Underdiversification in Private Companies - Required Returns and Incentive Effects

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JEL classification: G32, G11

Keywords: underdiversification, required returns, incentives, private companies, wealth, entrepreneurship

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All remaining errors are my own.

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Abstract

Owners of private companies are often highly underdiversified which exposes them to idiosyncratic risk. We investigate the consequences of underdiversification at the company level. Information on US companies and their owners is obtained from the Survey of Consumer Finances and the Survey of Small Business Finances. Underdiversification, measured as the share of the owner's net worth invested in the company, has a significant positive relationship with profitability, measured as the return on equity. We identify two causes for this underdiversification effect: higher required returns and higher effort. The results have important consequences for investment decisions at private companies.

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1 Introduction

Private companies rely for their financing mostly on the equity investment of a limited number of owners and on bank loans (Berger and Udell (1998)). Problems of asymmetric information influence the financing, because the effort of the entrepreneur and the riskiness of projects are difficult to observe for outsiders. It follows that banks need to cope with moral hazard and adverse selection, which can lead to credit rationing (Stiglitz and Weiss (1981)). This situation is aggravated by a lack of collateral in many companies, which could be pledged to make the lending less risky. Because of the problems of asymmetric information it follows that entrepreneurs need to invest their own wealth and that non-managing owners need to invest an amount high enough to justify the monitoring costs. The required investment volume is often large in relationship to the net worth of the owners – owners are therefore often highly underdiversified. Underdiversification means that a high share of the personal wealth is invested in one company.

Moskowitz and Vissing-Jørgensen (2002) document that average returns to private equity are not higher than average returns to public equity, even though owners of private companies are often highly underdiversified. This is puzzling, since theoretical models show that underdiversification increases the cost of equity capital substantially (see Kerins et al. (2004) and Heaton and Lucas (2000*a*)). We would therefore expect that owners require a compensation for their exposure to idiosyncratic risk reflected in higher returns to private equity. So far, it remains unclear whether owners do not require compensation for their exposure to idiosyncratic risk or whether other reasons are responsible for the relatively low returns to private equity. Or, to pose the problem differently, it is not known whether idiosyncratic risk is priced in private companies. The answer to this question has important implications for the investment decisions at private companies. If idiosyncratic risk is priced, then the selection of projects depends on the underdiversification of the owner, since the underdiversification influences the return required to make a project profitable.

We test empirically whether there is an underdiversification effect, i.e. whether underdiversification is related to higher company profitability. We investigate two ways in which owners can respond to underdiversification. First, owners can require higher returns. They can select the projects in which they invest such that the expected returns are sufficient to provide compensation for the exposure to idiosyncratic risk. Second, if owners are at the

same time managers, they can work harder to ensure the success of their company. The more underdiversified they are, the more their financial well-being depends on the profitability of the company.

Two data sources from the USA are used for the analysis: the Survey of Consumer Finances (SCF, wave 1989 to wave 2001) and the Survey of Small Business Finances (SSBF, wave 1998). Both surveys were conducted by the Board of Governors of the Federal Reserve System, Washington, DC. They are well-suited for this analysis, because they provide information on private companies *and* on the wealth of their owners.[1] The SCF data has the further advantage of differentiating between owners with and without an active management interest. This allows the separate identification of the two channels of the underdiversification effect. Owners who are not at the same time managers do not influence company profitability through managerial activity. If there is a positive relationship between underdiversification and profitability it must be due to higher required returns. In contrast, for owner-managers any positive effect could also be driven by higher effort. The SCF provides information on weekly hours worked for owner-managers, which can be used as a proxy for effort. It is therefore possible directly to test the second channel of the underdiversification effect, namely whether underdiversification increases effort.

Empirically, we measure underdiversification as the value of the equity investment in the private company divided by the net worth of the owner. It is important to note that there is no benchmark of zero underdiversification. Every individual is exposed to some idiosyncratic risk. For example, employees typically depend on the success of one company for most of their labour income. Also, even if investments in the stock market are divided between many companies, most investors do not achieve the theoretical ideal of full diversification of idiosyncratic risk. We approach underdiversification from a relative and not from an absolute perspective. The empirical measure allows a comparison of underdiversification between owners; it determines which owner has a higher degree of underdiversification.

In our econometric analysis we find that underdiversification has a positive, significant effect on the profitability of companies, which can be either due to higher required returns or

[1]These surveys have been widely used in the literature, e.g. to examine lending relationships (Petersen and Rajan (1994); Cole (1998)), agency costs (Ang et al. (2000); Bitler et al. (2005)), and returns to private equity (Moskowitz and Vissing-Jørgensen (2002)).

to higher effort. This effect is smaller for richer owners, which is consistent with decreasing relative risk aversion. For a sub-sample of owners who do not have an active management interest, we also find a positive relationship between underdiversification and profitability. This supports the view that underdiversified owners require higher expected returns, since higher effort can be excluded as a cause. For owners who are at the same time managers we establish a positive relationship between underdiversification and effort, measured as self-reported weekly hours worked. Owner-managers who are financially more dependent on the success of their companies have a higher incentive to work hard.

The plan of the paper is as follows: Section 2 provides an overview of the related literature; Section 3 gives more detail on the data sets and defines the variables used in the analysis; Section 4 develops the hypotheses; Section 5 presents the results, and Section 6 concludes.

2 Related Literature

The prevalence of underdiversification has been documented for the USA by Moskowitz and Vissing-Jørgensen (2002). Households with an investment in private equity have, on average, 41% of their net worth invested in private equity. In addition to the concentration with respect to the asset class, there is a concentration with respect to the selected investments. 85% of the total investment in private equity is, on average, invested in one actively managed company. Owners are therefore exposed to the idiosyncratic risk of the company. The main interest of the authors is the returns to private equity. With the SCF data they calculate value-weighted returns for the intervals between two waves that take the appreciation of the market value of equity and the retention of earnings into account. The returns are calculated under several differing assumptions and figures that range from 12.8% to 19.0% on average over the three intervals covered are obtained. The authors draw attention to the puzzle that the average return on private equity is not higher than the average return on public equity, even though the owners are underdiversified. On average there seems to be no compensation for idiosyncratic risk.

Moskowitz and Vissing-Jørgensen (2002) analyse average values, i.e. their study is at an aggregate level. It has therefore to remain as open question whether underdiversified owners do not receive a compensation for their exposure to idiosyncratic risk or whether the low

returns have a different explanation, for example the existence of non-pecuniary benefits or overoptimism by the owners. With an analysis at the company level, we directly test in this paper whether underdiversification and profitability are related.

For public equity, the Capital Asset Pricing Model (CAPM) predicts that idiosyncratic risk is not priced, since investors have the opportunity to diversify. There is only a compensation for the systemic risk component of the stock. In contrast, investors in private equity cannot diversify. Theoretical models show that underdiversification increases the cost of equity capital for private companies. Kerins et al. (2004) use the CAPM to derive the cost of capital for an underdiversified entrepreneur. In their model, the entrepreneur can choose between an investment in the own company and the market. The relative weights of the two assets determine the total risk of the portfolio. This total risk can be duplicated by leveraging an investment in the market. From the levered market investment it is possible to calculate the returns that can be achieved in the market. These returns are the opportunity cost of capital for the underdiversified portfolio. The authors use data on recent high-technology IPOs to calculate the opportunity cost of capital. Information on the betas and on the variance of returns of these companies is used. There is no information on actual underdiversification needed for this analysis – the authors calculate the cost of equity capital for different assumed levels of underdiversification. This method shows that underdiversification considerably increases the cost of equity capital. This is also the conclusion reached by the model of Heaton and Lucas (2000*a*). The theoretical models are complementary to the analysis of this paper. The models establish that there are costs due to underdiversification, but they cannot test whether owners actually demand a compensation for their exposure to idiosyncratic risk.

So far, data on underdiversification has been rarely used in the literature. Heaney and Holmen (2002) are an exception. They measure underdiversification due to concentrated investments in public companies for a sample comprised of the richest Swedes. The authors use the cost of underdiversification as a proxy for the value that controlling shareholders attach to their control.

Himmelberg et al. (2002) argue that concentrated ownership should be related to better company performance, since concentrated ownership leads to underdiversification for which a compensation is necessary. In a sample of public companies they find a positive effect of

concentrated ownership, which they interpret accordingly. However, the authors do not use information on the actual underdiversification of owners. In order to clearly differentiate between a positive incentive effect from ownership and a positive effect due to underdiversification, it is necessary to separately control for the ownership share and the personal underdiversification of the owner.

This paper analyses how exposure to idiosyncratic risk influences required returns and effort by owners. Related to this topic is the literature considering the effects of exposing risk-averse managers to idiosyncratic risk through stock or stock options. For example, managers value stock or stock options in their compensation contracts less, when they already have greater parts of their wealth correlated with the value of the company (Lambert et al. (1991), Kahl et al. (2003)). Also, risk aversion can influence the investment decisions of managers, when they are exposed to company specific risk (Parrino et al. (2005), Morellec (2003)).

3 Data

3.1 Data Sources

The analysis is based on information from two different surveys. Both the Survey of Consumer Finances (SCF) and the Survey of Small Business Finances (SSBF) provide information on the financial situation of owners and on their companies. The surveys aim to be representative for households and companies in the USA. From the SCF the waves 1989, 1992, 1995, 1998 and 2001 are used. From the SSBF only the wave 1998 is used, because this is the only wave with information on the net worth of owners. Both surveys were conducted by the Board of Governors of the Federal Reserve System, Washington, DC.

The Survey of Consumer Finances has the household as the primary unit of interest. The main purpose of the survey is to document the amount and the composition of household wealth. It therefore includes some questions on private companies owned by households. For the purpose of this analysis two sub-samples are used. The first sub-sample selects all households with an active management interest in a private company. For households that own several private companies, only the information about the largest one is used.[2]

[2]Of the households with an active management interest in private companies, 32% have a management interest in more than one company.

Overall, the sub-sample contains complete information on 4,973 households with an active management interest in a private company. Of these, 4,324 companies are finally included in the analysis. Observations for companies with an equity value below US-$ 1,000 are deleted, because such small values of equity can lead to very implausible returns on equity figures. Furthermore, companies are required to have positive sales and owners are required to have positive private wealth, i.e. positive net worth not considering the equity investment. As a further measure to ensure plausible return on equity values, the smallest and largest 1% of observations of this variable are excluded. Although the ownership share of the household is known, it is not clear whether the household is the largest owner. Households are asked to give an estimate of the market value of their equity share. Since there is no quoted price available, this value may be measured with error.[3]

For the second sub-sample of the SCF all households with ownership in a private business in which they do not have an active management role are selected. The survey provides information on the market value of the equity share owned and on the income that the household has received from the company. This information is given separately for companies of different legal forms. Should a household have ownership in two or more companies of the same legal form, then this information is only available as a sum for those companies. Overall, information on 1,486 households with ownership in 2,090 (partly combined) companies is available. The same selection rules as for the first sub-sample apply, with the sole difference that the minimum size of US-$ 1,000 applies to the equity share and not to the total equity. Finally, information on 1,429 households and 1,925 companies is used.[4]

The Survey of Small Business Finances has the company as the primary unit of interest. It provides information on 3,561 private companies with up to 500 employees from the non-farm, non-financial sectors. Financial data on the company, as well as information about the largest owner, is available. Although it is known whether the company is run by a hired manager, it is not known whether the largest owner is also active in the management. The SSBF data differentiates between only three categories of total net worth of the owner: the book value of the ownership share, the equity value of the primary residence and the

[3]See Kennickell et al. (2000) for more information on the 1998 SCF survey.

[4]35.6% households have ownership in only one company. 62.8% of households have ownership in more than one company, but each has a different legal form.

remaining net worth.[5] As in the SCF sample, companies with equity values below US-$ 1,000 are not included in the analysis. This survey contains a surprisingly high share of 21% of companies with negative equity values. (This issue is explored in more detail in section 3.2.2.) Likewise, companies are required to have positive sales, positive assets and owners are required to have positive private wealth. Since the SSBF data has more extreme values, trimming of the return on equity variable is done to the 5% level. 2,337 companies are finally included in the analysis.[6]

Descriptive statistics for all variables can be found in tables A, B and C in the appendix.

3.2 Variable Definitions

3.2.1 Measurement of Underdiversification

For the measurement of underdiversification it is important to have information on the owner's equity investment in the company and on the owner's net worth. The share of net worth invested in the company can then be used as proxy for the underdiversification. **Net worth** is defined as the sum of all assets minus the sum of all liabilities of the owner.

Two measures for the share of net worth invested (SNWI) are calculated. The first method considers only the value of the equity investment. This variable is denoted with SNWI A.

$$\textbf{SNWI A} = \frac{(ownership\ share * total\ value\ of\ equity)}{net\ worth}$$

This information is calculated for the largest owner of the company in the SSBF data, whereas in the SCF data the responding household needs not be the largest owner. An additional difference is that value of equity relates to the estimated market value in the SCF data and to the book value in the SSBF data.

[5]Browning et al. (2003) consider problems that may arise when questions about aggregate values are asked in surveys. They discuss the usefulness of total expenditure questions as opposed to asking for expenditure in different categories. First, rounding can happen, i.e. values may be noisy. However, even with rounding, the total expenditure questions still contain valuable information. Second, it is possible that total expenditure is underestimated, if only one question about the total is asked.

[6]More detailed information on the 1998 SSBF survey is available in Bitler et al. (2001).

The second calculation takes into account that the equity investment is not the only way in which the owner's assets are tied to the company. Owners can also give personal guarantees for company loans, they can use private assets as collateral and they can extend loans to the company. The second measure for underdiversification, SNWI B, takes these possibilities into account. It is calculated according to the following formula:

$$\textbf{SNWI B} = \frac{(ownership\ share * total\ value\ of\ equity) + guarantees + collateral + loans}{net\ worth}$$

The SCF states directly the amount of loans that are guaranteed by the household, the value of household assets that are used as collateral and the volume of loans that are extended to the company by the household. The SSBF data, having the company as primary unit of interest, gives only the sum over all owners for these variables. This information is therefore multiplied by the ownership share of the largest owner to get an approximation of this owner's personal involvement.

The measures SNWI A and SNWI B document a considerable degree of underdiversification. For owners with active management interest, SNWI A is on average 33.7% (SCF) and 27.7% (SSBF). By additionally considering guarantees, collateral and loans, the average value of SNWI B is 3.6% and 5.8% higher, respectively.

If owners exhibit decreasing relative risk aversion, then, at higher levels of wealth, they will be less affected by the same degree of underdiversification. Therefore we also control for the level of private wealth. **Private wealth** is defined as net worth minus the value of the equity investment. It measures the assets that are not directly invested in the company. The **Dummy high wealth** is equal to one, if the owner belongs to the highest third of the distribution of private wealth in the respective sample. The cut-off point is 3.3 million US-$ for the SCF and 0.6 million US-$ for the SSBF. This dummy is interacted with the measures of underdiversification in the empirical analysis. The wealth levels in the SSBF are smaller than in the SCF, since the SSBF is restricted to private companies with at most 500 employees. From the descriptive statistics in table B in the appendix it can be seen that households who hold equity without an active management interest are considerably richer than households who hold private equity with an active management interest. Private equity as a pure financial investment opportunity is especially attractive for richer households. In

both the SCF and the SSBF data owners with more private wealth have on average a lower degree of underdiversification.

We now turn to the discussion of whether SNWI is a good measure for the underdiversification and the risk exposure of owners. Owners are exposed to several types of risk. For example, there is a concentration of income from one source and the possibility that the value of the ownership share can fall. These risks certainly increase with SNWI. However, some owners have unlimited liability, i.e. they are liable for company obligations with all their private assets. In practise, even owners with unlimited liability lose only their equity investment in a bankruptcy, if their private assets are below exemption limits stipulated by the bankruptcy law. Fan and White (2003, p. 3) give evidence of the limited size of the personal losses in a bankruptcy. They state that: "they [entrepreneurs] often have no non-exempt assets". Therefore also for owners with unlimited liability, SNWI is a good proxy for the risk exposure.[7]

3.2.2 Company Profitability

Return on Equity (ROE), defined as pre-tax profits divided by total equity, is used as a measure for company profitability. The SCF data measures equity with an estimated market value and the SSBF with the book value. The profit figures in both surveys are reported before the payment of corporate and income tax. To make the numbers better comparable across legal forms, we calculate the corporate tax, which has to be paid only by C-corporations, and subtract it from the reported profits.[8]

[7]If a private company goes bankrupt in the USA with obligations still outstanding, an owner with unlimited liability can declare personal bankruptcy in order to dispose of the company debt. It is possible to give up all assets that are not exempt, but to keep future earnings (chapter 7) or to keep all assets and agree to a repayment plan to repay part of the debts (chapter 13). The exemption rules differ between states, but typically define an upper limit for home equity as well as for other personal assets. If owners agree to keep up payments on loans that are secured on their home or private car, they do not lose these assets. Furthermore, if the retirement savings are not excluded from the bankruptcy proceeding in the first place, they can be kept if the amount is reasonably necessary for the support upon retirement.

[8]C- and S-corporations are both characterised by limited liability. C-corporations have to pay corporation tax for profits that are paid out to the shareholders. In contrast, profits of S-corporations are only charged with the personal income tax rate of their owners. Corporate tax rates differ according to the size of profits and have changed over the years. For our calculations we use the historical rates according to tax brackets

The average of ROE in the SCF data is at 47.7% quite high. This is an average that gives equal weight to all observations. If one calculates an average that is weighted by the value of equity, one obtains a substantially lower number of 15.6%, comparable to the result of Moskowitz and Vissing-Jørgensen (2002).

As opposed to the SCF, where the value of equity is asked directly, the SSBF calculates the value of equity as the difference of the company's assets and liabilities. It is likely that company assets and liabilities are measured with error, because most respondents are not required by law to draw up a balance sheet. Any measurement error in assets and liabilities is passed on to the book value of equity. In the SSBF data it seems that assets are on average underreported, because a high share of 21% of companies have negative equity values. Underreporting of assets is consistent with the relatively high values for return on equity. Even the value-weighted average is, at 42.1%, quite high. Since SNWI is not well defined if the equity value is negative, only observations with positive equity values can be included in the empirical analysis.[9]

It is important to discuss whether there are problems in the measurement of ROE that could lead to a positive relationship between profitability and SNWI that would not be driven by higher required returns or higher effort. We first address the influence of tax evasion. Longenecker et al. (1996) find in a survey of 424 entrepreneurs that 54% of them have faced the issue of underreporting taxable income. However, the survey does not contain information on the size of underreporting. The question is to what extent the survey data used in this analysis can be affected by tax evasion. King and Ricketts (1980) and Parker (1984) conclude from an evaluation of the 1977 economic census that households report their true income to surveys, if the surveys don't use tax forms as a basis. The SCF is not based on tax forms, whereas the SSBF refers respondents to tax statements for the company details but not for the wealth questions. Tax evaders will report lower values of ROE and also lower values of SNWI to the extent that they saved the gains from tax evasion. Therefore a positive relationship between SNWI and ROE can be influenced by tax evasion. However,

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which can be found at www.taxpolicycenter.org and, for 1994 onwards, at the home page of the American Internal Revenue Service, www.irs.gov.

[9]The analysis was also done with share of net worth invested set equal to zero for observations with negative equity or negative net worth. A dummy for negative equity and a dummy for negative net worth were included. The results are robust with respect to this modification.

since SNWI is a stock variable shaped by many other factors, this effect is likely to be too small to drive the results.

As the surveys provide only cross-sectional information, it is not possible to control for entry and exit. There is a higher probability that a company exits shortly after the survey has taken place, if the entrepreneur was overoptimistic when starting the company. Overoptimism likely leads to a high investment volume and to low returns, i.e. overoptimism yields a negative relationship between SNWI and ROE. This makes it more difficult to identify an underdiversification effect.

Investments of venture capitalists may reduce the underdiversification of the other owners. For venture capitalists, the capital gains from selling the company are an important source of income, whereas the profitability of the company during the investment period may be low. This could lead to a positive relationship between SNWI and ROE. However, overall less than 1% of all private equity (i.e. equity in sole proprietorships, partnerships and corporations in private ownership) in the USA is held by venture capitalists (Moskowitz and Vissing-Jørgensen, 2002). This is also reflected in the SSBF data, which provides information on equity increases. Out of the 3,561 companies covered, only 4 raised equity from a venture capital firm in the year prior to the survey.

3.2.3 Other Characteristics of Companies and Owners

Following are definitions for the other control variables. Most variable names speak for themselves, but there are differences in the precise definition of the variables across the two surveys.

We consider the company-related variables first.

Company size is the logarithm of the number of employees in the SCF data. The SSBF data covers only companies up to 500 employees. For this data set, company size is measured directly as the number of employees.

Company age is defined as the number of years since the company was started or acquired.

Industry dummies in the SCF data differentiate between six industries. There is no industry information if the value of the equity that the household owns is above US-$ 100 million. The SSBF data identifies nine different industries. Tables D and E in the appendix

give an overview on the distribution of the companies according to industry.

Dummies legal form differentiate between sole proprietorships, partnerships, S- and C-corporations.

Dummies type of company acquisition indicate whether the company was founded, purchased or inherited.

It is important to know that the SCF data includes information on assets, such as private businesses, only at the household level, whereas education and job characteristics are included separately for the head of the household and the spouse. To be able to control for individual characteristics, we determine whether the head of the household or the spouse is the main owner according to the job characteristics. If only one person is working for the business, then this person is the main owner. If both are working for the business, then the single person being self-employed in the main job is the main owner. If both are self-employed in the main job, then the main owner is the one with the higher number of weekly hours worked in the main job. If both are working for the business, but neither is self-employed in the main job, then the single person being self-employed in the second job is the main owner. If both are self-employed in the second job, then the main owner is again the person with the higher hours of work in the second job.

The owner-related variables listed below are used in the analysis.

Value primary residence refers to the market value of the owner's primary residence in the SCF data. In the SSBF data only the equity value (i.e. market value minus mortgages) is available. The value of this variable is set to zero, if the owner is renting the primary residence.

Dummy home owner has a value of one if the owner owns the primary residence.

Experience is calculated in the SCF data from the information on the work history of the head of the household and the spouse. Years in full-time employment are counted as such and years in part-time employment are weighted with a factor of 0.5. The variable refers to all kind of occupations. In the SSBF data experience is defined as the number of years owning or managing a company.

Hours worked is only available in the SCF data. It is the self-reported hours of work in the main job in a normal week. This information is used for the empirical analysis if, first, the owner states to be working in or participating in the operation of the company and,

second, the owner states to be self-employed in the main job.

Ownership share refers to the share of equity owned. In the SCF data the household is not necessarily the largest owner, whereas the SSBF data always refers to the largest owner.

Owner age is the age of the owner measured in years.

Education dummies in the SCF data differentiate between a high school degree, a bachelor's degree, a master's degree, a PhD, or another higher degree. For the SSBF data the classification is no high school degree, a high school degree, some college but no degree, an associate degree, a vocational programme, a college degree, and a post graduate degree.

Ethnicity dummies in the SCF data set are available for White, Hispanic, African-American and Other. The SSBF data additionally covers Asian, Native Hawaiian or other Pacific Islander and American Indian or Alaska Native.

Dummy sex of owner is equal to one if the owner is female.

Year dummies are included in analyses using the SCF data. The distribution of observations according to year is given in table F in the appendix.

4 Development of Hypotheses

4.1 Influence on Required Returns

In this subsection we present a simple theoretical model in order to show how a positive relationship between underdiversification and profitability can be driven by higher required returns. This model will be also used to derive the regression specification of the empirical analysis. In the model there are two periods. Individual i invests initial wealth w_{1i} in period 1 and returns realise in period 2. Investment is possible in a safe asset and in a risky asset. The safe asset has no minimum investment requirement and a return of r_0. The risky asset can be thought of as establishing a company. The size of the minimum investment and the expected return vary depending on the business idea. The minimum investment requirement of the risky asset for individual i is denoted by k_i. The expected return of the risky asset is denoted by $E(r_i)$, and the realised return of the risky assets is r_i. The final wealth of individual i in period 2 depends on whether investment in the risky asset was chosen and, if this is the case, on the realised return of the risky asset.

$$w_{2i} = k_i(1 + r_i) + (w_{1i} - k_i)(1 + r_0) \tag{1}$$

Utility is derived from consumption of w_{2i}. Individuals have a utility function with constant relative risk aversion.

$$U(w_{2i}) = w_{2i}^{(1-\rho)}; \quad \rho > 0,\ \rho \neq 1 \tag{2}$$

In order to compute the minimum expected return that individual i requires for an investment in the risky asset, $E(r_{i\,min})$, suppose the individual is indifferent to investing in the safe asset only or in the safe and the risky asset. The expected utility from both possibilities is then identical:

$$E\,U \mid only\ safe\ asset\ =\ E\,U \mid safe\ and\ risky\ asset \tag{3}$$

This condition can be written with the resulting wealth levels inserted into the utility function.

$$(w_{1i}(1+r_0))^{(1-\rho)} = E(k_i(1+r_{i\,min}) + (w_{1i}-k_i)(1+r_0))^{(1-\rho)} \tag{4}$$

We rearrange this expression to arrive at:

$$E\left(\frac{k_i(r_{i\,min}-r_0)}{w_{1i}(1+r_0)}+1\right)^{(1-\rho)} - 1 = 0 \tag{5}$$

From a second-order Taylor expansion around r_0, we obtain an equation describing the determinants of the minimum expected return.

$$E(r_{i\,min}) = r_0 + 1/2 * 1/(1+r_0) \ast k_i/w_{1i} \ast \rho \ast E\{r_{i\,min}-r_0\}^2 \tag{6}$$

Individual i will invest in the risky asset, if $E(r_i)$ is larger than $E(r_{i\,min})$. The individuals underdiversification, k_i/w_{1i}, increases the minimum expected return required for investment. If the expected returns are not high enough for the given underdiversification, then the risky asset will not be chosen – the potential entrepreneur will not establish the company. Furthermore, the required return is increasing in the relative risk aversion, ρ, and in the volatility of the returns, $E\{r_{i\,min}-r_0\}^2$.

In the empirical implementation of equation (6) we use the realised return as a proxy for the required return. For this approach to be valid, it is important that realised returns and required returns are monotonically related. This is shown in the next equations.

The expected return for individual i is an increasing function of the minimum expected return.

$$E(r_i) = \alpha + \beta E(r_{i\,min}) + \eta_i; \quad \beta > 0 \tag{7}$$

And the realised return for individual i is equal to the expected return plus an error term.

$$r_i = E(r_i) + \mu_i \tag{8}$$

The realised return, r_i, is therefore monotonically related to the minimum expected return, $E(r_{i\,min})$.

$$r_i = \alpha + \beta E(r_{i\,min}) + \eta_i + \mu_i; \quad \beta > 0 \tag{9}$$

To derive the regression specification we substitute the expression for $E(r_{i\,min})$ from equation (6) into equation (9). After linearising we obtain the following regression specification:

$$\begin{aligned} ROE \;\; = \;\; & \alpha + \beta_1 SNWI + \beta_2 dummy\ high\ wealth + \beta_3 SNWI * dummy\ high\ wealth \\ & + \beta_4 company\ size + \beta_5 company\ age + \beta_6 industry\ dummies + \epsilon \end{aligned} \tag{10}$$

SNWI is the empirical counterpart of k_i/w_{1i} in the model. From our theoretical model we expect a positive relationship between the underdiversification of the owner and the profitability of the company. Since it is not possible to observe the risk aversion of owners in the data, we employ the common assumption that richer owners are less risk averse. A dummy for high wealth levels allows a different treatment of richer owners. As an overall effect of high wealth, we expect that the compensation for underdiversification will be smaller. The theoretical model also gives importance to risk, but there is no measure of risk at company level available in the surveys. The included industry dummies control for risk insofar as it is the same in one industry. The controls for company size and company age also account partly for the influence of risk. The final empirical specification includes additional controls that do not appear in the simple model, for example dummies for legal form and education of the owner-manager.

The simple theoretical model does not allow for an investment in the stock market. Investment is only possible in a save asset and in *one* risky asset. This is a simplification that should not affect the main insights of the model. Heaton and Lucas (2000*c*) show that

growth in proprietary income has a high variation in its correlation with returns to the stock market. As we cannot observe this correlation on a company-basis, we cannot control for it in the empirical analysis. Insofar as it is related to the industry, the industry dummies will control for it.

4.2 Influence on Effort

Why can there be a positive relationship between the underdiversification of an owner with an active management interest and the effort he is exerting? By working a bit harder the owner-manager can increase company profitability and thereby reduce the probability of company failure. The more the owner-manager is financially dependent on the success of the company, the higher are the incentives for effort. The incentive to work harder is especially high if the company is in difficulties, since a company failure has a big impact on the income and wealth of the owner-manager. After bankruptcy, labour income may be lost if a period of unemployment ensues; intangible assets, such as customer relationships, are destroyed and tangible assets can often only be sold with a loss. The effort cost of working longer hours may be small compared to the financial cost of a company failure. We expect that underdiversification has a smaller effect on effort for richer owner-managers, since, in absolute value, they have more assets to fall back on.

A positive relationship between underdiversification and effort is supported by standard utility functions, but utility functions using consumption relative to a reference point are an especially good description of the situation of an owner-manager confronted with the possibility of a bankruptcy (see, for example, Kahneman and Tversky (1979)). The utility function is flatter for consumption levels above the reference point than it is for consumption below the reference point, i.e. there is a kink at the reference point which makes losses relatively more painful. The reference point can be the consumption level of the last period or an expectation about future consumption. A company failure may have such pronounced effects on the financial situation of the owner-manager that he may be forced below the former reference point. Again, higher effort exerted to avoid this negative outcome may be worthwhile.

4.3 Hypotheses

This section describes the hypotheses that are tested in this paper. The first two hypotheses concern the existence of an underdiversification effect.

Hypothesis 1: There is an underdiversification effect, i.e. there is a positive relationship between the owner's degree of underdiversification and the profitability of the company. This effect can either work through higher required returns or through increased effort.

Hypothesis 2: The underdiversification effect is smaller for owners with higher private wealth. The required returns are smaller if owners exhibit decreasing relative risk aversion and the incentive effect of underdiversification is smaller if the owner-manager is less dependent on the success of the company.

The next two hypotheses describe a specific channel through which underdiversification affects profitability. It should be noted that the channels are not mutually exclusive.

Hypothesis 3: A positive relationship between the owner's degree of underdiversification and the profitability of the company is driven by higher required returns.

Hypothesis 4: A positive relationship between the owner's degree of underdiversification and the profitability of the company is driven by increased effort.

5 Empirical Analysis

5.1 Dealing With Endogeneity

In order to identify whether there is a positive relationship between underdiversification and company profitability that is driven by higher required returns or higher effort, it is necessary to deal with the problem of endogeneity. Several regressors used in the analysis are potentially endogenous. In general, we will use instrumental variables to deal with this problem. The variable for underdiversification, SNWI, is affected by reverse causality. Owners who know that a company is of high quality are willing to invest more. In this case there is a positive effect of the equity return on the share of net worth invested. The same effect is possible for ownership share. Owners may be willing to buy a higher share of a good

company. Effort can also be influenced by profitability. Since the reward of working for a good company is higher, the owner-manager may work longer hours. However, an opposite effect is also possible. The owner-manager may work longer hours to keep a company of low quality alive. This could lead to a negative relationship between effort and performance in an OLS regression. In order to get consistent coefficient estimates, we instrument the potentially endogenous regressors.[10]

The following instruments are used for the endogenous regressors: the value of the primary residence, a dummy for home ownership, the age of the owner, the sex of the owner and dummies for the type of company acquisition. The instruments are only valid, if there is no relationship between them and the profitability of the company.

We discuss first the validity of the value of the primary residence. Owners with profitable companies will accumulate wealth over time, which may be used to buy a more expensive house or to pay off the mortgage faster. For example, Gersick et al. (1997, p. 157) describe that the handing down of the company from parents to children can be at a time when the parents want to move to a larger house. A high value of the house would be related to high profitability. However, as is shown in the first-stage regression for SNWI, the direction of the effect in the empirical analysis is opposite. We find that a high value of the house is related to low profitability. If there is a relationship between instrument and dependent variable, then the coefficient for SNWI will be underestimated and we obtain a lower bound on the true effect. The use of this instrument for ownership share is more problematic. The value of the primary residence is positively related to the ownership share and the ownership share is positively related to profitability. If a larger home is bought in response to good company profitability, then the instrument has a direct relationship with the dependent variable. In this case the influence of ownership share on profitability will be overestimated. This possibility cannot be excluded. However, since the number of instruments is greater than the number of endogenous regressors, it is possible to test for overidentifying restrictions. The results of this test are reported along with all regressions.[11]

[10]Instrumenting of SNWI is important for a second reason. In the SSBF data it is likely that equity, which enters into the calculation of SNWI, is measured with error. If the instruments are not related to this measurement error, then it will cause no bias.

[11]The results of the second-stage regressions are qualitatively identical when the value of the primary residence is omitted from the instrument list.

It can be argued that age of the owner itself is unrelated with profitability. When using it as instrument, it is, however, important to include a control for work experience of the owner in the main regression, because work experience can be related to profitability. Since age is correlated with experience, age can be related to profitability, if no explicit control for experience is included.[12]

The sex of the owner should have no direct relationship with profitability. Also, the way the company was acquired, i.e. being founded, purchased or inherited, should be unrelated to profitability.

Table 1 presents the first stage results to determine the instrumented values.[13] The determinants for SNWI A are shown in columns (1) and (2) for the SCF and SSBF data. The natural logarithm of the value of the primary residence has a negative effect. This is as expected since home owners have part of their wealth tied up so that it is not possible to invest it in a company. The dummy for home ownership has no significant effect. Older owners have a smaller share of their total net worth invested in the company. They have had more time to accumulate other assets and may have passed on part of their stake to children or new owners. Women tend to invest a smaller share of their net worth. The dummies for the way they company was acquired show no clear pattern across the data sets. There is also no clear presumption on the sign that they should have. As can be expected, SNWI is higher for larger companies. For company age the effect differs between the data sets.

Columns (3) and (4) cover the determinants for ownership share. The value of the primary residence has a positive effect and the dummy for home ownership a negative one. Home owners have part of their assets bound in the home. They have fewer assets available to invest in a large ownership share. The age of the owner is insignificant and the sex of the owner does not have an identical effect across the data sets. Owners have the highest ownership share, if they have founded the companies themselves. 'Company founded' is the base category in the regression. Company size has a negative influence on ownership share

[12]Good instruments should have a higher correlation with the endogenous regressor. The finding by Heaton and Lucas (2000*b*) suggests that this is the case for age. The authors document that the portfolio composition of individuals is influenced by their age. Individuals above the age of 65 have a smaller share invested in private equity. This is also reflected in our first-stage regression.

[13]The SCF data includes imputations for missing values. Five different imputations are given for each missing value. The reported results are calculated for the average of the imputed values.

Table 1: Determining the Instrumented Values

Dep. variable:	SNWI A		Ownership share		Ln hours
	(1)	(2)	(3)	(4)	(5)
	SCF	SSBF	SCF	SSBF	SCF
Ln value primary	-3.12***	-2.91***	1.78***	1.05***	-0.026***
residence	(0.377)	(0.322)	(0.394)	(0.310)	(0.0093)
Dummy home owner	0.360	5.09	-5.14**	-10.9***	0.096*
	(2.13)	(3.24)	(2.23)	(3.12)	(0.053)
Owner age	-0.381***	-0.270***	-0.0060	-0.063	-0.023***
	(0.054)	(0.059)	(0.056)	(0.057)	(0.0015)
Dummy sex of owner	-4.72***	-3.14***	1.98*	-1.12	-0.189***
	(1.04)	(1.17)	(1.09)	(1.13)	(0.026)
Dummy purchased	-1.33	6.11***	-4.02***	-1.51	-0.042**
	(0.829)	(1.18)	(0.867)	(1.14)	(0.020)
Dummy inherited	-0.712	7.90***	-11.9***	-3.27*	-0.057
	(1.46)	(1.94)	(1.52)	(1.87)	(0.037)
Company size	4.58***	0.098***	-5.25***	-0.076***	0.034***
	(0.222)	(0.0087)	(0.232)	(0.0084)	(0.0055)
Company age	0.189***	0.051	0.235***	-0.152***	0.0020**
	(0.037)	(0.047)	(0.039)	(0.045)	(0.00094)
Number of observations	4,324	2,337	4,324	2,337	3,335
F-test of excluded instruments	49.2*** F(6, 4291)	55.7*** F(6, 2304)	17.8*** F(6, 4291)	3.10*** F(6, 2304)	63.3*** F(6, 3302)
Shea's partial R squared	0.055	0.121	0.021	0.0077	0.043
R squared	0.201	0.228	0.478	0.430	0.168

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors are in parentheses. The regressions contain additional controls for industry, year (only SCF), education, experience, ethnicity and legal form.

and company age has differing effects.

In column (5) we report the results for hours worked. This information is only available for the sub sample of the SCF including owners with an active management interest. Here it is interesting to note that owner-managers with a more valuable primary residence work shorter hours. This could be due to an income effect on labour supply. In contrast, owner-managers who own their primary residence work longer hours. Here it could have also been expected that owner-managers who own their primary residence have more security and are less under pressure to work long hours in order to secure the survival of the company.

The instrumenting of SNWI controls for problems of reverse causality, but not for owner-managers with a high degree of underdiversification exerting more effort. As found in the first-stage results for SNWI, an owner-manager with a primary residence of little value has, on average, a higher share of net worth invested in the company. In this case the owner-manager is more dependent on the success of the company as there are fewer assets to resort to and may therefore work harder. Indeed, this was found in the first stage for hours worked. We therefore need to split the sample into owners with and without management interest in order to separately identify influences on profitability stemming from higher required returns and higher effort. However, the division into sub samples of owners with and without a management interest can also be endogenous, since the decision whether to be active in the management can be related to the profitability of the company. For example, if the company is very good, then the owners may have become so rich that it is not worth any more for them to work. Or, if the company is very good, owners want to work, since returns on effort are high. However, even if the selection into the group is endogenous, we can still test whether there are specific relationships within the groups that are predicted by our hypotheses.

5.2 Is Underdiversification Related to Company Profitability?

This subsection discusses the existence of an underdiversification effect. It is analysed whether underdiversification of owners has a positive effect on the profitability of companies. For the moment we do not try to identify separate channels of the underdiversification effect, i.e. the effect can be driven by higher required returns or by higher effort.

Table 2 presents the results of the test of hypothesis 1, which postulates the existence of an underdiversification effect in general. The regressors SNWI and ownership share can be

endogenous and are instrumented as shown in table 1. There are four different specifications. Data from the SCF as well as the SSBF is used and both measures of underdiversification, SNWI A and SNWI B, are employed.

Regressions (1) and (2) use the underdiversification measure SNWI A and show results for the SCF and the SSBF data. SNWI A takes only the equity investment into account and disregards other ways in which owners' assets could be tied to the company. There is a positive relationship between SNWI A and return on equity that is significant to the 1% and 5% level, respectively.[14] This provides strong evidence for hypothesis 1. It is interesting

Table 2: Underdiversification and Profitability

Dep. variable: Return on equity				
	(1)	(2)	(3)	(4)
	SCF	SSBF	SCF	SSBF
	SNWI A		SNWI B	
SNWI	1.13***	1.40**	1.05***	1.31**
	(0.260)	(0.591)	(0.244)	(0.562)
Ownership share	0.769**	5.99**	0.614	5.64**
	(0.401)	(2.63)	(0.384)	(2.54)
Company size	-2.37	0.233	-3.16	0.180
	(2.17)	(0.224)	(2.19)	(0.220)
Company age	-0.468**	0.687	-0.377**	0.776
	(0.186)	(0.594)	(0.177)	(0.589)
Number of observations	4,324	2,337	4,324	2,337
Overidentification test, χ^2 (dof, p-value)	1.88 (4, 0.76)	6.89 (4, 0.14)	2.46 (4, 0.65)	7.71 (4, 0.10)

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors that are adjusted for the 1st step estimation are in parentheses. The regressors SNWI and ownership share are instrumented. Columns (1) and (2) refer to SNWI A and columns (3) and (4) refer to SNWI B. The regressions contain controls for industry, year (only SCF), education, experience, ethnicity and legal form.

[14]The results for SNWI remain qualitatively identical when the sample is split into companies with limited and unlimited liability.

to see whether the economic significance is of about the same order in both data sets. The change in return on equity when SNWI A is increased by one standard deviation is 28.2 percentage points for regression (1) and 34.8 percentage points for regression (2). However, because one return measure refers to the market value of equity and the other to the book value of equity, it is more meaningful to examine the change in the distribution. Starting from the median of return on equity, a one standard deviation change in SNWI A brings the return on equity up to the 76th percentile in regression (1) and up to the 62th percentile in regression (2). Underdiversification has therefore a sizable effect on company profitability.[15]

The ownership share has also a significant positive effect on profitability. This is plausible, since owners who obtain a higher share of the profits have an incentive to work harder. It is remarkable that the relative size of the coefficients for SNWI A and ownership share is opposite to the finding with the SCF data. Due to the differences in variable definition it is, however, difficult to interpret this finding. In the SCF data the household is not always the largest owner, whereas the SSBF data refers only to the largest owner. With the controls for SNWI and ownership share, we are able to separately identify a positive underdiversification effect and a positive incentive effect.[16]

Company size and company age are added as further controls. The only significant effect is a negative influence of age in the SCF data. The regression also includes controls for industry, year, education, experience, ethnicity, sex, legal form and type of company acquisition included. Their coefficients are not shown for brevity.

Since there are more instruments than endogenous regressors, it is possible to test the overidentifying restrictions. The test of the statistical validity of the instruments is passed with a p-value of 76% for the SCF data and with a p-value of 14% for the SSBF data.

Columns (3) and (4) of table 2 show the results for SNWI B. This measure of underdiversification takes the equity investment, guarantees, private assets used as collateral and personal loans to the company into account. We do not discuss the results here, because they are very similar to the results obtained with SNWI A.

[15]The SSBF data provides also information on total assets. When we use 'return on assets' as dependent variable, we also obtain a significant positive coefficient for SNWI.

[16]The quadratic terms of SNWI and ownership share have been included in the regression to allow for a more flexible functional form. Because the quadratic terms were not significant, we only use the linear form of SNWI and ownership share.

We now turn to the test of hypothesis 2. This hypothesis states that richer owners are less affected by underdiversification, because the absolute amount of wealth not tied up in the company is higher. We would therefore expect a smaller effect of underdiversification for richer owners. Since only a subset of the observations can be used for the identification of this effect, it will be more difficult to obtain a clear result. Indeed, when we include the dummy for high wealth and its interaction term, both coefficients are statistically not different from zero, although the results suggest lower returns for richer owners. In an attempt to obtain a sharper result from the data, we restrict the level effect to zero and work only with the interaction variable.

Table 3 presents the results for SNWI interacted with the dummy for high wealth. The estimates show that, indeed, the effect of underdiversification is smaller for richer owners. This is true for all four regression specifications. Again, both data sets and both measures of underdiversification are used. The coefficient on SNWI that obtains for richer owners is calculated as the sum of the coefficient for SNWI and its interaction term. It is separately displayed in table 3. This coefficient is only significant for regression (1). For the other specifications we observe no effect of underdiversification for richer owners. In order to test hypothesis 2 we also need to know whether there is a statistically significant difference between the effect of underdiversification for the groups of richer and poorer owners. This is not the case. Only for column (3) is the difference between the coefficient of SNWI for both groups significantly different to the 10% level.

To sum up, the underdiversification effect is not significantly smaller for richer owners, rather there is no significant influence of underdiversification at all. It is, however, difficult to judge whether there is genuinely no effect or whether it can not be identified with the limited number of observations. Overall, the evidence that richer owners are less affected by underdiversification is consistent with hypothesis 2, although the results are not significant.

Compared to the results without interaction terms, the coefficients of ownership share remain similar in size, but are generally more precisely measured. Concerning the other controls, it is sufficient to note that company size now has a marginally significant positive influence on company profitability.

Table 3: Controlling for Private Wealth

Dep. variable: Return on equity				
	(1)	(2)	(3)	(4)
	SCF	SSBF	SCF	SSBF
	SNWI A		SNWI B	
SNWI	1.04***	1.25**	0.918***	1.11**
	(0.274)	(0.581)	(0.250)	(0.559)
SNWI * dummy high wealth	-0.326	-1.00	-0.338**	-0.830*
	(0.206)	(0.658)	(0.173)	(0.516)
Ownership share	1.01**	5.67***	0.912**	5.58***
	(0.407)	(2.03)	(0.394)	(1.99)
Company size	0.526	0.334*	0.448	0.317*
	(2.79)	(0.185)	(2.82)	(0.190)
Company age	-0.482***	0.766	-0.403**	0.812
	(0.186)	(0.511)	(0.176)	(0.520)
Coeff. SNWI high wealth	*0.718**	*0.248*	*0.580*	*0.285*
	(0.423)	*(1.08)*	*(0.370)*	*(0.949)*
Number of observations	4,324	2,337	4,324	2,337
Overidentification test, χ^2 (dof, p-value)	10.5 (9, 0.31)	7.09 (9, 0.63)	12.4 (9, 0.19)	7.37 (9, 0.60)

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors that are adjusted for the 1st step estimation are in parentheses. The regressor SNWI and its interaction term as well as ownership share are instrumented. Columns (1) and (2) refer to SNWI A and columns (3) and (4) refer to SNWI B. The regressions contain controls for industry, year (only SCF), education, experience, ethnicity and legal form.

In table 4 we additionally control for effort. This is a first attempt to test whether more underdiversified owner-managers require higher returns independently of any effect of effort. If this is not the case, then SNWI should become insignificant once effort is controlled for. The SCF data includes information on the owner-manager's self-reported hours of work in a typical week, which can be used as a proxy for effort. The variable is a noisy proxy, because effort is multi-dimensional, whereas hours worked only covers the time dimension. It is, however, plausible that owner-managers who work longer, will, for example, also acquire

Table 4: Controlling for Effort

Dep. variable: Return on equity			
	(1)	(2)	(3)
	SCF	SCF	SCF
		SNWI A	SNWI B
Ln hours worked	27.4***	-2.90	-5.32
	(10.0)	(19.3)	(20.4)
SNWI		1.19**	1.18**
		(0.545)	(0.546)
Ownership share		1.57**	1.38**
		(0.678)	(0.628)
Company size	-3.14**	1.14	-0.057
	(1.39)	(3.31)	(3.34)
Company age	-0.244	-0.661**	-0.559**
	(0.194)	(0.288)	(0.267)
Number of observations	3,335	3,335	3,335
Overidentification test, χ^2 (dof, p-value)	15.4 (5, 0.009)	0.67 (3, 0.88)	0.94 (3, 0.82)

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors that are adjusted for the 1st step estimation are in parentheses. The regressors SNWI, ownership share and hours worked are instrumented. Column (2) refers to SNWI A and column (3) refers to SNWI B. The regressions contain controls for industry, year, education, experience, ethnicity and legal form.

more information and make better decisions. Regression (1) includes only the logarithm of hours worked and does not control for SNWI and ownership share. There is a significant positive effect of effort, but the test of overidentifying restrictions is not passed.[17] Regressions (2) and (3) contain SNWI and the ownership share as further controls. The results now show an insignificant effect for effort, but SNWI and ownership share remain significant. This is a first indication that there is a separate channel of higher required returns, but since hours

[17]An OLS regression with the specification from column (1) was also calculated. The coefficient on ln hours worked was positive, but insignificant. This is consistent with the potential endogeneity of hours worked. If owner-managers of companies with poor quality work more, then the relationship between effort and profitability is not necessarily positive.

worked is only an imperfect control for effort, we cannot conclude that the remaining positive effect of SNWI is only due to higher required returns. It is possible that SNWI proxies for the parts of effort that are not covered in the time dimension.

5.3 Do Underdiversified Owners Require Higher Returns?

This subsection covers the first proposed channel of the underdiversification effect. According to hypothesis 3 we test whether owners of private companies who are more underdiversified require higher returns on their investment. The second sub-sample of the SCF, including only owners who are not at the same time managers, is used for this test. This excludes the possibility that a positive relationship between underdiversification and profitability is caused by higher effort. The SSBF data cannot be used for a test of hypothesis 3, because it does not allow a clear distinction between owners who are and who are not active in the management. Although 10.7% of the companies have a hired manager responsible for the day-to-day management, it is not possible to exclude that the largest owner is also involved in the management.

Table 5 shows the regression results for the SCF data. The first- and second-stage regressions contain only variables relating to the household, since it is not possible to select one member of the household as main owner. In the first-stage regression (not reported) the value of the primary residence has a negative coefficient which is significant to the 1% level, whereas the dummy for home ownership is negative, but insignificant. The tests for overidentifying restrictions indicate the statistical validity of the instruments. For this subset of the SCF data we cannot calculate SNWI B, because we have no information on the financial engagement of the household besides the equity investment.

The regression in column (1) shows a positive relationship between SNWI A and return on equity that is significant to the 5% level.[18] There is therefore evidence that more underdiversified owners require higher returns. This effect is also economically significant. A change in SNWI A of one standard deviation increases the return on equity by 18.8 percentage points, or, in an alternative representation, it increases return on equity from its median to its 83rd percentile. It is also instructive to compare the size of this effect with

[18]We tested whether a quadratic form in SNWI A would be appropriate. Since the quadratic term was not significant, we dropped it again from the regression.

Table 5: Owners Without Management Interest

Dep. variable: Return on equity		
	(1)	(2)
	SCF	SCF
	SNWI A	
SNWI	0.917**	0.899*
	(0.430)	(0.531)
SNWI * dummy high wealth		0.173
		(0.697)
Coeff. SNWI high wealth		*1.07*
		(1.16)
Number of observations	1,925	1,925
Number of households	1,429	1,429
Overidentification test, χ^2 (dof, p-value)	0.29 (1, 0.59)	0.59 (2, 0.75)

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors allowing for heteroscedasticity and correlation within households are in parentheses. They are adjusted for the 1st step estimation. The regressor SNWI and its interaction term are instrumented. Columns (1) and (2) refer to SNWI A. The regressions contain controls for year and legal form.

the effect of underdiversification calculated by Kerins et al. (2004). This comparison can only be very tentative, since both calculations rely on strong assumptions. We impose a specific functional form with our regression specification and Kerins et al. (2004) rely on the applicability of the CAPM and restrict the investment opportunities of the household to a single company and the market portfolio. Kerins et al. (2004) calculate for companies with 26 – 100 employees that an increase of SNWI from 15% to 25% increases the cost of capital for an underdiversified entrepreneur by 9.8 percentage points. We come to a quite similar result. An increase of SNWI A by 10 percentage points is related to an increase of return on equity of 9.2 percentage points.

Two small caveats of our empirical results should be pointed out. First, it is not possible to observe the ownership share of the household for this sub-sample. A higher ownership share can be related to higher monitoring activities, which can secure higher profitability as

well. Limitations of the data set prevent us from controlling for this possibility. Second, the correlation of returns from other financial assets (for example publicly traded equity) with the returns from the private equity investment can influence the required returns. Since we cannot observe these correlations, we are also not able to control for them.

The regression in column (2) allows for a different effect of underdiversification for the highest third in the distribution of private wealth. The coefficient of SNWI is larger for richer owners, but it is not significant. A test on the sum of the coefficients for SNWI and SNWI interacted reveals that the influence of SNWI is not significant for the richer owners. This could be because only one third of the observations is used to estimate the effect, or, it could be that richer owners of private companies do indeed not require a compensation for underdiversification. There is no statistically significant difference between the coefficients of both groups.

Our finding that more underdiversified entrepreneurs require higher returns as a compensation for the exposure to idiosyncratic risk has important implications. The realisation of a business idea can depend on the net worth of the potential entrepreneur. If the investment volume is large relative to the net worth, then the business idea needs to have a higher expected return in order to be realised. Furthermore, the available volume of additional bank finance can also be crucial, since it allows the potential entrepreneur to employ fewer own resources. The influence of underdiversification is especially important for projects that are not scalable.

Holtz-Eakin et al. (1994*a*) observe that the probability of becoming an entrepreneur increases after an inheritance and note that this observation is consistent with the existence of liquidity constraints. Our results suggest an additional interpretation of this finding. Since the potential underdiversification decreases through the inheritance, the required rate of return on investment projects decreases and therefore more business ideas will become worthwhile. This alternative explanation does not require the existence of liquidity constraints. Holtz-Eakin et al. (1994*b*) find that an inheritance increases the probability of companies remaining in business, which again is consistent with liquidity constraints. Again, an improved company survival can also be explained by lower required returns after an inheritance.

5.4 Underdiversification and Effort

We now turn to the second channel of the underdiversification effect. This sub-section explores the relationship between the underdiversification of owner-managers and the effort they exert, measured as average weekly hours worked. This analysis is solely based on the SCF data, since the SSBF data does not provide information on effort. Table 6 presents a tabulation of hours worked according to a partition of SNWI A into the lowest, middle and highest third. A positive relationship between underdiversification and hours worked can clearly be seen. The difference between the mean of hours worked for the lowest and the highest third of SNWI A is also statistically significant at the 1% level. In addition, table 6 presents this tabulation separately for owner-managers with different levels of private wealth. It is interesting to note that the difference in the average of hours worked between the lowest and the highest third of SNWI is decreasing in private wealth. This is a first indication that the pressure from underdiversification could be smaller for richer owner-managers. Here the differences in hours worked between the highest and the lowest third of SNWI are also significant at the 1% level.

The incentive effect of ownership can lead to a positive relationship between hours worked and the ownership share. Owner-managers who own a larger share of the company will benefit more from increased effort – they obtain a higher share of total profits. Table 7

Table 6: Tabulation of Effort With Respect to SNWI A and Private Wealth

Mean (median) of hours worked			
	SNWI A		
	Lowest third	Middle third	Highest third
All owner-managers	44.3 (45)	48.4 (50)	52.8 (50)
Lowest third private wealth	44.0 (45)	49.8 (50)	54.5 (55)
Middle third private wealth	45.8 (50)	49.9 (50)	53.8 (50)
Highest third private wealth	43.0 (40)	45.7 (49)	49.6 (50)

Note: The calculation is based on 3,335 observations. The data source is wave 1989 to wave 2001 of the Survey of Consumer Finances (SCF). Hours worked is the self-reported hours worked in a typical week. The cut-off points for SNWI A are 16.2% and 42.2%. The cut-off points for private wealth are 0.49 million US-$ and 3.3 million US-$.

shows a tabulation of hours worked according to four categories of ownership. The means of weekly hours worked are very similar and the median is 50 hours for each category. No pronounced pattern emerges in this univariate analysis.

Table 8 presents the test of hypothesis 4. It is a test for a positive relationship between underdiversification and effort. Four different specifications are employed. SNWI A and SNWI B are used as regressors with and without an interaction term for especially rich owner-managers. In these regressions we cannot instrument SNWI and ownership share, since most of our instruments are in the regression in their own right. In regression (1) we use SNWI A without an interaction term as measure of underdiversification and find that it has a positive effect, significant to the 1% level. Hypothesis 4 is therefore confirmed. There is evidence that underdiversification increases company profitability through the channel of increased effort. Underdiversification also has a sizable effect on hours worked. If SNWI A is increasing by one percentage point, then hours worked will increase by 8.6%. Ownership share has a significant positive coefficient as well. Here an increase of the ownership share by 1 percentage point will increase hours worked by 3.1%.

The effects of SNWI and ownership merit a deeper reflection. Incentives emanate not only from ownership, but also directly from underdiversification. Owner-managers whose financial well-being depends more on the success of their companies work harder. This could cast a new light on the literature discussing the incentive effects of stock ownership and stock option programmes for employed managers. So far, it was criticised that the income of employed managers is not sensitive enough to changes in the value of the company and that therefore incentives to exert effort would be too low (Jensen and Murphy (1990). However, our results show that ownership can have incentive effects through underdiversification, even if the

Table 7: Tabulation of Effort With Respect to Ownership Share

Ownership share	<50%	50%	>50% and <100%	100%
Mean of hours worked	49.4	48.7	47.3	48.9
Median of hours worked	50	50	50	50
Number of observations	619	329	366	2,021

Note: The calculation is based on 3,335 observations. The data source is wave 1989 to wave 2001 of the Survey of Consumer Finances (SCF). Hours worked is the self-reported hours worked in a typical week.

Table 8: Underdiversification and Effort

Dep. variable: Ln hours worked				
	(1)	(2)	(3)	(4)
	SCF	SCF	SCF	SCF
	SNWI A		SNWI B	
SNWI	0.086***	0.095***	0.084***	0.094***
	(0.013)	(0.013)	(0.012)	(0.012)
SNWI * dummy high wealth		-0.054***		-0.054***
		(0.018)		(0.016)
Ownership share	0.031***	0.034***	0.029**	0.032***
	(0.012)	(0.012)	(0.012)	(0.012)
Company size	0.973***	1.18***	0.945***	1.17***
	(0.203)	(0.213)	(0.203)	(0.213)
Company age	0.510	0.055	0.055	0.059*
	(0.344)	(0.034)	(0.034)	(0.034)
Owner-manager age	1.09***	1.11***	1.08***	1.10***
	(0.186)	(0.186)	(0.186)	(0.185)
Square of owner-manager age	-0.014***	-0.014***	-0.014***	-0.014***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Coeff. SNWI high wealth		*0.040***		*0.040***
		(0.020)		*(0.018)*
Number of observations	3,400	3,400	3,400	3,400
R squared	0.160	0.162	0.161	0.164

Note: *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively. Robust standard errors are in parentheses. Columns (1) and (2) refer to SNWI A and columns (3) and (4) refer to SNWI B. The regressions contain controls for industry, year, education, ethnicity, sex, legal form and type of company acquisition.

ownership share is quite limited. This implication should be tested specifically for a sample of managers of large companies, because they are on average richer than the owner-managers in our sample. Also, the standard principal-agent models discuss the trade-off between risk and incentives only with regard to the variability of the labour income (see, for example,

Murphy (1999)). Our results suggest that the wealth situation of the manager should be taken into account as well. The same compensation scheme can provide more incentives for a manager with a lower level of wealth, because the degree of underdiversification is then higher.

Some of the other control variables have an influence on effort as well. Owner-managers of larger companies work longer hours, but the age of the company mostly doesn't matter. The age of the owner-manager has a significant influence. Hours worked increases until the age of 39 and then declines again.

Regression (2) allows for a different effect of underdiversification for richer owner-managers. As can be seen from the negative interaction term, richer owner-managers respond less to underdiversification. The total effect for the richer owner-managers can be calculated as the coefficient of the base category plus the coefficient of the interaction term. The sum of the coefficients is 0.04 and is significant at the 5% level. Underdiversification has also an effect on effort for richer owner-managers, but it is smaller than for poorer ones. The difference between the effects is significant at the 1% level.

Regressions (3) and (4) use SNWI B as a measure for underdiversification. Their results are very similar to the ones already discussed.

6 Conclusions

Owners of private companies are often underdiversified. In this paper we study whether underdiversification of owners increases company profitability. A positive effect could be driven by two mechanisms: higher required returns and higher effort. Kerins et al. (2004) show that underdiversification increases the cost of equity capital substantially. On theoretical grounds we would therefore expect that owners require a compensation for their exposure to idiosyncratic risk. However, Moskowitz and Vissing-Jørgensen (2002) find that returns to private equity are, on average, not higher than returns to public equity. So far, it remains unclear whether owners of private companies do not require a compensation for their exposure to idiosyncratic risk or whether other reasons are responsible for the relatively low returns to private equity. The Survey of Consumer Finances (SCF, wave 1989 to wave 2001) and the Survey of Small Business Finances (SSBF, wave 1998) are used for the analysis.

In our empirical analysis we find, first, a positive, significant relationship between underdiversification and the profitability of companies. This can be either due to higher effort or to higher required returns. The effect of underdiversification is smaller for richer owners, which is consistent with decreasing relative risk aversion. Second, for a sub-sample of owners without an active management interest, we also find a positive relationship between underdiversification and profitability. This supports the view that underdiversified owners require higher expected returns, since higher effort can be excluded as a cause. Third, for owners who are at the same time managers we establish a positive relationship between underdiversification and effort, measured as self-reported weekly hours worked. Owner-managers who are financially more dependent on the success of their companies have a higher incentive to work hard.

The empirical findings of this paper have important implications for our understanding of private companies. We show that underdiversified owners require higher returns as a compensation for the exposure to idiosyncratic risk. Since idiosyncratic risk is priced in private companies, it follows that the realisation of a business opportunity depends on the scale of the required investment in relationship to the net worth of the potential entrepreneur. If underdiversification drives the required return above the expected return of the project, then the business opportunity will not be realised. There remains the question of why average returns to private equity are not higher than average returns to public equity. Two likely explanations are that owners receive nonpecuniary benefits, such as utility from being ones own boss, or that owners are overoptimistic with respect to the future success of their companies.

Our finding that more underdiversified owner-managers work longer hours has implications for the efficacy and the design of managerial remuneration schemes. It has been noted that it is difficult to align the interests of managers and shareholders, when managers have a low ownership share (Jensen and Murphy (1990). But when the ownership share is high, underdiversification is very costly for managers. The evidence from our analysis suggests that underdiversification itself may induce managers to exert more effort. The strength of the incentives from a given scheme depends on the share of net worth of the manager that is tied to company performance.

The positive relationship between underdiversification and company profitability does not

imply that underdiversified owners realise a gain. It is more likely that the higher profitability is a compensation for the exposure to idiosyncratic risk and for higher effort. This observation has an interesting implication for banks extending loans to companies. Since the banks do not suffer a disutility of their own from the owner's underdiversification but gain from the higher profitability, it can be concluded that companies with more underdiversified owners should find it easier to obtain bank finance. A test of this consideration will be attempted in future research.

References

Ang, J. S., Cole, R. A. and Lin, J. W. (2000), 'Agency Costs and Ownership Structure', *Journal of Finance* **55**, 81–106.

Berger, A. N. and Udell, G. F. (1998), 'The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle', *Journal of Banking and Finance* **22**, 613–673.

Bitler, M. P., Moskowitz, T. J. and Vissing-Jørgensen, A. (2005), 'Testing Agency Theory With Entrepreneur Effort and Wealth', *Journal of Finance* **60**, 539–576.

Bitler, M. P., Robb, A. M. and Wolken, J. D. (2001), 'Financial Services Used by Small Businesses: Evidence from the 1998 Survey of Small Business Finances', *Federal Reserve Bulletin* **87**, 183–205.

Browning, M., Crossley, T. F. and Weber, G. (2003), 'Asking Consumption Questions in General Purpose Surveys', *Economic Journal* **113**, F540–F567.

Cole, R. A. (1998), 'The Importance of Relationships to the Availability of Credit', *Journal of Banking and Finance* **22**, 959–977.

Fan, W. and White, M. J. (2003), 'Personal Bankruptcy and the Level of Entrepreneurial Activity', *Journal of Law and Economics* **46**, 543–568.

Gersick, K. E., Davis, J. A., McCollom Hampton, M., Lansberg, I. and Gersick, K. E. (1997), *Generation to Generation: Life Cycles of the Family Business*, Harvard Business School Press, Boston.

Heaney, R. and Holmen, M. (2002), 'Shareholder Diversification and the Value of Control', Stockholm University School of Business Working Paper.

Heaton, J. and Lucas, D. (2000*a*), 'Capital Structure, Hurdle Rates, and Portfolio Choice - Interactions in an Entrepreneurial Firm', mimeo, Northwestern University.

Heaton, J. and Lucas, D. (2000*b*), 'Portfolio Choice and Asset Prices: The Importance of Entrepreneurial Risk', *Journal of Finance* **55**, 1163–1198.

Heaton, J. and Lucas, D. (2000*c*), 'Portfolio Choice in the Presence of Background Risk', *Economic Journal* **110**, 1–26.

Himmelberg, C. P., Hubbard, G. R. and Love, I. (2002), 'Investment, Protection, Ownership, and the Cost of Capital', National Bank of Belgium Working Paper No. 25.

Holtz-Eakin, D., Joulfaian, D. and Rosen, H. S. (1994*a*), 'Entrepreneurial Decisions and Liquidity Constraints', *RAND Journal of Economics* **25**, 334–347.

Holtz-Eakin, D., Joulfaian, D. and Rosen, H. S. (1994*b*), 'Sticking It Out: Entrepreneurial Survival and Liquidity Constraints', *Journal of Political Economy* **102**, 53–75.

Jensen, M. and Murphy, K. J. (1990), 'Performance Pay and Top-Management Incentives', *Journal of Political Economy* **98**, 225–264.

Kahl, M., Liu, J. and Longstaff, F. A. (2003), 'Paper Millionaires: How Valuable Is Stock to A Stockholder Who Is Restricted from Selling It?', *Journal of Financial Economics* **67**, 385–410.

Kahneman, D. and Tversky, A. (1979), 'Prospect Theory: An Analysis of Decision Under Risk', *Econometrica* **47**, 263–291.

Kennickell, A. B., Starr-McCluer, M. and Surette, B. J. (2000), 'Recent Changes in U.S. Family Finances: Results from the 1998 Survey of Consumer Finances', *Federal Reserve Bulletin* **86**, 1–29.

Kerins, F., Smith, J. K. and Smith, R. (2004), 'Opportunity Cost of Capital for Venture Capital Investors and Entrepreneurs', *Journal of Financial and Quantitative Analysis* **39**, 385–406.

King, C. S. and Ricketts, E. K. (1980), 'Evaluation of the Use of Administrative Record Data in the Economic Censuses', Proceedings of the Survey Research Methods Section of the American Statistical Association.

Lambert, R. A., Larcker, D. F. and Verrecckia, R. E. (1991), 'Portfolio Considerations in Valuing Executive Compensation', *Journal of Accounting Research* **29**, 129–149.

Longenecker, J. G., McKinney, J. A. and Moore, C. W. (1996), 'Ethical Issues of Entrepreneurs', mimeo, Baylor University.

Morellec, E. (2003), 'Investment, Compensation, and Risk Aversion', mimeo, University of Rochester.

Moskowitz, T. J. and Vissing-Jørgensen, A. (2002), 'The Returns to Entrepreneurial Investment: A Private Equity Premium Puzzle?', *American Economic Review* **92**, 745–778.

Murphy, K. J. (1999), 'Executive Compensation', *in* O. C. Ashenfelter and D. Card, eds, 'Handbook of Labor Economics, Volume 3B', Elsevier, Amsterdam, 2485-2566.

Parker, R. P. (1984), 'Improved Adjustments for Misreporting of Tax Return Information Used to Estimate the National Income and Product Accounts', *Survey of Current Business* **64**, 17–25.

Parrino, R., Poteshman, A. M. and Weisbach, M. S. (2005), 'Measuring Investment Distortions When Risk-Averse Managers Decide Whether to Undertake Risky Projects', *Financial Management* (forthcoming).

Petersen, M. and Rajan, R. G. (1994), 'The Benefits of Lending Relationships: Evidence from Small Business Data', *Journal of Finance* **49**, 3–37.

Stiglitz, J. E. and Weiss, A. (1981), 'Credit Rationing in Markets with Imperfect Information', *American Economic Review* **71**, 393–409.

Appendix

Table A: Descriptive Statistics SCF - Owners With Management Interest

Variable	**Mean**	**Median**	**Stdev.**	**Min**	**Max**
Company information					
Number of employees	113	6	459	1	5000
Company age	16.4	14	11.9	1	71
Market value total equity (in m. US-$)	22.9	0.700	394	0.001	24,740
Return on equity (in %)	47.7	14.5	106	-18.7	1071
ROE weighted with equity value (in %)	15.6				
Owner information					
Net worth (in m. US-$)	15.1	2.08	41.8	0.003	586
Private wealth (in m. US-$)	8.99	1.27	24.9	0.00003	333
SNWI A (in %)	33.7	29.1	25.0	0.039	99.9
SNWI B (in %)	37.3	32.8	26.6	0.039	99.9
Ownership share (in %)	75.9	100	32.4	0.001	100
Value primary residence (in m. US-$)	0.668	0.300	1.29	0	20
Dummy home ownership	0.932	1	0.252	0	1
Experience	29.6	29	13.2	0	85
Hours worked	48.8	50	18.0	1	133
Owner age	52.1	51	12.4	19	95
Dummy sex of owner	0.173	0	0.378	0	1

Note: Descriptive statistics refer to the sample information without weighting. The displayed statistics reflect the variation in the sample, but are not representative for the US economy.

Table B: Descriptive Statistics SCF - Owners Without Management Interest

Variable	**Mean**	**Median**	**Stdev.**	**Min**	**Max**
Company information					
Market value equity share (in m. US-$)	3.14	0.300	12.47	0.001	200
Return on equity (in %)	18.7	1.88	61.2	-24.0	634
ROE weighted with equity share (in %)	11.1				
Owner information					
Net worth (in m. US-$)	30.6	8.54	66.8	0.009	1018
Private wealth (in m. US-$)	27.4	7.17	63.17	0.003	1018
SNWI A (in %)	12.4	4.28	18.4	0.002	99.8
Value primary residence (in m. US-$)	1.09	0.600	1.74	0	20.0
Dummy home ownership	0.95	1	0.22	0	1

Note: Descriptive statistics refer to the sample information without weighting. The displayed statistics reflect the variation in the sample, but are not representative for the US economy.

Table C: Descriptive Statistics SSBF

Variable	**Mean**	**Median**	**Stdev.**	**Min**	**Max**
Company information					
Number of employees	29.1	5	59.1	1	482
Company age	15.7	13	12.7	1	104
Book value total equity (in m. US-$)	0.993	0.090	3.77	0.001	87.0
Return on equity (in %)	119	41.4	190	-60.0	1006
ROE weighted with equity value (in %)	42.1				
Owner information					
Net worth (in m. US-$)	1.59	0.468	4.55	0.002	116
Private wealth (in m. US-$)	1.06	0.325	3.75	0	115
SNWI A (in %)	27.7	20.9	24.8	0.004	100
SNWI B (in %)	33.5	24.6	29.3	0.041	100
Ownership share largest owner (in %)	79.6	100	27.8	1	100
Equity value primary residence (in m. US-$)	0.180	0.100	0.390	0	15
Dummy home ownership	0.900	1	0.302	0	1
Experience	20.2	20	12.0	0	72
Owner age	51.3	51	11.3	21	95
Dummy sex of owner	0.21	0	0.41	0	1

Note: Descriptive statistics refer to the sample information without weighting. The displayed statistics reflect the variation in the sample, but are not representative for the US economy.

Table D: Industry Distribution SCF - Owners With Management Interest

Industry	**No. of companies**	**% of companies**
Agriculture	447	10.3
Construction, mining	410	9.5
Manufacturing	477	11.0
Retail, wholesale	670	15.5
Personal and business services	2,228	51.6
Very large companies, not classified	27	0.6
Industry unknown	65	1.5
Total	4,324	100

Table E: Industry Distribution SSBF

Industry	**No. of companies**	**% of companies**
Mining, construction	230	9.8
Manufacturing	280	12.0
Transportation, communication, utilities	86	3.7
Retail trade	666	28.5
Services	1,075	46.0
Total	2,337	100

Table F: Observations per SCF Wave - Owners With Management Interest

Wave	**Number of companies**	**% of companies**
1989	590	13.6
1992	915	21.2
1995	928	21.5
1998	934	21.6
2001	957	22.1
Total	4,324	100