recognition are conditionally priced implying that investors require compensation for exposure to investor recognition.

5. Tables

Table 1

Descriptive statistics of measures of investors recognition and company attributes for the whole dataset

Average (median) number of investors in a period in our sample is 488216 (460297); of those 457016 (432809) are individual investors and 31200 (27665) are institutional investors.

Panel A reports the descriptive statistics for number of investors per company (overall and institutional) and our measures of investor recognition. The measures of investor recognition are defined as follows: M_1 is the logarithm of the number of common shareholders that hold more than 500 shares, M_2 is logarithm of the number of institutional shareholders in the company, M_3 is the ratio of the number of common shareholders of the company to the total number of investors in the market, M_4 is the ratio of the number of institutional shareholders of the company to the total number of institutional investors in the market, M_5 is the equity wealth weighted ratio of the number of common shareholders in the company to the total number of investors in the market, M_6 is the shadow cost of incomplete information about the company in the market $\lambda_i = \delta\sigma_i^2\omega_i(1-q_i)/q_i$ where δ is the aggregate coefficient of risk aversion, σ_i^2 is the idiosyncratic variance of company returns, ω_i is the market weight of the company and q_i is company investor recognition defined here as our measure M_3, M_7 is the shadow cost of incomplete dissemination of information, but with M_4 used as a proxy for q_i.

Panel B reports the descriptive statistics for the changes in measures of investor recognition. The measures of investor recognition are defined as in *Panel A*. The change in investor recognition is calculated as the difference between the current level of investor recognition and the level of investor recognition in the preceding six month period.

Panel C displays the descriptive statistics for company excess returns and control variables used in our regressions. The variables are defined as follows: *ER6* – the return on the company in excess of the return on the 30-day Swedish treasury bond, *Log(size)* – logarithm of company market capitalization, *Log(BE/ME)* – logarithm of book-to-market ratio of the company, *ResVar* – residual variance defined as the variance of the company returns not explained by market volatility, *Lag(ER6)* – lagged excess returns of the company.

Panel A: Measures of investor recognition

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
N (all investors)	3249.73	1115.00	8868.72	1986.00	200.00	218177.00
N (institutional investors)	463.71	193.00	959.41	308.00	20.00	26942.00
M1	7.232	7.109	1.160	1.581	5.298	12.293
M2	5.503	5.328	1.046	1.377	3.219	10.201
M3	0.007	0.002	0.017	0.004	0.000	0.317
M4	0.015	0.006	0.028	0.011	0.001	0.469
M5	0.461	0.456	0.090	0.102	0.003	0.831
M6	-0.025	-0.010	0.052	0.022	-0.715	-6.68E-06
M7	-0.007	-0.004	0.013	0.007	-0.141	-3.94E-06

Panel B: Changes in measures of investor recognition

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
ΔM1	0.072	0.009	0.343	0.200	-2.884	2.830
ΔM2	0.071	0.029	0.284	0.248	-2.620	2.193
ΔM3	0.000	-4.329E-05	0.005	0.001	-0.070	0.132
ΔM4	0.000	-2.470E-04	0.007	0.002	-0.079	0.145
ΔM5	0.004	2.393E-03	0.067	0.057	-0.526	0.519
ΔM6	0.003	2.664E-04	0.036	0.006	-0.342	0.554
ΔM7	0.001	7.404E-05	0.009	0.002	-0.131	0.113

Panel C: Excess returns and control variables

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
ER6	-0.0363	0.0026	0.4297	0.3905	-4.4420	2.4327
Market capitalization10^6*	8047.9	727.0	44320.1	3023.5	0.5	1373444.0
BE/ME	0.617	0.491	0.573	0.535	0.022	11.432
Log(size)	20.706	20.524	2.025	2.698	12.041	27.948
Log(BE/ME)	-0.767	-0.692	0.820	1.054	-4.061	5.129
Residual Variance	0.014	0.010	0.014	0.007	0.000	0.253
Lag(ER6)	-0.023	0.002	0.451	0.393	-6.22	2.433

Table 2

Descriptive statistics of measures of investors recognition and company attributes for seasoned and young companies

In this table we report investor recognition and key variables for of seasoned and young firms. *Seasoned companies* are defined as companies which are traded at the beginning of our sample period (June 30th, 1995). *Young companies* are defined as companies that enter our dataset at some point after June 30th 1995. Measures of investor recognition and key variables as defined in *Table 1*.

Panel A: Seasoned companies

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
N (all investors)	4168.05	1551.00	10680.35	2969.50	200.00	218177.00
N (institutional investors)	610.89	255.50	1202.67	518.50	29.00	26942.00
M1	7.449	7.380	1.205	1.703	5.298	12.293
M2	5.714	5.580	1.118	1.637	3.367	10.201
M3	0.009	0.003	0.020	0.006	0.000	0.317
M4	0.020	0.009	0.033	0.018	0.001	0.469
M5	0.463	0.452	0.099	0.130	0.015	0.831
Market capitalization$*10^6$*	12185.53	1327.47	59460.75	5442.34	9.97	1373443.98
BE/ME	0.691	0.598	0.474	0.528	0.036	5.576
Log(size)	21.304	21.071	1.878	2.665	16.115	27.948
Log(BE/ME)	-0.610	-0.526	0.708	0.883	-3.327	1.565

Panel B: Young companies

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
N (all investors)	2191.97	818.00	5973.76	1248.00	201.00	71795.00
N (institutional investors)	296.16	155.00	518.64	182.00	20	6275.00
M1	6.952	6.821	1.034	1.309	5.303	11.097
M2	5.230	5.100	0.873	1.078	3.219	8.744
M3	0.004	0.002	0.011	0.002	0.000	0.120
M4	0.009	0.005	0.016	0.005	0.001	0.167
M5	0.458	0.460	0.075	0.069	0.003	0.708
Market capitalization$*10^6$*	3444.45	382.30	13308.07	1358.06	0.53	183761.80
BE/ME	0.534	0.370	0.656	0.437	0.022	11.432
Log(size)	19.937	19.847	1.947	2.565	12.041	25.830
Log(BE/ME)	-0.969	-0.938	0.906	1.116	-4.061	5.129

Tests for the difference between the samples of seasoned and young companies

	M1	M2	M3	M4	M5	Log(size)	Log(BE/ME)
F-test	112.197	132.134	40.024	100.910	1.551	299.739	117.109
p-value	0.001	0.001	0.001	0.001	0.213	0.001	0.001
Wilcoxon z	10.626	10.697	13.208	14.565	1.543	16.014	11.208
p-value	0.001	0.001	0.001	0.001	0.061	0.001	0.001

Table 3

Correlations between variables

We report correlations between our measures of investor recognition and changes in our measures of investor recognition, excess returns of the company, and our controls variables. All variables are defined as in *Table 1*.

Panel A. Measures of investor recognition, excess returns, and control variables

	ER6	M1	M2	M3	M4	M5	M6	M7	log(size)	Log(BE/ME)	Res. Var	Lag(ER6)
ER6	1.00	-0.02	-0.01	0.03	0.04	-0.05	-0.15	-0.18	0.27	-0.24	-0.14	0.13
M1		1.00	0.91	0.67	0.72	0.57	0.02	-0.10	0.58	0.01	0.08	-0.03
M2			1.00	0.61	0.76	0.67	-0.11	-0.17	0.74	-0.02	-0.02	-0.02
M3				1.00	0.91	0.45	-0.03	-0.17	0.45	-0.03	0.00	0.03
M4					1.00	0.60	-0.09	-0.21	0.61	-0.05	-0.09	0.04
M5						1.00	-0.15	-0.19	0.61	-0.09	-0.10	0.07
M6							1.00	0.91	-0.42	0.25	-0.01	-0.20
M7								1.00	-0.49	0.26	-0.07	-0.23
Log(size)									1.00	-0.20	-0.26	0.31
Log(BE/ME)										1.00	0.00	-0.24
Res. Var											1.00	-0.14
Lag(ER6)												1.00

Panel B. Changes in measures of investor recognition, excess returns, and control variables

	ER6(a)	ER6(g)	ΔM1	ΔM2	ΔM3	ΔM4	ΔM5	ΔM6	ΔM7	Log(MC)	Log(BE/ME)	Res. Var	Lag(ER6)
ΔM1	-0.09	-0.15	1.00	0.85	0.46	0.48	0.24	-0.43	-0.38	-0.04	-0.15	0.09	-0.03
ΔM2	-0.13	-0.21	0.85	1.00	0.35	0.49	0.19	-0.35	-0.38	-0.02	-0.16	0.13	-0.12
ΔM3	-0.04	-0.05	0.46	0.35	1.00	0.81	0.13	-0.19	-0.24	0.05	-0.05	0.04	-0.01
ΔM4	-0.03	-0.06	0.48	0.49	0.81	1.00	0.17	-0.25	-0.32	0.07	-0.10	0.01	-0.01
ΔM5	-0.01	-0.02	0.24	0.19	0.13	0.17	1.00	-0.08	-0.10	0.08	-0.08	-0.10	0.18
ΔM6	0.17	0.15	-0.43	-0.35	-0.19	-0.25	-0.08	1.00	0.86	-0.02	-0.07	0.01	0.03
ΔM7	0.19	0.18	-0.38	-0.38	-0.24	-0.32	-0.10	0.86	1.00	-0.01	-0.09	0.03	0.04

Panel C. Levels and changes in measures of investor recognition

	M1	M2	M3	M4	M5	M6	M7
ΔM1	**0.13**	0.10	0.06	0.05	0.09	-0.09	-0.10
ΔM2	0.15	**0.16**	0.07	0.07	0.10	-0.04	-0.06
ΔM3	0.12	0.10	**0.34**	0.28	0.11	-0.01	0.01
ΔM4	0.11	0.11	0.33	**0.33**	0.10	0.00	0.01
ΔM5	0.04	0.04	0.04	0.05	**0.37**	-0.01	-0.03
ΔM6	-0.08	-0.08	-0.05	-0.06	0.01	**0.19**	0.18
ΔM7	-0.09	-0.09	-0.09	-0.10	0.03	0.17	**0.23**

Table 4

Descriptive evidence of relationship between investor recognition and excess returns: size and investors recognition sorting

We report descriptive evidence of the relationship between investor recognition and excess returns. At the beginning of each period companies are sorted into 16 portfolios based on their market capitalization and one of our measures of investor recognition. Quartile breakpoints are re-evaluated every period. Arithmetic average and median excess return for each portfolio are calculated. F-statistics for mean test and z-score for Wilcoxon two-sided median test between extreme quartiles with corresponding significance probabilities are reported on the bottom of each column. All variables are defined as in *Table 1*.

			size			
			1	2	3	4
M1	mean	1	-0.1364	-0.0270	0.0720	0.1483
	median		-0.0340	-0.0055	0.0326	0.0811
	mean	2	-0.1923	0.0252	0.0546	0.0634
	median		-0.0610	0.0270	0.0328	0.0720
	mean	3	-0.2686	-0.0674	-0.0105	0.0043
	median		-0.1700	-0.0202	0.0111	0.0266
	mean	4	-0.2384	-0.1677	-0.0668	0.0265
	median		-0.1206	-0.1190	-0.0008	0.0532
		t-test	1.64	3.17	2.96	3.57
			0.10	0.00	0.00	0.00
		Wilcoxon	2.1147	3.963	2.4096	2.4085
			0.02	0.00	0.01	0.01

			size			
			1	2	3	4
M2	mean	1	-0.1067	0.0262	0.0633	0.1643
	median		-0.0166	0.0269	0.0269	0.0903
	mean	2	-0.2216	-0.0142	0.0837	0.0694
	median		-0.0853	0.0024	0.0460	0.0816
	mean	3	-0.2042	-0.0373	0.0173	-0.0126
	median		-0.1217	-0.0052	0.0466	0.0188
	mean	4	-0.2963	-0.2082	-0.1140	0.0215
	median		-0.1437	-0.1342	-0.0371	0.0492
		t-test	2.80	5.19	3.96	4.10
			0.01	0.00	0.00	0.00
		Wilcoxon	3.9138	5.6227	3.3732	3.1032
			0.00	0.00	0.00	0.00

M3

		size 1	2	3	4
mean	1	-0.1364	-0.0270	0.0720	0.1483
median		-0.0340	-0.0055	0.0326	0.0811
mean	2	-0.1923	0.0252	0.0546	0.0634
median		-0.0610	0.0270	0.0328	0.0720
mean	3	-0.2686	-0.0674	-0.0105	0.0043
median		-0.1700	-0.0202	0.0111	0.0266
mean	4	-0.2384	-0.1677	-0.0668	0.0265
median		-0.1206	-0.1190	-0.0008	0.0532
	t-test	1.64	3.17	2.96	3.57
		0.10	0.00	0.00	0.00
	Wilcoxon	2.1147	3.963	2.4096	2.4085
		0.02	0.00	0.01	0.01

M4

		size 1	2	3	4
mean	1	-0.1067	0.0262	0.0633	0.1643
median		-0.0166	0.0269	0.0269	0.0903
mean	2	-0.2216	-0.0142	0.0837	0.0694
median		-0.0853	0.0024	0.0460	0.0816
mean	3	-0.2042	-0.0373	0.0173	-0.0126
median		-0.1217	-0.0052	0.0466	0.0188
mean	4	-0.2963	-0.2082	-0.1140	0.0215
median		-0.1437	-0.1342	-0.0371	0.0492
	t-test	2.80	5.19	3.96	4.10
		0.01	0.00	0.00	0.00
	Wilcoxon	3.9138	5.6227	3.3732	3.1032
		0.00	0.00	0.00	0.00

M5

		size 1	2	3	4
mean	1	-0.0983	0.0337	0.1528	0.1888
median		-0.0232	0.0071	0.0651	0.1182
mean	2	-0.2065	0.0201	0.0245	0.0111
median		-0.1016	0.0130	0.0148	0.0418
mean	3	-0.2489	-0.0956	-0.0176	0.0259
median		-0.1219	-0.0360	0.0238	0.0384
mean	4	-0.2810	-0.1935	-0.1078	0.0186
median		-0.1209	-0.0779	-0.0150	0.0319
	t-test	3.02	4.79	5.67	4.52
		0.00	0.00	0.00	0.00
	Wilcoxon	3.5627	4.3946	4.4637	3.8597
		0.00	0.00	0.00	0.00

M6

		size 1	2	3	4
mean	1	-0.0904	-0.0093	0.0926	0.1538
median		-0.0167	0.0205	0.0353	0.1326
mean	2	-0.1392	-0.0428	0.0179	0.0474
median		-0.081	-0.0311	0.0054	0.0542
mean	3	-0.196	-0.0631	-0.0165	0.0535
median		-0.1341	-0.0064	0.0171	0.0465
mean	4	-0.3626	-0.125	-0.0496	-0.0173
median		-0.1751	-0.0673	-0.0001	0.0268
	t-test	4.19	2.54	3.05	4.66
		0.00	0.01	0.00	0.00
	Wilcoxon	3.9701	3.0899	2.381	3.9571
		0.00	0.00	0.01	0.00

M7

		size 1	2	3	4
mean	1	-0.0798	-0.0119	0.0645	0.146
median		-0.0285	0.0003	0.02	0.0811
mean	2	-0.0949	-0.039	0.0864	0.0821
median		-0.0506	0.0014	0.1094	0.0983
mean	3	-0.227	-0.0377	-0.0068	0.0305
median		-0.1502	-0.0265	0.0008	0.0364
mean	4	-0.3803	-0.1522	-0.0995	-0.0204
median		-0.17	-0.0721	-0.0333	0.0268
	t-test	4.62	2.99	3.49	4.56
		0.00	0.00	0.00	0.00
	Wilcoxon	3.9428	3.2058	2.86	3.4367
		0.00	0.00	0.00	0.00

Table 5

Levels of investor recognition and excess returns

This table presents the results of the regression of our measures of investor recognition on semiannual excess returns of the company. The dependent variable is excess return defined as the difference between the return on the company and the return on the 30 day Swedish treasury over six months period. Number of observations is 2375. Measures of investor recognition and control variables are as defined in *Table 1*

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
intercept	-0.821	(-6.84)	-0.927	(-7.77)	-0.721	(-6.07)	-0.767	(-6.38)	-0.775	(-6.58)	-0.683	(-5.88)	-0.682	(-5.83)
M1	-0.078	(-8.38)												
M2			-0.169	(-12.42)										
M3					-2.372	(-5.89)								
M4							-2.647	(-7.04)						
M5									-1.421	(-6.53)				
M6											-0.196	(-1.06)		
M7													-1.442	(-1.60)
Log(size)	0.043	(8.21)	0.048	(9.18)	0.039	(7.47)	0.041	(7.78)	0.041	(8.01)	0.037	(7.36)	0.037	(7.36)
Log(BE/ME)	-0.090	(-5.42)	-0.082	(-5.21)	-0.100	(-5.98)	-0.099	(-6.02)	-0.091	(-5.75)	-0.100	(-5.57)	-0.099	(-5.42)
Res. Var.	-0.295	(-0.35)	0.170	(0.20)	-1.516	(-1.91)	-1.460	(-1.85)	-1.528	(-1.99)	-1.922	(-2.44)	-2.065	(-2.56)
Lag(ER6)	-0.057	(-1.45)	-0.106	(-2.77)	-0.026	(-0.66)	-0.044	(-1.13)	-0.051	(-1.30)	-0.017	(-0.43)	-0.019	(-0.48)
time dummies	yes		yes		yes		yes		yes		yes		yes	
Adj R2	0.278		0.312		0.261		0.271		0.283		0.254		0.255	

Table 6

Levels of investor recognition and excess returns: seasoned vs. young companies

We estimate the regression of excess returns on investor recognition while splitting our sample into young and seasoned firms. A company is defined as *seasoned* if it was traded at the beginning of our sample period. A company is defined as *young* if it entered our database at some point during the sample period. The dependent variable is excess as defined in Table 5. Number of observations is 1337 for seasoned companies and 1038 for young companies. Measures of investor recognition and control variables are as defined in *Table 1*

Seasoned companies

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
intercept	-0.1757	(-1.49)	-0.2121	(-1.85)	-0.0849	(-0.76)	-0.1008	(-0.90)	-0.1102	(-0.98)	-0.0758	(-0.67)	-0.0640	(-0.57)
M1	-0.0521	(-5.30)												
M2			-0.0978	(-7.51)										
M3					-1.1830	(-2.96)								
M4							-1.2834	(-4.69)						
M5									-0.8480	(-4.96)				
M6											-0.4746	(-2.83)		
M7													-2.6957	(-3.39)
Log(size)	0.0138	(2.67)	0.0155	(3.06)	0.0103	(2.08)	0.0110	(2.21)	0.0116	(2.33)	0.0104	(2.08)	0.0104	(2.06)
Log(BE/ME)	-0.0679	(-4.67)	-0.0638	(-4.50)	-0.0797	(-5.72)	-0.0789	(-5.71)	-0.0741	(-5.34)	-0.0750	(-5.27)	-0.0733	(-5.17)
Res. Var.	-2.0550	(-1.94)	-1.8354	(-1.83)	-3.2825	(-3.08)	-3.1648	(-3.00)	-3.2522	(-3.15)	-3.7966	(-3.58)	-4.2800	(-3.94)
Lag(ER6)	0.0104	(0.27)	-0.0234	(-0.62)	0.0337	(0.86)	0.0231	(0.59)	0.0126	(0.33)	0.0309	(0.79)	0.0205	(0.53)
time dummies	yes		yes		yes		yes		yes		yes		yes	
Adj R2	0.2716		0.2906		0.2571		0.2635		0.2730		0.2566		0.2608	

Young companies

intercept	-1.3227	(-5.97)	-1.5132	(-6.95)	-1.2330	(-5.39)	-1.3449	(-5.83)	-1.3070	(-5.82)
M1	-0.0883	(-5.36)								
M2			-0.2357	(-9.62)						
M3					-3.7789	(-3.35)				
M4							-6.1886	(-4.98)		
M5									-1.7391	(-4.06)
M6										
M7										
Log(size)	0.0679	(6.99)	0.0770	(8.00)	0.0641	(6.48)	0.0690	(6.92)	0.0678	(6.92)
Log(BE/ME)	-0.1259	(-4.64)	-0.1096	(-4.30)	-0.1295	(-4.78)	-0.1217	(-4.68)	-0.1156	(-4.45)
Res. Var.	1.0635	(0.78)	1.8585	(1.35)	0.0490	(0.04)	0.1126	(0.09)	-0.0345	(-0.03)
Lag(ER6)	-0.1195	(-2.40)	-0.1809	(-3.67)	-0.0935	(-1.88)	-0.1206	(-2.45)	-0.1121	(-2.25)
time dummies	yes		yes		yes		yes		yes	
Adj R2	0.2985		0.3450		0.2831		0.2984		0.3039	

Table 7

Changes in investor recognition and excess returns

The table reports our results for the regression of changes in investor recognition on the semiannual excess returns of the company. Changes in investor recognition are calculated over the period preceding the period for which excess returns are calculated. The dependent variable is excess return as defined in Table 5. Number of observations is 2375. Measures of investor recognition and control variables are as defined in *Table 1*

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
intercept	-0.6629	(-5.71)	-0.7108	(-6.16)	-0.7044	(-6.04)	-0.7123	(-6.12)	-0.6835	(-5.85)	-0.6189	(-5.31)	-0.5707	(-5.00)
ΔM1	-0.1861	(-6.09)												
ΔM2			-0.2910	(-6.80)										
ΔM3					-6.0138	(-4.45)								
ΔM4							-6.0141	(-5.63)						
ΔM5									-0.4453	(-2.92)				
ΔM6											-2.4617	(-6.73)		
ΔM7													-12.1561	(-6.76)
Log(size)	0.0360	(7.09)	0.0380	(7.54)	0.0380	(7.46)	0.0384	(7.55)	0.0372	(7.27)	0.0377	(7.45)	0.0368	(7.33)
Log(BE/ME)	-0.1154	(-6.70)	-0.1222	(-7.09)	-0.1044	(-6.13)	-0.1080	(-6.31)	-0.1040	(-6.09)	-0.0994	(-5.83)	-0.0978	(-5.82)
Res. Var.	-1.5628	(-1.97)	-1.4462	(-1.82)	-1.7243	(-2.21)	-1.7393	(-2.24)	-1.8403	(-2.37)	-1.9325	(-2.54)	-2.0371	(-2.70)
Lag(ER6)	-0.0228	(-0.61)	-0.0318	(-0.88)	-0.0177	(-0.45)	-0.0230	(-0.60)	-0.0133	(-0.34)	-0.0279	(-0.73)	-0.0343	(-0.90)
time dummies	yes		yes		Yes		yes		yes		yes		yes	
Adj R2	0.2750		0.2862		0.2592		0.2638		0.2568		0.2947		0.3092	

Table 8

Changes in investor recognition of different sign and excess returns

The table reports our regression results. We regress changes in investor recognition on semiannual excess returns, while using a positive change dummy. Changes in investor recognition are calculated over the preceding period that excess returns are calculated for. The dependent variable is excess return as defined in Table 5. Number of observations is 2375. Measures of investor recognition and control variables are as defined in *Table 1*

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
intercept	-0.6236	(-5.46)	-0.7065	(-6.19)	-0.5984	(-5.09)	-0.6655	(-5.78)	-0.6349	(-5.31)	-0.5141	(-4.99)	-0.5318	(-5.21)
ΔM1	-0.1466	(-4.07)												
ΔM2			-0.2811	(-5.12)										
ΔM3					-3.5259	(-3.30)								
ΔM4							-3.1862	(-3.52)						
ΔM5									-0.3528	(-2.28)				
ΔM6											-1.0347	(-3.07)		
ΔM7													-5.1218	(-3.40)
positive change dummy	-0.0512	(-2.75)	-0.0100	(-0.44)	-0.1142	(-6.79)	-0.1224	(-6.85)	-0.0501	(-2.04)	-0.3916	(-24.34)	-0.3948	(-23.61)
Log(size)	0.0352	(7.02)	0.0380	(7.54)	0.0356	(6.99)	0.0386	(7.66)	0.0368	(7.18)	0.0293	(6.53)	0.0307	(6.88)
Log(BE/ME)	-0.1170	(-6.80)	-0.1224	(-7.08)	-0.1135	(-6.67)	-0.1193	(-6.94)	-0.1049	(-6.13)	-0.0777	(-4.97)	-0.0821	(-5.35)
Res.Var.	-1.5641	(-1.97)	-1.4335	(-1.80)	-1.5403	(-1.97)	-1.5227	(-1.94)	-1.8537	(-2.39)	-2.5949	(-3.62)	-2.8570	(-4.18)
Lag(ER6)	-0.0246	(-0.66)	-0.0315	(-0.87)	-0.0202	(-0.53)	-0.0240	(-0.64)	-0.0124	(-0.32)	-0.0500	(-1.54)	-0.0525	(-1.62)
time dummies	yes		yes		yes		yes		yes		yes		yes	
Adj R2	0.2772		0.2860		0.2738		0.2783		0.2577		0.4509		0.4632	

Table 9 Conditional tests of pricing

	δ	φ_{size}	φ_{m1}	δ	φ_{size}	φ_{m2}	δ	φ_{size}	φ_{m3}	δ	φ_{size}	φ_{m4}
constant	0.76	126.32	-8.65	-0.36	233.85	4.79	0.76	126.32	-8.65	-0.36	233.85	4.79
	(0.51)	(1.93)	(-0.16)	(-0.29)	(3.14)	(0.09)	(0.51)	(1.93)	(-0.16)	(-0.29)	(3.14)	(0.09)
bond yield	-68.09	-4166.42	4268.09	-68.96	-6515.78	1270.34	-68.09	-4166.42	4268.09	-68.96	-6515.78	1270.34
	(-0.84)	(-1.52)	(1.24)	(-0.80)	(-2.10)	(0.47)	(-0.84)	(-1.52)	(1.24)	(-0.80)	(-2.10)	(0.47)
maturity spread	10.89	-2067.50	-1979.97	-110.68	-8425.68	-363.46	10.89	-2067.50	-1979.97	-110.68	-8425.68	-363.46
	(0.06)	(-0.50)	(-0.45)	(-1.46)	(-2.51)	(-0.11)	(0.06)	(-0.50)	(-0.45)	(-1.46)	(-2.51)	(-0.11)
exchange rate	-4.31	59.28	432.15	-6.03	482.21	-124.39	-4.31	59.28	432.15	-6.03	482.21	-124.39
	(-0.97)	(0.27)	(1.52)	(-1.07)	(2.34)	(-0.87)	(-0.97)	(0.27)	(1.52)	(-1.07)	(2.34)	(-0.87)
bill rate	119.54	-5823.2	31780.9	-151.17	-26991.4	**32220.8**	119.54	-5823.2	31780.9	-151.17	-26991.4	**32220.8**
	(0.35)	(-0.29)	(1.37)	(-0.54)	(-1.50)	**(2.00)**	(0.35)	(-0.29)	(1.37)	(-0.54)	(-1.50)	**(2.00)**
IRW	-0.32	-102.44	-6.29	1.02	-189.56	-4.50	-0.32	-102.44	-6.29	1.02	-189.56	-4.50
	(-0.24)	(-1.89)	(-0.13)	(0.81)	(-3.13)	(-0.08)	(-0.24)	(-1.89)	(-0.13)	(0.81)	(-3.13)	(-0.08)

constant	δ	φ_{size}	φ_{m5}	δ	φ_{size}	φ_{m6}	δ	φ_{size}	φ_{m7}
	1.16	228.64	54.56	0.28	88.16	57.66	0.38	82.86	-3.11
bond yield	(0.99)	(4.37)	(1.38)	(0.17)	(2.09)	(0.81)	(0.21)	(1.72)	(-0.10)
	-184.07	-9366.31	4836.25	-84.83	-4607.81	-4102.05	-89.95	-2613.85	-716.44
maturity spread	(-1.73)	(-3.00)	(1.13)	(-0.84)	(-1.86)	(-1.35)	(-0.67)	(-1.03)	(-0.24)
	-77.14	-6565.41	-8175.65	-1.40	-1994.59	4211.30	48.23	-3691.21	3221.18
exchange rate	(-0.75)	(-3.29)	(-1.78)	(-0.01)	(-0.57)	(0.75)	(0.28)	(-0.98)	(0.71)
	-5.82	200.19	107.93	-2.19	4.13	81.72	2.99	39.70	123.98
bill rate	(-1.31)	(1.30)	(0.49)	(-0.49)	(0.02)	(0.34)	(0.48)	(0.21)	(0.81)
	-18.53	-30197.7	**25700.2**	56.67	-22831.3	-8409.8	199.49	-12691.2	**13753.4**
IRW	(-0.07)	(-1.94)	**(1.62)**	(0.15)	(-1.23)	(-0.71)	(0.60)	(-0.71)	**(2.23)**
	0.06	-172.16	-60.74	0.28	-62.76	-42.34	0.11	-65.29	2.49
	(0.06)	(-4.33)	(-1.60)	(0.19)	(-1.68)	(-0.71)	(0.06)	(-1.57)	(0.08)

Table 10

Hypothesis testing

We report the results of the tests of whether the investor recognition (indexes based on our measures M1-M7) is priced. The factor the proxy for investor recognition has been previously orthogonalized by regressing it on SMB and HML factors. The first and the second column describe the hypothesis which is being tested and the alternative. The third, fourth and fifth column report, respectively, the Newey-West (1987) D-statistics, its number of degrees o freedom and the associated p-value. This statistics is distributed like χ^2. *, **, *** denotes the significance at 10% , 5%, 1% level respectively.

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Factors in unrestricted model	Null hypothesis	Stat	degrees offeedom	p-value
SMB,IR $_{M1}$	$\varphi_{m1}=0$	8.9	6	0.179
SMB,IR $_{M2}$	$\varphi_{m2}=0$	19.54	6	0.003*
SMB,IR $_{M3}$	$\varphi_{m3}=0$	8.9	6	0.179
SMB,IR $_{M4}$	$\varphi_{m4}=0$	19.54	6	0.003*
SMB,IR $_{M5}$	$\varphi_{m5}=0$	28.06	6	0.001*
SMB,IR $_{M6}$	$\varphi_{m6}=0$	6.69	6	0.350
SMB,IR $_{M7}$	$\varphi_{m7}=0$	8.02	6	0.237

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PAPER 4

Investor Recognition and the Long-Run Performance of Repurchases

with Andriy Bodnaruk

ABSTRACT. Theory suggests that firms with lower investor recognition should provide investors with greater returns. Using U.S. data we document a strong negative relationship between changes in investor recognition and asset returns. We demonstrate that investor recognition is a priced factor in asset returns different from the traditional ones. Undertaking a repurchase significantly reduces the firm's investor recognition. Accounting for changes in investor recognition reduces the abnormal performance of firms undertaking a repurchase by 1.4% (17% of abnormal performance) over one year.

1. Introduction

Recent work in corporate finance has challenged market efficiency by documenting abnormal stock performance following corporate events. One prevalent puzzle in this literature is the abnormal returns that firms earn after a stock repurchase (Ikenberry, Lakonishok and Vermaelen (1995), (2000)). In this paper we argue that a substantial part of the abnormal returns earned by firms undertaking a repurchase can be attributed to a decrease in the shareholder base and therefore the risk sharing opportunities provided to investors.

Merton (1987) illustrates how limited investor participation yields higher returns due to lower risk sharing. He examines the effect of relaxing the assumption of equal information across investors in the Sharpe-Lintner-Mossin Capital Asset Pricing Model (CAPM). In his model investors only have information about a subset of the available securities and optimize their portfolio holdings given the limited set of securities that they have information about. If capital markets are divided into information sets, then

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even if each set is mean variance efficient two securities with equal fundamental values from different sets may have different required returns. Assets of companies with a larger shareholder base (denoted by Merton as investor recognition) would be valued at a higher price and yield lower stock returns due to superior risk sharing.

Undertaking a repurchase implies a decrease in the firm's shareholder base and therefore by Merton's (1987) theory an increase in expected returns. Hence, all other things equal firms that undertake a repurchase should offer higher returns. Thus, when determining whether firms undertaking a repurchase earn abnormal returns one has to adjust for the reduction in risk-sharing that a repurchase entails.

Using data on all firms traded on NYSE, AMEX and NASDAQ we document that there is a strong relationship between changes in investor recognition and subsequent returns. If investor recognition affects returns then investors should require a premium to hold stocks with considerable variability in shareholder base. We use Fama and Macbeth (1973) methodology to demonstrate that investor recognition is a priced factor in U.S. stock returns. Additionally, we show that those firms that repurchase more also experience greater changes in investor recognition. Finally, we find that a substantial part of the excess returns experienced by firms undertaking a repurchase can be explained by a decrease in investor recognition.

There is a large strand of research that focuses on the agency aspects of repurchases. Jensen (1986) argues that repurchases reduce the amount of free cash flow that the manager can use for inefficient empire building. Since a repurchase is the reverse of an equity issue many authors have argued that a repurchase is a way for firms to signal their quality to investors. Both the moral hazard explanation advocated by Jensen and the signalling story imply that an announcement of an repurchase should be associated with positive returns.

Ikenberry et al. (2000) document a number of interesting stylized facts concerning repurchases. Firstly, they find that the market reaction to an announcement of a repurchase program is positive, but modest[1]. Secondly, over a three year holding period with a three factor model as benchmark they find a total cumulative abnormal return of 21.40 percent[2] to firms that undertake a repurchase[3]. Thirdly, firms that announce a repurchase program, but do not actually undertake any repurchases do not experience any abnormal returns.

We argue that these findings can be explained by a combination of an agency story and the limited participation story of Merton (1987). The modest announcement effect

[1] The average abnormal return is 0.93 percent.

[2] This translates to an abnormal return of 0.59 percent per month.

[3] Rau and Vermaelen (2002) find that the abnormal returns found in the U.S. do not appear in the U.K. due to peculiarities in the U.K. tax code.

can be explained in this setting due to the opposite predictions concerning the stock price reaction of the agency story and the limited participation story. By Merton's argument an anticipation of a reduction in the shareholder base results in a price drop due to a fall in risk sharing among the investors, but the agency models predict a positive announcement effect. So the firm trades-off the benefit of mitigating the agency problem against the reduction in the shareholder base and only undertakes the repurchase if the net of the two effects is positive. The reduction in investor base predicts positive future abnormal returns which corroborates Ikenberry et. al's (2000) second finding. Additionally, the effect of a repurchase program on risk sharing is monotonic in the amount of shares repurchased, implying that announced repurchase programs that are not executed should have no effect on returns (just like documented by Ikenberry et al. (2000)).

Our paper is related both to the extensive literature on repurchases and previous work that empirically documents the effect of investor recognition. Early papers that consider the effect of repurchases on agency problems within the firm include Dann (1981), Vermaelen (1981) and Comment and Jarrell (1991) highlight that US repurchases communicate information to the market. Li and McNally (1999) find support for Jensen's (1986) speculation that repurchases reduces the moral hazard problem faced by managers.

There has been a number of tests of Merton's (1987) theory using event-study methodology. Amihud, Mendelson and Uno (1999) find that a reduction in the minimum trading unit of a stock facilitates liquidity, increases firm's investors base and is associated with a significant increase in the stock price. Kadlec and McConnell (1994) find that stocks that announce a listing on the New York Stock Exchange (NYSE) earn abnormal returns of 5 percent in response to the listing announcement and that it is associated with an increase in the number of shareholders and a decrease in bid-ask spreads. Additionally, Foerster and Karolyi (1999) find that non-U.S. firms cross-listing on U.S. exchanges earn cumulative abnormal returns of 19 percent during the year before listing, but incur a loss of 14 percent during the year following listing. In a recent contribution Chen, Noronha and Singal (2004) find that inclusion into the S&P 500 leads to a positive price response while a deletion has no effect.

Bodnaruk and Östberg (2005) test Merton's theory in the absence of corporate events in both cross-section and time-series using a unique Swedish data set of individual stock holdings. They use Swedish data set and the Dumas and Solnik (1995) methodology to provide some evidence that changes in investor recognition represents a risk factor separate from the traditional ones. Considering the longer time horizon available in US data allows us to utilize the Fama and Macbeth (1973) methodology.

In general this literature examines the empirical merits of limited participation while this paper argues that limited participation may be useful in explaining abnormal returns surrounding corporate events.

Since this paper argues that a repurchase comes at the cost of a reduction in risk sharing this provides a rationale for paying shareholders through dividends which does not reduce the shareholder base. For some firms a repurchase will have a large effect on their shareholder base and they will prefer to pay shareholders through dividends rather than a share buyback. This implies that an investor recognition perspective can explain the coexistence of dividends and repurchases.

There are a number of other contributions that can explain the coexistence of dividends and repurchases. In an ingenious paper Brennan and Thakor (1990) show that if a repurchase is to qualify for preferential tax treatment it cannot be pro-rata. This feature implies that small shareholders may prefer dividend payments since then they do not risk trading against a large informed shareholder. Perhaps this could explain our results, if a repurchase increases the possibility that a counterparty is informed then shareholders are going to require a higher premium from firms that undertake a repurchase and this could explain the abnormal returns experienced by firms undertaking repurchases. However, an increase in the possibility that counterparties are informed reduces the incentives to acquire information and therefore the effect of a repurchase in this kind of a setting is not clear.

Ofer and Thakor (1987) note that a repurchase is costly to managers since they are overexposed to their own firms stock and they are not allowed to tender in a repurchase. Additionally, in the work of Ambarish, John and Williams (1987) dividends and repurchases coexist because both provide outsiders with signals and utilizing both tools minimizes the total signalling cost.

Merton's (1987) story is by no means the only possible explanation for the result that the shareholder base affects returns. Barber and Odean (2005) documents that high attention grabbing stocks[4] have lower subsequent returns. He interprets these returns as the result of shifts in demand for the high attention grabbing stocks.

Additionally, the shareholder base may be a proxy for investor sentiment (Baker and Wurgler (2005)). In which case an increase in the shareholder base is observed when the stock becomes overvalued and then after some time stock prices revert to fundamentals, generating the same return pattern that we observe.

The paper is organized as follows; section 2 describes the sample and variables. Section 3 establishes the cross-sectional relationship between investor recognition and

[4] Attention grabbing stocks are stocks with high volume or stocks that feature in the news or experience high abnormal returns.

stock returns. Section 4 evaluates investor recognition as a risk factor and section 5 documents the relationship between the amount repurchased and changes in investor recognition. Section 6 evaluates the impact of investor recognition on the abnormal returns earned by firms undertaking a repurchase and section 7 concludes.

2. Sample and Variable Description

Data on returns, prices, and shares outstanding of all NYSE, AMEX, and NASDAQ stocks are obtained from CRSP. Number of common shareholders (data item 100), purchase of commons and preferred stock (data item 115), carrying value of preferred stock (data item 130) and other company characteristics are collected from COMPUSTAT. Data is matched using the WRDS web interface.

We consider the time period 1975 to 2004. This period is chosen since the COMPUSTAT data on the number of common shareholders is only available from 1975. We utilize U.S. data rather than the detailed data set on individual stock holdings that Bodnaruk and Östberg (2005) consider because repurchases were not allowed in Sweden prior to 2000.

We define the change in investor recognition as the difference in the logarithm of the number of shareholders between year t and $t-1$. We consider a measure based on changes in investor recognition because of how the COMPUSTAT data is collected. The COMPUSTAT data is based on 10-K filings of firms. The 10-K form requires firms to report the "number of shareholders of record." However, that means that all brokerages and trustees that hold shares for individuals will be counted as one shareholder. Additionally, the responsibility for determining the number of shareholders is on the firm and it is likely to be less accurate for those years in which there has not been a significant change. The Swedish data that Bodnaruk and Östberg (2005) consider are collected for tax purposes by the tax authority so we expect the data to be calculated in a consistent manner for all firms[5]. To minimize measurement errors associated with firms determining the number of shareholders we consider like other studies on U.S. data (e.g. Kadlec and McConnell (1994) and Foerster and Karolyi (1999)) a measure based on changes. In order to limit the impact of extreme changes (that might be the result of unreliable reporting) in shareholder base we exclude observations with more than value of our measure in excess of 0.5 in absolute value. This amounts to approximately 2.5% of our sample in each tail of the distribution[6].

In order to be able to perform the statistical analysis we omit firms with missing or negative values of size, market-to-book and the number of common shareholders. This

[5] This level of accuracy means that they can consider measures based on levels as well.

[6] Our results are weakened by this sample reduction, but we feel that a lot of the extreme observations are not reliable.

leaves us with 71825 observations which is the basis for our cross-sectional analysis and factor pricing.

The descriptive statistics of our data set is presented in Table 1. From Panel A one can observe that the amount of firms reporting the number of common shareholders increases in the early part of the sample period and then remains fairly stable. This is surprising considering the remarkable growth in the number of firms traded. Additionally, there seems to a positive trend in the number of common shareholders reflecting an increase in individual stock market participation and mutual fund industry growth. From Panels B and C we find: a typical change in the number of common shareholders is -0.37%, but the mean change is negative for small firms while it is positive for large firms.

We construct our measure of repurchases using the COMPUSTAT data item Purchase of Common and Preferred Stock (data item 115), which reports the amount of money a company spends on repurchasing its own securities. As noted by Stephens and Weisbach (1998) and Jagannathan, Stephens, and Weisbach (2000) this item overstates actual repurchases of common stock because it also includes repurchases of other securities. Therefore, we follow Dittmar (2000) and Weisbenner (2002) and subtract any decreases in the par value of preferred stock (annual data item #130) from COMPUSTAT repurchase measure to get a better estimate. We further screen stock repurchases by setting repurchases equal to zero for any firm that does not repurchase at least 1% of its market value of equity (as in Dittmar (2000)).

The COMPUSTAT data includes both open market repurchases and tender offers, but there is no reason to suspect that investor recognition affects the two types of repurchase differently and therefore we do not separate open market repurchases from tender offers. Since open market repurchases are far more common they dominate our sample. For the results reported we do not exclude repurchases done in 1988[7]. However, our results remain qualitatively unchanged after the exclusion of repurchases undertaken in 1988.

A number of stylized facts found in the literature on repurchases are corroborated when examining the descriptive statistics for repurchases (reported in Table 2). First, a substantial number of companies conducted repurchases. Second, the ratio of repurchased equity to the market value of equity varies between 2.95% and 8.22%. Third, companies on average repurchased between 4.58% and 10.67% of shares outstanding. Fourth, the firms in the top decile in terms of amount repurchased, 3 times more than the median firm that conducted a repurchase. From inspecting the data it is apparent

[7] Other authors argue that the motives for repruchases are different during crashes.

that repurchases became much more common after 1984[8]. To be sure that our results are not are driven by some structural change we consider the effect of excluding all data prior to 1984 and this does not affect the results qualitatively.

3. Cross-sectional relationship between Investor Recognition and Returns

If the U.S. stock market is characterized by segmentation as described by Merton (1987) then we expect to find a cross-sectional relationship between investor recognition and returns. This leads to the following hypothesis:

(1) A positive/ negative change in investor recognition leads to negative/ positive future returns.

To establish this relationship we start with some univariate analysis and then we proceed with Fama-French (1992) style regressions.

At the end of each fiscal year from 1974 to 2004 we split firms into small and big, using the median firm on NYSE and AMEX as the break point. Additionally, we split firms into deciles on the basis of their changes in investor recognition. Breakpoints are determined using all firms in our sample. The portfolios are rebalanced each year. Monthly excess returns are calculated from January to December of next year. In Panel A of Table 3 we compare the average monthly excess return of the different portfolios. Examining the t-statistics of the mean and median difference we find strong support (even when considering portfolios 2 and 9) for firms with lower investor recognition having higher returns. In Panel B of Table 3 we split firms into size quintiles and investor recognition quintiles to illustrate that the results are robust to an alternative sorting choice.

One possibility is that the observed relationship between investor recognition and return is driven by a relationship between investor recognition and book-to-market. Though the correlation between these two variables is low (see Panel A of Table 4) we investigate this by first splitting firms into small and big firms as before and then we split firms into three different portfolios depending on book-to-market. We place the top 30% into the *high* group, the middle 40% into the *medium* group and the bottom 30% into the *low* group. Finally, we sort firms into quintiles on the basis of changes in investor recognition. These results are reported in Panel C of Table 4. The differences in average returns between firms with the highest changes in investor recognition and lowest changes in investor recognition are significant at least at the 5% level.

[8] Dittmar (2000) speculates that this may be due to the adoption of the regulation 10b-18 that clarified the legal standing of repurchases.

The variables used in our regression analysis are: firm beta (β), the market equity of the firm (ME), the firm's book-to-market (BE/ME) and the change in investor recognition ($\log(N_{it}/N_{i(t-1)})$, N is the number of common shareholders). To estimate β we use a 36 to 60 month estimation window depending on availability. In Panel B of Table 4 we present the correlations between the different explanatory variables. There is no significant correlation between the change in investor recognition and any of the other explanatory variables.

Using the Fama-French (1992) methodology we estimate the following regression

$$ER_{it} = a + b_{1t}\beta_{it} + b_{2t}\log(ME_{it}) + b_{3t}\log(BE/ME_{it}) + b_{4t}\log(N_{it}/N_{i(t-1)}) + e_{it}$$

In the above specification ER denotes excess return on 25 size and book-to-market based portfolios and e_{it} is an error term. Portfolios are formed at the end of each fiscal year and rebalanced annually. The excess returns are monthly excess returns in the year $t+1$. We estimate month-by-month regressions and report average slopes. From hypothesis 1 we expect the sign of b_4 to be negative.

Table 5 presents the results of the regression analysis. We observe that changes in investor recognition is statistically significant both in a specification only with the market and with all the explanatory variables (in fact it is the only significant variable). A one standard deviation increase in change in investor recognition implies approximately an annual return difference of 1.39% (1.08%) over the entire period (after 1984).

As in Fama and French (1992) we find that the inclusion of size into the regression drives beta downwards. Interestingly, including investor recognition drives beta upwards, so in fact the only specification in which the market is positive is when all explanatory variables are included.

We excluded firms that undertook a repurchase from the analysis to verify that it is not solely repurchases that are driving the results. The relationship (not reported her for the sake of brevity) remains statistically and economically significant albeit smaller. As an additional robustness check we excluded years prior to 1984 in which repurchases were less frequent and this does not alter the results.

4. Investor Recognition as a Risk Factor

Given that there is a cross-sectional relationship between investor recognition and excess returns then we expect investors to require a premium to hold stocks of firms with large changes of investor recognition. The intuition for this is simply that when investors consider purchasing a firm's stock if that firm has a high volatility in investor recognition they will require a premium for exposure to the uncertainty associated with the shareholder base.

This leads to the following hypothesis:

(1) Changes in investor recognition should be a priced factor in stock market returns.

The length of our time series implies that we can use Fama-Macbeth (1973) methodology to test for pricing. We construct a factor on investor recognition in a very similar manner to Carhart's (1997) momentum factor. We use six value-weighted portfolios formed on size and change in investor recognition to construct our investor recognition factor (IRF). The portfolios, which are formed at the end of each year, are the intersections of 2 portfolios formed on size (market equity, ME) and 3 portfolios formed on change in investor recognition. The size breakpoint is the median value of market equity of all firms in our sample on NYSE and AMEX. The investor recognition breakpoints are 30th and 70th NYSE and AMEX percentile. IRF is the average return on the two low change in investor recognition portfolios minus the average return on the two high change in investor recognition portfolios.

We obtain data on the time-series returns to the momentum factor (umd), the excess return on the market ($r_m - r_f$), the value factor (hml) and the size factor (smb) from the Kenneth French's web site. Table 6 presents descriptive statistics of our risk factors. The market, size, value and momentum factors exhibit the same characteristics as found in other studies. On average the IRF factor has a value of 0.41% per month with a standard deviation of 2.18%. The correlation between IRF and all other factors is moderate with the exception of HML. In fact HML has high correlation with all factors (−0.52 with market, −0.39 size, −0.14 momentum and 0.47 with the investor recognition factor)

Factor loadings are estimated over a 36 to 60 month period prior to the month t depending on data availability using 25 portfolios based on size and book-to-market with NYSE and AMEX breakpoints. For the first observation we use a three year estimation period for the factor loadings, for the second we use a three year and one month estimation window and so on until the estimation window is five years after which all factor loadings are estimated with a five year estimation period.

After our factor loadings have been estimated we use them to estimate month-by-month regressions of the following type:

$$R_{pt} = \gamma_{0t} + \gamma_{mt}\beta_{m,t-1} + \gamma_{st}\beta_{s,t-1} + \gamma_{\nu t}\beta_{\nu,t-1} + \gamma_{mom}\beta_{mom,t-1} + \gamma_{IRFt}\beta_{IRF,t-1} + \nu_{pt}$$

Table 7 reports the average risk premia with corresponding t-statistics. Since the investor recognition factor is defined as the spread between companies with low and high change in investor recognition the coefficient on the factor is expected to be

positive. We observe that in both the specifications in which IRF is included it enters significantly and with a positive sign. Economically it implies that there is a risk premium to the investor recognition factor of 4.6% per year.

Somewhat surprisingly we find that the market is negative and insignificant when estimated with only an intercept. As noted by Fama and French (1992) the inclusion of size reduces the coefficient on the market and eventually the market turns out to be negative and significant. Size on the other hand never turns out to be significant. The effect of the value factor is very similar to investor recognition both in terms of significance and economic magnitude.

5. Size of Repurchase and Shareholder Base

This section establishes the link between the amount of equity repurchased and the shareholder base. If a repurchase resulted in all stockholders tendering a fraction of their shares held in the firm then the repurchase would not change investor recognition. Therefore in this section we estimate the relationship between the amount repurchased and the effect on our measure of investor recognition. There are several reasons for why investors may have incentives to liquidate their portfolios at the time of the repurchase. For example Massa et. al. (2005) document that firms with institutional owners, who are more likely to have short investment horizons, also are more likely to undertake a repurchase.

We split firms that undertake a repurchase into deciles depending on what fraction of market equity they have repurchased and investigate by how much their shareholder base decreased over the same period.

The results are reported in Table 8. There is a almost a monotonic relationship between amount of equity repurchased and the shareholder base and all statistical tests indicate that there is significant difference in the reduction in shareholder base between those firms that repurchase the most and the least.

So in this section we have showed that there is a strong relationship between undertaking a repurchase and investor recognition. From section 3 we know that there is a negative relationship between investor recognition and asset returns. Thus, we would expect that the abnormal returns earned by firms undertaking a repurchase can to some degree be explained by the reduction investor base that a repurchase implies.

6. Investor Recognition and the Abnormal Performance of Repurchases

We have established that there is a negative relationship between investor recognition and returns. Additionally, there is a negative relationship between undertaking a repurchase and investor recognition. Thus, there should be a positive relationship

between repurchases and returns (as has been documented in the literature). This leads to the following hypothesis:

(1) The abnormal returns to a repurchase should be reduced when investor recognition is accounted for.

In this section we use the event-study methodology developed by Barber and Lyon (1997) to test the above hypothesis.

For all repurchasing firms we calculate the buy-and-hold abnormal return (BHAR)

$$BHAR_{it} = \prod_{t=1}^{\tau}[1 + R_{it}] - \prod_{t=1}^{\tau}[1 + E(R_{it})]$$

The first term of the expression is the return of the repurchasing firm and the second term is the expected return which we proxy for using a control firm. The control firm is defined as the non-repurchasing firm among the sample of firms within a market cap range of 30% around the firm with the closest BE/ME to the repurchasing firm. The BHAR is just the difference between the return of the repurchasing firm and the control firm. We calculate the post-repurchase performance over 1,2 and 3 years. We select this methodology since Barber and Lyon (1997) demonstrate that the Fama-French (1993) methodology relies on utilizing Cumulative Abnormal Returns (CAR) which results in negatively biased test statistics over the time horizons which we consider.

The descriptive statistics of our analysis is reported in Table 9. We find that a repurchasing firm earns an abnormal return of 4.90%, 7.63%, 8.83% over 1, 2 and 3 years. Even though the average repurchasing firm earns significant returns, bottom 25% of all repurchasing firms experience substantial negative returns following a repurchase over all time horizons considered.

To relate the abnormal returns to company characteristics we estimate the following regression

$$BHAR_{it} = \alpha + \beta_s \log(ME) + \beta_v \log(BE/ME) + \beta_{IR} \log(N_t/N_{t-1})$$

Where $BHAR_{it}$ is defined as above, α is an intercept, $\log(ME)$ is the logarithm of firm size, $\log(BE/ME)$ is the logarithm of book-to-market and $\log(N_t/N_{t-1})$ is the logarithm of the change in the number of shareholders.

Table 10 reports the estimations. In Panel A we estimate the above relationship without the investor recognition term. We find that both the intercept term and book-to-market are significant at the 1% level (and have expected signs) while size is not significant at conventional levels. The positive intercept for all specifications illustrates that repurchasing firms earn a cumulative abnormal return of 8.1%, 13.6%, 17% for the 1,2 and 3 year time period respectively. So the effect of a repurchase is most

pronounced in the first year, but it has a positive effect for three years. Ikenberry et al. (2000) find cumulative abnormal returns of 21.4% over a 3 year period. It is reassuring that our abnormal returns are comparable in both direction and magnitude to those found by Ikenberry et al. (2000) even though we consider a different country and different sample period.

Panel B illustrates estimations when we have included investor recognition. The intercept and value remain significant at the 1% level. Our measure of investor recognition is highly significant over all time periods. The estimates of the intercept have however been reduced implying that a repurchasing firm earns 6.7%, 11.9%, 15.2% abnormal return over 1, 2 and 3 years respectively. Hence, between between 10.6% and 17.3% of the abnormal returns earned by repurchasing firms can be attributed to changes in investor recognition (abnormal returns are reduced between 1.4% and 1.7%).

7. Conclusion

This paper has provided some evidence that abnormal performance that has previously been attributed to behavioral explanations can be partially explained by capital market segmentation. More specifically, we have documented a strong relationship between investor recognition and asset returns. The persistence of the relationship between investor recognition and asset returns over time hints that in fact investor recognition may represent a risk factor. If investor recognition in fact affects asset returns then a investors will require compensation for the possibility of future declines in the shareholder base (which will also reduce the stock price). We provide evidence that investor recognition is indeed a priced factor in U.S. stock returns. Since a repurchase reduces the firm's investor recognition we hypothesize that repurchases should be associated with positive abnormal returns (which has been documented in the literature on repurchases). We find that there is a strong relationship between repurchases and a change in the shareholder base. Including a measure for investor recognition in the estimation of the abnormal returns associated with a repurchase reduces the abnormal returns significantly. Hence, the abnormal returns associated with repurchases can be partially attributed to changes in the shareholder base.

We have examined repurchases in light of investor recognition, but further evidence is needed to evaluate the impact of investor recognition on other corporate events that alter the firm's shareholder base. Previous authors have documented that seasoned equity offerings subsequently underperform as would be anticipated by Merton's theory. Other potential events include stock splits (reverse stock splits), spin offs and mergers.

8. Tables

Table 1

Descriptive statistics of the dataset of the companies reporting number of common shareholders of record

This table presents information on the companies which provide the data on the number of common shareholders of record in the COMPUSTAT. In Panel A we report by 5 year periods the average number of companies in our database, number of companies reporting the number of shareholders of record (overall and those with number of shareholders in excess of 500) and the average number of shareholders in reporting companies. In Panel B we provide descriptive statistics on company monthly excess returns, market capitalization, book-to-market equity, and annual changes in investor recognition for all companies in our sample. Company market capitalization and book-to-market are calculated at the end of each fiscal year. A change in company investor recognition in year t is estimated as a difference between logarithms of the number of shareholders of record at the end of fiscal year t and t-1. Panel C provides the descriptive statistics separately for small and large companies. NYSE and AMEX median firm values of market capitalization are used as breakpoints.

Panel A

period	average number of companies in the sample			average number of common shareholders of record (ths)
	all	reporting number of common shareholders of record		
		overall	>=500	
1976-1980	2926	2848	2789	16.20
1980-1984	3524	3345	3109	15.42
1985-1989	3848	3342	2881	19.13
1990-1994	4709	3675	2949	18.47
1995-1999	5085	3889	2873	21.07
1999-2004	5134	3560	2641	41.95

Panel B

all companies

	mean	**median**	**stdev**	**p1**	**p99**	**interquartile range**
ER	0.81%	0.27%	12.01%	-29.82%	36.16%	11.56%
ME	2053.90	228.61	10505.39	7.31	32500.11	886.61
log(ME)	5.58	5.43	1.90	1.99	10.39	2.68
BE/ME	3.06	1.54	6.00	0.14	29.64	2.00
log(BE/ME)	0.46	0.43	1.06	-1.98	3.39	1.23
ΔIR	-0.37%	-1.92%	12.74%	-32.84%	42.26%	10.36%

Panel C

small companies

	mean	median	stdev	p1	p99	Interquartile range
ER	0.85%	0.05%	13.16%	-31.81%	40.10%	12.42%
ME	168.11	81.95	219.41	5.93	1074.68	167.02
log(ME)	4.44	4.41	1.21	1.78	6.98	1.74
BE/ME	3.02	1.60	6.13	0.13	30.21	1.97
log(BE/ME)	0.48	0.47	1.03	-2.08	3.41	1.17
ΔIR	-1.05%	-2.22%	13.02%	-34.97%	42.41%	10.12%

large companies

	mean	median	stdev	p1	p99	Interquartile range
ER	0.76%	0.51%	10.13%	-25.85%	29.02%	10.53%
ME	4792.59	1278.68	16059.48	98.25	67889.33	2845.61
log(ME)	7.25	7.15	1.42	4.59	11.13	1.87
BE/ME	3.12	1.46	5.80	0.15	29.23	2.02
log(BE/ME)	0.43	0.38	1.10	-1.91	3.38	1.31
ΔIR	0.60%	-1.57%	12.27%	-28.11%	42.12%	10.77%

Table 2

Descriptive statistics of the sample of repurchases

This table reports the descriptive statistics on the number of companies in our sample, number of companies which conducted a repurchase program, percentage of market equity and fraction of shares outstanding repurchased by the repurchasing firms. The sample of our companies consists of all COMPUSTAT firms listed on NYSE, AMEX, and NASDAQ which satisfy the following criteria: a) share price exceeds 5$; b) non-missing and positive values on market capital and book value of shares; c) report information on the number of common shareholders of record; d) number of common shareholders of record exceeds 500. Number of companies is defined as all companies at NYSE, AMEX, and NADAQ which provide information on the number of common shareholders of record. Number of repurchases is a subset of companies reporting the number of common shareholders of record which repurchased at least 1% of their market equity between the end of fiscal year t-1 and t. Percentage of ME repurchased is the ratio of the market value of equity repurchased by the repurchasing companies to the total market value of repurchasing companies expressed in percentages.

year	number of companies	number of repurchases	% ME repurchased	percentage of shares outstanding repurchased		
				mean	median	p90
1976	27135	2914	4.81%	7.45%	3.22%	18.74%
1977	28784	3665	4.53%	7.61%	3.75%	17.82%
1978	29565	4156	3.74%	7.35%	3.51%	17.68%
1979	30382	4371	4.20%	8.23%	3.70%	17.49%
1980	30559	3861	3.70%	7.48%	3.63%	16.80%
1981	30679	3982	4.71%	7.92%	3.78%	16.68%
1982	30473	4869	5.89%	8.82%	4.22%	18.36%
1983	30957	3238	3.96%	10.67%	4.29%	22.77%
1984	31165	5955	6.71%	8.42%	4.24%	18.58%
1985	30007	4916	8.22%	8.93%	3.54%	17.53%
1986	28541	5349	5.11%	7.58%	3.83%	16.53%
1987	27324	8028	5.02%	8.55%	3.81%	17.38%
1988	27766	6583	5.29%	7.57%	3.68%	16.55%
1989	27180	5888	5.28%	6.51%	3.64%	13.36%
1990	25516	6973	4.54%	6.74%	4.03%	13.31%
1991	25235	3815	3.26%	5.31%	2.80%	9.56%
1992	27010	4250	3.03%	4.60%	2.89%	8.85%
1993	29438	4565	3.58%	4.86%	2.87%	9.57%
1994	31187	5949	3.30%	6.07%	3.04%	12.17%
1995	31405	5767	3.84%	4.74%	2.81%	9.63%
1996	32141	7335	3.37%	5.22%	3.04%	10.33%
1997	32411	8035	3.31%	5.07%	3.18%	9.99%
1998	30546	10781	3.38%	7.52%	3.79%	12.92%
1999	27761	10479	3.52%	6.22%	4.17%	13.21%
2000	24351	9386	3.47%	6.50%	3.91%	13.49%
2001	24204	6057	2.79%	5.13%	2.88%	9.52%
2002	23201	6516	3.01%	4.85%	3.37%	10.19%
2003	21688	5416	2.95%	4.58%	2.84%	9.62%

Table 3

Average excess returns on portfolios formed on size, book-to-market, and change in investor recognition

This table reports the results of univariate analysis of the relationship between changes in investor recognition and excess returns. We analyze average monthly excess returns on portfolios based on size, book-to-market, and change in investor recognition. Portfolios are formed yearly. The breakpoints for size (ME, price times shares outstanding) and book-to-market (BE/ME) groups are determined at the end of fiscal year t (t=1975-2005) using NYSE and AMEX stocks on CRSP. Breakpoints for change in investor recognition (ΔIR, $\log(N_t/N_{(t-1)})$ where N_t is number of shareholders) groups are determined using all NYSE, AMEX, and NASDAQ stocks. We use all NYSE, AMEX, and NASDAQ stocks which meet the CRSP-COMPUSTAT data requirements and report number of commons shareholders of record in year t-1 and t. Panel A and Panel B report the results for, correspondingly, 20 and 25 portfolios based on size and change in investor recognition. Panel C presents the results for 30 portfolio based on size, book-to-market value, and change in investor recognition.

Panel A

Average monthly excess returns for 20 portfolios based on size and change in investor recognition

At the end of each fiscal year companies are split into big and small using NYSE and AMEX median values of market capitalization. Each size group is then subdivided into 10 ΔIR portfolios using all NYSE, AMEX, and NASDAQ stocks. Average values of change in investor recognition and average excess returns for each portfolio are presented. Mean and median value analysis for extreme (1 and 10) and next to extreme (2 and 9) deciles is performed.

size				Change in Investor recognition deciles						
group	Low	2	3	4	5	6	7	8	9	High
	-20.50%	**-10.15%**	**-7.03%**	**-4.90%**	**-2.92%**	**-0.92%**	**0.36%**	**0.36%**	**10.31%**	**27.88%**
Small	0.881%	0.869%	0.945%	0.875%	0.876%	0.907%	0.575%	0.624%	0.736%	0.298%
			score	**significance**					**score**	**significance**
t-test (1-10)			4.68	0.01		**t-test (2-9)**			1.18	0.23
Wilcoxon (1-10) 1-sided			5.37	0.01		**Wilcoxon (2-9) 1-sided**			1.37	0.09
	-16.69%	**-8.44%**	**-5.81%**	**-3.98%**	**-2.19%**	**-0.36%**	**1.96%**	**5.75%**	**12.27%**	**28.65%**
Big	0.769%	0.731%	0.841%	0.716%	0.637%	0.691%	0.777%	0.610%	0.584%	0.487%
			score	**significance**					**score**	**significance**
t-test (1-10)			2.44	0.01		**t-test (2-9)**			1.40	0.16
Wilcoxon (1-10) 1-sided			2.22	0.02		**Wilcoxon (2-9) 1-sided**			1.69	0.05

Panel B

Average monthly excess returns for 25 portfolios based on size and change in investor recognition

At the end of each fiscal year companies are split into quintiles using NYSE and AMEX breakpoints for market capitalization. Each size group is then subdivided into 5 ΔIR portfolios using all NYSE, AMEX, and NASDAQ stocks. Average values of change in investor recognition and average excess returns for each portfolio are presented. Mean and median values analysis for extreme (1 and 5) portfolios is performed.

Size quintile	Change in Investor recognition quintiles: Low	2	3	4	High
	-15.83%	**-6.31%**	**-2.48%**	**8.41%**	**16.13%**
Small	8.759%	7.656%	8.494%	5.408%	6.316%
			score	**significance**	
		t-test (1-5)	1.79	0.08	
		Wilcoxon (1-5) 1-sided	3.20	0.01	
	-15.01%	**-5.77%**	**-1.61%**	**2.89%**	**20.94%**
2	8.877%	9.925%	8.548%	6.804%	4.387%
			score	**significance**	
		t-test (1-5)	3.39	0.01	
		Wilcoxon (1-5) 1-sided	3.90	0.01	
	-14.23%	**-5.40%**	**-1.34%**	**3.80%**	**21.10%**
3	9.469%	9.000%	8.336%	6.141%	4.629%
			score	**significance**	
		t-test (1-5)	3.84	0.01	
		Wilcoxon (1-5) 1-sided	3.81	0.01	
	-13.21%	**-5.08%**	**-1.13%**	**4.35%**	**21.25%**
4	7.572%	7.667%	7.711%	6.970%	6.369%
			score	**significance**	
		t-test (1-5)	0.96	0.338	
		Wilcoxon (1-5) 1-sided	0.46	0.32	
	-10.78%	**-4.51%**	**-1.34%**	**3.51%**	**18.97%**
Big	6.875%	7.335%	5.693%	6.279%	4.696%
			score	**significance**	
		t-test (1-5)	1.89	0.06	
		Wilcoxon (1-5) 1-sided	2.22	0.02	

Panel C

Average monthly excess returns for 30 portfolios based on size, book-to-market and change in investor recognition

At the end of each fiscal year companies are split into big and small using NYSE and AMEX median values for market capitalization. Each size group is then subdivided into low (bottom 30%), medium (middle 40%), and large (top 30%) portfolios based on book-to-market breakpoints for NYSE and AMEX firms. Each of the six resulting portfolios is then split into 5 portfolios based on the change in investor recognition. Average values of change in investor recognition and average excess returns for each portfolio are presented. Mean and median values analysis for extreme (1 and 5) groups is performed.

size group	ΔIR quartile	Book-to-market group: Lowest 30%		Medium 40%		Largest 30%	
Small		**ΔIR**	**return**	**ΔIR**	**return**	**ΔIR**	**return**
	Low	-15.52%	0.747%	-15.52%	0.849%	-14.56%	1.134%
	2	-5.23%	0.591%	-6.35%	1.092%	-6.23%	0.925%
	3	-0.54%	0.601%	-2.70%	1.080%	-2.80%	1.051%
	4	5.31%	0.451%	0.91%	0.631%	0.37%	0.827%
	High	25.02%	0.365%	15.11%	0.726%	13.15%	0.608%

	score	significance	score	significance	score	significance
t-test (1-5)	2.62	0.01	0.98	0.33	3.29	0.01
Wilcoxon (1-5) 1-sided	3.66	0.01	0.89	0.19	1.70	0.04

Big	**ΔIR**	**return**	**ΔIR**	**return**	**ΔIR**	**return**
Low	-13.71%	0.668%	-12.71%	0.807%	-10.92%	0.847%
2	-3.92%	0.529%	-5.63%	0.752%	-4.62%	0.884%
3	1.11%	0.538%	-2.55%	0.644%	-1.52%	0.795%
4	8.65%	0.634%	1.59%	0.734%	2.52%	0.798%
High	26.65%	0.595%	15.91%	0.445%	16.34%	0.623%

	score	significance	score	significance	score	significance
t-test (1-5)	0.47	0.64	3.00	0.01	1.88	0.06
Wilcoxon (1-5) 1-sided	0.55	0.29	2.50	0.01	1.19	0.12

Table 4

Correlation table between the variables used in univariate and cross-sectional analysis

This table reports correlations between variables used in univariate and cross-sectional analysis. In Panel A we report correlations on company-by-company level. Panel B reports correlations between the aggregate variables for 25 size and book-to-market based portfolios. Market equity of the portfolio is calculated as the sum of market values of all companies in the portfolio. Book-to-market value of the portfolios is derived as the sum of book value of equity of all companies in the portfolio divided by the sum of market value of the portfolio. Change in investor recognition of the portfolio is calculated as a difference between the logarithms of the sum of number of shareholders of all companies in the portfolio in the year t and t-1.

Panel A

Company-by-company correlations

	log(BE/ME)	ΔIR
log(ME)	-0.135	0.070
log(BE/ME)		-0.112

Panel B

Portfolio-wise correlations

	beta	log(ME)	log(BE/ME)	lag(pER)	ΔIR
ER	0.008	-0.023	0.033	0.132	-0.004
beta		-0.241	-0.331	0.001	0.055
log(ME)			-0.221	-0.026	0.048
log(BE/ME)				0.033	-0.071
lag(ER)					0.001

Table 5

Average slopes (t-statistics) from Month-by-Month Regressions of Stock returns on β, Size, Book-to-Market Equity, and Change in Investor Recognition (Fama-French type regressions)

Stocks are assigned the post-ranking β of the size/book-to-market portfolio they are in at the end of fiscal year t. ME is market equity, price times number of shares outstanding. BE is the book value of common equity (compustat item 60). ΔIR is change in investor recognition from year t-1 to year t, $\log(N_t/N_{(t-1)})$ where N_t is number of common shareholders of record outstanding. The average slope is the time-series average of the monthly regressions slopes for 1979-2004 and 1984-2004 and t-statistic is the average slope divided by its time-series standard error. Although the data on number of common shareholders of record is reported in COMPUSTAT since 1975, years between 1975 and 1979 are sacrificed to estimate portfolio's βs.

1979-2004

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
Intercept	0.0087	(2.81)	0.0095	(2.44)	0.0108	(3.10)	0.0077	(2.38)	0.0059	(2.12)	0.0062	(2.02)
B	-0.0015	(-0.40)			-0.0033	(-0.81)	-0.0003	(-0.11)	0.0018	(0.56)	0.0014	(0.55)
ln(ME)			-0.0004	(-1.05)	0.0000	(-0.10)	0.0000	(-0.05)			0.0000	(0.11)
ln(BE/ME)							0.0013	(1.72)			0.0007	(1.11)
ΔIR									-0.0098	(-4.26)	-0.0090	(-4.23)

1984-2004

	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat	estimate	t-stat
Intercept	0.0081	(2.31)	0.0045	(1.07)	0.0071	(1.85)	0.0041	(1.15)	0.0056	(1.76)	0.0034	(1.01)
B	-0.0021	(-0.48)			-0.0030	(-0.64)	-0.0001	(-0.03)	0.0012	(0.34)	0.0013	(0.45)
ln(ME)			0.0004	(0.99)	0.0004	(0.96)	0.0004	(0.98)			0.0004	(1.00)
ln(BE/ME)							0.0015	(1.79)			0.0009	(1.22)
ΔIR									-0.0068	(-2.80)	-0.0066	(-2.84)

Table 6

Descriptive statistics of risk factors

In this table we report descriptive statistics and correlations between the risk factors used in Fama-MacBeth regressions. Market return in excess of risk-free rate (MRF), size factor (SMB), value factor (HML), and momentum factor (UMD) are obtained from Ken French's website. Investor recognition factor (IRF) is constructed in the following way: companies are split into small and big by market capitalization using NYSE and AMEX median values. Each of the size groups is split into three groups (30-40-30) by change in investor recognition over the previous year. The average return on two portfolios of companies with high change in investor recognition is then subtracted from the average return on two portfolios of companies with low change in investor recognition. By construction IRF factor is expected to be positive on average. We analyze the entire period over which the data on the number of common shareholders of record is available in COMPUSTAT (1975-2004) as well as the period after the adoption of SEC rule 10b-18 (1985-2004). Panel A presents descriptive statistics. Panel B reports correlations.

Panel A

1975-2004

	mean	median	stdev	min	max	qrange
mrf	0.57%	0.99%	4.49%	-23.09%	12.42%	5.77%
smb	0.25%	0.22%	3.27%	-16.69%	21.49%	3.50%
hml	0.39%	0.39%	3.15%	-12.03%	13.75%	3.37%
umd	0.91%	1.29%	4.33%	-25.00%	18.38%	3.53%
irf	**0.41%**	**0.39%**	**2.18%**	**-6.73%**	**9.33%**	**2.44%**

1985-2004

	mean	median	stdev	min	max	qrange
mrf	0.63%	1.10%	4.48%	-23.09%	12.42%	5.74%
smb	0.00%	-0.16%	3.43%	16.69%	21.49%	3.79%
hml	0.39%	0.27%	3.28%	-12.03%	13.75%	3.45%
umd	0.84%	1.29%	4.49%	-25.00%	18.38%	3.45%
irf	**0.27%**	**0.26%**	**2.27%**	**-6.73%**	**9.33%**	**2.48%**

Panel B

Correlation table (1975-2004)

	smb	hml	umd	irf
mktrf	0.220	-0.517	0.005	-0.164
smb		-0.390	0.141	0.034
hml			-0.137	0.476
umd				0.070

Correlation table (1985-2004)

	smb	hml	umd	irf
mktrf	0.176	-0.511	-0.094	-0.203
smb		-0.439	0.100	0.014
hml			-0.067	0.487
umd				0.071

Table 7

Investor Recognition as a Risk Factor:
Fama-MacBeth Regressions

This table reports the results of Fama-MacBeth (1973) style regressions performed on 25 portfolios based on size and book-to-market. Market factor, size (SMB), value (HML), and momentum (UMD) factors are obtained from Ken French's website. Investor recognition factor (IRF) is constructed in the spirit of Carhart momentum factor: companies are split into small and big by market capitalization using NYSE and AMEX median values. Each of the size groups is split into three groups (30-40-30) by change in investor recognition over the previous year. The average return on two portfolios of companies with high change in investor recognition is then subtracted from the average return on two portfolios of companies with low change in investor recognition. By construction IRF factor is expected to have a positive risk premium.

Summary results for the regression

$$R_p=\gamma_{0t}+\gamma_{mt}\beta_p+\gamma_{st}\beta_s+\gamma_{vt}\beta_v+\gamma_{momt}\beta_{mom}+\gamma_{irt}\beta_{ir}$$

Panel A: 1980-2004	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
γ_0	0.0143	(3.69)	0.0174	(5.60)	0.0165	(4.85)	0.0211	(6.02)	0.0198	(5.29)
γ_m	-0.0065	(-1.41)	-0.0111	(-3.22)	-0.0101	(-2.83)	-0.0148	(-3.97)	-0.0134	(-3.48)
γ_s			0.0006	(0.33)	0.0007	(0.37)	0.0007	(0.36)	0.0008	(0.39)
γ_v			0.0044	(2.29)	0.0043	(2.20)	0.0043	(2.20)	0.0042	(2.13)
γ_{mom}					-0.0015	(-0.43)			-0.0004	(-0.12)
γ_{ir}							**0.0052**	**(2.53)**	**0.0047**	**(2.36)**

Nobs=297

Panel B: 1985-2004	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
γ_0	0.0145	(3.32)	0.0174	(5.12)	0.0155	(4.07)	0.0193	(5.17)	0.0183	(4.48)
γ_m	-0.0072	(-1.38)	-0.0111	(-2.95)	-0.0090	(-2.26)	-0.0129	(-3.12)	-0.0118	(-2.75)
γ_s			0.0006	(0.31)	-0.0004	(-0.17)	-0.0005	(-0.21)	-0.0004	(-0.18)
γ_v			0.0044	(2.09)	0.0041	(1.91)	0.0041	(1.90)	0.0040	(1.88)
γ_{mom}					-0.0009	(-0.23)			-0.0004	(-0.10)
γ_{ir}							**0.0045**	**(2.01)**	**0.0038**	**(1.70)**

Nobs=249

Table 8

Size of Repurchase and Changes in Investor Recognition

At the end of each year t, companies which conducted repurchases are split into deciles based on the fraction of market equity they repurchased between end of fiscal year t-1 and t. A company is identified to have conducted a share repurchase in year t if between the end of fiscal years t-1 and t it repurchased at least 1% of its common equity. Amount of equity repurchased is estimated as the difference between Purchase of Common and Preferred Stock (COMPUSTAT data item 115) and the decrease in Par Value of Preferred Stock (data item 130) =#115-Δ#130. Average values for fraction of market equity repurchased and corresponding change in investor recognition between years t-1 and t are reported. Mean and median analysis for extreme (1 and 10) and next to extreme (2 and 9) deciles is performed.

1975-2004 — **Fraction of company equity repurchased in a given year**

	Low	2	3	4	5	6	7	8	9	High
	1.16%	**1.52%**	**1.96%**	**2.52%**	**3.19%**	**4.06%**	**5.23%**	**7.15%**	**10.69%**	**29.13%**
ΔIR	**-1.05%**	**-1.24%**	**-1.37%**	**-1.77%**	**-2.44%**	**-2.26%**	**-2.62%**	**-2.71%**	**-3.63%**	**-5.89%**
Nobs	1395	1382	1426	1341	1385	1381	1385	1374	1381	1423

	score	significance		score	significance
t-test (1-10)	9.83	0.01	**t-test (2-9)**	4.89	0.01
Wilcoxon (1-10) 1-sided	11.67	0.01	**Wilcoxon (2-9) 1-sided**	6.43	0.01

1984-2004 — **Fraction of company equity repurchased in a given year**

	Low	2	3	4	5	6	7	8	9	High
	1.17%	**1.53%**	**1.98%**	**2.52%**	**3.16%**	**3.97%**	**5.09%**	**6.84%**	**10.07%**	**27.52%**
ΔIR	**-1.12%**	**-1.26%**	**-1.45%**	**-1.71%**	**-2.30%**	**-2.06%**	**-2.61%**	**-2.82%**	**-3.70%**	**-5.20%**
Nobs	1161	1149	1183	1097	1134	1144	1161	1136	1147	1191

	score	significance		score	significance
t-test (1-10)	7.44	0.01	**t-test (2-9)**	4.44	0.01
Wilcoxon (1-10) 1-sided	9.23	0.01	**Wilcoxon (2-9) 1-sided**	5.77	0.01

Table 9

Abnormal performance of the Repurchases: Descriptive Statistics

This table reports descriptive statistics on the abnormal returns of the repurchasing companies and company characteristics. Buy-and-hold abnormal return (BHAR) for a the company which undertook a repurchase between the end of fiscal year t-1 and t is calculated as the difference between the buy-and-hold returns of the firm and a control company from January of year t to December of year t+k. The control company is defined as the company with the closest book-to-market value among the companies within 30% of market capitalization of the sample company. We analyze abnormal returns on repurchasing companies over 1, 2, and 3 year periods following the repurchase. Market capitalization (ME) and book-to-market values (BE/ME) are calculated at the end of each fiscal year. Lag(ret(1)) is a return on the sample company over the year t-1. Change in investor recognition ΔIR is defined as difference between the logarithms of the sum of number of shareholders of all companies in the portfolio in the year t and t-1

	mean	median	std	min	max	interquartile range	p25
BHAR(1)	4.90%	3.58%	54.28%	-500.96%	450.04%	55.51%	-23.33%
BHAR(2)	7.63%	5.26%	78.48%	-506.82%	568.83%	77.74%	-32.34%
BHAR(3)	8.83%	6.33%	93.58%	-707.50%	658.20%	89.05%	-36.82%
log(ME)	5.961	5.904	2.070	0.588	12.881	3.096	4.356
log(BE/ME)	0.398	0.396	0.882	-3.080	4.450	1.137	-0.176
lag(ret(1))	50.03%	47.56%	58.24%	-370.07%	579.05%	65.67%	15.83%
ΔIR	-2.50%	-3.32%	12.45%	-49.98%	49.98%	9.56%	-8.09%

Table 10

Change in Investor Recognition and Long-run Performance of the Repurchases

This table presents the results from company-by-company regressions of abnormal returns on repurchasing companies and company characteristics. Buy-and-hold abnormal return (BHAR) for a the company which undertook a repurchase between the end of fiscal year t-1 and t is calculated as the difference between the buy-and-hold returns of the firm and a control company from January of year t to December of year t+k. The control company is defined as the company with the closest book-to-market value among the companies within 30% of market capitalization of the sample company. ME is company market equity at the end of fiscal year t, BE/ME is book-to-market value at t, ΔIR is change in investor recognition of the company between t-1 and t. Panel A and Panel B report the results of the estimation without and with change in investor recognition correspondingly.

Panel A

	Time period					
	1 year		2 years		3 years	
	estimate	t-stat	estimate	t-stat	estimate	t-stat
Intercept	0.081	(5.24)	0.136	(6.09)	0.170	(6.37)
log(ME)	-0.003	(-1.37)	-0.007	(-1.97)	-0.010	(-2.43)
log(BE/ME)	-0.032	(-5.86)	-0.050	(-6.29)	-0.057	(-6.08)
F-stat	17.260		19.77		18.73	
Nobs	13791		13791		13791	

Panel B

	Time period					
	1 year		2 years		3 years	
	estimate	t-stat	estimate	t-stat	estimate	t-stat
intercept	0.067	(4.29)	0.119	(5.29)	0.152	(5.67)
log(ME)	-0.002	(-0.72)	-0.005	(-1.43)	-0.008	(-1.96)
log(BE/ME)	-0.035	(-6.31)	-0.053	(-6.65)	-0.061	(-6.40)
ΔIR	-0.246	(-6.57)	-0.293	(-5.41)	-0.304	(-4.71)
F-stat	25.94		22.97		19.91	
Nobs	13791		13791		13791	

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