

# The Better Angels of our Nature?\*

Johan Karlsen  
Norwegian School of Economics

Katja Kisseleva  
Frankfurt School of  
Finance & Management

Aksel Mjøs  
Norwegian School of Economics

David T. Robinson  
Duke University and NBER

*Preliminary draft. Please do not circulate.*

## Abstract

What characterizes the business angels that invest in early stage innovative firms and what determines their investment performance? We use Norwegian population data on equity transactions for the years 2004–2018 and find that angel investors earn higher returns in their public stock investments than other investors. Their angel investment returns in innovative firms are highly skewed and we document a pronounced performance persistence in angel investments among angel investors.

*Keywords:* returns, investment behavior, entrepreneurship, angel investing, informal investing.

*JEL codes:* G11, G23, G24, G32.

---

\*Karlsen: johan.karlsen@nhh.no; Kisseleva: k.kisseleva@fs.de; Mjøs: aksel.mjøs@nhh.no; Robinson: davidr@duke.edu. We thank Norwegian Tax Authorities for granting us data access.

# 1 Introduction

Direct investments from individual investors, aka *angel investors*, represent an important source of early-stage capital for startups. Despite the importance of this segment of the capital market, we know relatively little about it. Who are angel investors? What are their investment portfolios like? Are some angels persistently better than others?

These questions are important not just because they inform our understanding of household finance and of the connections between angel investment and later-stage investment by institutional venture capital. Numerous policy initiatives around the world aim to encourage investments by individuals in startups. For example, several U.S. states have implemented programs that provide accredited angel investors with investment tax credits.<sup>1</sup> The emergence of online crowdfunding platforms also raises important questions about the nature of the angel investment market.

To study these questions we draw on detailed administrative and tax records from Norway. Our data include equity transactions by individuals into privately held as well as publicly traded firms. Detailed information on actual share transactions allows us to provide large-scale evidence on realized returns to angel investing as well as to observe the performance of angel investors in other asset classes. Multiple investments by the same investors allow us to analyze performance persistence among angel investors and to get at the importance of (unobserved) differences between angel investors for explaining variation in investment performance. Our findings are informative for policy makers in their efforts to encourage investments by individual investors in early stage firms as well as for individuals considering to enter the market for entrepreneurial finance.

---

<sup>1</sup>See Denes, Howell, Mezzanotti, Wang, and Xu (2020) for detailed description of such programs. Norway, the setting of our study, has begun to allow personal tax payers to generate income tax deductions based on their investments in startup companies. See <https://www.skatteetaten.no/person/skatt/hjelp-til-riktig-skatt/aksjer-og-verdipapirer/om/skatteinsentivordningen/> for more information.

For our purposes, an angel investor is an individual who makes an investment in a potentially innovative firm but is not a part of that firm’s founding team. We identify all such individuals in Norway between 2004 and 2017. Our definition hinges critically on constructing an ex ante measure of expected innovative potential based on characteristics observable at the time of firm founding, potentially before the firm has realized its innovative potential. For this we build on Kisseleva, Mjøs, and Robinson (2022). Their methodology, which is inspired by the Startup cartography Project, described in Andrews, Fazio, Guzman, Liu, and Stern (2022), defines four indicators for high innovation propensity<sup>2</sup>. A potentially innovative firm is one satisfying at least two of these four criteria, as in Kisseleva, Mjøs, and Robinson (2022).

We compare angel investors to two other groups of investors: individual investors who invest only in public stock (public-only investors) and individual investors who invest in private firms that do not meet our definition of a potentially innovative firm (private, non-angel investors). Angel investors are younger, more often male, and more likely themselves to be entrepreneurs.<sup>3</sup> Compared to other private non-angel investors, angel investors are much more likely to also be public stock investors. Perhaps unsurprisingly, they are wealthier.

This part of our analysis complements contemporaneous work by Bach, Baghai, Strömberg, and Warg (2022). They have much more detailed data on angels’ family backgrounds, personality traits, etc. Nevertheless, our demographic analysis supports their main findings in a different sample, using different criteria for defining angel investment.

A key difference between our work and earlier work in this area is that we examine the performance of angel investors’ repeated investments over time in both public and private investments. Angel investors are more active in the public market, measured by a

---

<sup>2</sup>The indicators are an English language company name, location by the largest university cities, at least one board member located far away from the company, and not being in an industry which is regarded as not innovative.

<sup>3</sup>That is, they are founders of firms other than those in which they make angel investments.

greater number of transactions, and they invest larger amounts, both per transaction and in total. This holds when we control for the time period (year) of purchase and realization, investment size, holding period and investor-level variables correlated with being an angel investor (gender, age, founder experience and public stock market experience).

But how do their angel investments perform? To answer this we document the distribution of realized returns to angel investments. The average return to angel investing in our data is negative, but returns are highly right-skewed, in keeping with recent findings in Kisseleva, Mjøs, and Robinson (2022). Inspired by prior literature on performance persistence among private equity firms (Kaplan and Schoar (2005), Korteweg and Sorensen (2017) and Nanda, Samila, and Sorenson (2020)), we document pronounced performance persistence for the angel investors in our sample. The returns in the previous angel investment are strong predictors of the performance in the current investment. This pattern holds if we consider the most recent investment, the next most recent, or the third most recent investment, indicating that it is not likely to be driving by contemporaneous exposure to economy-wide shocks. Moreover, investor fixed effects explain about 35% of the total variation in angel investment performance—far more than any other observable factor.

Taken together, our results are informative to policy makers trying to encourage investments in startups by individuals. To the extent that our findings say something about the pool of potential investors who might react to such policies, our results point to the importance of considering whether any given policy design mainly will serve to benefit people already well off and whether it will serve push individuals with low investment ability into excessively risky savings portfolios.

Our findings contribute to a burgeoning literature on angel investment, including Kerr, Lerner, and Schoar (2011), Lerner, Schoar, Sokolinski, and Wilson (2018), Denes, Howell, Mezzanotti, Wang, and Xu (2020), Lindsey and Stein (2020) and Wong (2002).

That literature highlights the importance of exposure to angel investors for the subsequent success of the firms in question. Our work adds to this literature by illustrating the fact that some angels appear to possess better investment skills than others.

In that regard, we also add to the literature on performance persistence in private equity investing. Important papers here are Kaplan and Schoar (2005), Korteweg and Sorensen (2017), Braun, Jenkinson, and Stoff (2017), and Nanda, Samila, and Sorensen (2020). The fact that we find even stronger persistence than is documented elsewhere highlights the importance of networks and what insiders refer to as “proprietary deal flow”; i.e., access to investment opportunities that others do not have. In that regard, our paper is also related to Hellmann, Schure, and Vo (2021), who studies the relation between angel and VC markets.

Finally, our paper adds to a large literature documenting the returns to private equity investing. Papers in this area include Hamilton (2000), Moskowitz and Vissing-Jørgensen (2002), Korteweg and Sorensen (2010), Harris, Jenkinson, and Kaplan (2014), and Kisseleva, Mjøs, and Robinson (2022).

The paper is structured as follows. Section 2 describes our setting and data. Section 3 analyzes who becomes an angel investor. Section 4 evaluates whether angel investors are better investors in the public equity. Section 5 analyzes angel investment performance and their persistence and Section 6 concludes.

## **2 Setting, data and sample construction**

### **2.1 Data on firms, transactions and investors**

Our main data ingredient is information from tax declarations of the population of Norwegian public and private limited liability companies and their shareholders, for the period from 2004 to 2018. We have information about shareholder identities, their shareholdings, and

all (direct) equity purchase-, sale- and liquidation transactions. For all firms we also have complete accounting data and information about board composition and firms' CEO, all recorded on an annual basis. Each firm is identified by a unique firm identifier that is common across all data sets. While individuals are identified by name and a unique personal identification numbers in all data sourced from tax declarations, board members and CEOs are only identified by name, meaning that matching on names must be carried out to identify investors as board members and CEOs.

The tax declaration data includes equity transactions in firms in which a given investor owned shares during any of the years in the period from 2004 to 2018. This means that, while the data includes transactions in firms founded before 2004, we observe the complete transaction history only for firms founded in 2004 or later. When it comes to private limited liability firms, we choose to include in our sample firms founded in 2004-2017, yielding a large sample of startups observable from their very beginning. Limited Liability Companies in Norway are analogous to C-corporations in the U.S.; however, unlike the US where many new firms organize as sole proprietorships, Norwegian business registration standards are such that our data comprise essentially all new firm starts.<sup>4</sup> However, our firm and transaction data is not limited to firms founded in or after 2004. Nor is the data limited to private limited liability firms, meaning we observe purchases and realizations of shares also in firms listed on the Oslo Børs stock exchange. When it comes to publicly traded firms, we do not exclude any firms from our sample.

We clean and process the transaction data such that unique investments are defined by a combination of the following variables: investor (a unique and consistent investor identification number), purchase date, firm (a unique and consistent firm identification number), share class and purchase type (primary or secondary). This means that, while the raw data

---

<sup>4</sup>See Kisseleva, Mjøs, and Robinson (2022), Appendix A for an introduction to the legal setting for Norwegian early stage companies.

may correctly show two purchase transactions of the same type, by the same investor, on the same date, of shares in the same firm that are of the same share class we aggregate these two records to one observation that is uniquely defined at the level of investor-purchase date-firm-share class-purchase type. Correspondingly, we process the transaction such that a unique realization is defined by a unique combination of the following variables: investor, purchase date, firm, share class, purchase type, realization date and realization type.

We filter the transaction data to include only investments of at least 10,000 Norwegian Kroner (NOK), which, given an exchange rate of approximately 8 Norwegian kroner to the dollar over our sample period, corresponds to USD 1,250. Correspondingly, when analyzing investment returns we only consider realizations of shares worth at least NOK 10,000 at the time of the investment. In addition, we only consider realizations of investments in private firms with a holding period of at least 30 days. We do not filter the data based on holding period when it comes to realizations of public stock investments.

For a sub-sample of investors we have obtained, from the Norwegian Tax Authority, information about wealth for the period 2010–2017. We use this data to control for potential effects of wealth in some of our main model specifications, in sub samples for which the data is available. The investors for which we have wealth data are selected based on having invested in startups that have received either venture capital financing, governmental financing or any other financing and operate in a potentially innovative industry (negative inclusion).

## **2.2 Innovative firms and angel investors**

In this study, we define angel investors as individuals who, in their own name or through a fully owned holding company, invests at least once in a financing round of a potentially innovative firm in which they are not one of the founders. In this section we describe how we identify potential innovators in our sample of private limited liability firms, and how we

identify angel investors among the investors in these firms.

To identify a sample of potentially innovative ones among all private limited liability firms in our sample, we rely on the sample of likely innovators defined by Kisseleva, Mjøs, and Robinson (2022). This sample is based on constructing an ex ante measure of expected innovative potential that is based on characteristics observable when the firm is founded, potentially before they receive outside equity funding. Their methodology, which is inspired by the 'Startup cartography Project', described in Andrews, Fazio, Guzman, Liu, and Stern (2022), defines four indicators for high innovation propensity. The four indicators are an English language company name, location by one of the largest university cities, at least one board member located far away from the company, and not being in an industry which is regarded as not innovative. Importantly, the relevance of these indicators for predicting innovative potential is verified empirically by showing that they are strong predictors of growth and the use of venture financing. Following their definition of a broad innovation sample, we define as potentially innovative firms, those that tick of on at least two of the four indicator variables.

Because our data does not contain any pre-defined categories for potential growth (innovative) firms or angel investors, identifying these among all firms and investors is a crucial step in our analysis. As a result of not having information about family- or employment relationships, our data is best suited to study angel investors defined in a broad sense, a definition that potentially also includes investors who otherwise might be grouped into a category of family, friends and fools. The transaction data identifies share purchases that are attributable to firms' incorporation as a separate purchase category. We use this information to identify firms' founders, to avoid defining a founder as an angel investor. Consequently, in our study, angel investors refers to individual investors in potentially innovative firms in which they are not part of the founding team. These individual investors may invest in their



own name or through a fully owned holding company.

## 2.3 Final sample

As explained above, we restrict the coverage of our sample to private limited liability firms founded in 2004-2017 and all listed firms. In the private firm sample, we exclude investments by founders. Furthermore, among the private firms in this sample we identify potentially innovative ones. Angel investors are defined as individual investors who purchase shares (worth at least NOK 10,000) in a financing round of a potentially innovative firm in which they are not one of the founders. Non-founder investors who make equivalent investments in private firms that are not identified as potentially innovative ones will throughout the study be referred to as private (non-angel) investors.

When it comes to transactions in private firms, we include in our sample investments by angel investors and private (non-angel) investors. This means that we exclude from our analysis investments by founders and also investments by angel investors and private (non-angel) investors that are secondary market transactions, meaning transactions that are not attributed to firms' financing rounds.

When it comes to transactions in listed firms, we include all investments (of at least NOK 10,000) in our sample. We refer to investors in public stock that are not included in any of the private firm investor groups as public only investors. As a result of restricting our focus to private firm investments by non-founders in firms for which we observe the complete transaction history, namely those founded in or after 2004, public only investors may or may not be investors in private firms not covered by our private firm sample or founder-investors in private firms covered by our sample.

To summarize, our final sample includes three separate investment types: angel investments, private firm investments in non-innovative firms and public stock investments.

Each investor is, in a mutually exclusive fashion, categorized as being either an angel investor, a private (non-angel) investor or a public only investor. While all investor types may make public stock investments, only angel investors and private (non-angel) investors make private firm investments in non-innovative firms and only angel investors make angel investments. The total number of investors in the sample is 359,508, of which 23,030 are angel investors, 10,714 are private (non-angel) investors and 325,764 are public only investors. The number of investors, of each type, present in each investment category, as well as the number of investments they make, is reported in section 4, for public stock investments, and section 5, for private firm investments.

### 3 Who Becomes an Angel Investor?

In this section, we present some illustrative evidence on the investments made by angel investors and examine differences between angel investors and other investors as well as between different types of angel investors.

Figure 1 shows the split between the different types of investments for angel investors. The investment types are public investments, private investments in potentially non-innovative firms and angel investments. The percentages are based on the number of investments made over the 2004-2017 period. The figure separates between mutually exclusive groups of angel investors based on investor gender, in the top panel, and investor birth year, in the bottom panel. It is evident from the figures that, as judged by the number of investments, for female angel investors, their angel investments constitute a larger share of the total investments made. The same is true for younger angel investors.

Insert Figure 1 here.

Next, we categorize angel investors according to their experiences prior to making an

angel investment. The categorization is carried out on an investment-by-investment basis, meaning that the same angel investors may be present in both panels. Specifically, on an investment-by-investment basis, we say that an investment is made by a sophisticated angel investor if the investor is above 40 years of age, has any prior board director experience and has made at least one public stock investment. Based on this exercise, Figure 2 shows the distribution of angel investments across 8 investment size buckets, the smallest one being investments of less than NOK 50,000 and the largest one being investments of NOK 5,000,000 or more, amounts that, given an exchange rate of 8 Norwegian Kroner to the Dollar, corresponds to USD 6,250 and USD 625,000, respectively. Two insights can be drawn from these figures, the first being that most angel investments in our sample belong to the smallest size buckets and the second being that the distribution of investment amounts for sophisticated angel investors, as defined by us, is more skewed towards the larger size buckets.

Insert Figure 2 here.

Figure 1 and figure 2 serve to compare different types of angel investors. As a next step, we are interested in the question: Who, among all individual investors, are more likely to invest in potentially innovative startups? To get at this question, we compare angel investors to private (non-angel) investors and public only investors by running the following probit regression model (Equation 1):

$$\begin{aligned}
 Angel_i = & \alpha + \beta_1 Age_{i,2017} + \beta_2 Male_i + \beta_3 Founder_{i,2003-2017} \\
 & + \beta_4 Public\ Stock_{i,2003-2017} + \beta_5 Wealth_i + \varepsilon_i
 \end{aligned}
 \tag{1}$$

We carry out regressions in samples at the investor-level, meaning that each individual investor corresponds to one observation. In Equation 1  $Angel_i$  is a dummy variable equal

to one for individuals who are angel investors, meaning that they made an angel investment over the 2003-2017 period.  $Age_{i,2017}$  is the natural logarithm (+1) of the investor's age, as measured in 2017.  $Male_i$  is a dummy variable taking the value of one for male investors.  $Founder_{i,2003-2017}$  is a dummy variable taking the value of one for investors who are identified as the founder of at least one firm founded between 2003 and 2017.  $Public\ Stock_{i,2003-2017}$  is a dummy variable equal to one for investors making at least one public stock investment over the 2003-2017 period.  $Wealth_i$  is a dummy variable taking the value of one if the angel investor is above median wealthy (about 1.8 Mio NOK) in the year before their first angel investment in the period 2011-2017. This period applies as information about wealth is only available from 2010.

Table 1 reports average marginal effects from probit estimates from running Equation 1. In the first specification (column 1), the sample consists of angel investors, private (non-angel) investors and public only investors, while in the second specification (column 2) the sample consists of angel investors and private (non-angel) investors. In columns (3)-(8) the sample consists of only angel investors and the dependent variable is modified to indicate different types of angel investors. Specifically, we distinguish between different angel investor types based on the age of the oldest startup they invest, the size of their largest angel investment and the number of angel investments they make over the sample period. An angel investor is classified as early-stage if only investing in startups aged less than 2 years and as late-stage if ever investing in a startup aged 5 years or older. An angel investor is classified as large if they ever make an investment of NOK 500,000 or more and small if only making investments of less than NOK 50,000. An angel investor is classified as active if making three or more angel investments.

From column 1 and 2 in Table 1 it is evident that angel investors, compared to all other investors (column 1) and private (non-angel) investors (column 2) are younger, more

likely to be males and more likely to be founders. Furthermore, compared to private (non-angel) investors only (column 2), angel investors are more likely to be public stock investors. The same interpretation applies when comparing late-stage investors to other angel investors, as evident from the estimates in column 4. The estimates in column 6 and 8 suggest that angel investors who make larger and multiple investments are older, more likely to be male, more likely to be founders and more likely to make public stock investments, compared to other angel investors.

Insert Table 1 here.

Table 2 replicates Table 1, columns (3)-(8) for a sub-sample of angel investors making angel investments in the period 2011-2017 and for which we observe their gross wealth in the year prior to their first angel investment. The results suggest that, compared to other angel investors, early-stage angels are less wealthy and that angels making larger and multiple angel investments are wealthier.

Insert Table 2 here.

## 4 Are Angels Better Public Investors?

In this section we compare angel investors, private (non-angel) investors and public only investors by their investments and realized investment returns in publicly listed stocks, the only investment category that is common all three investor types.

Table 3 provides descriptive evidence on direct public equity investments and realized investment returns, separately for the three groups of investors. All amounts enter the table as million Norwegian Kroner, meaning that 0.50 refers to NOK 500,000. *N investors* shows the number of investors from each investor group that make at least one public stock investment,

while *N investments* shows shows the total number of investments made by all investors in the respective investor groups. Following this we report the mean and median number of investments per investor. The numbers suggest that angel investors are more active public stock investors, especially compared to public only investors. *Investment amount* refers to the amount invested per transaction, while *Total amount per investor* refers to the per-investor total amount invested over the sample period. These numbers suggest that angel investors make larger investments and invests more in total in public stock, compared to other public stock investors. *Beta* refers to the beta of the individual stocks and is computed by regressing daily log stock returns on daily log market returns measured over the 180 day period prior to the investment date, requiring a minimum of 60 return observations within the 180 day window.

*Daily investment return* shows the mean and standard deviation of daily returns to all individual realizations. Note that this is the cross-sectional standard deviation of the mean daily returns, not a time-series standard-deviation. All transaction returns, which refer to the realization amount divided by the purchase amount, are converted to daily returns based on the holding period of realized shares. Furthermore, all daily returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. We next report the average holding period of each realized investment, which is around 160 days for all investor groups. Under *Annualized investment return* we report annualized figures of the mean daily returns and then the cross-sectional standard deviation of these annual returns.

The results from the comparison of investor groups in Table 3 suggest that angel investors on average have higher realized returns on their public stock investments. At the same time, the realized returns of angel investors express volatility that is comparable to that for other investors. Taken together, these results are indicative of a better risk-return relationship for angel investors, compared to other investors in public stock, when judging

by investment-level performance.

*Daily investor return* shows the mean and standard deviation of daily returns measured at the level of each individual investor. Investor-level returns are computed as the investment-amount weighted return across all transactions of each investor over the sample period. Thus, the mean daily investor return refers to the mean across all investors in the respective investor category. Under *Annualized investor return* we report annualized figures of the mean and standard deviation of daily investor returns. We note that, when evaluated at the investor-level, the returns for angel investors is halved and drops more than for the other investors, yielding a lower return for angel investors than private (non-angel) investors. Public only investors still have the lowest returns of all investor categories.

Insert Table 3 here.

To further evaluate whether angel indeed have generated higher returns on their public stock investments we turn to OLS regressions analysis, which allows us to model transaction returns for different investor types while controlling for factors such as investment size and timing (the year of investment and realization), as well as factors that are correlated with being an angel investors, such as investor age, gender and prior founding and investment experience. We do not control for holding period of the investment.

We perform regression analysis at the transaction level, meaning that each observation corresponds to a unique investment realization, which is defined at the level of investor-purchase date-firm-share class-purchase type-realization date-realization type, by estimating the following regression model (equation 2):

$$\begin{aligned}
Return_{i,j,t,s} = & \alpha + \beta_1 Angel_i + \beta_2 Private_i + \beta_3 Ownership_{i,j,s} \\
& + \beta_4 Liquidation_{i,j,s} + \beta_5 Male_i + \beta_6 Age_{i,t} \\
& + \beta_7 Firms\ Founded_{i,t} + \beta_8 Public\ Investments_{i,t} + \\
& + \beta_9 Wealth_{i,t} + \gamma_{t,s} + \varepsilon_{i,j,t,s}
\end{aligned} \tag{2}$$

The dependent variable  $Return_{i,j,t,s}$  is daily return by investor  $i$  in a public stock  $j$ , which was purchased at time  $t$  and realized at time  $s$ . As in table 3, daily returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles.  $Angel_i$  and  $Private_i$  are dummy variables taking the value of one for angel investors and private (non-angel) investors, respectively.  $Ownership_{i,j,s}$  is the natural logarithm of the ownership stake of the investment to which the realized shares are related.  $Liquidation_{i,j,s}$  is a dummy variable taking the value of one when the realization is a shares liquidation (as opposite to shares sale).  $Male_i$  is an indicator variable taking the value of one for male investors.  $Age_{i,t}$  is the natural logarithm of the investor age at the time of investment.  $Firms\ Founded_{i,t}$  is the natural logarithm of the number of firms the investor has founded up until the year of the investment (+1) and measures investors' founding experience.  $Public\ Investments_{i,t}$  is the natural logarithm of investor's number of public investments prior to the current investment (+1) and measures prior public investment experience.  $Wealth_{i,t}$  is a dummy variable taking the value of one if the angel investor is above median wealthy (about 1.9 Mio NOK) one year prior to the investment year.  $\gamma_{t,s}$  represents purchase and realization calendar year fixed effects. We only have information about wealth for a sub sample of investors, and only for the period 2010-2017. As a result, regressions including the wealth variable as a control, reported separately in column 5 and 6, yield a much smaller regression sample.

Table 4 reports OLS estimates from running regressions and gradually introducing right hand side variables according to equation 2. The omitted investor type category is



public only investors. Across all specifications, standard errors are clustered at the firm level and reported in parentheses. Across all specifications, the coefficient estimate for  $Angel_i$  confirm the descriptive evidence in 3. The estimates in column 4 suggest that, compared to public only investors, angel investors have, on average, generated daily returns that are 7.8 basis points (or 0.078 percentage points) higher, as judged by all realized investment returns. The results across all specification, also suggest that also private (non-angel) investors have generated higher realized returns, compared to public only investors, although to a lesser extent than angel investors.

Insert Table 4 here.

In column 5 and 6 of Table 4 we control for potential wealth effects in investors' performance on public equity investments. Overall, we find that wealthier investors have higher returns. The other results are consistent with those in column 1-4, but with the coefficient estimates for  $Angel_i$  and  $Private(non - angel)_i$  being somewhat reduced.

## 5 Private Investment Performance

In section 4 we examined differences in performance between different groups of investors, judging investor performance by realized transaction returns in public equity. In this section, we turn to examination of investments and performance in private firms.

In a fashion similar to table 3, table 5 provides descriptive evidence on private firm investments and realized investment returns, separately for angel investors and private (non-angel) investors. While only angel investors make angel investments, both angel investors and private (non-angel) investors make investments in non-innovative private firms. Column 1 applies to angel investments, while column 2 and 3 applies to investments in non-innovative

private firms. *N investors* shows the number of investors from each investor group that make at least one investment in a given investment category, while *N investments* shows the total number of investments made by all investors in the respective investor group. Following this we report the mean number of investments per investor. The table shows that our samples includes 40,406 angel investments by 23,030 unique angel investors. Of these angel investors, 1,153 make 1,920 investments in non-innovative private firms. In addition, 10,714 unique private (non-angel) investors make 13,354 investments in private non-innovative firms.

*Investment amount* refers to the (mean and median) amount invested per transaction, while *Total investment amount* refers to the per-investor (mean and median) total amount invested over the sample period. The average figures suggest that angel investors make larger investments and invest more in total in private firms, compared to private (non-angel) investors. *Investment ownership %* reports the mean and median ownership stake of individual investments. While angel investors make larger investments in monetary terms, the ownership stakes they acquire are smaller. This result holds also when comparing angel investors to private (non-angel) investors along their investments in private non-innovative firms. *% with realization* reports the percentage of investments for which at least one realization is observed as of 31.12.2018 and shows that, for all investment categories, around 40% of investments in our sample are (partly) realized. We also report the average holding period of each realized investment, which is around 3.6 years for angel investors and 3.9 year for private (non-angel) investors. A realization may be either a sale or a liquidation of shares. *Monthly investment return* shows the mean and cross-sectional standard deviation of daily returns to all individual realizations. All transaction returns, which refers to the realization amount divided by the purchase amount, are converted to monthly returns based on the holding period of realized shares. Furthermore, all monthly returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. As for public investments in table 3, we report the transaction

level returns as well as investor level returns.

The results across all investment and investor types suggest that realized monthly returns to private firm investments are negative. On average, the returns to angel investments are slightly less negative than the returns to investments in non-innovative private firms. While, the cross-sectional standard deviations of investment returns across all columns are comparable, the distribution of realized returns to angel investments (column 1) is far more right-skewed than the distribution of realized returns to investments in non-innovative private firms.

Insert Table 5 here.

## **5.1 Are Some Angels Better Than the Others?**

In this section we explore how realized angel investment returns correlate with investment and investor characteristics in an OLS regression framework. The aim of the analysis is to gain evidence on whether angel investors differ in their performance due to observable characteristics, such as investor age, gender or prior founding experience, and also whether unobserved heterogeneity across investors is important for explaining observed realized investment performance. The regression models we run are defined by the following equation

(equation 3):

$$\begin{aligned}
Return_{i,j,t,s} = & \alpha + \beta_1 Ownership_{i,j,t} + \beta_2 Liquidation_{i,j,s} + \beta_3 Board\ Seat_{i,j,t} \\
& + \beta_4 Male_i + \beta_5 Age_{i,t} + \beta_6 Firms\ Founded_{i,t} \\
& + \beta_7 Public\ Stock\ Investor_i + \\
& + \beta_8 Public\ Portfolio\ Return/SD_i \\
& + \beta_9 Wealth_{i,t} \\
& + \gamma_{t,s} + \theta_{j,t} + \delta_j + \varepsilon_{i,j,t,s}
\end{aligned} \tag{3}$$

The dependent variable,  $Return_{i,j,t,s}$ , is the monthly return by investor  $i$  on an investment in firm  $j$  in year  $t$  that was realized in year  $s$ . Monthly returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles.  $Ownership_{i,j,t}$  is the natural logarithm of the ownership stake of the investment.  $Liquidation_{i,j,s}$  is a dummy variable taking the value of one when the realization is shares liquidation (as opposite to shares sale).  $Board_{i,j,t}$  is a dummy variable taking the value of one if the angel investor receives a board seat at the time of investment.  $Male_i$  is an indicator variable taking the value of one for male investors.  $Age_{i,t}$  is the natural logarithm of the investor's age at the time of investment.  $Firms\ Founded_{i,t}$  is the natural logarithm of the number of firms the investor has founded up until the year of the investment (+1) and measures investor's founding experience.  $Public\ Stock\ Investor_i$  is an indicator variable equal to one for angel investors who invested in public stock over the sample period.  $Public\ Portfolio\ Return/SD_i$  is the ratio of the mean daily public portfolio return of investor  $i$  over the time-series standard deviation of the portfolio. Portfolio returns and standard deviations are measured over the full period the investor held a portfolio of public stock during the sample period. This implies that this variable is not time-varying.  $Wealth_{i,t}$  is a dummy variable taking the value if the angel investor is above median wealthy

(about 2.4 Mio NOK), measured one year prior to the investment year.  $\gamma_{t,s}$  is purchase and realization calendar year fixed effects,  $\theta_{j,t}$  is firm age at time of investment fixed effect and  $\delta_j$  is investor fixed effects. Regressions are run on a sample where each observation corresponds to one transaction. As shown in Table 5, about 42% of 40,406 angel investments has one or more realizations associated with it. The exact number of unique realizations is 18,868, which corresponds to the sample size in Table 6 before including investor fixed effects.

A key takeaway from Table 6 comes from the increase in explanatory power, as judged by adjusted R-squared, when including investor fixed effects in column 4. Judging from the estimated adjusted R-squared in column 3, we see that the included observables, the year of investment and realization and firm age explains only 6.7% of the variation in monthly investment returns. When including investor fixed effects in column 6, adjusted R-squared increases to 44.2%, which we consider suggestive evidence that angel investors vary systematically in their average angel investment performance and that unobserved differences across investors lie behind observed variation in performance.

In Table 6 column 5 and 6 we consider the interaction between investors' public stock market participation and performance, and the performance of their angel investments. Column 5 indicates that whether an angel investor made public stock investments over the sample period is not related to her angel investment performance. In column 6, we focus on the sample of angel investors who held a portfolio of public stocks for any number of days during our sample period, and include investors return-to-risk ratio as an explanatory variable.

Column 7 and 8 adds a high wealth indicator as an explanatory variable. These results suggest that whether an angel investor is above median wealthy is itself unrelated to angel investment performance. In addition, the negative relationship between investors' return-to-risk ratio and angel investment performance holds up in the sample limited by

the information regarding investor wealth, and is not altered when controlling for investor wealth.

Insert Table 6 here.

## 5.2 Performance Persistence in Angel Investing

We now turn to examine performance persistence among angel investors. In the previous section, we modelled monthly realized returns at the transaction level, with some of the observations representing multiple realizations (e.g., at different points in time) of the same initial investments. To analyze performance persistence we aggregate multiple realizations to the level of the investments, with an investment being uniquely defined at the level of investor-investment date-firm. We do this in order to, for each investor with multiple investments, establish an investment sequence based on when investments were made (investment dates). Thus, for each investment we compute the monthly return as the average of monthly realization returns across all (future) realizations of a given investment. An investor's angel investment sequence is a function of investment dates without accounting for the date of shares realization, and the performance of a given investment is defined by all its future realizations. We do so, assuming that the conditions of realizations of shares are written down in contractual terms (e.g., a shareholder agreement) at the time of the investment. Through this aggregation, the 18,868 unique angel investment realizations in our sample are collapsed to 16,310 realized angel investments. Figure 3 presents the distribution of angel investment returns by investment sequence. The figure displays a pattern where investments further out in investors' investment sequence have a lower returns, when judging by mean and median returns. This is consistent with such investments being less risky, as they are implicitly conditional on firm survival.

Insert Figure 3 here.

For 5,385 of the 16,310 realized investments, who all belong to the investment sequence of an individual angel investor, we observe a lagged realized investment. The drop in the number of observations is caused by the large number of angel investors with only one realized angel investment. In the spirit of Kaplan and Schoar (2005), we extend the basic specification of the previous section to include lagged performance as a right-hand-side variable when modelling realized angel investment returns. Our regression model is defined by the following equation (equation 4):

$$\begin{aligned}
Return_{i,j,t,s} = & \alpha + \beta_1 Return_{i,j-1,t,s} + \beta_2 Return_{i,j-2,t,s} + \beta_3 Return_{i,k,t-3} \\
& + \beta_4 Same Firm_{j,k} + \beta_5 Sequence_{i,t} + \beta_6 Ownership_{i,j,t} \\
& + \beta_7 Liquidation_{i,j,s} + \beta_8 Board Seat_{i,j,t} + \beta_9 Male_i + \beta_{10} Age_{i,t} \\
& + \beta_{11} Firms Founded_{i,t} + \beta_{12} Wealth_{i,t} + \gamma_{t,s} + \theta_{j,t} + \varepsilon_{i,j,t,s}
\end{aligned} \tag{4}$$

The dependent variable,  $Return_{i,j,t,s}$ , is the monthly return by investor  $i$  on an investment in firm  $j$  in year  $t$  that was realized in year  $s$ . Monthly investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles.  $Return_{i,j-1,t,s}$ ,  $Return_{i,j-2,t,s}$  and  $Return_{i,j-3,t,s}$  are the returns of the investor's one-, two- and three sequence-lagged investments.  $Same Firm_{j,k}$  is a dummy variable taking value of one if the lagged investment is in the same firm as the current investment,  $j=j-1$ .  $Sequence_{i,t}$  is the natural logarithm of the investor's angel investment sequence.  $Ownership_{i,j,t}$  is the natural logarithm of the ownership stake of the investment.  $Liquidation_{i,j,s}$  is a dummy variable taking the value of one when at least one of the realizations of an investment is a liquidation.  $Board Seat_{i,j,t}$  is a dummy variable taking the value of one if the angel investor takes a board seat at the time of investment.  $Male_i$  is an indicator variable taking the value of one for male investors.  $Age_{i,t}$  is the natural

logarithm of the investor age at the time of investment.  $Firms\ Founded_{i,t}$  is the natural logarithm of the number of firms the investor has founded up until the year of the investment (+1), and measures investor’s founding experience.  $Wealth_{i,t}$  is a dummy variable taking the value if the angel investor is above median wealthy (about 2.4 Mio NOK) one year prior to the investment year.  $\gamma_{t,s}$  is purchase and realization calendar year fixed effects and  $\theta_{j,t}$  is the firm age at time of investment fixed effect. Because we include the lagged returns as a right-hand-side variable, we cannot simultaneously control for investor fixed effects in the persistence regressions.

Table 7 reports OLS estimates from running the regressions as shown in Equation 4. We find strong persistence in angel investment returns across different investments for the same angel investor. Column (1) contains the results of a regression of current monthly return on lagged monthly return. In columns (2) and (3) we gradually introduce year and firm age fixed effects and columns (4) and (5) control for investment and investor characteristics. The coefficient on lagged monthly return is positive and strongly significant; the point estimate is 0.601 with a standard error of 0.058. The coefficient implies that a previous angel investment with 1% higher performance is associated with a 60 basis point better performance in the current angel investment. These point estimates are very close to fund performance persistence found in Kaplan and Schoar (2005). The regression in column (6) includes the performance of both the previous angel investment and the angel investment before that. Again the coefficients on both performance measures are positive and significant. The coefficients imply that a 1% increase in past performance is associated with a combined 71 basis point (sum of the two coefficients) increase in performance in subsequent angel investments.

Insert Table 7 here.

Both Kaplan and Schoar (2005) and Korteweg and Sorensen (2017) raise a concern



of spurious persistence, which — in their private equity (PE) fund setting — may arise from the partial overlap of consecutive funds that are managed by the same PE firm. They argue that partially overlapping funds are exposed to the same market conditions during the overlap period, which may induce a positive correlation in the performance of subsequent overlapping funds, showing up as spurious persistence in the AR(1) model. In contrast to the fund performance setting, our setting is advantageous in the sense that we can track the exact timing of investments in individual firms. We take care of overlap concern by including the dummy variable  $Same\ Firm_{j,k}$  as well as by controlling for the year of investment and realization. In addition, in our investment-level data, if such overlaps are important, persistence should disappear with the amount of time between the current and lagged investment. To test it, we include only second-lagged angel investment in Table 7’s column (7) and only third-lagged angel investment in Table 7’s column (8). The coefficient on the performance of the second previous angel investment is positive and significant. The point estimate of 0.49 compares to that of 0.61 on the first-lagged angel investment, but the adjusted R-squared decreases from 33.8% to 27%. When we include the performance of the third-lagged angel investment only, the point estimate decreases to 0.33 and adjusted R-squared to 25.3%. These results indicate that some angel investors might experience more luck than skill in the long term, as the performance on investments further back in an investor’s investment sequence explains less, compared to performance on the most recent investment, of current performance.

While previous private equity literature find evidence of long-term performance persistence for professional investors, i.e., venture capitalists (e.g., Korteweg and Sorensen, 2017; Nanda, Samila, and Sorenson, 2020), our evidence of more luck than skill can be attributable either to the fact that we consider both “sophisticated” and “unsophisticated”<sup>5</sup> individual

---

<sup>5</sup>As described in Section 3, sophisticated investors are defined as being above 40 years of age, have any prior board director experience, and have made at least one public stock investment.

investors as angel investors. Even a highly experienced individual might be less skilled than a professionally managed VC firm in systematically picking the most promising firms. If the first argument is the case, the exposure to luck rather than skill should be less profound for these “sophisticated” angel investors. Thus, we replicate Table 7 for a sub sample of “sophisticated” angel investors. The results are reported in Table 8, and show no evidence that these investors have a higher performance persistence than our full sample.

Insert Table 8 here.

In Table 9 we examine performance persistence while controlling for investor wealth, by replicating Table 7 including a dummy variable for whether the investor is above median wealthy. The results confirm the positive and statistically significant performance persistence from Table 7. The coefficient on the wealth dummy itself is negative and statistically significant; the point estimate is -1.55 after inclusion of year and firm age fixed effects, indicating that above median-wealth angel investors have on average a 155 basis points lower monthly return, all else equal. However, this result does not hold once we control for investment and investor characteristics.

Insert Table 9 here.

### **5.3 Decomposing the Variance in Angels’ Performance**

In this section we take an approach towards assessing performance persistence that focuses on the the importance of unobserved differences between individual investors when explaining variation in investment returns. The aim is to capture the importance of variation in performance between angel investors for explaining the residual variation in observed returns, which refers to the variance left unexplained after controlling for observable factors.

We take inspiration from Korteweg and Sorensen (2017), who argue that an AR(1) model, which we applied to examine performance persistence in the previous sub section, is constrained to capture different components of performance persistence within a single beta coefficient, which is too restrictive given their variation in the investment data. That is, while the AR(1) model may point to the presence of performance persistence, it tells us little about its nature, e.g. where it might come from. Following their reasoning, we assess performance persistence by comparing variation in performance within angel investors' series of realized returns with performance variation between angel investors. Excess variation between investors implies persistence.

Our approach involves a decomposition of the variance in realized returns into a component attributable to variation across individual investors and a component attributable variation within individual investors. Specifically, to capture the residual variance component attributable to unobserved heterogeneity between investors, we estimate a mixed effects model. The model we estimate is similar to equation 3, but with  $\delta_j$  denoting investor random effects rather than investor fixed effects. The regressions are carried out on a sample including investors with at least two observed realizations, the same set of observations as when including investor fixed effects in Table 6. Moreover, the dependent and explanatory variables included in the model resemble those of Table 6.

The results from mixed effects regressions are reported in Table 10. Wanting to infer something about the importance of unobserved differences between investors,  $Rho$  is the parameter of main interest. While the  $R - squared\ between$  tells us how much of the variance between separate panel units (individual investors) is accounted for by our model,  $Rho$  is an estimate of the variance in returns left unexplained by our model that is accounted for by variances in returns between (as opposed to within) investors. The estimates suggest that a substantial part, almost 40%, of the residual variance is due to some unobserved

and time-invariant differences between investors. Unreported results from estimating the regressions on the sub sample of angel investors for which we observe gross wealth in the year prior to each investment date show very similar estimates of  $Rho$ .

## 6 Conclusion

The better angels that echo through English literature, from Shakespeare's Othello to the writings of Abraham Lincoln, are of course references to the better temperaments of the human spirit. Nevertheless, applied to early-stage investing in innovative startups, the phrase encourages us to ask whether some angel investors possess traits that make them systematically better than others.

This question would be impossible to answer without highly detailed, investment-level, time-series data linked back to individual investors in private companies. We assemble such data from Norwegian equity transaction records to measure the performance of angel investors, to compare angels to other types of investors, and to ask, ultimately, whether variation across investors is important for understanding this segment of the capital market.

Indeed, there are better angels among us in the early-stage capital market. Investor fixed effects absorb about 35% of the total variation in returns, indicating that persistent individual differences are critical for understanding this market. Concomitantly, there is strong performance persistence across investments made by the same investor. One explanation for this is that some angel investors have access to better deal flow than other investors, such that even if they choose randomly, they are choosing from a set of potential investments with better ex ante returns than other investors. Another explanation is that some angel investors possess better due diligence skills, such that some angel investors are pickier than others even though all investors face more or less the same ex ante distribution of invest-

ments. Distinguishing between these explanations is important for guiding policy and is an important question for future research.

## References

- Andrews, Raymond J, Catherine Fazio, Jorge Guzman, Yupeng Liu, and Scott Stern, 2022, The startup cartography project: Measuring and mapping entrepreneurial ecosystems, *Research Policy* 51, 104437.
- Bach, Laurent, Ramin P. Baghai, Per Strömberg, and Katarina Warg, 2022, Who Becomes a Business Angel, Working paper.
- Braun, Reiner, Tim Jenkinson, and Ingo Stoff, 2017, How Persistent is Private Equity Performance? Evidence from Deal-Level Data, *Journal of Financial Economics* 123, 273–291.
- Denes, Matthew, Sabrina T. Howell, Filippo Mezzanotti, Xinxin Wang, and Ting Xu, 2020, Investor Tax Credits and Entrepreneurship: Evidence from U.S. States, Working paper.
- Hamilton, Barton H., 2000, Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment, *Journal of Political Economy* 108, 604–631.
- Harris, Robert S., Tim Jenkinson, and Steven N. Kaplan, 2014, Private Equity Performance: What Do We Know?, *The Journal of Finance* 69, 1851–1882.
- Hellmann, Thomas, Paul Schure, and Dan H. Vo, 2021, Angels and Venture Capitalists: Substitutes or Complements?, *Journal of Financial Economics* 141, 454–478.
- Kaplan, Steven N., and Antoinette Schoar, 2005, Private Equity Performance: Returns, Persistence, and Capital Flows, *The Journal of Finance* 60, 1791–1823.
- Kerr, William R., Josh Lerner, and Antoinette Schoar, 2011, The Consequences of Entrepreneurial Finance: Evidence from Angel Financings, *The Review of Financial Studies* 27, 20–55.

- Kisseleva, Katja, Aksel Mjøs, and David T. Robinson, 2022, Firm Dynamics and the Returns to Early-Stage Investment, Working paper.
- Korteweg, Arthur, and Morten Sorensen, 2010, Risk and Return Characteristics of Venture Capital-Backed Entrepreneurial Companies, *The Review of Financial Studies* 23, 3738–3772.
- , 2017, Skill and Luck in Private Equity Performance, *Journal of Financial Economics* 124, 535–562.
- Lerner, Josh, Antoinette Schoar, Stanislav Sokolinski, and Karen Wilson, 2018, The Globalization of Angel Investments: Evidence across Countries, *Journal of Financial Economics* 127, 1 – 20.
- Lindsey, Laura A., and Luke S.D. Stein, 2020, Angels, Entrepreneurship, and Employment Dynamics: Evidence from Investor Accreditation Rules, Working paper.
- Moskowitz, Tobias J., and Annette Vissing-Jørgensen, 2002, The Returns to Entrepreneurial Investment: A Private Equity Premium Puzzle?, *American Economic Review* 92, 745–778.
- Nanda, Ramana, Sampsa Samila, and Olav Sorenson, 2020, The Persistent Effect of Initial Success: Evidence from Venture Capital, *Journal of Financial Economics* 137, 231–248.

Figure 1: Direct Equity Composition of Angel Investors

Figure 1 shows the split between different types of direct equity investments (public investments, private investments in potentially non-innovative firms and angel investments) made by angel investors. An angel investor is defined as an individual investor, who has made at least one investment of at least NOK 10,000 in a potentially innovative startup in which the investor is not member of the founding team. Disclosed percentages are based on the number of investments made over the 2004–2017 period.

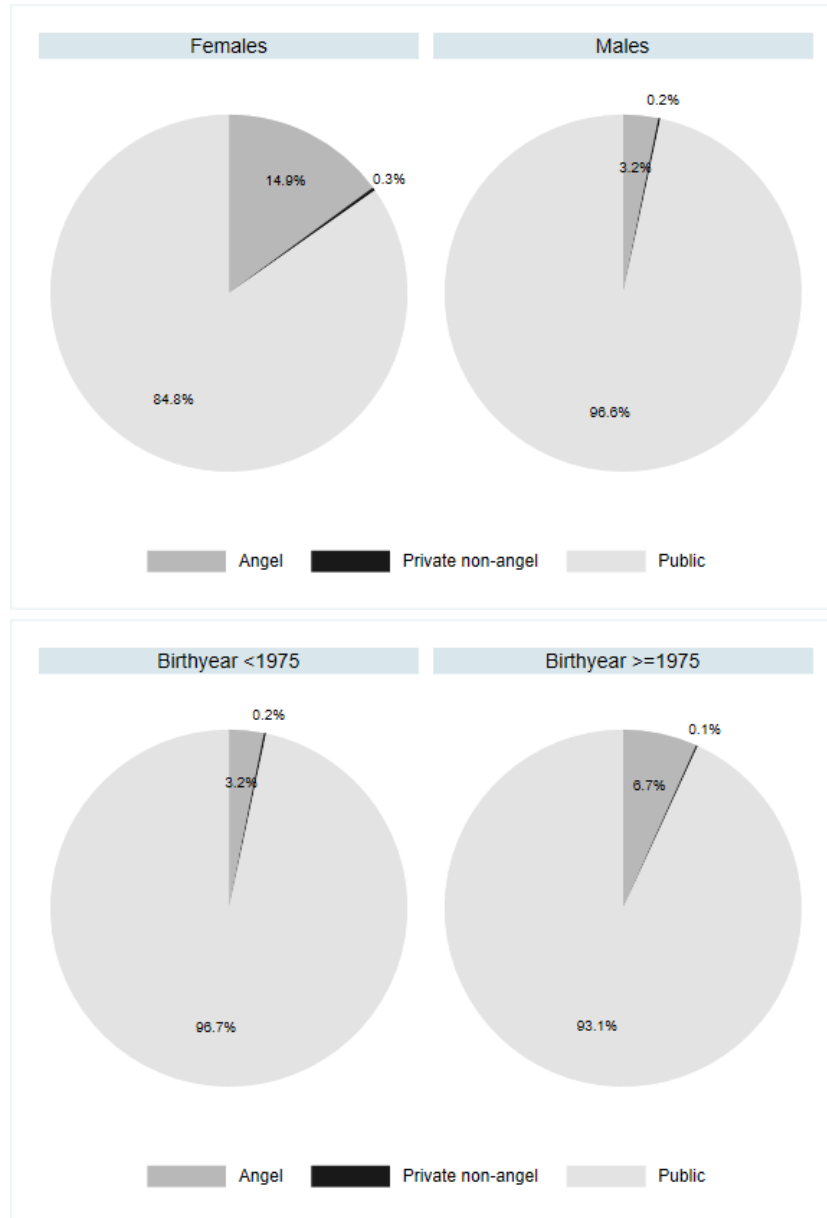




Figure 2: Size Distribution of Angel Investments

Figure 2 presents size distributions of angel investments, separately for “unsophisticated” and “sophisticated” angel investors. We define “sophisticated” angel investors as individual investors who, at the time of the investment, are older than 40 years, have board experience and have made at least one direct public equity investment. The investment size buckets along the x-axis refer to investment amounts in Norwegian Kroner.

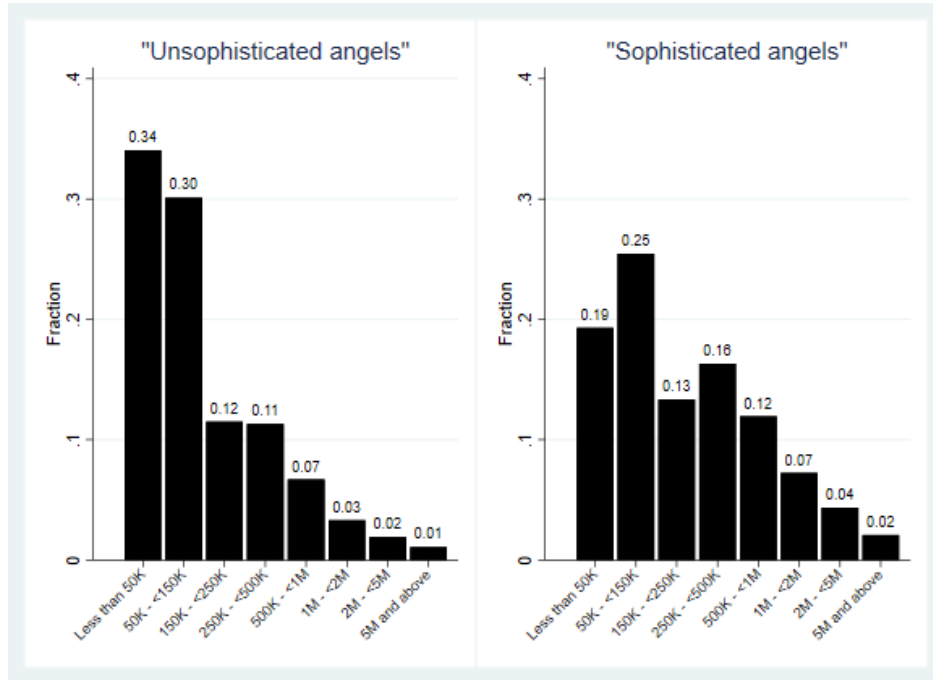


Figure 3: Angel Investment Returns by Investment Sequence

Figure 3 presents the distribution of angel investment returns by investment sequence. Investment return refers to the average monthly return of all realizations of an investment. Investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles.

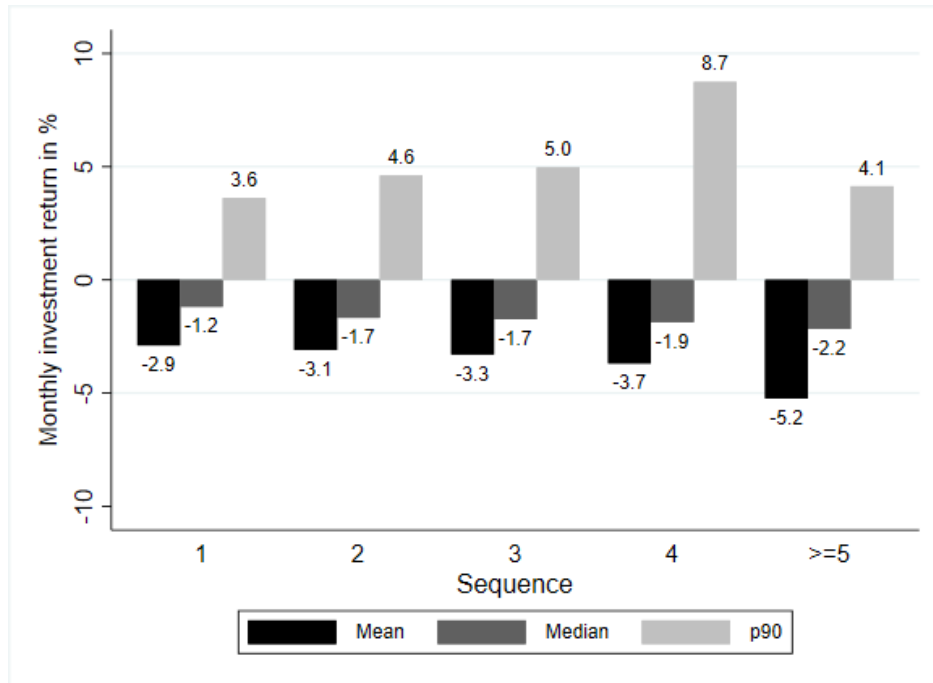


Table 1: Who Becomes an Angel Investor?

Table 1 reports average marginal effects of probit estimates from running regressions defined by Equation 1, with the dependent variable in column (1) and (2) being a dummy variable equal to 1 for investors who are angel investors, as defined in section 2. In column (3)-(8), the dependent variable denotes different types of angel investors. Regressions are carried out in investor level samples, where one observation corresponds to one unique investor. The sample covers angel investors, private non-angel investors and public only investors in the first specification, angel investors and private non-angel investors in the second specification and angel investors otherwise. In column (3)-(8), angel investors are classified as early-stage if only investing in startups aged less than 2 years and as late-stage if ever investing in a startup aged 5 years or older. An angel investor is classified as large if ever making an investment of 500,000 NOK or more and small if only making investments of less than 50,000 NOK. An angel investor is classified as active if making at least in three angel investments. Log (Age) is the natural logarithm (+1) of the investor's age, as measured in 2017. Male (1/0) is a dummy variable taking the value of one for male investors. Founder experience (1/0) is dummy variable taking the value of one for investors identified as the founder of at least one firm between 2003 and 2017. Public stock investor (1/0) is a dummy variable equal to one for investors who made at least one public stock investment over the 2003-2017 period. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

Angel investors	All	Early-Stage	Late-Stage	Small	Large	One-time	Active	
N	23,030 100%	23,030 100%	10,053 44%	5,319 23%	6,329 27%	4,381 19%	15,400 67%	3,473 15%
Log (Age)	-0.017*** (0.001)	-0.113*** (0.009)	0.078*** (0.012)	-0.021** (0.011)	-0.222*** (0.010)	0.231*** (0.010)	-0.087*** (0.012)	0.112*** (0.009)
Male (1/0)	0.015*** (0.001)	0.038*** (0.007)	-0.031*** (0.009)	0.021*** (0.007)	-0.036*** (0.008)	0.034*** (0.007)	-0.028*** (0.008)	0.025*** (0.006)
Founder Experience (1/0)	0.109*** (0.002)	0.009* (0.006)	-0.047*** (0.007)	0.019*** (0.006)	-0.092*** (0.006)	0.063*** (0.006)	-0.085*** (0.007)	0.067*** (0.005)
Public Stock Investor (1/0)		0.168*** (0.005)	-0.045*** (0.007)	0.055*** (0.006)	-0.095*** (0.006)	0.089*** (0.005)	-0.094*** (0.006)	0.071*** (0.005)
Observations	359,508	33,744	23,030	23,030	23,030	23,030	23,030	23,030
Pseudo R2	3.75%	3.02%	0.49%	0.53%	4.22%	5.25%	1.90%	3.58%
Investor Population	Public+Private	Private	Angel	Angel	Angel	Angel	Angel	Angel

Table 2: How Wealthy Are Different Angel Investors?

Table 2 replicates Table 1, column (3)-(8), for a sub sample of angel investors investing in the time period 2011-2017 and for which data on wealth is available. High wealth is a dummy variable taking the value of one if the angel investor is above median wealthy (about 1.8 Mio NOK) in the year before their first angel investment. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

Angel investors	Early-Stage	Late-Stage	Small	Large	One-time	Active
Log (Age)	-0.048** (0.023)	0.112*** (0.025)	-0.116*** (0.021)	0.125*** (0.020)	-0.087*** (0.025)	0.099*** (0.021)
Male (1/0)	-0.008 (0.017)	0.010 (0.018)	-0.042*** (0.016)	0.040*** (0.014)	-0.024 (0.018)	0.011 (0.015)
Founder experience (1/0)	0.010 (0.012)	-0.068*** (0.013)	-0.071*** (0.011)	0.039*** (0.010)	-0.057*** (0.013)	0.046*** (0.010)
Public stock investor (1/0)	0.038*** (0.012)	0.015 (0.013)	-0.070*** (0.012)	0.061*** (0.010)	-0.066*** (0.013)	0.051*** (0.010)
High wealth (1/0)	-0.050*** (0.013)	0.021 (0.014)	-0.147*** (0.012)	0.160*** (0.011)	-0.068*** (0.014)	0.051*** (0.011)
Observations	6,380	6,380	6,380	6,380	6,380	6,380
Pseudo R2	0.41%	0.72%	7.49%	10.50%	1.91%	2.84%
Investor Population	Angel	Angel	Angel	Angel	Angel	Angel

Table 3: Direct Public Equity Investments

Table 3 describes direct public equity investments made by angel, private (non-angel) and public only investors. A unique investment is defined by the following variables: Investor, purchase date, firm, share class and purchase type (primary or secondary). Investment amount refers to the amount per investment and total amount per investor refers to the total amount invested in public stock per investor over the sample period. Amounts are expressed in millions of Norwegian Kroner (approximately 8 Norwegian kroner to the dollar over our sample period). Beta refers to the beta of the stock of each individual investment and is computed by regressing daily log stock returns on daily log market returns over the 180 day period prior to the investment date, requiring a minimum of 60 return observations within the 180 day window. Returns are based on realized investments. All returns are converted to daily returns based on the holding period and are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Daily investment return refers to the return on individual investments, while daily investor return refers to the amount-weighted daily return of all investments by each investor over the sample period.

Investor type:		Angel	Private (non-angel)	Public only
N investors		10,315	2,812	325,764
N investments		1,081,197	186,837	12,043,753
N investments per investor	<i>mean</i>	105	66	37
	<i>median</i>	13	10	4
Investment amount	<i>mean</i>	0.67	0.37	0.24
	<i>median</i>	0.12	0.08	0.05
Total amount per investor	<i>mean</i>	70.43	24.38	8.82
	<i>median</i>	0.84	0.52	0.15
Beta	<i>mean</i>	0.99	1.00	1.02
	<i>median</i>	1.00	1.01	1.03
Average holding period (days)		157	165	163
<b>Performance investment-level</b>				
Daily investment return	<i>mean</i>	0.11%	0.09%	0.05%
	<i>sd</i>	1.53%	1.56%	1.63%
Annualized investment return	<i>mean</i>	51.12%	41.01%	20.86%
	<i>sd</i>	29.18%	29.79%	31.21%
<b>Performance investor-level</b>				
Daily investor return (vw)	<i>mean</i>	0.06%	0.08%	0.04%
	<i>sd</i>	0.73%	0.74%	0.79%
Annualized investor return (vw)	<i>mean</i>	24.73%	32.56%	15.27%
	<i>sd</i>	13.87%	14.14%	15.18%

Table 4: Are Angels Better Public Investors?

Table 4 reports OLS estimates from running regressions defined by Equation 2, with the dependent variable being return on investment realizations. Returns are converted to daily returns and winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. The omitted investor type category is public only. Log (Ownership %) is the natural logarithm of the ownership stake of the investment. Shares Liquidation (1/0) is a dummy variable taking the value of one when the realization is a liquidation (as opposed to a sale). Male (1/0) is an indicator variable taking the value of one for male investors. Log (Investor age) is the natural logarithm of the investor age at the time of investment. Log (1+Firms Founded) is the natural logarithm (+1) of the number of firms the investor has founded up until the year of the investment and measures investor's founding experience. Log (1+ N prior public investments) is the natural logarithm (+1) of the investor's number of public investments prior to the current investment and measures prior public investment experience. High wealth (1/0) is a dummy variable taking the value of 1 if the investor is above median wealthy (about 1.9 Mio NOK) in the one year prior to the investment year. Standard errors are clustered at the firm level and reported in parentheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Angel (1/0)	0.061*** (0.006)	0.065*** (0.006)	0.078*** (0.006)	0.078*** (0.006)	0.052*** (0.007)	0.055*** (0.007)
Private (non-angel) (1/0)	0.042*** (0.005)	0.044*** (0.005)	0.047*** (0.005)	0.048*** (0.005)	0.027*** (0.009)	0.030*** (0.009)
Log (Ownership %)		-0.000 (0.003)	0.003 (0.003)	0.000 (0.003)	0.001 (0.004)	-0.001 (0.004)
Shares Liquidation (1/0)		-1.679*** (0.225)	-1.704*** (0.224)	-1.690*** (0.227)	-1.319*** (0.211)	-1.297*** (0.210)
Male (1/0)			-0.063*** (0.008)	-0.067*** (0.008)	-0.067*** (0.007)	-0.068*** (0.007)
Log (Investor Age)			0.102*** (0.009)	0.103*** (0.008)	0.028* (0.014)	0.022* (0.013)
Log (1+Firms Founded)			0.024*** (0.004)	0.031*** (0.004)	0.004 (0.007)	0.002 (0.007)
Log (1+N Prior Public Investments)			-0.017*** (0.003)	-0.014*** (0.003)	0.000 (0.003)	-0.001 (0.003)
High Wealth (1/0)					0.106*** (0.008)	0.110*** (0.007)
Observations	12,048,366	12,048,366	12,048,366	12,048,366	3,557,055	3,557,055
Adjusted R-squared	0.00 %	0.90 %	0.90 %	1.30 %	0.40 %	0.60 %
Calendar years FE	NO	NO	NO	YES	NO	YES

Table 5: Private Investments

Table 5 describes investments in private potentially innovative firms (angel investments) and private non-innovative firms by angel and private (non-angel) investors. A unique investment is defined by the following variables: Investor, purchase date, firm, share class and purchase type (primary or secondary). Investment amount refers to the amount per investment and total amount per investor refers to the total amount invested in the respective investment categories per investor over the sample period. Amounts are expressed in millions of Norwegian Kroner (approximately 8 Norwegian kroner to the dollar over our sample period). Ownership % refers to the ownership stake of individual investments. % investments with (at least one) realization reports the percentage of investments for which at least one realization through shares sale or shares liquidation is observed as of 31.12.2018. Returns are based on realized investments. All returns are converted to monthly returns and winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Monthly investment return refers to the monthly return on individual investments, while monthly investor return refers to the amount-weighted monthly return of all investments by each investor over the sample period.

Investor type	Investments in Private Firms			
		Potentially Innovative	Non-innovative	
		Angel	Angel	Private (non-angel)
N investors		23,030	1,153	10,714
N investments		40,406	1,920	13,354
N investments per investor		1.8	1.7	1.2
Investment amount	<i>mean</i>	0.78	0.83	0.33
	<i>median</i>	0.10	0.15	0.08
Total investment amount	<i>mean</i>	1.36	1.38	0.41
	<i>median</i>	0.14	0.22	0.09
Investment ownership %	<i>mean</i>	5.08%	9.57%	13.48%
	<i>median</i>	0.66%	2.50%	4.00%
% investments with (at least one) realization		42.10%	40.52%	40.85%
Average investment holding period (years)		3.6	3.6	3.9
<b>Performance investment-level</b>				
Monthly investment return	<i>mean</i>	-2.57%	-4.05%	-4.26%
	<i>sd</i>	10.05%	11.28%	10.99%
	<i>median</i>	-1.23%	-1.41%	-1.51%
	<i>p90</i>	4.48%	3.44%	2.10%
	<i>p99</i>	27.97%	14.54%	14.43%
<b>Performance investor-level</b>				
Monthly investor return (vw)	<i>mean</i>	-3.06%	-4.34%	-4.48%
	<i>sd</i>	9.39%	11.06%	10.96%
	<i>median</i>	-1.31%	-1.55%	-1.68%
	<i>p90</i>	3.32%	2.83%	1.54%
	<i>p99</i>	17.37%	14.54%	11.09%

Table 6: Are Some Angels Better Than the Others?

Table 6 reports OLS estimates from running regressions defined by Equation 3, with the dependent variable being return on investment realizations. Returns are expressed as monthly returns and winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Log (Ownership %) is the natural logarithm of the ownership stake of the investment. Shares Liquidation (1/0) is a dummy variable taking the value of one when the realization is a liquidation (as opposed to a sale). Board Seat (1/0) is a dummy variable taking the value of one if the angel receives a board seat at the time of the investment. Male (1/0) is an indicator variable taking the value of one for male investors. Log (Investor age) is the natural logarithm of the investor age at the time of the investment. Log (1+Firms Founded) is the natural logarithm (+1) of the number of firms the investor has founded up until the year of the investment and measures investor's founding experience. Public stock investor is a dummy variable equal to 1 for angel investors who invested in public stock during the sample period. Public Portfolio Return/SD is the ratio of mean to standard deviation of the daily return on the investor's public stock portfolio. High Wealth (1/0) is a dummy variable taking the value if the angel investor is above median wealthy. Standard errors are clustered at the firm level and reported in parentheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (Ownership %)	-0.188 (0.130)	-0.212* (0.127)	-0.212* (0.120)	0.144 (0.231)	-0.211* (0.121)	-0.005 (0.149)	-0.218 (0.211)	-0.037 (0.268)
Shares Liquidation (1/0)	-3.023*** (0.499)	-3.589*** (0.496)	-3.498*** (0.461)	-4.844*** (1.018)	-3.495*** (0.462)	-3.791*** (0.573)	-5.205*** (0.713)	-5.799*** (0.809)
Board Seat (1/0)	-1.217*** (0.370)	-1.225*** (0.338)	-1.117*** (0.328)	0.126 (0.925)	-1.119*** (0.328)	-1.240** (0.481)	-1.990*** (0.579)	-1.569** (0.727)
Male (1/0)	0.033 (0.274)	0.173 (0.260)	0.204 (0.255)		0.150 (0.254)	0.234 (0.341)	0.721 (0.529)	0.505 (0.683)
Log (Investor Age)	-1.946*** (0.580)	-1.830*** (0.574)	-1.795*** (0.568)	35.009** (14.595)	-1.840*** (0.563)	-2.383*** (0.755)	-4.255*** (1.214)	-4.973*** (1.404)
Log (1+Firms Founded)	-1.170*** (0.338)	-1.010*** (0.331)	-0.921*** (0.320)	-1.558 (1.102)	-0.948*** (0.319)	-0.882** (0.370)	-0.714 (0.515)	-0.445 (0.578)
Public Stock Investor (1\0)					0.224 (0.280)			
Public Portfolio Return/SD						-1.984*** (0.739)		-2.150** (0.903)
High Wealth (1/0)							0.707 (0.712)	0.122 (0.790)
Observations	18,868	18,868	18,868	11,850	18,868	10,092	5,966	3,768
Adjusted R-squared	0.035	0.060	0.067	0.442	0.067	0.069	0.117	0.115
Calendar years FE	NO	YES	YES	YES	YES	YES	YES	YES
Firm age at investment FE	NO	NO	YES	YES	YES	YES	YES	YES
Investor FE	NO	NO	NO	YES	NO	NO	NO	NO



Table 7: Performance Persistence in Angel Investments

Table 7 reports OLS estimates from running regressions defined by Equation 4, with the dependent variable being monthly investment return. Monthly investment return is computed as the average monthly return of an investment's future realizations, as explained in section 5. Monthly investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Same Firm (1/0) is a dummy variable taking value one if the lagged investment is made in the same firm as the current investment. Log (Ownership %) is the natural logarithm of the ownership stake of the investment. Shares Liquidation (1/0) is a dummy variable taking the value of one when the realization is a liquidation (as opposed to a sale). Board Seat (1/0) is a dummy variable taking the value of one if the angel receives a board seat at the time of their investment. Male (1/0) is an indicator variable taking the value of one for male investors. Log (Investor Age) is the natural logarithm of the investor age at the time of the investment. Log (1+Firms Founded) is the natural logarithm (+1) of the number of firms the investor has founded up until the year of the investment and measures investors' founding experience. Standard errors are clustered at the firm level and reported in parentheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Monthly Return</i> <sub><i>j-1</i></sub>	0.657*** (0.065)	0.639*** (0.059)	0.627*** (0.058)	0.626*** (0.058)	0.601*** (0.059)	0.457*** (0.056)		
<i>Monthly Return</i> <sub><i>j-2</i></sub>						0.248*** (0.057)	0.490*** (0.094)	
<i>Monthly Return</i> <sub><i>j-3</i></sub>								0.334*** (0.088)
Lagged is same Firm (1/0)				-0.501 (0.566)	-0.485 (0.569)	-0.011 (0.755)		
Second lagged is same Firm (1/0)						-0.577 (0.600)	-0.629 (0.784)	
Third lagged is same Firm (1/0)								-0.127 (1.121)
Log (Ownership %)					-0.038 (0.136)	0.051 (0.203)	-0.002 (0.261)	0.191 (0.371)
Shares Liquidation (1/0)					-2.875*** (0.582)	-3.536*** (0.831)	-4.059*** (0.890)	-4.560*** (1.140)
Board Seat (1/0)					-1.109*** (0.388)	-1.150** (0.565)	-1.401** (0.654)	-2.078** (0.931)
Male (1/0)					0.334 (0.404)	0.141 (0.738)	0.072 (0.678)	-0.029 (1.082)
Log (Investor Age)					-2.434*** (0.769)	-2.877** (1.237)	-3.652*** (1.403)	-4.697** (1.908)
Log (1+Firms Founded)					-0.400 (0.409)	-0.136 (0.569)	-0.118 (0.596)	-0.247 (0.878)
Observations	5,385	5,385	5,385	5,385	5,385	2,455	2,455	1,334
Adjusted R-squared	28.30 %	30.90 %	31.70 %	31.70 %	33.80 %	37.90 %	27.00 %	25.30 %
Calendar years FE	NO	YES	YES	YES	YES	YES	YES	YES
Firm age at investment FE	NO	NO	YES	YES	YES	YES	YES	YES

Table 8: Performance Persistence of “Sophisticated” Angel Investors

Table 8 replicates Table 7 for a sub sample of “sophisticated” angel investors. The dependent variable is monthly investment return, which is computed as the average monthly return of an investment’s future realizations, as explained in section 5. Monthly investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. We define “sophisticated” angel investors as individual investors who, at the time of making their first angel investment, were older than 40 years, had board experience and had made at least one direct public equity investment. All monthly investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Standard errors are clustered at the firm level and reported in parentheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Monthly Return</i> <sub><i>j</i>-1</sub>	0.572*** (0.099)	0.542*** (0.077)	0.530*** (0.074)	0.532*** (0.072)	0.521*** (0.072)	0.403*** (0.066)		
<i>Monthly Return</i> <sub><i>j</i>-2</sub>						0.249*** (0.072)	0.446*** (0.093)	
<i>Monthly Return</i> <sub><i>j</i>-3</sub>								0.177** (0.081)
Lagged is same Firm (1/0)				-1.156 (0.746)	-1.043 (0.805)	0.349 (1.007)		
Second lagged is same Firm (1/0)						-1.692** (0.840)	-1.433 (1.053)	
Third lagged is same Firm (1/0)								-0.402 (1.493)
Log (Ownership %)					-0.129 (0.171)	-0.125 (0.245)	-0.189 (0.260)	-0.058 (0.316)
Shares Liquidation (1/0)					-2.645*** (0.842)	-3.611*** (1.168)	-3.976*** (1.192)	-4.929*** (1.578)
Board Seat (1/0)					-1.319** (0.659)	-1.903** (0.933)	-2.127** (1.003)	-3.048** (1.401)
Male (1/0)					-0.285 (0.924)	-0.213 (1.341)	0.093 (1.033)	0.552 (1.096)
Log (Investor Age)					-2.341 (1.826)	-0.177 (2.809)	-1.395 (2.868)	-1.349 (3.691)
Log (1+Firms Founded)					-0.051 (0.599)	0.174 (0.848)	0.413 (0.877)	0.801 (1.373)
Observations	1,743	1,743	1,743	1,743	1,743	947	947	565
Adjusted R-squared	23.70 %	27.40 %	28.40 %	28.50 %	29.70 %	36.30 %	27.60 %	27.40 %
Calendar years FE	NO	YES	YES	YES	YES	YES	YES	YES
Firm age at investment FE	NO	NO	YES	YES	YES	YES	YES	YES

Table 9: Angels' Performance Persistence Controlling for Wealth

Table 9 replicates Table 7 for a sub sample of angel investors investing in the time period 2011-2017 (due to availability of wealth data). The dependent variable is monthly investment return, which is computed as the average monthly return of an investment's future realizations, as explained in section 5. Monthly investment returns are winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. High Wealth (1/0) is a dummy variable taking the value if the angel investor is above median wealthy (about 2.4 Mio NOK). Standard errors are clustered at the firm level and reported in parentheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Monthly Return</i> <sub><i>j</i>-1</sub>	0.638*** (0.074)	0.617*** (0.067)	0.595*** (0.065)	0.595*** (0.064)	0.563*** (0.067)	0.402*** (0.066)		
<i>Monthly Return</i> <sub><i>j</i>-2</sub>						0.273*** (0.067)	0.477*** (0.096)	
<i>Monthly Return</i> <sub><i>j</i>-3</sub>								0.237*** (0.089)
Lagged is same Firm (1/0)				-1.034 (0.790)	-0.838 (0.799)	-0.181 (1.004)		
Second lagged is same Firm (1/0)						-0.828 (0.860)	-0.981 (1.065)	
Third lagged is same Firm (1/0)								1.037 (1.636)
High Wealth (1/0)	-2.327*** (0.819)	-1.666** (0.664)	-1.554*** (0.582)	-1.678*** (0.591)	-0.312 (0.692)	-0.283 (1.016)	-0.353 (1.172)	-0.887 (1.579)
Log (Ownership %)					0.004 (0.231)	0.099 (0.311)	0.031 (0.387)	0.256 (0.506)
Shares Liquidation (1/0)					-3.970*** (0.816)	-4.629*** (1.049)	-5.256*** (1.085)	-5.445*** (1.382)
Board Seat (1/0)					-1.367** (0.624)	-1.854** (0.835)	-1.954** (0.904)	-2.208* (1.135)
Male (1/0)					0.092 (0.609)	0.652 (0.893)	0.609 (0.839)	0.455 (1.316)
Log (Investor Age)					-4.190*** (1.217)	-4.852*** (1.772)	-6.629*** (2.005)	-6.661*** (2.550)
Log (1+Firms Founded)					-0.079 (0.580)	0.115 (0.738)	0.098 (0.765)	-0.072 (1.092)
Observations	2,536	2,536	2,536	2,536	2,536	1,418	1,418	879
Adjusted R-squared	27.20 %	29.80 %	31.10 %	31.20 %	34.10 %	38.50 %	30.50 %	26.20 %
Calendar years FE	NO	YES	YES	YES	YES	YES	YES	YES
Firm age at investment FE	NO	NO	YES	YES	YES	YES	YES	YES

Table 10: Modeling Angels' Investment Returns with Random Effects

Table 10 reports estimates from running equation 3 as a mixed effects model, with  $\delta_j$  denoting random effects rather than investor fixed effects. The regressions are carried out using STATA's xtreg command on a sample including investors with at least two observed realizations. The dependent variable is return on investment realizations. Returns are expressed as monthly returns and winsorized at the 1<sup>th</sup> and 99<sup>th</sup> percentiles. Log (Ownership %) is the natural logarithm of the ownership stake of the investment to which the realized shares are related. Shares Liquidation (1/0) is a dummy variable taking the value of one when the realization is a liquidation (as opposed to a sale). Board Seat (1/0) is a dummy variable taking the value of one if the angel receives a board seat at the time of their investment. Male (1/0) is an indicator variable taking the value of one for male investors. Log (Investor age) is the natural logarithm of the investor age at the time of the investment. Log (1+Firms Founded) is the natural logarithm (+1) of the number of firms the investor has founded up until the year of the investment and measures investors' founding experience. Public stock investor is a dummy variable equal to 1 for angel investors who invested in public stock during the sample period. Public Portfolio Return/SD is the ratio of mean to standard deviation of the daily return on the investor's public stock portfolio. High Wealth (1/0) is a dummy variable taking the value if the angel investor is above median wealthy (about 2.4 Mio NOK). Fixed effects are incorporated in the model by including (unreported) dummy variables for years and firm age at investment. Rho refers to the part of the residual variance in the dependent variable that is attributed to unobserved heterogeneity across investors. Standard errors are clustered at the investor level and reported in parantheses. One, two and three asterisks denote statistical significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (Ownership %)	-0.102* (0.060)	-0.138** (0.061)	-0.148** (0.062)	-0.148** (0.062)	-0.148** (0.062)	0.036 (0.088)	-0.014 (0.129)	0.154 (0.162)
Shares Liquidation (1/0)	-3.587*** (0.297)	-4.190*** (0.310)	-4.089*** (0.308)	-4.089*** (0.308)	-4.089*** (0.308)	-4.105*** (0.430)	-5.434*** (0.577)	-5.730*** (0.751)
Board Seat (1/0)	-1.067*** (0.368)	-1.095*** (0.362)	-0.988*** (0.361)	-0.988*** (0.361)	-0.990*** (0.361)	-0.994** (0.469)	-2.223*** (0.595)	-1.925*** (0.729)
Male (1/0)	-0.417 (0.322)	-0.237 (0.314)	-0.167 (0.310)	-0.167 (0.310)	-0.133 (0.313)	-0.325 (0.453)	0.171 (0.641)	0.218 (0.835)
Log (Investor Age)	-3.574*** (0.490)	-3.200*** (0.480)	-3.171*** (0.483)	-3.171*** (0.483)	-3.142*** (0.486)	-4.004*** (0.691)	-5.917*** (1.075)	-5.668*** (1.361)
Log (1+Firms Founded)	-1.614*** (0.376)	-1.500*** (0.376)	-1.392*** (0.374)	-1.392*** (0.374)	-1.379*** (0.377)	-1.327*** (0.415)	-0.999* (0.565)	-0.566 (0.585)
Public market investor (1/0)					-0.144 (0.255)			
Public market Return/SD						-1.776 (1.119)		-1.125 (1.024)
High Wealth (1/0)							-0.043 (0.502)	-0.647 (0.532)
Observations	11,850	11,850	11,850	11,850	11,850	7,076	4,232	2,890
Number of investor_id	3,814	3,814	3,814	3,814	3,814	2,121	1,547	981
Calendar years FE	NO	YES	YES	YES	YES	YES	YES	YES
Firm age at investment FE	NO	NO	YES	YES	YES	YES	YES	YES
R-squared between	7.00 %	8.80 %	10.00 %	10.00 %	10.00 %	8.40 %	14.80 %	12.70 %
Rho	37.70 %	38.10 %	37.70 %	37.70 %	37.70 %	33.50 %	34.90 %	34.10 %