Essays in Empirical Corporate Finance and Portfolio Choice

Andriy Bodnaruk

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to my father Yosip

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Stockholm, July 2005

Andriy Bodnaruk

Contents

Introduction and Summary

One of the main tenets of finance is diversification. Investors choose their portfolios so as to diversify away their idiosyncratic risk. In four essays included into this dissertation the implications of less than perfect diversification on investors' performance and asset pricing are investigated.

In ***Essay I*** we examine one particular instance in which diversification may play a role in a non-portfolio type of investment: the IPO. In an IPO, a set of potentially non-diversified investors – the existing shareholders – reduce their holdings of a company, listing the company and selling part of its shares. In doing this, in general, they fetch a price that is lower to the one they would have been able to get at the market price ("undepricing phenomenon").

Up to now, many theories have been brought forward to explain the determinants of the IPOs and how these affect the underpricing of the company, but have ignored the role played by the diversification of the shareholders. Our contribution is to show how portfolio diversification conditions the IPO. In particular, we argue that the level of underdiversification of the portfolio of the existing shareholders determines their incentive to resort to the IPO and the price at which it takes place (i.e., offer price). The less diversified the shareholders are, the more likely they are to resort to an IPO and the lower (with respect to the market level) the price they ask. Indeed, the less diversified the shareholder is, the greater is the risk of the shareholders' wealth and the lower is his personal valuation of the company.[†] The higher the risk, the more the shareholder is induced to rebalance his portfolio. That is, the more undiversified the shareholder is, the more likely he will take the company public.

At the same time, the higher the systematic risk, the higher the required rate of return and the lower the valuation of the company. This implies that a less diversified shareholder is willing to accept a lower price for the sale of shares in the company than a more diversified shareholder would. If we the investors who buy at the IPO are well diversified, this implies a higher underpricing.

We test these hypotheses by considering all the IPOs that took place in Sweden in the period 1995-2001. We construct measures of portfolio diversification of the holders of the stocks of a company being taken public, before and after the IPO. We then relate both the probability of

[†] Effectively, an undiversified shareholder perceives a greater fraction of the total risk of the company as idiosyncratic.

the IPO as well as the underpricing to the degree of portfolio diversification of such shareholders. In doing this, we control for the other determinants that have been uncovered in the literature. We show that the degree of portfolio diversification of the main shareholders matters. There is a negative and significant correlation between the degree of diversification and the underpricing. Companies sold by more diversified shareholders suffer a lower underpricing.

The probability of the IPO is negatively related to the degree of diversification of the shareholders. Companies held by more diversified shareholders are less likely to be taken public. Moreover, even after conditioning for the different probability of being taken public, companies held by more diversified shareholders are still displaying a lower underpricing.

In ***Essay II*** we empirically investigate the impact of incomplete diversification on asset returns. We base our analysis on Merton's (1987) theoretical paper where he relaxes the assumption of equal information across investors in the Sharpe-Lintner-Mossin CAPM model. In his model investors 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. Under such circumstances, two securities with identical pay-offs would be priced differently and carry different returns: assets of companies with a larger shareholder base (denoted by Merton as investor recognition) would be valued higher and yield lower stock returns.

The economic mechanism behind this phenomenon is that the restriction on the investment opportunity set leads to inadequate diversification of investors. The restriction on investment implies that they hold fewer assets, but allocate more of their wealth that they do invest into. The latter implies that investors have a greater exposure to idiosyncratic risk which they would require to be compensated for. The fewer number of investors (investor recognition) a firm has, the larger the fraction of company idiosyncratic risk on average its investors have to carry, and the higher return they would demand.

We test Merton's (1987) investor recognition hypothesis using data on individual holdings of Swedish investors between June 1995 and June 2001. We use ownership of a stock as a proxy of being informed about the stock and construct 7 measures of investor recognition.

We demonstrate that there is a negative and significant relationship between investor recognition and stock returns. This effect is more pronounced for younger companies, but remains statistically and economically significant for seasoned companies as well. Change in investor recognition over the previous period also is negatively related to future excess returns on the company. Positive changes in investor recognition affect returns more significantly than negative changes; a result which would like to interpret as an evidence in support of Diamond and Verrecchia (1987) argument of slower downward price adjustment in the presence of short-selling constraints. Finally, we utilize the methodology of Duma and Solnik (1995) to demonstrate that investor recognition may be a priced factor in asset returns.

In ***Essay III*** we extend our analysis of the relationship between investor recognition and asset returns to corporate events. Recent work in corporate finance has challenged market efficiency by documenting abnormal stock performance following corporate events. One well-documented 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 abnormal returns earned by firms undertaking a repurchase are substantially lower if accounted for a reduction in risk-sharing opportunities they provide to their investors.

We have demonstrated in Essay II that changes in investor recognition are negatively related to asset returns. Undertaking a repurchase implies a decrease in a firm's investor recognition and, therefore, an increase in expected returns. Hence, ceteris paribus 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 between 1975 and 2004 we document a strong negative relationship between changes in investor recognition and subsequent stock returns. Utilizing Fama and MacBeth (1973) methodology we demonstrate that investor recognition is a priced factor different from traditional ones. We show that the companies which repurchase larger fraction of their market capital also suffer a larger drop in their shareholder base. Finally, we demonstrate that abnormal performance of the repurchases is substantially reduced after accounting for changes in shareholder base.

In ***Essay IV*** I investigate the motives behind one of the most puzzling examples of investors' underdiversification – the local bias. Though classical financial theory predicts that investors should make their portfolio decisions based solely on the distribution of returns, it has long been known that investors on aggregate overweight stock of proximate companies in their portfolios. A number of theories have been put forward to explain this phenomenon, including information asymmetry, familiarity and competition for local resources. However, it has not been possible to evaluate the importance of each of these explanations to date due to the difficulty in identifying exogenous proxies specific for only one theory at a time.

I utilize a unique dataset on Swedish individual investors which allows to me investigate portfolio choices of investors whose set of local companies changes. I place the focus of my attention on movers, individual investors which change their place of residence. When the geographic distance between an investor and a company changes, it has implications on the determinants of all hypotheses of local bias existence. An analysis of portfolio rebalancing and investment decisions of movers enables me to distinguish between these hypotheses.

I demonstrate that being placed in a new community individual investors soon become biased towards companies with establishments in this new locality. Moreover, they are being able to extract abnormal returns from these investments.

I begin with an analysis of changes in holdings of the "originally held" stocks after the move. I find that over a 2½-year period after the change of residence, movers sell about 3.27% more of the originally-held stocks than non-movers for every unit of change in the logarithm of distance to the company's closest establishment. Multiple-stock holders are fully responsible for the effect, which enables me to argue that my results are not driven by employee shareholders.

I then proceed to investigate sales and acquisitions of common equity by movers at their new location. I split stocks in movers' portfolios into three groups: new purchases, originally held stocks which holdings increased, and originally held stocks which holdings decreased or remained the same. I find that originally-held stocks which holdings have not been changed or have been reduced after the move are located further from investors and provide investors with lower abnormal return than, (i) new companies purchased, and (ii) originally-held stocks which holdings have been increased after the move. The results provide evidence the individual investors learn to become biased toward local companies and that information reasons play a substantial role in the formation of local bias phenomenon.

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Shareholder Diversification and the Decision to Go Public[‡]

with Eugene Kandel, Massimo Massa, and Andrei Simonov

Abstract

We study IPOs by focusing on the degree of portfolio diversification of the shareholders taking the company public. We argue that a less diversified shareholder has more to gain from taking the company public and would be more willing to accept a lower price for the sale of its shares, i.e. tolerate higher underpricing. We test these hypotheses by considering **all** the IPOs that took place in Sweden in the period 1995-2001. We have obtained detailed information on the portfolio composition of the investors in the companies being taken public, both before and after the IPO, as well as the portfolio composition of investors in similar (in terms of size and industry) companies not taken public. The information is detailed at the stock level, for both private and public companies. We construct several proxies for portfolio diversification of the shareholders and relate them to both the probability of the IPO and the underpricing. We show that companies held by less diversified shareholders are more likely to go public and suffer a higher underpricing. We show that, as predicted, the degree of diversification explains a significant (economically and statistically) part of the probability of going public, and may account for between one third and one half of the reported underpricing. This suggests that the degree of diversification of controlling shareholders should play a prominent role in the discussion of the process of going public.

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Introduction

Portfolio diversification is one of the cornerstones of Finance. Investors form portfolios to diversify away their idiosyncratic risk. Publicly traded corporation with limited liability emerged as a vehicle to diversify the private shareholders' risk, and is widely credited with the success of capitalism. Textbooks state that the main reason for going public is diversification. In an IPO, a set of potentially non-diversified investors – the existing shareholders – reduce their holdings of a company, and become more diversified. While widely accepted, the conjecture that diversification is the main reason for IPOs is very hard to test directly, because it requires data on investors' holdings in private companies. We utilize a unique data set that allows us to form proxies for the degree of diversification of shareholders of private companies, some of which end up going public. This feature allows us to test directly the effect of diversification on the propensity to initiate an IPO.

We are able to address the question of underpricing as well. The literature contains many theories on the determinants of underpricing, but little attention is paid to the role of diversification of the controlling shareholders. In fact, the degree of their diversification determines the difference between their valuation and the valuation of the same company by a well diversified investor. We conjecture that the degree of diversification of the controlling shareholders prior to the IPO has a profound effect on underpricing.

We test these hypotheses by studying **all** 124 IPOs that took place in Sweden in the period 1995-2001.[1] For each IPO we have obtained (in addition to the standard variables) detailed information on the portfolio composition of the investors in the companies being taken public, both *before* and *after* the IPO, as well as the portfolio composition of the investors in *all* the other similar (in terms of size, book-to-market and industry) companies not being taken public. The information is detailed at the stock level, for both private and public companies. This allows us to form a clear picture of the degree of shareholders' diversification. It is important to emphasize that we account for investments in *both* publicly traded and privately held financial assets.

We construct four proxies of portfolio diversification of shareholders before and after the IPO. We then relate both the probability of the IPO, and the underpricing to the degree of portfolio diversification of the controlling shareholders prior to the IPO, while controlling for other variables used in the literature. We show that the probability of an IPO is negatively related to the degree of diversification of the controlling shareholders. Companies held by more

[1] In particular, due to data availability, the sample starts in July 1995 and ends in June 2001.

diversified shareholders are less likely to be taken public. Variation in the diversification explains a significant part of the variance in the IPO decision. We also document a negative and significant relation between the degree of diversification and the underpricing. Companies controlled by more diversified shareholders suffer a lower underpricing in an IPO; between one third and a half of the magnitude of the underpricing may be attributable to a variation in diversification. Moreover, even after conditioning on the different probabilities of being taken public, companies that are held by more diversified shareholders still display lower underpricing.

These findings make two main contributions. First, they shed light on a hitherto unexplored dimension of the IPO process. Second, they provide additional evidence on the role of portfolio diversification in a clean experiment not examined before.

We borrow heavily from the literature on IPOs, some of which is surveyed in the next section. The closest papers are Loughran and Ritter (2002) and Edelen and Kadlec (2003). Loughran and Ritter (2002) show that behavioral biases in general and prospect theory in particular, affect underpricing. Shareholders are willing to suffer underpricing if their "reference point" is low enough to make them perceive the selling price as satisfactory. They are "more tolerant of excessive underpricing if they simultaneously learn about a post-market valuation that is higher than what they expected. In other words the greater the recent increase in their wealth, the less is the bargaining effort of issuers in their negotiations over the offer price with underwriters." Our findings are related to theirs and show that the level of the "reference point" can be explained in terms of risk aversion and portfolio diversification. Less diversified investors are willing to sell at a lower price if this allows them to diversify away. This effectively reduces their reference points.

Edelen and Kadlec (2003) offer a rational story. They show that issuers, in order to maximize the expected surplus from public versus private ownership, trade-off offer proceeds and the probability of offer completion. This implies that the probability of observing an IPO and the price at which it takes place are related. We show that the degree of portfolio diversification of the inside shareholders taking the company public is one factor that directly affects both variables they study.

The remainder of the paper is structured as follows. In Section 1, we describe our contribution, relate it to the existing literature, and lay out testable predictions. In Sections 2, we describe the datasets we use and the construction of the variables. In Section 3, we discuss the econometric issues and report the main empirical results. A brief conclusion follows.

1. The literature and our contribution

The literature on IPOs is vast and well developed, both theoretically and empirically. Among other reasons, IPO has been seen as a way of increasing the visibility of a company to become a potential takeover target (Zingales, 1995), making it possible for entrepreneurs to regain control of their companies from venture capitalists (Black and Gilson, 1998) or increasing the dispersion of ownership (Chemmanur and Fulghieri, 1994, 1999).

The explanations for underpricing are even more numerous. Theories based on asymmetric information assume that the issuer is more informed than the investors, thus the underpricing is due to a "lemons problem". Higher asymmetry implies higher adverse selection risk premium, leading to higher underpricing (Allen and Faulhaber, 1989, Welch, 1989, Chemmanur, 1993). If some investors are much better informed than the rest, the underpricing may be explained in terms of a "winner's curse" (Rock, 1986, Welch, 1992). Alternatively, the underpricing is viewed as a way to remunerate investors for truthfully revealing their information in the bookbuilding process (Benveniste and Spindt, 1989, Benveniste and Wilhelm, 1990, Cornelli and Goldreich, 2002).

Habib and Ljungqvist (2001) claim that underpricing may substitute for costly marketing expenditures, while Hughes and Thakor (1992) emphasize its role in reducing the expected legal liabilities of issuers. Booth and Chua (1996) develop a model where IPO underpricing arises as a result of issuer's demand for a broad ownership dispersion and a liquid secondary market. Underpricing may be also positively correlated to the trading volume in the secondary market, see e.g. Krigman, Shaw and Womack (1999), Ellis, Michaely and O'Hara (2000), and Ellul and Pagano (2003). Finally, underpricing may be related to the way shares are allocated to the investors (Benveniste and Spindt, 1989, Sherman, 2000 and Sherman and Titman, 2002) and to the level of the conflict of interest between underwriters and issuers (Loughran and Ritter, 2002). Underpricing creates incentives to acquire a block of stocks and manage it (Stoughton and Zechner, 1998). Loughran and Ritter (2004) present the "spinning" hypothesis for why issuers are willing to hire underwriters with a high expected underpricing. Rocholl (2004) shows the link between underpricing and private benefits, such as allocations to family and friends, as well as the allocation of executive stock options with a strike price equal to the offer price.

We claim that a significant part of the cross-sectional (across firms) differences in underpricing may be explained by differences in the degree of diversification of the controlling shareholders prior to the IPO. The degree of diversification determines the required rate of return, which, in turn, determines the valuation of the stock by the non-diversified shareholder relative to the valuation of the same stock by well diversified investors. Therefore, the degree of diversification determines the size of the surplus that must be divided between the existing shareholders and the outside investors at the IPO. How this surplus is divided depends on the bargaining power of the parties, as well as on the other IPO features described above. All else equal, if the controlling shareholders are well diversified, the surplus must be small; thus one cannot anticipate large underpricing – the owners will not part with their shares below their own valuation.[2] Thus, if the IPO takes place, we should expect to observe a negative relation between the degree of diversification and underpricing.

Ritter and Welch (2002) suggest that "...simple fundamental market mis-valuation or asset pricing risk premia are unlikely to explain the average first-day return..." (in an IPO). The assumption underlying this statement is a quantification of the required risk premium based on a standard asset pricing model with fully diversified investors. We conjecture that a significant part of underpricing may be explained by the idiosyncratic risk premium of the existing shareholders. Ritter and Welch (2002) also point out that there has been little research on how the surplus was split among buy-side participants and sell side participants. This paper contributes to this line of inquiry as well.

Finally, Amihud and Mendelson (1988) stress the importance of an IPO as a vehicle for increasing the liquidity of the stock. It may well be that the demand for liquidity plays an important role in determining the likelihood of an IPO alongside the demand for diversification of the risk. Unfortunately, we are not able to measure the liquidity of the investors' portfolio, since we do not observe their cash and bonds holdings. Nevertheless we do show that the liquidity of the portfolio of all investors, except for the financial institutions, increases dramatically following the IPO, which is consistent with their story.

1.1 Our approach

The extant literature does not focus much on the size of the surplus created by the IPO, while we make it the main focus of the paper. We study how the shareholders' degree of diversification affects both the level of underpricing and the probability of the IPO. Standard theory posits that the valuation of an asset is a function of its expected return and of its systematic risk. Higher systematic risk yields higher required rate of return and lower valuation. In a standard CAPM framework the underlying assumption is that all the investors are well diversified and hold the market portfolio, thus only the systematic risk is considered. This is not the case for

[2] While the literature has found that it is common for owners to part with their shares below the *market* valuation (e.g. underpricing), the non-diversified owner's valuation was not considered.

a non-diversified investor, who must take the idiosyncratic risk into account. At the limit, for a fully undiversified investor holding only one asset, the total risk of the asset contains both systematic and idiosyncratic risk.

Therefore, the required rate of return on the asset increases in the degree of non-diversification of the investor. It follows that a less diversified shareholder should be willing to accept a lower price for the sale of shares in a company, than a more diversified shareholder would for the very same company. The undiversified investor has the private market valuation, while the diversified investor has the public market valuation. We focus directly on the difference between the valuations of diversified and undiversified shareholders, by constructing diversification proxies using investors' holdings. We estimate that the non-diversified investors' valuation is less than 75% of that of the diversified investor in our sample. This is consistent with the evidence presented in Sarin, Koeplin and Shapiro (2000) that privately held companies are sold at a discount of 20-30% relative to the market price of similar public companies. Clearly, diversification of the controlling shareholders affects the valuations of these companies.

We derive two main empirical predictions: one that is related to the probability that the IPO takes place and another to the underpricing. Let us start with the probability of initiating an IPO. The degree of diversification of the shareholders should also affect the probability of the IPO taking place. Indeed, if the IPO is a way of reducing the stake in the company by the existing shareholders, less diversified shareholders are more likely to resort to the IPO, since they have more to gain from rebalancing their portfolio. This provides our first prediction.

H1: The probability of an IPO is negatively related to the level of diversification of the controlling shareholders prior to the IPO.

That is, the existing shareholders rebalance their portfolio away from the company by taking the company public and selling part of their stake. We assume (as is the case in our sample) that the proceeds are not reinvested in the company, nor do they accrue to the company – as would be the case if the IPO simply consisted of issuing new shares – but may be used by the shareholders to invest elsewhere. If this is the case, we expect that the need for an IPO increases with the lack of diversification of the existing shareholders.

Let us now consider the underpricing at the IPO. This is defined as the difference between the offer price and the first day price. The offer price is determined by the degree of diversification of the *old shareholders* of the company; while the first day price is based on the degree of diversification of the *new shareholders*, most likely the institutional investors, who are *more diversified* than the existing shareholders. The difference between valuations of the two types creates a surplus, and if the outside investors are able to capture part of this surplus, underpricing should be positive. It should also decrease with the degree of diversification of the selling shareholders. This provides our second testable prediction:

H2: The underpricing at the IPO is negatively related to the degree of diversification of the controlling shareholders prior to the IPO.

This hypothesis is consistent with Chemmanur and Fulghieri's (1999) view that IPO is a way of increasing the dispersion of ownership. That is, IPOs allow the transfer of property from "angel" investors or venture capitalists to diversified public-market investors. Given that the latter are better diversified, they are willing to pay a higher price for the company.

Why is it the case that outside investors are able to capture part of the surplus? In other words, why doesn't the competition among the outside investors for the issue drive the price to the valuation of the fully diversified investors? First of all, it is not clear who has a better bargaining position: the issuer or the outside investors. After all the latter have many other assets to invest in. Edelen and Kadlec (2004) present this argument by assuming that issuers (underwriters) are averse to a failed offering; thus would like to reduce the probability of such an event. The higher the cost of a failed IPO, the lower the price outside investors will demand. This cost depends on the increase in value following a successful IPO. Thus, less diversified controlling shareholders with a low reservation price are also the ones with the strongest incentives to ensure the success of an IPO, therefore willing to offer price concessions.

We proceed to test these hypotheses by constructing measures of portfolio diversification of the shareholders of the company being taken public and relating them to the level of underpricing and the probability of the IPO. In the next section we describe the data and present our proxies for portfolio diversification.

2. The data and the measures of portfolio diversification

2.1 IPO data

We analyze all the IPOs undertaken on Stockholm Stock Exchange (SSE)[3] from July 1995 to June 2001: altogether 124 companies. Offer price, first day close price, size of the issue,

[3] Construction of our data base required to verify many variables. We have sent inquiries to companies about their underwriters and the type of issue (IPO or private placement or even SEO); requested annual reports from Royal Library - the ultimate storage facility for all printed documents in Sweden; confirmed

timing of the IPO, and name of the underwriter are provided by SSE. We cross-check this information with SDC, IPO prospectuses and Mediearkivet[4], a registry of publications in Swedish newspapers. Percentage of cash flow and voting rights offered to outside investors are collected from IPO prospectuses. There is a customary lockup period of six month following the IPO.

For each IPO company we have the offer price and the (unadjusted) first day close price, size of the issue, exchange of the listing, percentage of cash flow and voting rights offered to outside investors, and name of the underwriter. We define *underpricing* as the difference between the first day close price and the offer price of the issue normalized by the offer price.

2.2 Individual stockholdings

We use the data on individual shareholders collected by Vardepapperscentralen (VPC), the Security Register Center. The data contain both stockholding held directly and on the street name, including holdings of US-listed ADRs. In addition, SIS Agarservice AB collects information on ultimate owners of shares held via trusts, foreign holding companies and the like (for details, see Sundin and Sundquist 2002). Our data cover the period 1995-2001. Overall, the records provide information about the owners of 98% of the market capitalization of publicly traded Swedish companies. For the median company, we have information about 97.9% of the equity, and in the worst case we have information on 81.6% of market capitalization of the company. We also possess information about equity holders of (almost) all privately held limited liability Swedish companies. For each investor we have detailed information about its individual holdings of stocks (broken down at the stock level) and its type (private person or institutional investor). For private investors, we also have information whether the investor is a member of the board of directors of a particular company or not. It is important to note that we observe the stockholdings data twice a year: December 31 and June 30. The IPOs take place throughout the year, which means that the time that passes between the calculation of the diversification of the shareholders, and the time of the IPO is random. The further is the IPO from the time of the last diversification measure calculation, the less precise that measure is for predicting the IPO. Many changes may have occurred in the meantime. The post IPO measure is also imprecise. To gauge

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the offer and first day close prices through various sources (stock exchange registries, newspapers etc). We eliminated the companies, which have been delisted because of merger, acquisition, or failure to comply with the exchange rules within half a year period after the IPO date, or with unreliable data on offer or (unadjusted) first day close price. These are mostly very small companies with a market capitalization less that US$1Mln. The elimination of these companies is mostly motivated by data availability – typically the companies which have been delisted from the exchange leave very few traces in data sources. This resulted in dropping 7 observations.

[4] For more information see www.mediearkivet.se

the degree of the problem, we also re-estimate the basic regressions in Table 4 (Panel A) and Table 5 (Panel A) using dummy variables for the month of the IPO. The results confirm our main findings and suggest that no bias is induced by this sampling.[5]

We restrict our analysis to investors, who should have influence over companies' decisions as in Faccio and Lang (2002). For private investors, we require an investor to control at least 10% of voting rights in the IPO company or to be a member of the board of directors of the issuing company or both. For institutional investors the requirement is to control at least 10% of voting rights. Our results are qualitatively unchanged if we exclude from our analysis members of the board with less then 10%-votes stake in the IPO companies.

2.3 Company-level information and other data

We use the SIX Trust Database to obtain individual security returns (including dividends), and to track the overall market index (SIX Index). We use the Market Manager Partners Databases for various firm-level characteristics. These two databases are the equivalents, respectively, of CRSP and COMPUSTAT for the US. For the analysis of private companies which did not undertake IPO during the sample period we require them to have reliable information on the total assets, return on assets, and book value of equity for a one year period prior to corresponding IPO date.

2.4 Proxies of portfolio diversification

We consider four different measures of portfolio diversification. The first two measures are derived from Goetzmann and Kumar (2002); we refer the reader to their paper for a more extensive description of these proxies. The first measure of diversification, D_1, is constructed as:

$$D_1 = -\sum_{i=1}^{N}\left(w_i - w_{mkt}\right)^2,$$

where w_i is the weight of the stock in the portfolio of the investor and w_{mkt} is the weight that the same stock would have in the market portfolio. This measure expresses diversification in terms of divergence of the financial portfolio of the investor from the market portfolio. This and all the other measures are constructed in such a way that they increase in the degree of diversification.

The second measure, D_2, is the average correlation of the return of the industry to which the company belongs with the rest of investor's portfolio, multiplied by –1. We define the industry return as the weighted average of returns of all the publicly traded companies that fall

[5] Not reported but available from the authors.

into the same industrial category (SNI92[6]), weighed by their market capitalization. There are 12 industries. D_2 proxies for the degree of industry diversification of the investor. Diversification increases when the investor includes in her portfolio stocks from industries whose returns are not highly correlated with each other.

We also consider two additional proxies that capture the relative importance of the company being taken public in the shareholders' portfolio. D_3 is the negative of the fraction of the portfolio of the investor allocated to the company being taken public and D_4 is the negative of the fraction of the portfolio allocated to the companies that belong to the same industry. The proxy D_3 (D_4) captures the sensitivity of the investor's equity portfolio to his exposure to the specific firm (the industry). As the fraction of her portfolio allocated to particular asset or industry goes down its diversification increases.

To calculate the proxies, we use all the holdings in both public and private equity. The public equity is evaluated at the market close at the date of the IPO. The value of private equity is estimated as the most recent pre-IPO book value of investor's holdings multiplied by the corresponding average industry market-to-book ratio. We summarize the definitions of the proxies in the Appendix. Unfortunately, we do not observe cash and bond holdings. While these clearly affect the absolute degree of diversification, we assume that these holdings do not affect the relative rankings in a systematic way.

All the proxies, D_1 to D_4, are constructed first at the investor level and then aggregated at the company level by averaging the degree of diversification of each investor in the company. We consider both the simple average and the value-weighed one, where the weights are given by the percentage of company cash flow rights held by each investor. We consider an overall measure that contains all the investors, as well as measures based on subsets of investors. We stress two partitions: institutional versus private investors, and controlling versus non-controlling ones. This yields four mutually exclusive investor groups. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake, and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake. An investor is assumed to have a controlling stake if she is member of the board or has at least 10% of the votes in the company.

2.5 Control variables

[6] For more information see www.scb.se

We consider five sets of control variables which are taken from the literature described above: measures of uncertainty of issuer's valuation, IPO market conditions, momentum variables, measures of general market conditions, and underwriter's reputation.

We control for the uncertainty of the IPO company valuation by including the following set of variables: the logarithm of age of the company being taken public (*age*), its market capitalization on the first day close (*size*), and the fraction of cash flow rights in the post-IPO company offered to outside investors (*outside rights*). We also include a variable that control for the financial solidity of the firm (*own equity*). This variable is defined as a ratio of the company equity to company total assets. We also include telecom and carve-out dummies (*telecom dummy* and *carve-out dummy*). These dummies take the value of 1 if the IPO is a telecom (carve-out) and zero otherwise.

We control for the IPO market conditions controls by including the average underpricing (*market underpricing*) and the number of IPOs taken place in the previous six months (*number of IPOs*). We also include the return on the market portfolio in the previous six months (*momentum*) and its average daily standard deviation in the analogous period (*volatility*) to control for the market momentum and the riskiness of the investment environment respectively.

Finally, we include a variable that proxies for the reputation of the underwriter (*underwriter reputation*), which are claimed to explain part of the underpricing. The variable has been constructed to represent the number of deals conducted by the leading manager over the observed period. This criterion is similar to the one used by Balvers *et al.* (1988) and Beatty, Bunsis and Hand (1998) who partition underwriters into "prestigious" and "non-prestigious" groups based on their appearance in the Top 25 annual ranking by the Institutional Investor. In Sweden, firms that appear at the top of the rankings are also the ones that receive most of the deals.

3. Empirical findings

3.1 Descriptive statistics

The descriptive statistics about our sample are in Table 1. In Panel A, we describe the level of underpricing and the main financial and accounting variables of the firms being taken public. The mean underpricing is a little over 14%, which is consistent with many studies around the world, and suggests that our sample is representative.

Industry distribution of the IPO firms is presented in Panel B: Business Services and Hi-Tech constitute the majority. Panel C presents the distributions of types of institutional investors in the sample: Swedish non-financial institutions dominate. These include corporations, as well as VCs. Panel D reports the descriptive statistics for the main control variables as described in Section 2.4.

Table 2 focuses on diversification measures. In Panel A, we report the descriptive statistics of shareholders' diversification, partitioned into the four shareholder groups. The diversification of the private controlling investors is usually the lowest, followed by the private non-controlling investors. The diversification of the institutional controlling investors is the highest. In all categories there is a significant variation in the degree of diversification across firms.

Panel B shows the correlation matrix between various diversification measures of controlling shareholders. The findings can be summarized as follows: the majority of shareholders are poorly diversified, but there is also significant variation in diversification levels. The four measures are correlated within each investor group, but the correlation is far from perfect, suggesting that the different proxies are not redundant. The correlation of the same proxy between the institutional and private investors is very low, suggesting that investments of the two groups are driven by different considerations.

Panel C presents a test of differences between the firms going public and those that stay private. We first partition all firms into High and Low groups based on whether their diversification proxy is above or below the median of the entire sample. We then present the distribution of these among the two samples of firms. Firms that stay private exhibit a bit higher chances to end up in high diversification part of the sample. On the contrary, firms that end up going public are disproportionately located in the low diversification category; the difference between the two is in excess of 15%, and is statistically significant. The degree of diversification seems to affect the decision of going public, as conjectured.

Panel D shows similar results, but from a different angle. It presents the comparison of diversification proxies before and after the IPO for firms that end up going public. Recall that we observe the holdings every 6 months, so "before" means the last semi-annual observation before the IPO, and "after" means the first semi-annual observation after the IPO. It is clear that private investors significantly reduce their holdings and increase their portfolio diversification. We do not find the same result for institutions. This suggests that private investors do use IPOs to reduce their holdings.

We also study the distribution of the number of controlling shareholders in the sample of firms going public (see Figure 2). Over a quarter of the companies have just one controlling shareholders, while 80% of the companies have 4 or less. This suggests that these are quite tightly controlled companies. In such an environment the coordination is reasonably easy, which justifies our approach of "a representative agent" - we average all the measures of diversification across the controlling shareholders.

In Table 3, we report the required rate of return of the company's shareholders and compare it to the required rate of return for a well-diversified shareholder before the IPO. The *diversified required rate of return* is the rate of return that would be asked by a diversified shareholder. We calculate it using the Fama-French three-factor pricing model.[7]

The undiversified required rate of return depends on the degree of diversification of their portfolios. It is constructed in the following way. For each investor, we calculate the "beta" between the return on the stock and the average return on the investor portfolio. This is then multiplied by the excess return of the investor portfolio over the riskless (3 month Swedish T-bill) rate. Then, the required rate of return for each investor is aggregated across all the shareholders of each taken public company. As before, we consider a breakdown for institutional and private investors as well as for controlling and minority shareholders. We estimate the parameters using either 36 or 60 months.

Let us, for example, consider the required rate of return of the controlling institutions. This is determined as follows. First, we identify the institutions with controlling power among the shareholders. Then, for each of them, we calculate their required rate of return on the basis of their portfolio holdings. Finally, we construct the aggregate required rate of return for the institutions with controlling power by averaging the required rate of returns individually constructed for all the controlling institutions. These rates represent how much different classes of shareholders would require for the same firm, depending on their degree of portfolio diversification.

Both in the case of diversified and undiversified shareholders, the return on the company stock before the IPO as well as the return of all stocks held in the portfolio of the investors which are not listed, are proxied by the return on "similar" (in terms of size and book-to-market) listed stocks. We use two criteria to select such companies: a) we first select companies with a market capitalization within 30% of the market capitalization of the company at the date of IPO; b)

[7] The results based on one factor model are similar and are omitted for brevity. We did not use four-factor model. As it was shown by Rouwenhorst(1998), the momentum effect in Sweden is negligible.

among the companies satisfying condition a) we pick those that have the book-to-market ratio closest to the book-to-market ratio of the company going public[8].

We report the *mean values* of the estimates of the required rates of return, the t-*stat* and the significance levels (one-sided) for the *mean test*, *Wilcoxon z-score* and significance level (one-sided) for *median test* of the undiversified required rate of return of particular group of investors being larger than that required by diversified investors. It is always the case that the rate of return required by the main classes of investors holding shares in the firm before the IPO, being private investors or institutions, controlling or minority shareholders, is higher than that required by the market (i.e., diversified investors). This difference is always strongly statistically significant, both in terms of mean and median tests.

These findings show that the existing shareholders have a significantly higher required rate of return than the fully diversified shareholder. Figure 1 presents the discount implied in the valuation of the non-diversified investors (similar to those presented in Table 3) relative to the valuation of a fully diversified investor. The discount depends on the expected growth rate of cash flows, but it starts at almost 30% and may go as high as 60%. This implies that a variation in the degree of diversification may create significant variation in the size of the surplus. This suggests that large variation in diversification may translate into a large variation in the propensity to undergo an IPO, and in the degree of underpricing, which we may be able to capture in the data. In the next section we proceed to test these hypotheses.

3.2 Probability of an IPO and portfolio diversification

The decision to go public has been the subject of many studies. We consider the specification used by Pagano, Panetta, Zingales (1998), adding our measures of portfolio diversification. In particular, we estimate the probit model:

$$l_i^* = \alpha_1 + \beta_1 D_i + \gamma_1 C_{1,i} + \varepsilon_{1,i}, \qquad 1)$$

where, for the i^{th} company, l_i^* is a latent unobservable variable that represents the decision to list the company. In practice we observe l_i, a dummy that takes the value of 1 if the company is listed and zero otherwise. That is, $l_i = 1$ if $l_i^* > 0$ and $l_i = 0$ if $l_i^* < 0$. The probability of listing ($Prob(l_i=1)$) is modeled as a normal c.d.f. All the other variables are defined as before.

[8] Average (median) control company is 3.98% (5.07%) smaller in terms of market capitalization and has book-to-market ratio lower by 0.057 (0.042).

We consider an expanded dataset that contains all the non-listed companies that are similar (in terms of size and industry) to the one being taken public. The dataset includes a total of 1,309 companies/observations for non-listed companies. For these companies, we construct all the control variables as defined before. $C_{1,i}$ is the vector of control variables defined above and D_i is one of our measures of portfolio diversification. Recall that Hypothesis 2 requires that $\beta_1 < 0$; i.e. more diversified companies should be less prone to initiate an IPO. The results are reported in Table 4. We consider four different specifications, based on the different measures of portfolio diversification, to test the robustness of results. In Panel A, we report the results for the measures of portfolio diversification based on simple average across all the shareholders using the entire sample of IPOs. For robustness, we also considered a smaller sample of larger companies (assets exceeding 50 Mln. SEK); the results are in Panel B. In Panel C we report the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. Finally, Panel D contains the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake of at least 10% of the voting rights.

The results show a strong and negative correlation ($\beta_1 < 0$) between the degree of portfolio diversification, D_1, - D_4, and the probability of going public. As conjectured, more diversified controlling shareholders are clearly less likely to initiate an IPO. These results are consistent across specifications, and the effect is quite strong. In particular, an increase of 1 standard deviation of the degree of portfolio diversification of the institutional controlling shareholders decreases the probability of the company being taken public by 1.12% if we consider D_1, by 1.46% if we consider D_2, by 2.45% if we consider D_3, and by 1.90% if we consider D_4. The unconditional probability of going public in our sample is 8.65%, which means that diversification explains a significant part of the reported variation, making it an economically as well as statistically significant feature of the IPO process.

3.3 Underpricing and portfolio diversification

Next we relate the degree of underpricing to our measures of portfolio diversification. We estimate:

$$u_i = \alpha_2 + \beta_2 D_i + \gamma_2 C_{1,i} + \varepsilon_{2,i}, \qquad 2)$$

where u_i is the underpricing for the ith company being taken public, $C_{2,i}$ is the vector of control variables defined above and D_i is one of our measures of portfolio diversification for the controlling shareholders. Equation (2) is estimated by using White heteroskedasticity-consistent estimator. The results are reported in Table 5.

Recall that Hypothesis 1 implies that $\beta_2 < 0$. We consider three alternative specifications, based on the different measures of portfolio diversification described in section 2.3. In Panel A, we report the results for the measures of portfolio diversification based on simple averages; in Panel B, the results for the measures of portfolio diversification based on the value-weighted averages, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighted averages, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

The results clearly show that underpricing declines in the degree of diversification, as predicted. This is true for all our measures of diversification for the private controlling shareholders; and in three of them the relationship is significant at less than 5% level. We then replicate the same estimation procedure with the minority shareholders and find no relation between their diversification and the degree of underpricing (the results are reported in Panels D and E of Table 5). The comparison clearly indicates that it is the diversification of the controlling shareholders that matters as they decide on whether to take the company public and on its offer price.

An interesting result is that the negative relationship is entirely due to private controlling investors. Institutions with a controlling stake, while strongly influencing the decision to go public (see Table 4), do not seem to affect the price. These findings are consistent across specifications and may arise for two reasons. First, the institutional investors with controlling stakes are likely to be Venture Capital or Private Equity Funds, while the private investors are mostly the original inventors or entrepreneurs. The former are mostly interested in a profitable exit, and may be willing to sacrifice the price for the sake of the success of an IPO. Realizing that it is a repeated game, they are willing to forego some of the current gains to increase the probability of raising the next round of financing, which depends on their ability to deliver profitable exits. The private investors usually view it as a one shot game, which makes them less willing to make concessions, and, perhaps, less anxious for an exit. This would mean that less diversified institutional investors (e.g. the VCs) would push for a quicker exit, while the diversified private investors would insist on lower underpricing.

Alternatively, our findings may be due to the fact that the estimation of Equation (2) does not account for a potential selection bias: the same factors that determine the underpricing may also determine the probability of the company being taken public. We address this issue in the next section.

3.4 Selection bias and underpricing

In the previous section we directly related underpricing to investor characteristics and a set of control variables. It is however, possible that the very same variables that determine the probability of the IPO, also determine the size of the underpricing. This may generate a sample selection problem. To address this issue we resort to an econometric specification that explicitly controls for it. Let us assume that:

$$l_i^* = \alpha_1 + \beta_1 D_{1i} + \gamma_1 C_{1i} + \varepsilon_{1i} \tag{3}$$

$$u_i^* = \alpha_2 + \beta_2 D_{1i} + \gamma_2 C_{2i} + \varepsilon_{2i} \ . \tag{4}$$

We also know that $u = u_i^*$, $l_i = 1$ if $l_i^* > 0$ and that u_i is not observed and $l_i = 0$ if $l_i^* \leq 0$. Equation 4) represents the level of underpricing, conditional on the company being taken public and equation 3) represents the probability that such IPO takes place. This specification captures the fact that we do not observe the underpricing for companies that are not taken public. However, the probability of being taken public is itself a function of the some of the explanatory variables that affect the premium. We assume the following correlation structure:

$$\begin{pmatrix} \varepsilon_{1i} \\ \varepsilon_{2i} \end{pmatrix} \approx NID\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{matrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{matrix} \right).$$

In this case, the standard OLS estimates of equation (3) are biased (Maddala, 1983). We, therefore, adopt the Heckman (1979) two-stage procedure. We first estimate equation (3) using a standard probit choice model, and then we estimate:

$$u_i^* = \alpha_2 + \beta_2 D_j + \gamma_2 C_{2i} + \delta \lambda_i + \varepsilon_{2i} \qquad 5)$$

where $\lambda_i = \dfrac{\phi(\alpha_1 + \beta_1 O_{1i} + \gamma_1 C_{1i})}{\Phi(\alpha_1 + \beta_1 O_{1i} + \gamma_1 C_{1i})}$ is the Heckman's Lambda and is estimated from the results of the first stage. In equation (5) the standard errors are corrected for heteroskedasticity and selection bias (Greene, 1981). The value and significance of the δ provides a test of the null of no sample selection bias.

The results are reported in Table 6. As in the previous section, we consider 4 different specifications, based on the different measures of portfolio diversification. Again, in Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.[9]

The results show two important points. First, selection bias does not seem to be important, since the coefficient of Heckman's Lambda is almost always insignificant. This suggests that the previous results were not due to selection bias. Moreover, the results concerning the ownership variables are consistent with the ones previously reported. Indeed, underpricing is negatively related to the degree of diversification of the shareholders before the IPO. This holds in across specifications of the diversification proxies and control variables.

As in the previous section, the negative relationship is restricted to private controlling shareholders, while the institutional controlling investors do not seem to play a role. These findings provide a useful robustness check and show that the underpricing at the IPO can be, at least partially, explained in terms of the degree of diversification of the private controlling shareholders. In particular, an increase of 1 standard deviation of the degree of portfolio diversification of the private controlling shareholders reduces the underpricing by 8.16% if we consider D_1, by 5.56% if we consider D_2, by 6.82% if we consider D_3, and by 5.55% if we consider D_4. Considering the unconditional underpricing of 14.2%, it implies that between one third and a half of the underpricing may be explained by the diversification of the controlling private shareholders. This is a very significant economic effect, which, in our opinion, ought to be introduced into the literature.

3.5 Robustness

Most of the IPOs in our sample are subject to the customary lockup period during which old shareholders cannot sell shares. It may well be that we are underestimating the increase in the diversification of the controlling shareholders by looking at their holdings before the end of the lockup period, since we observe their holdings twice a year. To test this issue, we re-estimate

[9]As a robustness check, we also estimate a specification in which we restrict the sample to the private companies that have at least 50 million SEK in assets (roughly $5 Mln). The results are consistent with the ones reported and available upon request.

Table 2 D, looking at the difference between the post-IPO diversification of controlling shareholders before and after the customary 6-months lock-up period expires. The results (not reported) show that there is no difference in the degree of diversification, suggesting that our earlier findings are not affected by the lock-up period restriction.

Another issue is liquidity.[10] Amihud and Mendelson (1988) argue that one of the most important features of an IPO is that it dramatically increases the liquidity of the firm's stock, thus raising its value. The two arguments are similar: in both cases the post-IPO outside investor values the stock more than the pre-IPO insider. Consequently, we cannot rule out that the demand for liquidity may be partly responsible for the results that we observe, along with the demand for diversification. We would like to test the liquidity hypothesis separately. Unfortunately, the fact that we do not observe investors' holdings of cash and bonds does not allow us to estimate the liquidity of their overall portfolio. We perform the tests for the effects of diversification, since it is much less sensitive to these omissions. Nevertheless, we have computed the changes in the liquidity of the equity portfolio for shareholders in our sample. We define liquidity as the ratio between the value of liquid assets and the total value of the portfolio, where liquid assets are publicly traded assets before and after the IPO. We separate institutional investors into financials (banks, mutual funds, insurance companies and alike) and others.

Table 7 presents the findings. It is clear that all the shareholders, except for the financial institutions greatly increase the liquidity of the equity portfolio following the IPO. This is not surprising, given that the firm goes public, and the shareholdings are quite concentrated. Unfortunately we cannot say much more with our data.

Conclusion

We study IPOs from a new perspective, by focusing on the degree of portfolio diversification of the shareholders taking the company public. We argue that a less diversified shareholder is willing to accept a lower price for the sale of shares than a more diversified shareholder. At the same time higher idiosyncratic risk induces shareholders to rebalance their portfolio. This implies that the more undiversified the shareholder is, the more willing he is to diversify by taking the company public.

We test these hypotheses by considering all the IPOs that took place in Sweden in the period 1995-2001. We construct measures of portfolio diversification of the holders of the stocks

[10] We would like to thank Yakov Amihud for suggesting this line of inquiry to us.

of the companies being taken public, before the IPO and then we relate them to the probability of the IPO and the underpricing of the IPO. We find that the degree of portfolio diversification of the main shareholders matters. The probability of the company being taken public is negatively related to the degree of diversification of the controlling institutional shareholders. We also show that there is a negative and significant correlation between the level of underpricing and the degree of diversification of the controlling private shareholders. These results are robust across alternative specifications and different measures of the degree of shareholder portfolio diversification and after controlling for selection bias.

These findings shed some light on the one of the two of the most persistent puzzles of finance: the underpricing and underperformance around IPOs. They contribute to explain them in a simple finance set-up that uses the most elementary of financial tenets: portfolio diversification. These results also have important implications in terms of the debate on financial diversification. We expect that, if underpricing is related to the lack of diversification of the private controlling shareholders of the company being taken public, an increase in the fraction of the company's capital held by institutional investors should reduce the level of underpricing.

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Appendix

We summarize here the definitions of our proxies for the degree of diversification.

1. D_1 is defined as follows:

$$D_1 = -\sum_{i=1}^{N} \left(w_i - w_{mkt} \right)^2,$$

   where w_i is the weight of the stock in the portfolio of the investor and w_{mkt} is the weight of the same stock in the market portfolio.

2. D_2 is the average correlation of the return of the industry to which the company belongs with the return of the rest of investor's portfolio, multiplied by –1. We construct the industry return as a weighted average of the returns of all the publicly traded companies in the same SNI92[11] industrial category, weighed by their market capitalization. The classification contains 12 industries.
3. D_3 is the negative of the percentage of the portfolio of the investor allocated to the company being taken public.
4. D_4 is the negative of the percentage of the portfolio of the investor allocated to the industry to which the company in question belongs.

[11] For more information see www.scb.se

Table 1: Descriptive statistics for the companies going public

Panel A reports some descriptive statistics for the underpricing and main financial and accounting variables of the taken public companies. The data are obtained from the SIX Trust Database and the Market Manager Partners Databases. *Underpricing* is defined as the difference between the first-day close and offer price normalized by the offer price. *Size* is defined as the market capitalization of the company (in *Mln.* of SEK) on the first trading day (during the period of our sample the exchange rate varied between 7 and 10 SEK per USD). *Mkt/bk* is market-to-book value of the company at the closest end of January/June date after the IPO. *Total assets* and *ROA* are, respectively, the total accounting value of the company assets and the return on total assets at the closest available date before the IPO. *Own equity* is defined as a ratio of the company own equity to company total assets. *Panel B* reports the distribution of IPOs over industries based on SNI92 classification. *Panel C* reports the distribution of institutional investors by type. *Panel* D displays the descriptive statistics for the control variables we use in our regressions. We report the following variables: *age* – time in years from the registration of the IPO company to its IPO date, *outside rights* – fraction of the cash flow rights offered to the outside investors at the IPO, *telecom* and *carve-out* – telecom industry dummy and carve-out dummy, *market underpricing* and *number of IPOs* – average underpricing and number of IPOs over the previous six months period, *momentum* and *volatility* – total return and average daily standard deviation on the market portfolio in the previous six months, *underwriter reputation* – the highest number of deal conducted by the leading manager over the observed period.

Panel A: Underpricing, underperformance, main financial and accounting variables

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
Underpricing	0.142	0.075	0.324	0.204	-0.467	2.435
Size (Mln. SEK)	1915	512	4814	1431	20	32995
Mkt/bk	4.73	3.76	3.29	3.07	0.57	18.47
Total assets (Mln. SEK)	753	114	3649	249	15	38232
ROA	0.012	0.015	0.315	0.184	-2.646	0.713
Own equity	0.655	0.689	0.242	0.354	0.076	0.999

Panel B: Distribution of IPO's by industry

Industry	Number	%
Mining and heavy machinery manufacturing	11	9%
Other manufacturing	7	6%
Trade	12	10%
Transport	5	4%
Financials	3	2%
Business services	51	41%
High tech	32	26%
News and entertainment	3	2%
Total	124	100%

Panel C: Distribution of Institutional Investors by Type

Type of Institution	Number of IPO	Percentage in the Sample	Percentage of the IPO value
Foreign non-financial	11	6.63%	12.23%
Foreign financial	11	6.63%	9.64%
Swedish non-financial	92	55.42%	54.13%
Swedish financial	49	29.52%	22.71%
Others	3	1.81%	1.28%

Panel D: Control variables

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
Age	15.089	11.000	16.088	9.500	1.000	96.000
Outside Rights	0.351	0.297	0.177	0.226	0.045	0.855
Telecom Dummy	0.250	0.000	0.435	1.000	0.000	1.000
Carve-Out Dummy	0.194	0.000	0.397	0.000	0.000	1.000
Market Underpricing	0.160	0.127	0.123	0.158	0.014	0.657
Number of IPOs	11.815	12.000	5.537	8.000	1.000	24.000
Momentum	0.132	0.179	0.166	0.198	-0.299	0.525
Volatility	0.013	0.011	0.004	0.007	0.007	0.022
Underwriter Reputation	15.468	12.000	8.513	15.500	2.000	27.000

Table 2: Descriptive statistics on diversification proxies

Panel A reports the descriptive statistics for the average levels of diversification of the shareholders of the companies being taken public, breaking them down into institutional and private shareholders, controlling and minority shareholders. The measures of diversification are defined as follows: D_1 is the negative of the sum of squared differences between the weight a particular position has in the investor's portfolio and its weight in the market portfolio, D_2 is the average correlation of the return of the industry to which the company belongs with the return of the rest of investor's portfolio, multiplied by –1. We construct the industry return as a weighted average of the returns of all the publicly traded companies in the same SNI92[12] industrial category, weighed by their market capitalization. The classification contains 12 industries, D_3 is the negative of the percentage of the portfolio of the investor allocated to the company being taken public, D_4 is the negative of the percentage of the portfolio of the investor allocated to the industry to which the company in question belongs. These variables are constructed at the investor level and then aggregated at the company level by averaging the degree of diversification of each investor in the company. We consider both the simple average and the value weighed one, where the weights are given by the fraction of shares held by the investors in the company. We consider the institutional and private investors as well as the controlling investors and the minority ones. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake. An investor is assumed to have a controlling stake if he is member of the board or has at least 10% of the votes in the company. *Panel B* displays the correlation matrix among the diversification proxies described above, but only for the controlling shareholders. *Panel C* reports the percentages of the IPO-ed and non-IPOed private companies in lower and upper half of the sample based on diversification measures D_1-D_4. We also report the result of Wilcoxon test of equality between the diversification proxies distribution of the two samples. *Panel D* reports time series changes of the degree of diversification for private and institutional investors before and after the IPO.

Panel A: Diversification Proxies

Variable	Mean	Median	StdDev	Interquartile Range	Minimum	Maximum
D_1^{ip}	-0.723	-0.858	0.316	0.580	-1.000	-0.053
D_1^{inp}	-0.757	-0.999	0.306	0.531	-1.000	-0.048
D_1^{pp}	-0.935	-0.992	0.122	0.074	-1.000	-0.205
D_1^{pnp}	-0.883	-0.998	0.183	0.225	-1.000	-0.208
D_2^{ip}	-0.552	-0.439	0.384	0.804	-1.000	0.123
D_2^{inp}	-0.704	-1.000	0.347	0.629	-1.000	-0.056
D_2^{pp}	-0.743	-0.894	0.312	0.495	-1.000	0.082
D_2^{pnp}	-0.757	-0.947	0.292	0.481	-1.000	-0.043
D_3^{ip}	-0.636	-0.776	0.390	0.677	-1.000	-0.001
D_3^{inp}	-0.655	-0.995	0.407	0.767	-1.000	-0.001
D_3^{pp}	-0.926	-0.995	0.152	0.065	-1.000	-0.179
D_3^{pnp}	-0.839	-0.994	0.256	0.225	-1.000	-0.006
D_4^{ip}	-0.713	-0.845	0.329	0.472	-1.000	-0.002
D_4^{inp}	-0.741	-1.000	0.343	0.480	-1.000	-0.015
D_4^{pp}	-0.948	-0.997	0.117	0.046	-1.000	-0.231
D_4^{pnp}	-0.879	-0.999	0.209	0.180	-1.000	-0.074

[12] For more information see www.scb.se

Panel B: Correlations among the Diversification Proxies

Variable	D_1^{ip}	D_1^{pp}	D_2^{ip}	D_2^{pp}	D_3^{ip}	D_3^{pp}	D_4^{ip}
D_1^{ip}	1.000						
D_1^{pp}	0.074	1.000					
D_2^{ip}	0.674	-0.088	1.000				
D_2^{pp}	0.183	0.546	0.080	1.000			
D_3^{ip}	0.824	0.064	0.717	0.161	1.000		
D_3^{pp}	0.094	0.778	-0.005	0.472	0.051	1.000	
D_4^{ip}	0.756	0.031	0.677	0.151	0.924	0.008	1.000
D_4^{pp}	0.055	0.899	-0.084	0.483	0.021	0.845	0.028

Panel C: Diversification of shareholders of firms going public versus the shareholders of other firms.

Measures of diversification	Degree of diversification	% of IPO	% of NON-IPO	Wilcoxon Test Z	Wilcoxon Test Pr<Z
D_1	Low	58.06%	49.35%	1.8542	0.0319
	High	41.94%	50.65%		
D_2	Low	56.45%	49.50%	1.4783	0.0697
	High	43.55%	50.50%		
D_3	Low	61.29%	49.05%	2.6054	0.0046
	High	38.71%	50.95%		
D_4	Low	58.87%	49.27%	2.0419	0.0206
	High	41.13%	50.73%		

Panel D: Test of changes in diversification before and after IPO for private and institutional investors.

	Private		Institutional	
	Wilcoxon's Z	*p-value*	*Wilcoxon's Z*	*p-value*
D_1	-1.570	0.058	-0.466	0.320
D_2	-1.830	0.034	0.467	0.320
D_3	-1.800	0.036	-1.403	0.0803
D_4	-1.675	0.047	0.038	0.4851

Table 3: Required rate of return for the IPO companies

This table presents estimates of monthly required rate of returns for different groups of investors. We consider both the undiversified and the diversified rate of return. For each company, the diversified required risk premium is constructed as the product between the Fama and French factor risk premium and the loading of the company return on that factor. The company stock return in the years before the IPO is proxied by the return of a listed company with analogous characteristics (in terms of size and book-to-market). The undiversified required rate of returns is constructed as follows. For each investor, we calculate the loading ("beta") between the return on the stock and the return on the investor portfolio. This is then multiplied by the excess return of the investor portfolio over the riskless (30-days T-bill) rate. Then, for each company being taken public, we calculate the required rate of returns (undiversified as well as diversified) by aggregated across all the shareholders of the company. As before, we report a breakdown for institutional and private investors as well as for controlling and minority shareholders. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake.
We present the results for 3-factor (Fama-French) models using factor loadings estimated over 36- and 60 months prior to the IPO date. We use the following matching mechanism to identify listed companies most similar to the IPO companies in our sample: a) we select companies with a market capitalization within 30% of the market capitalization of the company at the date of its IPO; b) among companies satisfying condition a) we select the ones that have the book-to-market ratio closest to the book-to-market ratio of the company going public.
The notations on the types of investors are as in Table 1. We report the *mean values* of the estimates of required rates of return (for undiversified investors and for each group of investors), t-*stat* and significance levels for *mean tests* (one-sided), and *Wilcoxon z-score* and significance level (one-sided) for *median test* of the undiversified required rate of return of particular group of investors being larger than that required by diversified investors. The number of observation is 124 and the number of degrees of freedom for mean and median test is 246.

	Non Controlling Institutions (inp)	*Controlling Institutions (ip)*	*Non Controlling Private (pnp)*	*Controlling Private (pp)*	*Diversified Investors*
Required rate of returns with loadings constructed over 36 months					
Mean (%)	2.59	2.65	2.75	2.78	2.08
t-value	2.45	2.50	2.87	2.85	
p-value	0.015	0.013	0.004	0.005	
Wilcoxon' Z	2.20	2.47	2.44	2.36	
p-value	0.014	0.007	0.007	0.009	
Required rate of returns with loadings constructed over 60 months					
Mean (%)	2.42	2.43	2.53	2.56	1.86
t-value	3.29	3.26	3.68	3.69	
p-value	0.001	0.001	0.001	0.001	
Wilcoxon' Z	2.44	2.51	2.62	2.66	
p-value	0.007	0.006	0.004	0.004	

Table 4: Probability of an IPO and portfolio diversification

This table reports results of the probit regression of the decision to go public on our proxies of investors' diversification and a set of control variables. We report the results for companies with at least 20 mln SEK (roughly 2 Mln. USD) in total assets (Panels A, C, and D). We also report a robustness check for for companies with assets above 50 mln SEK in Panel B. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B we report the same measure as in Panel A, but for 50 Mln. SEK cutoff; in Panel C, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel D, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.
Our sample includes 124 companies which were taken public during the sample period and 277 companies which remain private (199 companies which remain private for the 50 mln SEK cut-off). The dependent variable is a dummy that takes the value 1 if the company got listed in the observed ½ -year period and 0 otherwise. The total number of observations is 1,433 in Panels A, C and D and 1,122 in Panel B. Definition of equally weighted and value weighted aggregation measures are the same as before. Diversification measures and control variables are defined in Table 1.

Panel A: Equally weighted diversification measures – all firms

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-1.270	(-3.59)	-1.299	(-4.43)	-1.451	(-4.47)	-1.646	(-4.77)
$D1^{ip}$	-0.303	(-1.86)						
$D1^{pp}$	0.377	(1.74)						
$D2^{ip}$			-0.267	(-1.98)				
$D2^{pp}$			0.441	(3.06)				
$D3^{ip}$					-0.507	(-3.96)		
$D3^{pp}$					0.288	(1.47)		
$D4^{ip}$							-0.512	(-3.39)
$D4^{pp}$							0.084	(0.39)
Log(Assets)	-0.126	(-3.58)	-0.110	(-3.11)	-0.129	(-3.65)	-0.137	(-3.86)
ROA	0.042	(0.22)	0.038	(0.20)	0.001	(0.00)	0.0.52	(0.27)
Own equity	0.385	(1.94)	0.366	(1.84)	0.429	(2. 13)	0.390	(1.95)
Time Dummies	Yes		Yes		yes		Yes	
Log likelihood	-383.736		-380.516		-377.523		-381.187	
Pseudo R^2	0.126		0.133		0.140		0.131	

Panel B: Equally weighted diversification measures – firms with assets exceeding SEK 50 mln

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.420	(-1.05)	-0.363	(-1.06)	-0.602	(-1.61)	-0.802	(-2.03)
$D1^{ip}$	-0.355	(-2.04)						
$D1^{pp}$	0.105	(0.45)						
$D2^{ip}$			-0.252	(-1.75)				
$D2^{pp}$			0.197	(1.25)				
$D3^{ip}$					-0.533	(-3.89)		
$D3^{pp}$					0.007	(0.03)		
$D4^{ip}$							-0.556	(-3.44)
$D4^{pp}$							-0.215	(-0.91)
Log(Assets)	-0.309	(-6.72)	-0.290	(-6.30)	-0.311	(-6.78)	-0.326	(-7.02)
ROA	-0.323	(-1.29)	-0.317	(-1.28)	-0.306	(-1.29)	-0.261	(-0.41)
Own equity	0.467	(2.16)	0.444	(2.06)	0.553	(2.51)	0.510	(2.37)
Time Dummies	yes		Yes		Yes		Yes	
Log likelihood	-333.158		-333.116		-327.703		-329.243	
Pseudo R^2	0.127		0.128		0.142		0.138	

Panel C: Value-weighted diversification measures – all firms

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-1.540	(-3.63)	-1.752	(-6.13)	-2.281	(-8.71)	-2.459	(-5.86)
$D1^{ip}$	-0.342	(-2.13)						
$D1^{pp}$	0.117	(0.34)						
$D2^{ip}$			-0.258	(-1.91)				
$D2^{pp}$			-0.224	(-1.46)				
$D3^{ip}$					-0.495	(-3.86)		
$D3^{pp}$					-0.677	(-2.41)		
$D4^{ip}$							-0.456	(-3.02)
$D4^{pp}$							-0.855	(-2.42)
Log(Assets)	-0.127	(-3.61)	-0.119	(-3.39)	-0.127	(-3.56)	-0.135	(-3.77)
ROA	0.027	(0.15)	0.044	(0.24)	-0.001	(-0.01)	0.059	(0.31)
Own equity	0.400	(2.02)	0.406	(2.05)	0.437	(2.15)	0.388	(1.93)
Time Dummies	Yes		Yes		yes		yes	
Log likelihood	-385.175		-383.988		-374.739		-377.918	
Pseudo R^2	0.098		0.101		0.129		0.115	

Panel D: Value-weighted diversification measures – all firms; controlling shareholders are those with at least 10% of voting rights)

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-3.401	(-5.25)	-2.103	(-7.07)	-3.693	(-7.00)	-3.775	(-6.37)
$D1^{ip}$	-0.286	(-1.77)						
$D1^{pp}$	-1.850	(-3.05)						
$D2^{ip}$			-0.187	(-1.38)				
$D2^{pp}$			-0.737	(-4.44)				
$D3^{ip}$					-0.421	(-3.21)		
$D3^{pp}$					-2.234	(-4.66)		
$D4^{ip}$							-0.386	(-2.51)
$D4^{pp}$							-2.257	(-4.13)
Log(Assets)	-0.121	(-3.37)	-0.123	(-3.44)	-0.130	(-3.54)	-0.137	(-3.71)
ROA	0.056	(0.30)	0.048	(0.26)	0.015	(0.80)	0.067	(0.35)
Own equity	0.374	(1.88)	0.443	(2.21)	0.447	(2.15)	0.399	(1.95)
Time Dummies	Yes		Yes		Yes		yes	
Log likelihood	-378.639		-374.375		-360.002		-367.668	
Pseudo R^2	0.144		0.145		0.183		0.167	

Table 5: Underpricing and portfolio diversification

This table presents the results of the regression of underpricing on our diversification measures. We report two sets of results, one for diversification measures equally weighted across investors with controlling stake (at least 10% of voting rights) in the company and one for value weighted (by cash flow rights) across investors with controlling stake or sitting on the board of directors or both. The dependent variable is underpricing defined as the difference between the first day close and offer price normalized by the offer price. The number of observations is 124. Diversification measures and control variables as defined in table 1. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighted average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighted average, considering only the investors with a controlling stake at least equal to 10% of the voting rights. Panels D and E are equivalents of Panels A and B, but the estimation is done for non-controlling shareholders.

Panel A: Equally weighted diversification measures

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.438	(-1.58)	-0.117	(-0.56)	-0.255	(-1.09)	-0.2777	(-1.16)
$D1^{ip}$	0.042	(0.52)						
$D1^{pp}$	-0.582	(-2.68)						
$D2^{ip}$			-0.043	(-0.54)				
$D2^{pp}$			-0.171	(-1.79)				
$D3^{ip}$					-0.004	(-0.07)		
$D3^{pp}$					-0.363	(-2.37)		
$D4^{ip}$							-0.004	(-0.06)
$D4^{pp}$							-0.390	(-2.23)
Log(Age)	0.007	(0.39)	0.013	(0.60)	0.008	(0.45)	0.007	(0.41)
Outside Rights	0.124	(0.54)	0.119	(0.51)	0.111	(0.48)	0.106	(0.45)
Telecom Dummy	0.208	(2.17)	0.224	(2.15)	0.198	(2.08)	0.200	(1.96)
Carve-Out Dummy	0.091	(1.28)	0.109	(1.61)	0.095	(1.40)	0.091	(1.34)
Market Underpricing	-0.014	(-0.08)	0.002	(0.01)	-0.008	(-0.04)	-0.004	(-0.03)
Number of IPOs	-0.007	(-1.97)	-0.008	(-2.07)	-0.008	(-2.03)	-0.008	(-2.17)
Momentum	0.296	(1.72)	0.337	(1.87)	0.301	(1.69)	0.298	(1.66)
Volatility	-8.105	(-1.02)	-7.906	(-1.00)	-8.352	(-1.05)	-8.268	(-1.01)
Underwriter Reputation	0.001	(0.58)	0.002	(0.96)	0.001	(0.68)	0.001	(0.73)
Adj R2	0.082		0.088		0.074		0.073	

Panel B: Value-weighted diversification measures

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.205	(-0.69)	-0.201	(-0.91)	-0.167	(-0.69)	-0.250	(-0.94)
$D1^{ip}$	0.019	(0.22)						
$D1^{pp}$	-0.329	(-1.58)						
$D2^{ip}$			-0.047	(-0.60)				
$D2^{pp}$			-0.226	(-2.40)				
$D3^{ip}$					-0.032	(-0.51)		
$D3^{pp}$					-0.257	(-2.12)		
$D4^{ip}$							-0.039	(-0.45)
$D4^{pp}$							-0.333	(-1.88)
Log(Age)	0.008	(0.42)	0.018	(0.94)	0.009	(0.47)	0.008	(0.46)
Outside Rights	0.119	(0.52)	0.100	(0.45)	0.095	(0.42)	0.097	(0.43)
Telecom Dummy	0.182	(2.00)	0.195	(2.08)	0.175	(1.86)	0.186	(1.85)
Carve-Out Dummy	0.113	(1.41)	0.145	(1.87)	0.114	(1.60)	0.111	(1.54)
Market Underpricing	0.036	(0.20)	0.032	(0.17)	0.013	(0.07)	0.054	(0.30)
Number of IPOs	-0.008	(-2.13)	-0.008	(-2.11)	-0.008	(-2.16)	-0.007	(-2.09)
Momentum	0.301	(1.70)	0.38	(2.06)	0.292	(1.62)	0.275	(1.52)
Volatility	-8.596	(-1.06)	-6.00	(-0.79)	-8.020	(-1.01)	-9.130	(-1.10)
Underwriter Reputation	0.001	(0.74)	0.002	(0.90)	0.001	(0.82)	0.001	(0.81)
Adj R2	0.079		0.108		0.075		0.074	

Panel C: Value-weighted diversification measures (controlling stake >= 10% of voting rights)

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.478	(-1.76)	-0.128	(-0.60)	-0.261	(-1.11)	-0.294	(-1.22)
$D1^{ip}$	0.034	(0.43)						
$D1^{pp}$	-0.613	(-3.02)						
$D2^{ip}$			-0.052	(-0.65)				
$D2^{pp}$			-0.172	(-1.85)				
$D3^{ip}$					-0.020	(-0.32)		
$D3^{pp}$					-0.356	(-2.43)		
$D4^{ip}$							-0.024	(-0.28)
$D4^{pp}$							-0.387	(-2.26)
Log(Age)	0.008	(0.44)	0.013	(0.62)	0.009	(0.50)	0.009	(0.48)
Outside Rights	0.126	(0.55)	0.123	(0.53)	0.109	(0.47)	0.105	(0.45)
Telecom Dummy	0.209	(2.18)	0.226	(2.17)	0.198	(2.08)	0.203	(1.99)
Carve-Out Dummy	0.092	(1.31)	0.109	(1.61)	0.096	(1.43)	0.093	(1.37)
Market Underpricing	-0.001	(-0.01)	0.001	(0.01)	-0.005	(-0.03)	0.002	(0.02)
Number of IPOs	-0.007	(-2.00)	-0.008	(-2.11)	-0.008	(-2.04)	-0.008	(-2.18)
Momentum	0.284	(1.64)	0.343	(1.89)	0.295	(1.65)	0.289	(1.60)
Volatility	-8.161	(-1.02)	-7.627	(-0.97)	-8.432	(-1.06)	-8.454	(-1.02)
Underwriter Reputation	0.001	(0.58)	0.002	(0.95)	0.001	(0.70)	0.001	(0.76)
Adj R2	0.083		0.090		0.075		0.074	

Panel D: Equally weighted diversification measures, non-controlling shareholders

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	0.185	(1.11)	0.266	(1.26)	0.192	(1.07)	0.190	(1.20)
$D1^{inp}$	0.087	(0.91)						
$D1^{pnp}$	-0.037	(-0.21)						
$D2^{inp}$			0.086	(0.78)				
$D2^{pnp}$			0.111	(0.69)				
$D3^{inp}$					0.021	(0.22)		
$D3^{pnp}$					0.035	(0.31)		
$D4^{inp}$							0.163	(1.73)
$D4^{pnp}$							-0.115	(-0.89)
Log(Age)	0.010	(0.49)	0.012	(0.67)	0.012	(0.59)	0.007	(0.31)
Outside Rights	0.146	(0.55)	0.186	(0.68)	0.141	(0.54)	0.137	(0.53)
Telecom Dummy	0.193	(2.11)	0.197	(2.01)	0.194	(2.00)	0.177	(1.85)
Carve-Out Dummy	-0.076	(-1.44)	-0.041	(-0.93)	-0.082	(-1.42)	-0.061	(-1.13)
Market Underpricing	-0.056	(-0.30)	-0.122	(-0.61)	-0.045	(-0.23)	-0.108	(-0.60)
Number of IPOs	-0.009	(-2.09)	-0.009	(-1.99)	-0.009	(-2.04)	-0.009	(-2.32)
Momentum	0.331	(1.66)	0.374	(1.88)	0.328	(1.66)	0.352	(1.82)
Volatility	-6.847	(-0.87)	-5.965	(-0.78)	-7.050	(-0.92)	-5.736	(-0.72)
Underwriter Reputation	0.002	(1.10)	0.003	(1.27)	0.003	(1.26)	0.002	(0.86)
Adj R2	0.061		0.078		0.060		0.071	

Panel E: Value-weighted diversification measures, non-controlling shareholders

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	0.181	(1.10)	0.283	(1.25)	0.195	(1.06)	0.182	(1.17)
$D1^{inp}$	0.051	(0.56)						
$D1^{pnp}$	-0.020	(-0.12)						
$D2^{inp}$			0.095	(1.17)				
$D2^{pnp}$			0.127	(0.75)				
$D3^{inp}$					0.072	(1.01)		
$D3^{pnp}$					-0.013	(-0.13)		
$D4^{inp}$							0.214	(2.27)
$D4^{pnp}$							-0.190	(-1.20)
Log(Age)	0.010	(0.49)	0.012	(0.61)	0.011	(0.54)	0.006	(0.27)
Outside Rights	0.139	(0.54)	0.195	(0.72)	0.136	(0.53)	0.144	(0.57)
Telecom Dummy	0.192	(2.09)	0.198	(2.05)	0.190	(2.01)	0.169	(1.91)
Carve-Out Dummy	-0.085	(-1.49)	-0.033	(-0.71)	-0.069	(-1.27)	-0.055	(-1.06)
Market Underpricing	-0.048	(-0.26)	-0.142	(-0.67)	-0.062	(-0.30)	-0.138	(-0.74)
Number of IPOs	-0.009	(-2.15)	-0.009	(-2.08)	-0.009	(-2.07)	-0.010	(-2.33)
Momentum	0.324	(1.68)	0.370	(1.89)	0.324	(1.63)	0.343	(1.82)
Volatility	-7.145	(-0.91)	-5.992	(-0.82)	-7.233	(-0.94)	-6.130	(-0.81)
Underwriter Reputation	0.002	(1.17)	0.003	(1.34)	0.002	(1.16)	0.002	(0.66)
Adj R2	0.059		0.085		0.064		0.086	

Table 6: Underpricing and portfolio diversification (accounting for the endogeneity of an IPO)

This table presents the results of the effect the diversification of investors has on underpricing controlling for self-selection bias. Heckman's lambda is estimated from probit regressions in Table 4. The definition of equally weighted and value weighted aggregation measures is the same as before. Diversification measures and control variables are defined in Table 1. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

Panel A: Equally weighted diversification measures

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.894	(-1.52)	-0.585	(-1.26)	-0.692	(-1.46)	-0.701	(-1.43)
$D1^{ip}$	-0.021	(-0.18)						
$D1^{pp}$	-0.669	(-2.48)						
$D2^{ip}$			-0.101	(-0.88)				
$D2^{pp}$			-0.178	(-1.85)				
$D3^{ip}$					-0.075	(-0.70)		
$D3^{pp}$					-0.449	(-2.36)		
$D4^{ip}$							-0.071	(-0.57)
$D4^{pp}$							-0.474	(-2.23)
Log(Age)	0.009	(0.36)	0.015	(0.56)	0.011	(0.42)	0.009	(0.37)
Outside Rights	0.151	(0.63)	0.161	(0.66)	0.139	(0.58)	0.136	(0.56)
Telecom Dummy	0.222	(2.09)	0.247	(2.13)	0.210	(2.03)	0.214	(1.91)
Carve-Out Dummy	0.167	(1.34)	0.210	(1.65)	0.166	(1.48)	0.158	(1.43)
Market Underpricing	-0.023	(-0.13)	-0.020	(-0.09)	-0.022	(-0.11)	-0.016	(-0.09)
Number of IPOs	-0.003	(-0.79)	-0.002	(-0.59)	-0.004	(-0.92)	-0.004	(-0.99)
Momentum	0.359	(1.87)	0.439	(2.01)	0.366	(1.83)	0.358	(1.81)
Volatility	-9.351	(-1.11)	-9.643	(-1.15)	-9.311	(-1.13)	-9.350	(-1.10)
Underwriter Reputation	0.001	(0.23)	0.001	(0.53)	0.001	(0.31)	0.001	(0.38)
Heckman Lambda	0.137	(1.05)	0.182	(1.27)	0.133	(1.14)	0.125	(1.09)
Adj R2	0.088		0.104		0.081		0.078	

Panel B: Value-weighted diversification measures

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-0.681	(-1.20)	-0.728	(-1.50)	-0.691	(-1.41)	-0.777	(0.16)
$D1^{ip}$	-0.047	(-0.39)						
$D1^{pp}$	-0.384	(-1.65)						
$D2^{ip}$			-0.107	(-0.97)				
$D2^{pp}$			-0.270	(-2.38)				
$D3^{ip}$					-0.104	(-1.01)		
$D3^{pp}$					-0.379	(-2.19)		
$D4^{ip}$							-0.103	(-0.86)
$D4^{pp}$							-0.482	(-1.94)
Log(Age)	0.012	(0.47)	0.020	(0.76)	0.014	(0.53)	0.012	(0.45)
Outside Rights	0.152	(0.63)	0.142	(0.60)	0.125	(0.53)	0.129	(0.54)
Telecom Dummy	0.193	(1.95)	0.215	(2.09)	0.186	(1.84)	0.199	(1.84)
Carve-Out Dummy	0.205	(1.46)	0.253	(1.84)	0.203	(1.67)	0.192	(1.60)
Market Underpricing	0.038	(0.20)	0.008	(0.04)	0.008	(0.04)	0.055	(0.29)
Number of IPOs	-0.003	(-0.76)	-0.002	(-0.62)	-0.003	(-0.88)	-0.003	(-0.71)
Momentum	0.370	(1.89)	0.505	(2.19)	0.359	(1.81)	0.335	(1.73)
Volatility	-10.153	(-1.17)	-7.457	(-0.95)	-9.224	(-1.12)	-10.560	(-1.21)
Underwriter Reputation	0.001	(0.33)	0.001	(0.46)	0.001	(0.38)	0.001	(0.40)
Heckman Lambda	0.156	(1.14)	0.195	(1.37)	0.154	(1.26)	0.144	(1.20)
Adj R2	0.083		0.127		0.085		0.085	

Panel C: Value-weighted diversification measures (controlling stake >= 10% of voting rights)

Variable	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
Intercept	-1.133	(-1.60)	-0.681	(-1.31)	-0.843	(-1.43)	-0.8393	(-1.37)
$D1^{ip}$	-0.028	(-0.25)						
$D1^{pp}$	-0.862	(-2.40)						
$D2^{ip}$			-0.102	(-0.97)				
$D2^{pp}$			-0.283	(-1.85)				
$D3^{ip}$					-0.077	(-0.78)		
$D3^{pp}$					-0.596	(-2.10)		
$D4^{ip}$							-0.074	(-0.63)
$D4^{pp}$							-0.607	(-2.02)
Log(Age)	0.015	(0.53)	0.020	(0.72)	0.016	(0.56)	0.014	(0.51)
Outside Rights	0.150	(0.62)	0.153	(0.63)	0.130	(0.54)	0.127	(0.52)
Telecom Dummy	0.219	(2.03)	0.242	(2.09)	0.206	(1.94)	0.212	(1.84)
Carve-Out Dummy	0.182	(1.39)	0.201	(1.69)	0.170	(1.49)	0.162	(1.41)
Market Underpricing	-0.008	(-0.04)	-0.017	(-0.08)	-0.010	(-0.05)	0.001	(0.00)
Number of IPOs	-0.003	(-0.69)	-0.002	(-0.61)	-0.003	(-0.87)	-0.004	(-0.93)
Momentum	0.354	(1.80)	0.457	(2.03)	0.358	(1.78)	0.349	(1.74)
Volatility	-9.914	(-1.17)	-8.980	(-1.10)	-9.706	(-1.17)	-9.650	(-1.12)
Underwriter Reputation	0.001	(0.18)	0.001	(0.47)	0.001	(0.26)	0.000	(0.36)
Heckman Lambda	0.155	(1.08)	0.184	(1.28)	0.137	(1.08)	0.126	(0.99)
Adj R2	0.092		0.108		0.082		0.079	

Table 7

We report the liquidity of the portfolio for different types of investors in power before and after IPO. Liquidity is defined as the ratio between the value of liquid assets and the total value of the portfolio, where liquid assets are publicly traded assets. We separate institutional investors into financials (banks, mutual funds, insurance companies and alike) and others. We report mean and median tests of the difference of liquidity before and after IPO.

			Mean Test		Wilcoxon Test	
Investor Type		Mean	t-stat	p-value	Wilcoxon Z	p-value
Individual investors	Before	0.1537	55.03	0.001	26.17	0.001
	After	0.9796				
Institutional investors	Before	0.4176	15.48	0.001	13.15	0.001
	After	0.9353				
Institutional Investors, Financials	Before	0.9248	0.66	0.514	-0.732	0.232
	After	0.9485				
Institutional Investors, non-financials	Before	0.3231	17.67	0.001	13.117	0.001
	After	0.9324				

Figure 1: This figure depicts the discount implied in the valuation of the non-diversified investors relative to the valuation of a fully diversified investor for the same expected cash flows by a diversified investor, as a function of the growth rate of cash flows. We assume that the discount rate of the fully diversified investor is 2% per period, while the discount rate of the non-diversified investor is 2.75% per period.

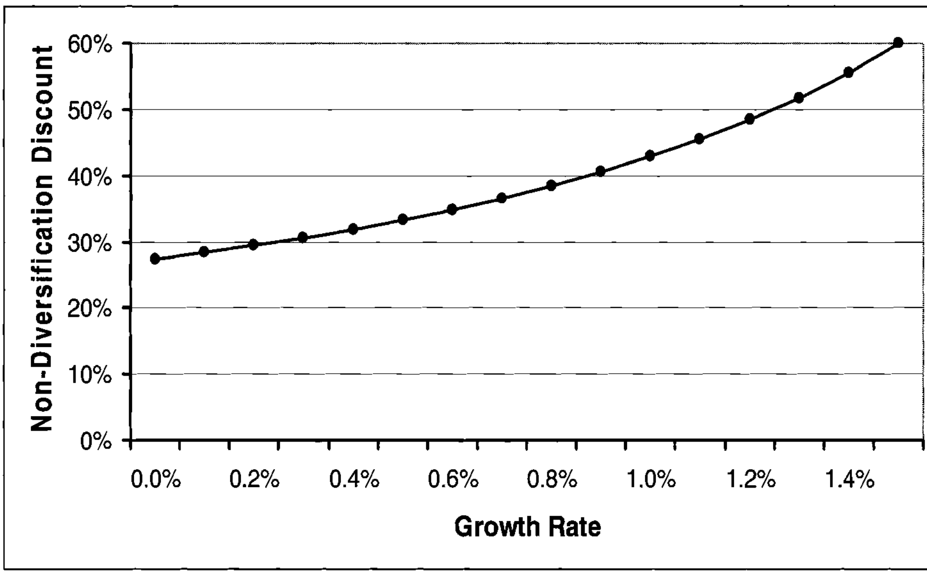
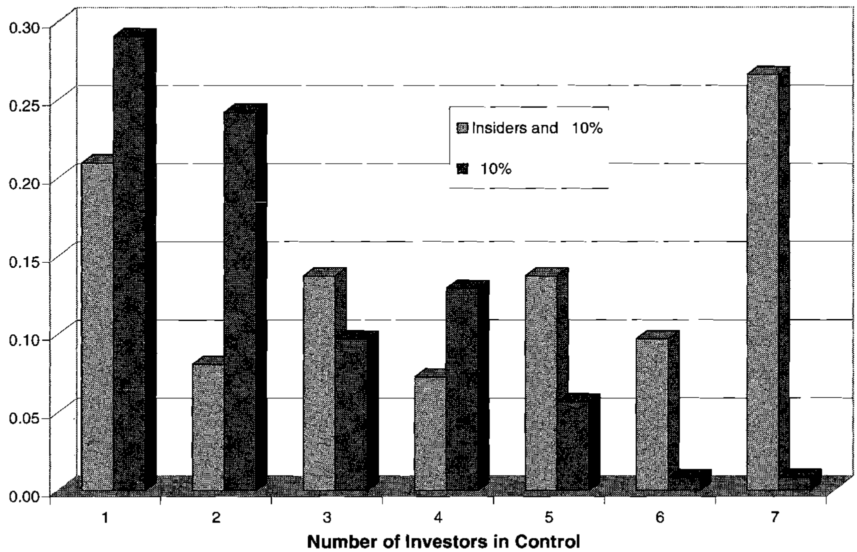


Figure 2: Frequency distribution of investors in control/company. Investors in control are defined either as insiders and owners of blocks in excess of 10% of equity (left bars) or as owners of blocks in excess of 10% (right bars).



Does Investor Recognition Predict Excess Returns?*

with Per Östberg

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 is conditionally priced.

JEL Classification: G11, G12
Keywords: Investor recognition, limited stock market participation, Incomplete information, Asset pricing

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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 the 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 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.

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[1] Grubel (1968) and DeSantis and Gerard (1997) document the benefits 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 investors also earn abnormal returns when trading in local stocks.

[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.

The economics 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 risk-sharing for their shareholders, but yield higher returns.

This paper tests Merton's (1987) investor recognition hypothesis using data on individual 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 1.46-30.14% lower annualized excess return. The effect is more pronounced for young firms than for seasoned firms. However, the effect is statistically and economically significant even for seasoned firms.

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 5.43-22.99%. 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 separate from the fundamental ones.

A number of papers have tested Merton's (1987) hypothesis 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 investor 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

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

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 implies 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&P500 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'shypothesis.

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 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 derives 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.

A 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.

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 of investor recognition will also experience high price volatility. Hence, investor will require a premium for holding stocks of firms with highly

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

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.

1. The data and measures of investor recognition

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

B. 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.

C. 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

$$IR_i = \frac{\sum_{j=1}^{N} I_i^j}{N} \quad (1)$$

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

$$WWIR_i = \frac{\sum_{j=1}^{N} W^j I_i^j}{\sum_{j=1}^{N} W^j} \quad (2)$$

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

M1: The logarithm of the number of shareholders.

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.

[6] Although we do not analyze the relationship between the returns on the private equity and investor recognition we use information about private firms to calculate estimates of investor wealth.
[7] Foerster and Karolyi (1999) and Kadlec and McConnel (1994) use the inverse of the number of shareholders as a measure of investor recognition.

M3: IR (equation (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).

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 only a subset of the investors in the economy being informed about the company. 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

$$\lambda_i = \delta\sigma_i^2 x_i \frac{1-q_i}{q_i} \quad (3)$$

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 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 from equation (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.

2 Empirical Findings

A. 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 is Panel A. Interpreting M3 and M¤ 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 1999.

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.

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 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 significant and economically meaningful. The difference in average excess return between extreme quartiles of investor recognition ranges from 10.20 to 30.05 percent 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.

B. 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

$$R_{i,t+1} = \alpha + \beta IR_{it} + \gamma D_{it} \quad (4)$$

where i is the company index and t is the time index. The next period $(t+1)$ excess return is denoted by $R_{i,t+1}$ 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 of book to market ratio, previous period return and residual variance. 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

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

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.

C. 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 very 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.

Splitting the sample and estimating (4) 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 pronounced 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.

D. 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

$$R_{i,t+1} = \alpha + \beta \Delta IR_{i(t-1)} + \gamma D_{it} \quad (5)$$

where for the company i at time t, $R_{i,t+1}$ 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 specifications 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% percent 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 suggests 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.

E. 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 $j=1,\dots,M$. There are N factors (F_n) with $i=1,\dots,N$. The factors contain the standard ones and our measures of investor recognition. The conditional expected returns in an asset pricing model are given by:

$$E\left[R_{jt}\middle|\Omega_{t-1}\right]=\sum_{i=1}^{N}\lambda_{n,t-1}\operatorname{cov}\left[R_{j,t},F_{n,t}\middle|\Omega_{t-1}\right] \quad (6)$$

where $R_{j,t}$ is the excess return on the portfolio j. 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

$$\begin{gathered} E\left[m_t\left(1+R_{f,t-1}\right)\middle|\Omega_{t-1}\right]=1 \\ E\left[m_t R_{j,t}\middle|\Omega_{t-1}\right]=0 \end{gathered} \quad (7)$$

where $R_{f,t-1}$ is the risk free rate. Dumas and Solnik (1995) show that

$$m_t=\frac{\left[1-\lambda_{0,t-1}-\sum_{i=1}^{N}\lambda_{n,t-1}F_{n,t}\right]}{\left(1+R_{f,t-1}\right)} \quad (8)$$

where the time-varying term $\lambda_{0,t-1}$ ensures that (7) is satisfied.

We assume that Ω_{t-1} is generated by a vector of instrumental variables 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 Z. So $\lambda_{0,t-1} = -Z_{t-1}\delta$ and $\lambda_{n,t-1} = -Z_{t-1}\phi_n$ where δ and ϕ are time-invariant vector of weights. The innovation in the marginal rate of substitution is defined as

$$u_t = 1 - m_t\left(1 + R_{f,t-1}\right) \quad (9)$$

Then given (8) u_t becomes

$$u_t = -Z_{t-1}\delta + \sum_{i=1}^{N} Z_{t-1}\phi_n F_{n,t} \quad (10)$$

Define $h_{j,t} = R_{j,t} - R_{j,t}u_t$. The first-order conditions (7) imply the following orthogonality conditions

$$\begin{aligned} E\left[u_t \middle| \Omega_{t-1}\right] &= 0 \\ E\left[h_t \middle| \Omega_{t-1}\right] &= 0 \end{aligned} \quad (11)$$

where 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 $\varepsilon_t = \left(u_t, h_t\right)$ we obtain

$$E\left[\varepsilon_t \middle| Z_{t-1}\right] = 0 \quad (12)$$

which implies the restriction $E\left[\varepsilon_t' \middle| Z_{t-1}\right] = 0$ and the sample version

$$Z'\varepsilon = 0 \quad (13)$$

Here Z is a $T \times Q$ matrix, where Q is the number of instruments used and T is the number of time periods. The estimate of ε is a $T \times \left(1 + M\right)$ 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 (13) represent our testable restrictions. The λ_s have been replaced by combinations of instruments such that $\lambda_{0,t-1} = -Z_{t-1}\delta$ and $\lambda_{n,t-1} = -Z_{t-1}\phi_n$. So we estimate the moment conditions in (13) 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 (11). Under the null hypothesis that (11) holds then the quadratic form of (13) 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

$$H_0 : \phi_{IRF} = 0 \text{ and } H_A : \phi_{IRF} \neq 0 \quad (14)$$

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 are 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.

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 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.

By examining the relationship between investor recognition and excess returns we are able to trace the effect of individual portfolio choice on excess returns.

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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
M1	0.072	0.009	0.343	0.200	-2.884	2.830
M2	0.071	0.029	0.284	0.248	-2.620	2.193
M3	0.000	-4.329E-05	0.005	0.001	-0.070	0.132
M4	0.000	-2.470E-04	0.007	0.002	-0.079	0.145
M5	0.004	2.393E-03	0.067	0.057	-0.526	0.519
M6	0.003	2.664E-04	0.036	0.006	-0.342	0.554
M7	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 capitalization$*10^6$	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 measures and changes in measures of investor recognition, excess returns on 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)	M1	M2	M3	M4	M5	M6	M7	Log(MC)	Log(BE/ME)	Res. Var	Lag(ER6)
M1	-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
M2	-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
M3	-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
M4	-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
M5	-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
M6	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
M7	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
M1	**0.13**	0.10	0.06	0.05	0.09	-0.09	-0.10
M2	0.15	**0.16**	0.07	0.07	0.10	-0.04	-0.06
M3	0.12	0.10	**0.34**	0.28	0.11	-0.01	0.01
M4	0.11	0.11	0.33	**0.33**	0.10	0.00	0.01
M5	0.04	0.04	0.04	0.05	**0.37**	-0.01	-0.03
M6	-0.08	-0.08	-0.05	-0.06	0.01	**0.19**	0.18
M7	-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	size 2	size 3	size 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	size 2	size 3	size 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

			size			
			1	2	3	4
M3	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
M4	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

			size			
			1	2	3	4
M5	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

		size			
		1	2	3	4
M6 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

		size			
		1	2	3	4
M7 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)
M1	-0.1861	(-6.09)												
M2			-0.2910	(-6.80)										
M3					-6.0138	(-4.45)								
M4							-6.0141	(-5.63)						
M5									-0.4453	(-2.92)				
M6											-2.4617	(-6.73)		
M7													-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)
M1	-0.1466	(-4.07)												
M2			-0.2811	(-5.12)										
M3					-3.5259	(-3.30)								
M4							-3.1862	(-3.52)						
M5									-0.3528	(-2.28)				
M6											-1.0347	(-3.07)		
M7													-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.

16 size and book-to-market portfolios

Factors in unrestricted model	Null Hypothesis	D-stat	degrees of freedom	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

Investor Recognition and

the Long-Run Performance of Repurchases*

with Per Östberg

Abstract

Theory suggests that firms with lower investor recognition should provide investors with higher 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% over one year.

JEL classification: G11, G12, G35.
Keywords: Investor recognition, repurchases, limited stock market participation, Incomplete information, Asset pricing, event studies, long-run performance

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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 segmented, then 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 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 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 have 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 investor base and is associated with a

[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.

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 a seminal 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 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 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.

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

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 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

[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.

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 a repurchase. 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 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:

H1: 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.

[7] Other authors argue that the motives for repurchases are different during crashes.
[8] Dittmar (2000) speculates that this may be due to the adoption of the regulation 10b-18 that clarified the legal standing of repurchases.

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.

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_{it} 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:

H2:.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:

$$R_{pt} = \gamma_{0t} + \gamma_{mt}\beta_{m,t-1} + \gamma_{st}\beta_{s,t-1} + \gamma_{vt}\beta_{v,t-1} + +\gamma_{momt}\beta_{mom,t-1} + \gamma_{IRFt}\beta_{IRF,t-1} + v_{pt}$$

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 Gaspar 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:

H3: 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 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.

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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 : Number of companies in the sample by type

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 : change in investor recognition, main financial and accounting variables – entire sample

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
IR	-0.37%	-1.92%	12.74%	-32.84%	42.26%	10.36%

Panel C: change in investor recognition, main financial and accounting variables – small vs. large companies

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
IR	-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
IR	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 (IR, $\log(N_t/N_{(t-1)})$ 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 IR 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 group	Change in Investor recognition deciles									
	Low	2	3	4	5	6	7	8	9	High
IR	**-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
IR	**-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 IR 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
IR	**-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	
IR	**-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	
IR	**-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	
IR	**-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	
IR	**-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	IR quartile	Lowest 30% IR	Lowest 30% return	Medium 40% IR	Medium 40% return	Largest 30% IR	Largest 30% return
Small		IR	return	IR	return	IR	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

size group	IR quartile	Lowest 30% IR	Lowest 30% return	Medium 40% IR	Medium 40% return	Largest 30% IR	Largest 30% return
Big		IR	return	IR	return	IR	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)	IR
log(ME)	-0.135	0.070
log(BE/ME)		-0.112

Panel B

Portfolio-wise correlations

	beta	log(ME)	log(BE/ME)	lag(pER)	IR
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). IR 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)
IR									-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)
IR									-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- #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%**
IR	**-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%**
IR	**-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 IR 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%
IR	-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, IR 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)
IR	-0.246	(-6.57)	-0.293	(-5.41)	-0.304	(-4.71)
F-stat	25.94		22.97		19.91	
Nobs	13791		13791		13791	

Proximity always matters: evidence from Swedish data*

Abstract:

In this paper I investigate portfolio rebalancing and investment decisions of investors when their set of local companies changes: to do this I analyze the portfolios of individual investors who have changed their places of residence. My analysis indicates that the further investors move away from the closest establishment of a company that is held in their portfolio, the more of its shares they abnormally sell relative to those investors who do not move. Originally-held stocks which holdings have not been changed or have been reduced after the move are geographically more distant and provide lower abnormal returns to the investors at their new location than (i) stocks acquired after the move and (ii) originally-held stocks which holdings have been increased after the move. Confirming the results of other studies, I demonstrate that Swedish individual investors derive economically and statistically significant gains from investing locally. The results provide support for the idea that local bias of individual investors is a result of their having superior information about proximate investment opportunities.

JEL classification: G11

Keywords; economic geography, local bias, information asymmetry, familiarity

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Introduction

Classical financial theory predicts that all investors should hold well-diversified portfolios of risky assets. Within this framework, each rational, risk-averse, utility-maximizing investor is expected to choose her optimal portfolio based solely on the distribution of returns. Other stock characteristics, in particular the geographic distance from an investor to an asset, should be given no consideration.

However, it has long been known that most investors shun stocks of distantly-headquartered companies in their portfolios. This phenomenon was originally observed as underweighting of foreign stocks in portfolios of domestic investors and, hence, is known as "home bias"[1]. Some recent evidence suggests that investors not only put their money primarily into domestic stocks, but they also demonstrate a significant preference for locally-headquartered companies relative to other domestic companies. Coval and Moskowitz (2001) document that US mutual fund managers hold a disproportionately large share of their portfolios in firms that have local headquarters. Ivkovic and Weisbenner (2003) find that the average American household invests nearly a third of its portfolio in firms headquartered within 250 miles. Both of these studies demonstrate that local investments yield statistically and economically significant higher returns than non-local stocks. Huberman (2001), who introduced the concept of "familiarity", documents that shareholders of a Regional Bell Operating Company tend to live in the area served by the company. Grinblatt and Keloharju (2001) show that Finnish investors are more likely to hold, buy, and sell stocks of Finnish firms which are not only located close to the investor, but also communicate in the same language as the investor. Hau (2001) shows that non-German-speaking traders significantly underperformed German-speaking traders when trading the 11 largest blue-chip German stocks on the German electronic trade system Xetra. In the latter case, however, speaking German is highly correlated with living closer to companies' headquarters. The phenomenon of investor preference for proximate domestic companies observed in these studies has become known as "local bias".

The commonly-accepted interpretation of local bias is that people prefer to invest in the familiar. However, there is much less agreement about what "familiarity" is about: is it an information-driven phenomenon or a behavioral bias? Coval and Moskowitz (2001) suggest that investors buy local stocks because they believe they possess significant informational advantages in evaluating nearby investments. Huberman (2001), however, attributes local bias to people being "comfortable investing their money in businesses that are visible to them", which he explains as a cognitive bias for the familiar. DeMarzo, Kaniel, and Kremer (2002) offer non-familiarity based justification of the local bias phenomenon. They demonstrate that, under certain plausible assumptions, local bias can be the outcome of competition for local resources within the community as investors try to correlate pay-off of their portfolios with the prices of local goods. A separation of the

[1] Lewis (1999) surveys a large literature documenting "home bias".

theories of local bias existence has not been possible to date due to the difficulty in identifying exogenous proxies specific for only one theory at a time.

Unlike the previous literature on local bias, which deals with investors facing a fixed set of local and non-local stocks, this paper investigates investors' portfolio choices when the set of local companies changes. One obvious example of such a situation is when an investor changes residence. When the geographic distance between an investor and a company changes, then the determinants of the different hypotheses of local bias existence (proximity-related information advantage in evaluating the prospects of the company, attribution of the company to an investor's set of local companies, and an investor's degree of familiarity with a company) are all likely to be affected. An analysis of portfolio rebalancing and investment decisions of the movers enables me to investigate previously unobserved instances of local bias behavior and provide additional support for the information-based hypothesis of local bias existence.

The contribution of this paper is twofold. Firstly, I demonstrate that Swedish individual investors derive statistically and economically significant gains from investing locally in Sweden. Over a 5½-year period, the average abnormal return from investing in companies located nearby was, controlling for size and book-to-market ratio of the company, 1.81% annualized for every unit of logarithm of a distance from the investor to the company's closest establishment. The results are robust to different sets of controls and confirm previous findings of Massa and Simonov (2002), which document positive gains from investing locally in Sweden for a smaller group of individual investors (the latter analysis was controlled for labor shocks).

Secondly, I observe and investigate local bias behavior in portfolio rebalancing and investment decisions of individual investors who change their place of residence (hereafter "movers"). I argue that the set of local stocks for a mover is likely to change as a result of a move, which has implications for an investor's portfolio choice. I begin with an analysis of changes in holdings of the "originally held" stocks[2] after the move. I find that over a 2½-year period after the change of residence, movers sell about 3.27% more of the originally-held stocks than non-movers for every unit of change in the logarithm of distance to the company's closest establishment. Multiple-stock holders are fully responsible for the effect, which enables me to argue that my results are not driven by employee shareholders. Reductions in holdings of originally-held stocks are more pronounced for wealthier investors, which could be attributed to their lower search/processing and transaction costs and greater financial sophistication. I could not find evidence that abnormal selling of the originally-held stocks by movers is induced by a difference in the degree of local competition at the old and new location.

[2] Throughout this paper, "originally-held" stocks are those stocks which were already held in a portfolio before the investor moved residence. Investors may keep originally held stock in their portfolios after the move.

I then proceed to investigate the relationship between the distances separating investors' residences from the originally-held stocks and from the new companies purchased after the move. I find that originally-held stocks which holdings have not been changed or have been reduced after the move (hereafter "OHNI[3] stocks") are located further from investors than, (i) new companies purchased, and (ii) originally-held stocks which holdings have been increased after the move (hereafter "OHI[4] stocks").

Finally, I investigate the relationship between returns that individual investors make on originally-held stocks and new purchases. I find strong evidence that both OHI stocks and new purchases provide higher abnormal returns than OHNI stocks. The results provide support for the idea that local bias could be the outcome of investors' having superior information about proximate investment opportunities. However, I cannot exclude that investors' desire to hedge against price volatility of local resources, and investor familiarity with companies located nearby can partly explain their preference for local stocks.

The remainder of this paper is organized as follows. Section 1 presents the three main hypotheses of local bias existence and their empirical implications. Section 2 provides a description of the dataset and outlines the methodology I used to examine the performance of the proximate and distant domestic stocks held in Swedish investor portfolios. Section 3 describes the variables and reports on the relationship between abnormal return and proximity of the firm. Section 4 proposes a methodology to match movers with investors who do not change their place of residence, and provides a description of the movers' dataset. Section 5 examines changes in movers' holdings in stocks that they had acquired before the move. Section 6 analyzes the relationship between distances to new purchases and to the stocks held before the move, and the returns investors make on them. Section 7 concludes the paper.

1. Hypotheses of local bias existence and their empirical implications

In this section I discuss the empirical implications of the hypotheses of local bias existence. These hypotheses are derived from theoretical and empirical literature on proximity effects on portfolio choice. There are three kinds of considerations that may lead investors to hold stocks of local companies.

"Informed investors" hypothesis: investors are likely to possess superior information about the prospects of proximate companies; at the same time they should have no information advantage in distant investment opportunities. By investing in stocks of selected local firms, investors should therefore obtain higher returns than by investing in similar companies elsewhere.

[3] OHNI – Originally Held stocks which holdings have Not been Increased after the move
[4] OHI – Originally Held stocks which holdings have been Increased after the move

"Local competition" hypothesis: risk-averse investors could face competition for local resources within their community. If the supply of local resources, e.g. real estate, labor, services etc, is relatively inelastic, prices will rise with the wealth of the community. The desire to hedge this price volatility implies that investors will wish to positively correlate their portfolios with the price of local goods. As a result, investors in a given community would tilt their portfolios toward local stocks.

"Pure familiarity" hypothesis: investors may feel comfortable holding stakes in companies that they are familiar with. It is natural to assume that people familiarize themselves with the businesses visible to them. Huberman's (2001) "cognitive bias for the familiar" is a driving force behind the "pure familiarity" hypothesis.

Although all three hypotheses predict that investors should tilt their portfolios towards stocks of local companies, they differ in their implications on investors' performance in these stocks and how the investors' portfolio composition would be affected when the set of local companies changes. Assuming proximity and information are related, the "informed investors" hypothesis argues that investors should earn higher risk-adjusted returns from investing locally than by putting their money in similar companies elsewhere. Not every local company is well-suited for this strategy: superior returns would be achieved by picking stocks with better than average expected returns and ignoring "lemons" using private information about local companies[5]. In its turn, the "local competition" hypothesis does not provide any definite answer about investors' relative performance in local stocks. Finally, if the "pure familiarity" hypothesis is true, then merely following the "buying what you see" strategy should not help investors to derive any additional returns, as on average local companies have the same risk-return profile as the universe of investments.

I analyze the hypotheses' implications on investors' portfolio choices when the set of local companies changes by considering portfolios of investors who change their place of residence. I focus on changes in residence, as this would potentially affect the attributes of each of the hypotheses of local bias existence. As investors move from one location to another, the degree of information advantage that investors have in various companies, the applicability of these stocks to hedge against price volatility of local resources, and the strength of the familiarity bond between investors and the companies are all likely to be affected.

After investors move to a new location they still hold the stocks of the companies that were proximate to them at their old place of residence (hereafter "formerly-local" companies/stocks). After settling in a new location, investors familiarize themselves with a different set of local companies and the ways to gather information about them. Investors may also need to invest in stocks that are better suited than the formerly-local stocks as a hedge against price volatility of local resources at the new locality. On the other hand, investors are likely to keep some private knowledge and skills in collecting

[5] See, for example, Coval and Moskowitz (2001)

information about old investments. The familiarity bond between investors and formerly-local companies can also be strong. Thus, investors face a trade-off between keeping their money in formerly-local stocks and reallocating their funds to companies proximate to them in their new locality.

The "informed investors" hypothesis provides us with contradictory implications regarding investors' holdings of formerly-local stocks. On the one hand, after moving to a new location people do not generally cut all ties. They may still keep in touch with friends and (former) colleagues who continue to reside in the "old" location; they may still subscribe to some of the now formerly-local newspapers; and they are likely to follow formerly-local companies in the media. Therefore, movers are likely to possess some informational advantage in formerly-local stocks for a certain period of time after the move. At the same time, given that formerly-local companies do not have an establishment in the new neighborhood, the movers are no longer exposed to the spillover risks associated with these companies. This flow of logic implies that movers should increase their holdings in formerly-local stocks relative to non-movers, who are still exposed to the risks of holding local companies. On the other hand, as time passes, investors acquire private knowledge in proximate companies in their new community while probably gradually losing their information advantage in formerly-local stocks. Following this argument, investors should sell "formerly-local" stocks from their portfolios after the move. The direction of the overall effect is, therefore, ambiguous and should be investigated empirically.

According to the "local competition" hypothesis, investors' primary concern is net income smoothing. The desire to hedge volatility of the prices of local goods in the new community should encourage movers to reallocate their resources by investing in local companies in the new locality and reducing their holdings of formerly-local stocks relative to non-movers. The abnormal selling of the formerly-local stocks should be more pronounced for moves associated with larger differences in the degree of competition for local resources between the new and old location.

Finally, the "pure familiarity" hypothesis provides us with no guidance about what investors should do with the stocks of the companies that they moved away from, as the nature of the familiarity bond between an investor and a company is still to be investigated. A summary of the implications of these hypotheses on investors' performance in "formerly-local" stocks and their holdings of these stocks after the move is presented below.

	Abnormal Return from Holding Local Stocks	Holdings of Formerly Local Companies
Informed Investors	Yes	Increase/Decrease
Local Competition	Unclear	Decrease
Pure Familiarity	No	Unclear

2. Identifying Gains from Investing Locally: Data and Methodology

A. Data

Värdepapperscentralen AB (VPC) of Sweden registers all stockholders with more than 500 shares of all Swedish listed companies on a semiannual basis. Many companies, however, provide information about their smaller stockholders as well. As of July 29th 2001 about 98% of the market capitalization of 410 Swedish publicly-traded companies is reflected in this database. For the median company, 97.9% of equity is represented, and in the worst case I have information on 81.6% of company market capitalization. The dataset contains both shares held directly by the owner and indirectly via brokerage houses, custodian banks etc for the period between June 1995 and June 2001. Since VPC does not require any minimum survival period for the companies it covers, this database does not suffer from survivorship bias. VPC also provides the following investor and company attributes which I use in my analysis: investor type (individual, bank, mutual fund etc), date of birth and sex of individual investors, number of shares held by each investor by share type, share type, number of votes per share, three-digit zip code of the residential address for Swedish individuals and country of residence for foreigners. I adjust investors' shareholdings for splits/reverse splits.

VPC dataset is combined with company specific information (semiannual returns, market capitalization, ME/BE, industry classification, listing etc) obtained from SIX/Dextel Findata's TRUST database. I exclude from my analysis companies with missing or negative values of book-to-market ratio, instances of suspended trading, missing trading day close prices, or unavailable data on the number of shares outstanding. I also exclude Ericsson AB for the reason of magnitude of its market capitalization, which for some time periods cannot be compared to that of any other Swedish firm. These exclusions reduce the sample of my companies from 147 to 141 in June 1995 and from 410 to 350 in June of 2001.

Finally, for each investor I calculate distances to the closest establishments[6] (DCE) of the companies held. DCEs can be obtained for Swedish investors by using zip codes of the location of

[6] Company's **establishment** is defined here as company's office or production facility, which has a separate zip code.

company's establishment and the residence of the investor. The choice of DCE as a measure of proximity of investment is motivated by two reasons. Firstly, it aims to correct for the proximity of those firms that are headquartered in large cities, but have their principal production facilities in small towns[7]. Secondly, it should help me to control for company employee shareholdings[8]. The distribution of number of establishments per company is presented in Table 1.

From the resulting sample, I exclude Swedish institutional shareholders as well as Swedish individual investors with incomplete or unidentifiable identification number and/or zip code of their residence. This leaves me with 8,600,242 individual-company combinations for the observed six-year period. The number of individual investors in my database has increased about 3.25 times from 181,041 to 589,495 between June 1995 and June 2001. There has also been a rise in the number of stocks held by the average investor from 1.82 to 1.90 (from 2.07 to 2.17 for Stockholm residents). The proportion of Stockholm-based investors and their share in the number of positions held by Swedish individual investors has remained relatively unchanged at 19.65% and 22.67% respectively. A summary of the distribution of individual investors, and their equity holdings by year and geographic location is presented in Table 2.

B. Research Method

Abnormal return on a sample stock AR_6 is used as a measure of investment performance. To calculate buy-and-hold abnormal returns I follow adopted control-firm methodology proposed by Barber and Lyon (1997). They found that filtering on size and then matching on the book-to-market ratio yields test statistics that are well specified in virtually all sample situations. To identify a size and book-to-market matched control firm, I first selected all firms with a market capitalization that is between 70 and 130 percent of the market capitalization of the sample firm. From this subset of firms I chose the firm with the book-to-market ratio closest to that of the sample firm[9]. The abnormal return AR_6 is calculated as the difference between the six months returns on the sample and control stocks adjusted for dividends and stocks splits. Since the sample of my companies increases from 141 to 350 over the observed period, it is difficult to preserve matched pairs over the whole period. Therefore, for each six months period I calculated matched companies separately.

Table 3 presents descriptive statistics of the dataset. The mean (median) abnormal semiannual return is -3.74% (-3.0%). The mean (median) company market capitalization and book-to market ratio

[7] Example of such a company is SCA (pulp and paper industry), which is headquartered in Stockholm, but has its principal business facilities in the north of Sweden.
[8] Let's consider investor A, who holds the stocks of only one company, B, and at the same time is B's employee. When A moves residence and still remains the employee of B (e.g. moves from regional office to headquarters) the distance from A's residence to the closest establishment of B after the move is likely to be of a similar magnitude as the distance before the move. Since the information advantage of A with respect to B is unlikely to differ much after the move and B would remain a local asset and as familiar to A as before the move, these kinds of movements would be excluded from the analysis of movers' behavior in sections 4-6.
[9] Barber and Lyon (1997), p.172

are 141.2bln (23.1bln) SEK and 0.661 (0.514) respectively. The average (median) distance from investor to the closest establishment of the company held is 145.1 (138.2) km. More than ¾ of individual investors in my data sample reside outside the Stockholm area, which closely follows the distribution of population between the Stockholm metropolitan area and the rest of the country[10]. Women account for slightly more than 1/3 of all investors. A correlation matrix of my dataset is presented in Table 4.

3. Variables description and discussion of investors' performance in local stocks

I take as given that Swedish investors bias their portfolios towards local stocks; this result was established by Giannetti and Simonov (2002) and Massa and Simonov (2002). To analyze the effect of proximity of investment on investor performance I ran panel regressions of abnormal return on a constant, measure of geographic proximity of a stock, and a set of company attributes generally used in the literature.

The logarithm of the distance from the investor to the closest establishment of the company she holds, LOG(DCE) is used to measure the proximity of investment. I take the logarithm of the distance to capture the non-linearity of the effect documented in the earlier studies, e.g. Grinblatt and Keloharju (2001). Logarithm of company market capitalization LOG(SIZE), book-to-market ratio BE/ME, and return over previous six months RET_{-6} are used to control for size effect, book-to-market effect, and momentum. I use a location dummy CAPITAL to separate investors based in Stockholm and the rest of the country. Monthly standard deviation over the previous twelve months STDEV is included as a proxy for company's idiosyncratic risk. Gender dummy SEX takes value of 1 for male investors and 0 for female investors. Finally, SEX_DIST variable, the interaction of SEX and LOG(DCE), measures the speed of deterioration of information advantage in proximate stocks for investors of different sexes.

The results presented in Table 5 show that proximity of investment is highly statistically and economically significantly related to the abnormal return on the stock. This is consistent with the results of Coval and Moskowitz (2001) and Massa and Simonov (2002). By investing in proximate companies, investors gain 1.81% annualized for a unit of logarithm of a distance from the investor to the company's closest establishment. Regression analysis of industry-and-size controlled abnormal returns, unreported here, yields qualitatively similar results.

Female investors gain, on average, higher abnormal returns than male investors. This phenomenon is most pronounced for proximate stocks and decreases with distance. The results are

[10] Information on population distribution by administrative areas in Sweden can be found on the official website of central bureau of statistics of Sweden http://www.scb.se

consistent with empirical evidence on gender differences in portfolio returns[11] and factual evidence from cognitive sciences on gender differences in spatial ability and spatial activities[12]. Stockholm-based investors perform worse than the rest of the country. Finally, local investors derive higher abnormal returns from more volatile stocks.

4. Portfolio Rebalancing and Investment Decisions of Movers: Methodology and Description of the Dataset

In this part of the paper I investigate local bias behavior in the investment decisions of investors who change their place of residence. I start with an analysis of portfolio rebalancing of movers, and then proceed to explore the relationship between distances and returns on the stocks that investors buy and sell after the move. However, there are three methodological aspects in this portfolio rebalancing analysis that I need to address first: the choice of a benchmark for portfolio rebalancing; the choice of a measure of portfolio rebalancing; and the choice of a measure of change of proximity of investment.

Choice of a benchmark for portfolio rebalancing: Investors change their holdings of securities as a result of experiencing either group- or individual-specific shocks in the determinants of portfolio allocation. Individual investors who are exposed to the same sources of information, exhibit the same behavioral biases, or have similar hedging needs are likely to make similar investment decisions. Alternatively, portfolio rebalancing decisions by a particular investor could be a result of, for example, a change in investor-specific information advantage in some stocks. Detecting abnormal portfolio rebalancing by movers, therefore, requires a separation of changes in movers' stock holdings into group- and individual-specific components. Portfolio rebalancing of the relevant investor group or of its representative agent would then serve as a benchmark for portfolio rebalancing. The non-movers from the mover's original geographic community seem to be the most relevant investor group to use in constructing such a benchmark.

A control individual approach is introduced to measure the abnormal change in movers' stock holdings relative to non-movers. In this approach, sample individuals with holdings in a particular company are matched to control individuals who also hold stocks of this company, on the basis of specified individual investor characteristics. Each investor who moves out of a particular geographic area is paired with a non-mover from the same geographic community (controls for familiarity bond and hedging needs) who is most similar to the mover in quality and amount of information she possessed about a particular company before the move (controls for information advantage), and in her ability to process this information (controls for investor sophistication). After the sample investor

[11] See Agnew, Balduzzi, and Sunden (2003)

[12] See Newcombe, Bandura, and Taylor (1983) and Harris (1978).

moves residence, sample and control investors are no longer likely to have similar access to information about the company. Also, the company can no longer be a suitable hedge against the mover's exposure to price shocks in local resources. The familiarity bond between the mover and the formerly-local company can also be affected. The difference in changes in stocks held by sample and control investors would be tested for coherence with the implications of the different hypotheses of local bias existence.

The matching mechanism is implemented as a three step procedure: 1) for every position of a mover, all non-movers with holdings in the same stock are identified; 2) from this subset of non-movers, investors whose first 3 (of 5) zip code digits for their place of residence is the same as the mover's original location are selected; 3) the control investor selected meets the above two criteria and is closest to the mover in wealth invested in equities in my data sample. The motivation behind the choice of matching criteria is as follows. People living in the same area are likely to obtain information about a particular company through similar sources, have similar hedging needs, and be familiar with the same set of companies. At the same time, wealthier individuals enjoy lower relative search and processing costs, have better access to non-public information about companies' prospects, and are likely to be better educated and more experienced in their investments than their less wealthy counterparts. From this matching process, a measure of portfolio rebalancing of the control non-mover would then be used as a benchmark for the portfolio rebalancing of the sample mover.

Choice of a measure of portfolio rebalancing: For well-diversified portfolios, a measure of portfolio rebalancing would be the difference between portfolio weights allocated in particular stocks after and before the event unrelated to changes in market weights. Individual investors in my sample, however, appear to be very poorly diversified (portfolio of a median individual investor consists of 1 stock) which makes it impossible to use changes in portfolio weights to measure portfolio rebalancing. An alternative measure – relative change in stock holdings between time periods t and t+k, $RC=(N_{t+k}-N_t)/N_t$, where N_t is a number of shares of a particular company held by investor at time t – is proposed to fill the gap. The abnormal portfolio rebalancing by mover, abnormal relative change ARC would then be calculated as a difference between corresponding values of RCs for sample and control investors.

Construction of ARC is implemented in the following manner: I identify an investor as a "mover" if the first 3 digits of zip code of her place of residence have changed over the observed half-year period (between time t and t+½); moves within the Stockholm area are excluded. Relative change of each stock holding $RC_{t+½,\, t+3}=(N_{t+3}-N_{t+½})/N_{t+½}$ is calculated over the 2½-year period[13] after the move

[13] Analysis of changes in stock holdings calculated over a 3-year period after the move yields qualitatively similar results.

has been confirmed[14], given that the investor has not changed her place of residence once again. I chose the first post-event date rather than the last pre-event date as a reference point of move event to minimize the effect of sales of securities for liquidity reasons[15] and employee compensation schemes. This allows me to construct 7 time-series data points over the period between June, 1995 and June, 2001.

Each position of the mover is then matched with the corresponding position of the non-mover, who resides in the zip code area of the mover's original location and is most similar to her by wealth proxy. For each of the positions in stocks originally held by a mover, there will be a different control investor with a position in this stock[16]. Abnormal relative change (ARC) is calculated as the difference between corresponding relative changes of stock holdings for sample and control investors. Picture 1 illustrates the mechanism of calculating ARC.

Choice of a measure of change of proximity of investment: 33.05% of the companies in my sample have more than one establishment in Sweden. As movers change their place of residence, some of the establishments of the companies that they hold become more proximate to them and some become more distant. This raises the question as to which distance should be used as a measure of proximity of investment after the move: distance to the establishment that was the closest to the investor before the move, or distance to the establishment that became the most proximate to the investor after the move? To illustrate this dilemma let's consider an example (see Pic.2).

Let's consider an investor A who lives in a location l and is a shareholder of the company B which has two establishments in the country: e and e'. e is the closest establishment to A at her current location. Suppose A has decided to move from location l to l' and now e' becomes the closest establishment of company B for A at the new place of residence. What is the relevant measure of proximity of investment at the new location: distance from l' to the all familiar, but now distant establishment e, or distance from l' to the establishment e' which may not be as familiar to investor A as the establishment e, but is now the closest office or production facility of the company B?

It is reasonable to assume that once an investor holds shares in a company, she is likely, for example, to have acquired some skills in collecting information about this company and is capable of applying them at the new location. Therefore, DCE at the new place of residence is chosen to proxy for the strength of local bias of investor towards a particular company after the move.

[14] If an investor changes her place of residence during some ½-year period the end-day of this period is taken as a move-confirmation date.

[15] e.g. to finance acquisition of new real estate

[16] Identifying control individual which satisfies above mentioned matching criteria and has positions in all the stocks that are in the portfolio of sample investor is not possible due to the small sample of the dataset of movers and low diversification of most investors.

I use the difference in logarithms of DCEs after and before the move, log(DCE) to measure deterioration of strength of local bias from investor to a particular company. The further away an investor moves from a company's establishments the more her information advantage with respect to the company can be affected and the less she should find this company a suitable hedge against price volatility of local resources at her new place of residence. Therefore, I would expect that larger values of log(DCE) would lead to larger changes in company's stock holdings. To ensure that attribution of the company to the set of local companies has changed, I consider only those moves which resulted in a change in logarithm of DCE by at least 0.2[17]. The logarithm of wealth invested in equities, log(WEALTH) is used to control for differences in relative search/processing and transaction costs across investors. I also use the relative change in average price of apartment at the new and old place of residence as a proxy for the change in the competition for local resources, LOCAL COMPETITION.

Table 6 summarizes the descriptive statistics of a dataset of movers. The average (median) abnormal change in investors' holdings of originally-held stocks 2.5 years after the move is -26.76% (0%). The average (median) change in the logarithm of distance to closest establishment is about 0.0278 (-0.2378). The average (median) market capitalization and book-to-market ratio of the company in the mover's original portfolio is 99.41bln (48.60bln) SEK and 0.4528 (0.3976) respectively. The average (median) wealth invested in the stocks in my data sample is 5.38mln (0.38mln) SEK. The average (median) value of proxy of change in the local competition is 0.1615 (0). A correlation matrix of the dataset of movers is presented in Table 7.

5. Changes to originally-held stocks

Table 8 presents the results of panel regression of abnormal relative change in stock holdings, ARC on log(DCE) controlling for size, BE/ME, and wealth invested in equity. I also estimate the regression separately for multiple and single stock holders. The regression specification is as follows:

$$ARC^{m,c}_{t+1/2,t+3} = \alpha \cdot \Delta\log(DCE^{m,c}_{t,t+3}) + \beta\log(SIZE^{c}_{t+1/2}) + \gamma\left(\frac{BE}{ME}\right)^{c}_{t+1/2} + \delta\log(wealth^{m}_{t+1/2}) + \vec{K}(\overrightarrow{TD}),$$

where $\overrightarrow{TD}$ is a vector of time period dummies, index m denotes mover, c -- company she holds, and t is a time index in years.

For every unit of change in the logarithm of distance to the closest establishment 2.5 years after the move, movers sell 3.27% more than investors who did not change their place of residence.

[17] Regression analysis for different cut-off levels of changes in DCE, unreported here, produces qualitatively similar results.

Multiple-stock holders are responsible for the effect, while there is no conclusive evidence about any distinctive pattern of behavior for investors who hold only one stock. The difference in the results for the two groups of investors can be explained by the presumably lower sophistication of investors who hold only one stock. Since abnormal portfolio rebalancing is observed only for the multiple-stock holders, it allows me to argue that my results are not driven by employee shareholders.

Large abnormal selling of the formerly-local stocks is also observed for wealthier individuals. These findings can be attributed to lower relative search/processing and transaction costs of wealthier investors as well as their greater financial sophistication. There is also some evidence that, after a move, investors are more reluctant to sell the larger companies in their portfolios.

I also add a proxy for change in the competition for local resources, LOCAL COMPETITION, to the set of control variables in regression (1). The results are presented in Table 8a. Estimates of the effect of LOCAL COMPETITION on ARC are insignificant for all groups of investors - this finding does not allow me to claim evidence in support of the "local competition" hypothesis. The estimates and the significance of other determinants of abnormal relative change in stock holdings remain qualitatively unchanged.

6. New Purchases and Originally-held stocks after the Move: Distances and Returns

In this section I consider stocks that have become part of investors' portfolios only after a move. I analyze the distances from investors to the three different groups of stocks as well as the returns investors make on these stocks over a 2.5-year period after the change of residence. I divide the stocks which investors hold after the move into three groups: 1) new purchases[18] (NP); 2) stocks held before the move and which holdings have been increased after the move (OHI), and 3) stocks held before the move and which holdings have not been changed or have been decreased after the move (OHNI). All three hypotheses predict that investors should acquire more proximate stocks after the move both from the set of originally-held stocks and from the universe of all available investments. However, only the "informed investors" hypothesis predicts that investors should gain abnormal returns from these investments.

Table 9 reports arithmetic averages for distances from investors to NP, OHI, and OHNI stocks after the move. Both mean and median tests demonstrate that in 6 out of 7 cases distances to newly purchased stocks are smaller than distances to old stocks which holdings have not been increased after the move. The relationship between distances from investors to OHI and OHNI stocks is as expected in all time periods.

[18] By new purchases we mean those securities that were not in movers' portfolios before the move, but entered investors' portfolios at some point over the 2.5 year period after the move.

Abnormal returns that investors make on three groups of stocks over 2½ years after the move are presented in Table 10. Because of the volatile nature of abnormal returns over the observed period, I report sample averages. T-stat for mean test and statistics for Wilcoxon 2-sided median test for the difference with the abnormal return on the OHNI stocks are reported.

The results provide evidence that investors on average derive economically and statistically significant higher abnormal returns on both the NP and OHI stocks than OHNI stocks. Given the relationship between distances to these three types of stocks, the results provide evidence for the "informed investors" hypothesis.

7. Conclusions

This paper examines the link between geographic proximity and individual investors' portfolio choice. Using geographic distance to the company's closest establishment as a measure of proximity between an investor and the company she holds, I find strong evidence that Swedish individual investors extract economically and statistically significant gains from investing locally. Stocks of the more volatile companies yield higher abnormal returns. These results are consistent with the findings of Coval and Moskowitz (2001) for mutual funds and Massa and Simonov (2002) for smaller group of Swedish individual investors, and are robust to changes in control variables.

I also find that as proximity of investment opportunities changes, investors revise their portfolio composition. Investors who change their place of residence are likely to abnormally sell stocks of the formerly-local companies after the move. New purchases and originally-held stocks which holdings have been increased after the move, are located closer to investors and provide higher abnormal returns than the originally-held stocks which holdings have not been changed or have been reduced. The results support the "informed investors" hypothesis, but do not rule out that some part of investors' behavior could be explained by the "local competition" and the "pure familiarity" hypotheses.

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Picture 1

Calculating Abnormal Relative Change in Stock Holding (ARC)

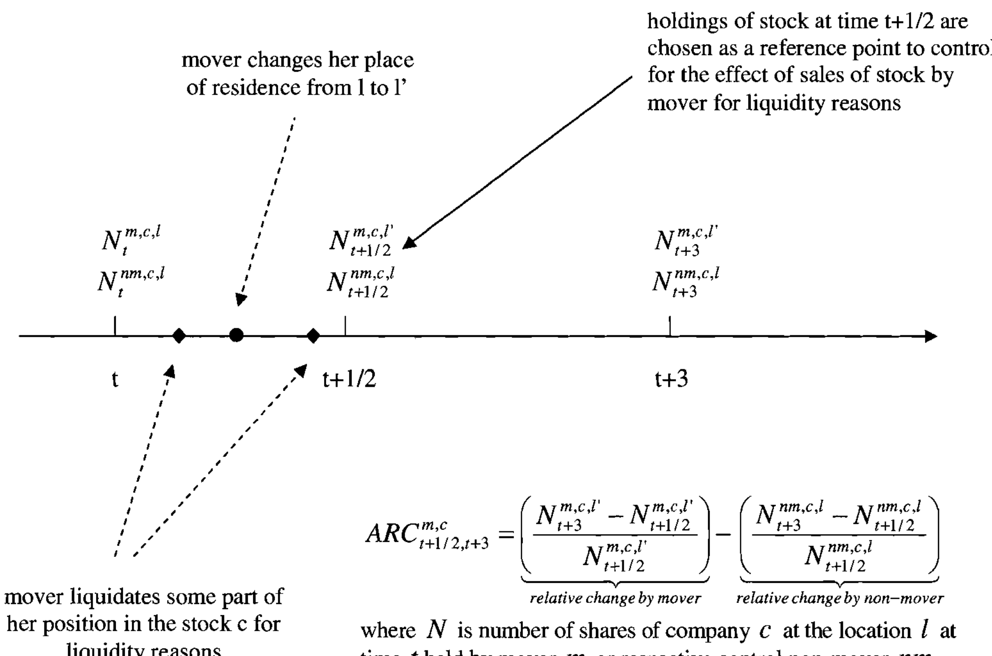
1) identifying control non-mover

Step 1: for every mover m which originally resided in location l and holds company c all non-movers with holdings of company c are identified

Step 2: from the subset of non-movers obtained in Step 1 non-movers residing in location l are selected

Step 3: control non-mover nm is picked as individual investor which satisfies the above two criteria and is closest to m in wealth invested in equities in my database.

2) calculating ARC as a difference in relative changes in stock holding for sample mover and control non-mover

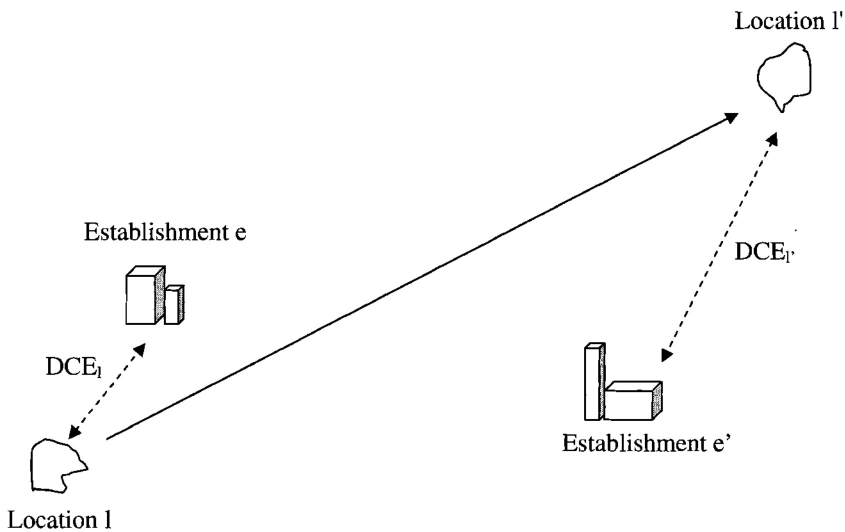


$$ARC_{t+1/2,t+3}^{m,c} = \underbrace{\left(\frac{N_{t+3}^{m,c,l'} - N_{t+1/2}^{m,c,l'}}{N_{t+1/2}^{m,c,l'}} \right)}_{\textit{relative change by mover}} - \underbrace{\left(\frac{N_{t+3}^{nm,c,l} - N_{t+1/2}^{nm,c,l}}{N_{t+1/2}^{nm,c,l}} \right)}_{\textit{relative change by non-mover}}$$

where N is number of shares of company c at the location l at time t held by mover m or respective control non-mover nm

Picture 2

Defining a change in proximity of investment resulting from the change of residence by investor



Investor moves from location l to location l':

Proximity of investment at location l = DCE$_l$

Proximity of investment at location l' = DCE$_{l'}$

Table 1

Distribution of Number of Establishment per Company

# of establishments	# of companies	% of total
1	237	66.95
2	48	13.56
3	18	5.08
4	9	2.54
5	5	1.41
6	5	1.41
7	5	1.41
8	5	1.41
9	4	1.13
10-20	6	1.69
>20	12	3.39

Table 2

Distribution of Individual Investors and Their Positions by Year and Geographic Location

	# of individuals		# of positions		# stocks per individual	
date	total	% of Stockholmers	total	% held by Stockholmers	overall	per Stockholmer
9506	181041	20.18	330142	22.91	1.82	2.07
9512	181343	19.86	328485	22.63	1.81	2.06
9606	186712	19.68	366630	22.48	1.96	2.24
9612	189289	20.83	367603	23.90	1.94	2.23
9706	208924	20.59	430828	23.73	2.06	2.38
9712	331726	18.81	569129	21.86	1.72	1.99
9806	371466	19.51	680014	22.71	1.83	2.13
9812	380731	19.53	705861	22.81	1.85	2.17
9906	416237	19.24	775937	22.48	1.86	2.18
9912	424080	19.48	778809	22.63	1.84	2.13
0006	551341	19.60	1047029	22.68	1.90	2.20
0012	575266	19.64	1088844	22.49	1.89	2.17
0106	589495	19.82	1130931	22.45	1.90	2.17
total	4587651	19.65	8600242	22.67	1.87	2.16

Table 3

Descriptive statistics of the original dataset

	Mean	Median	St.Dev
AR_6	-0.037	-0.030	1.38
DCE (km)	145.1	138.2	105.25
SIZE (bln SEK)	141.2	23.1	380
BE/ME	0.661	0.514	0.800
CAPITAL	0.227	0	0.419
SEX	0.656	1	0.475
Sex*LOG(DCE)	2.96	3.89	2.41

All the monetary values are in SEK (10 SEK ~ 1.06USD)

Variables description:

AR_6 – abnormal return over six months with control firms matched by company Size and BE/ME

DCE – Distance from investor to the Closest Establishment of the company she holds

SIZE – company's market capitalization in bln SEK

BE/ME – ratio of book equity to market equity

CAPITAL – dummy variable, distinguishes Stockholm based investors (1) from the rest of the country (0)

SEX – dummy variable, distinguishes investors of different gender: take value of 1 for male investors and 0 for female investors

Table 4: Correlation Matrix of the Original Dataset (All correlation coefficients statistically significant at 1% level)

	AR_6	LOG(DCE)	LOG(SIZE)	BE/ME	CAPITAL	STDEV	RET_{-6}	SEX	SEX*LOG(DCE)
AR_6	1.000	-0.022	-0.011	-0.006	0.002	0.021	-0.017	0.002	-0.006
LOG(DCE)	-0.022	1.000	-0.264	0.077	-0.269	0.164	-0.004	0.094	0.436
LOG(SIZE)	-0.011	-0.264	1.000	-0.309	0.055	-0.451	0.003	-0.153	-0.238
BE/ME	-0.006	0.077	-0.309	1.000	-0.041	0.211	-0.041	0.042	0.066
CAPITAL	0.002	-0.269	0.055	-0.041	1.000	-0.028	0.010	-0.060	-0.147
STDEV	0.021	0.164	-0.451	0.211	-0.028	1.000	0.064	0.107	0.156
RET_{-6}	-0.017	-0.004	0.003	-0.041	0.010	0.064	1.000	0.006	0.003
SEX	0.002	0.094	-0.153	0.042	-0.060	0.107	0.006	1.000	0.892
SEX*LOG(DCE)	-0.006	0.436	-0.238	0.066	-0.147	0.156	0.003	0.892	1.000

Table 5

Benefits from investing locally in Sweden for individual investors

Dependent variable: abnormal buy-and-hold return for the six months period AR_6

Explanatory variables: LOG(DCE) – logarithm of the Distance from investor to the Closest Establishment of the company she holds; LOG(SIZE) – logarithm of the company's market capitalization; BE/ME – ratio of book equity to market equity; CAPITAL – Stockholm city dummy; STDEV – standard deviation of monthly stock returns; RET_{-6} – stock return over the previous six months period; SEX – sex of investor dummy (1 – male, 0 – female); SEX_DIST – the product of sex and log(DCE)

Standard deviation in parentheses. Third column reports results excluding inhabitants of Stockholm metropolitan area.

Parameter			
LOG(DCE)	-0.00899*** (0.000309)	-0.01103*** (0.000373)	-0.01009*** (0.000358)
LOG(SIZE)	0.00021 (0.000362)	0.00025 (0.000363)	-0.0005 (0.000410)
BE/ME	-0.00492*** (0.000492)	-0.00486*** (0.000492)	-0.00838 (0.000544)
CAPITAL	-0.00902*** (0.000964)	-0.00908*** (0.000964)	
STDEV	0.95273*** (0.0152)	0.952069*** (0.0152)	0.998556*** (0.0168)
RET_{-6}	-0.00441*** (0.000112)	-0.0044*** (0.000112)	-0.0053*** (0.000146)
SEX	-0.00562*** (0.000727)	-0.01973*** (0.00153)	-0.00494*** (0.000814)
SEX_DIST		0.003264*** (0.000381)	
Industry Controls	yes	yes	yes
Time Controls	yes	yes	yes
$\overline{R}^2$	1.40%	1.40%	1.49%
N	7529183	7529183	5845177

*** -- statistically significant at 1% level.

Table 6

Descriptive statistics of the dataset of movers

	Mean	Median	St.Dev	Midrange
ARC	-0.2676	0	2.5694	0.8183
log(DCE)	0.0277	-0.2378	1.5191	1.5472
SIZE (bln SEK)	99.41	48.60	182.89	65.08
BE/ME	0.4528	0.3976	0.2896	0.4471
Wealth (ths SEK)	408.55	47.23	3546.98	119.17

Variables description:

ARC – abnormal relative change in stock holdings after the move; defined as

$[(N^i_{t+2.5} - N^i_t)/ N^i_t]_{sample} - [(N^i_{t+2.5} - N^i_t)/ N^i_t]_{control}$, where N^i_t and $N^i_{t+2.5}$ is a number of shares of company i in individual's portfolio right after the move and 2.5 years after the move respectively

log(DCE) – change in the logarithm of distance to the company's closest location after and before the move; defined as $\log(DCE_{after})-\log(DCE_{before})$

SIZE – company's market capitalization in bln SEK

BE/ME – ratio of book equity to market equity

Wealth – investor's wealth invested in the stocks in my dataset

All the monetary values are in SEK (10 SEK ~ 1.06USD)

Table 7

Correlation Matrix for the Dataset of Movers

	ARC	log(DCE)	LOG(SIZE)	BE/ME	LOG(WEALTH)	LOCAL COMPETITION
ARC	1.000	-0.012	0.017	-0.015	-0.056	-0.008
log(DCE)	-0.012	1.000	-0.013	-0.050	-0.016	-0.402
LOG(SIZE)	0.017	-0.014	1.000	-0.352	0.048	0.026
BE/ME	-0.015	-0.050	-0.352	1.000	0.048	-0.12
LOG(WEALTH)	-0.056	-0.0281	0.048	0.048	1.000	0.052
LOCAL COMPETITION	-0.008	-0.402	0.026	-0.012	0.052	1.000

ARC – abnormal relative change in stock holdings after the move; defined as $[(N^i_{t+2.5} - N^i_t)/ N^i_t]_{sample}$ -- $[(N^i_{t+2.5} - N^i_t)/ N^i_t]_{control}$, where N^i_t and $N^i_{t+2.5}$ is a number of shares of company i in individual's portfolio right after the move and 2.5 years after the move respectively

log(DCE) – change in the logarithm of distance to the company's closest location after and before the move; defined as $\log(DCE_{after})$-$\log(DCE_{before})$

Log(SIZE) – logarithm of company market capitalization in bln SEK

BE/ME – ratio of book equity to market equity

Log(wealth) -- logarithm of wealth invested in equity

Local competition – relative change in average price of the apartment at the new and old place of residence

Table 8

Stock holdings change 2.5 year after the move

Dependent variable:

ARC – abnormal relative change in stock holdings after the move; defined as $[(N^i_{t+2.5} - N^i_t)/ N^i_t]_{sample}$ -- $[(N^i_{t+2.5} - N^i_t)/ N^i_t]_{control}$, where N^i_t and $N^i_{t+2.5}$ is a number of shares of company i in individual's portfolio right after the move and 2.5 years after the move respectively

Explanatory variables:

log(DCE) – change in the logarithm of distance to the company's closest location after and before the move; defined as $\log(DCE_{after})$-$\log(DCE_{before})$
Log(size) -- logarithm of market capitalization in bln SEK
BE/ME -- ratio of book equity to market equity
Log(wealth) -- logarithm of wealth invested in equity

Standard deviation in parentheses

	all sample	single stock holders	multiple-stock holders
Number of Observations	5979	2899	3080
log(DCE)	-0.0327**	-0.0067	-0.0394*
	(0.0156)	(0.0176)	(0.0226)
LOG(SIZE)	0.0559***	0.0275	0.0596***
	(0.0153)	(0.0204)	(0.0203)
BE/ME	-0.0163	0.0250	-0.0801
	(0.0661)	(0.0805)	(0.1001)
LOG(WEALTH)	-0.0919***	-0.0656***	-0.1470***
	(0.0158)	(0.0179)	(0.0330)
Time controls	yes	yes	yes
F-stat (joint significance)	50.60***	15.14***	46.17***

***, **, * -- statistically significant at 1%, 5% and 10% level respectively

Table 8a

Stock holdings change 2.5 year after the move: adding proxy for change in local competition

Dependent variable:

ARC – abnormal relative change in stock holdings after the move; defined as $[(N^i_{t+2.5}-N^i_t)/N^i_t]_{sample}$ -- $[(N^i_{t+2.5}-N^i_t)/N^i_t]_{control}$, where N^i_t and $N^i_{t+2.5}$ is a number of shares of company i in individual's portfolio right after the move and 2.5 years after the move respectively

Explanatory variables:

log(DCE) – change in the logarithm of distance to the company's closest location after and before the move; defined as $\log(DCE_{after})-\log(DCE_{before})$
Log(size) -- logarithm of market capitalization in bln SEK
BE/ME -- ratio of book equity to market equity
Log(wealth) -- logarithm of wealth invested in equity
Local competition – relative change in average price of apartment at the new and old place of residence

Standard deviation in parentheses

	all sample	single stock holders	multiple-stock holders
Number of Observations	5967	2899	3080
log(DCE)	-0.0414**	-0.0153	-0.0497*
	(0.0174)	(0.0188)	(0.0262)
LOG(SIZE)	0.0548***	0.0249	0.0592***
	(0.0153)	(0.0204)	(0.0203)
BE/ME	-0.0201	0.0165	-0.0855
	(0.0669)	(0.0808)	(0.1005)
LOG(WEALTH)	-0.0912***	-0.0654***	-0.1464***
	(0.0159)	(0.0180)	(0.0330)
LOCAL COMPETITION	-0.0598	-0.0805	-0.0497
	(0.0469)	(0.0507)	(0.0707)
Time controls	yes	yes	yes
F-stat (joint significance)	51.81***	16.19***	46.76***

***, **, * -- statistically significant at 1%, 5% and 10% level respectively

Table 9

Average distances to companies' closest establishments after the move

Dependent variable: Average distance (in km) from movers to the closest establishments of the companies they hold after the move

Groups of stocks:

OHI – Originally-Held stocks, which holdings have been Increased after the move

OHNI – Originally-Held stocks, which holdings have Not been Increased after the move

NP – New Purchases

t-statistics for mean test and t-statistics for Wilcoxon 2-sample 2-sided median test for the difference with a distance to the OHDNI stocks with correspondent probabilities are reported in parentheses.

	OHI	OHNI	NP
9806	135.92 *** (-5.10, <0.01) (-4.91, <0.01)	163.81	169.19 (1.04, 0.29) (0.97, 032)
9812	142.96 *** (-6.01, <0.01) (-5.77, <0.01)	177.46	157.32*** (-3.68, <0.01) (-3.58, <0.01)
9906	127.32 *** (-14.30, <0.01) (-14.10, <0.01)	174.24	145.30*** (-8.88, <0.01) (-8.61, <0.01)
9912	135.28 *** (-8.86, <0.01) (-9.06, <0.01)	174.99	140.32*** (-7.83, <0.01) (-7.94, <0.01)
0006	158.33 *** (-4.47, <0.01) (-4.81, <0.01)	181.01	152.96*** (-6.54, <0.01) (-6.43, <0.01)
0012	150.28 *** (-7.58, <0.01) (-7.74, <0.01)	187.76	158.07*** (-6.99, <0.01) (-7.04, <0.01)
0106	115.74 *** (-19.98, <0.01) (-18.88, <0.01)	182.93	154.66*** (-8.67, <0.01) (-8.59, <0.01)

*** -- lower than corresponding value of OHD, statistically significant at 1% level

Table 10

Average abnormal returns on different groups of stocks

Dependent variable: Average abnormal return over 2½ year period

Groups of stocks:

OHI – Originally-Held stocks, which holdings have been Increased after the move

OHNI – Originally-Held stocks, which holdings have Not been Increased after the move

NP – New Purchases

t-statistics for mean test and t-statistics for Wilcoxon 2-sample 2-sided median test for the difference with the average abnormal return on OHDNI stocks with correspondent probabilities are reported in parentheses.

	OHI	OHNI	NP
N(obs)	1990	7447	2599
AR_6	0.024***	-0.085	-0.015***
	(6.54, <0.01)		(5.45, <0.01)
	(7.96, <0.01)		(2.13, 0.28)

*** -- lower than corresponding value of OHD, statistically significant at 1% level

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