Stock Market Wealth and Entrepreneurship*

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Abstract

We use detailed data on stock portfolios of Norwegian households to isolate plausibly exogenous variation in stock market returns. An increase in stock market wealth increases the propensity to start a firm. The response concentrates in households with moderate levels of financial wealth, for whom a 20 percent increase in stock wealth increases the likelihood to start a firm by about 25%, and in years when the aggregate stock market return in Norway is high. We present a method to correct for the selection bias introduced by entry into business and show that an increase in stock market wealth also has a causal effect on the initial firm size and the likelihood of business success. Together, our findings suggest that higher stock market wealth relaxes would-be entrepreneurs' financial constraints.

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1 Introduction

New business creation constitutes an integral part of economic growth. What determines who starts a firm? Does initial wealth constrain potential entrepreneurs? In theory, higher wealth might facilitate entry into business by allowing would-be entrepreneurs to overcome fixed costs of entry. Higher wealth might also induce entrepreneurs to start larger and more profitable firms if they do enter. However, despite decades of research, empirical evidence of a relationship between financial wealth and entrepreneurship remains elusive. The difficulty in establishing direct evidence on entry arises because high wealth individuals may be more likely to start businesses for other reasons. The difficulty in finding evidence on firm-level outcomes such as size and profitability emerges because the entry effect induces non-random selection on firm productivity across entrepreneurs with different initial wealth.

In this paper we provide new evidence on the causal effect of *stock market wealth* on entrepreneurship activity. Stock market is an important source of aggregate wealth fluctuations: in Norway, for instance, the quarterly standard deviation of the aggregate household wealth would decline by around 28% if the aggregate stock market return were constant (and set equal to its historical average). Moreover, the stock market presents opportunities to address the identification challenges that plagued the previous literature. Individuals' stock portfolios are highly heterogeneous, and at least some of this heterogeneity is driven by idiosyncratic forces (such as financial speculation) that are unlikely to be correlated with entrepreneurial talent. We exploit this type of portfolio heterogeneity to identify the causal effect of stock market wealth on entry into business. Specifically, our research design compares individuals with the same *ex ante* stock portfolio characteristics but different *ex post* market returns arising from idiosyncratic holdings. We then use a simple but general model of entrepreneurial choice to show how to separate the selection effect from the causal effect of wealth on firm outcomes. Our findings imply that stock market wealth has a significant effect on business creation, consistent with greater stock wealth relaxing entrepreneurs' borrowing constraints.

To frame the empirical analysis, we start by describing the model and derive testable hypotheses. Individuals differ in initial wealth and potential business productivity. Since our empirical approach isolates random variation in wealth, we assume that initial wealth is independent of productivity. An individual starts a business only if her potential business profits exceed her wage from employment. In view of borrowing constraints, potential business profits are increasing in initial wealth. Therefore, greater initial wealth increases the propensity to enter into business. Moreover, comparing individuals with high and low initial wealth correctly identifies the magnitude of this entry effect (see Proposition 1). Greater initial wealth might also affect firm-level outcomes, but these effects are harder to identify because we observe firm outcomes *only for entrants*, and the entrants with different initial wealth have non-random differences in productivity. We show that, under a natural monotonicity assumption, the model satisfies a rank preservation property that enables us to match entrants by productivity and estimate the causal effect of wealth on firm-level outcomes (see Proposition 2). Intuitively, we compare firm outcomes when the founder has low and high initial wealth, after removing the left tail of firms with high initial wealth that would not exist if the founder instead had low initial wealth.

We empirically test these hypotheses for Norway, where we have rich administrative data for both households and firms. Specifically, we merge several Norwegian administrative records, including a registry of individual-level stock holdings, total financial wealth from tax records, labor market history from the employer-employee register, and firm balance sheet and income statements. In short, we observe household financial wealth, the portfolio allocation at the individual stock level, business ownership, and firm-level outcomes. We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm, which has less than 3 stock owners, and which has at least one employee in the year of foundation or subsequent year.

Our first set of results compares entry into entrepreneurship across individuals with different stock market returns. There are two important threats to causal identification. First, realized stock market returns may correlate with other factors that affect the entrepreneurship decision. For example, home bias in portfolio choice could result in better returns in periods when the individual's industry or local area is booming. We solve this concern by including sector$\times$time and geography$\times$time fixed effects. Second, individuals more likely to become entrepreneurs might hold systematically different portfolios, for example if risk-tolerant individuals both hold riskier portfolios and are more likely to start firms. Following the results in Borusyak and Hull (2021), we address this concern by including flexible controls for *ex ante* portfolio characteristics such as the market beta. Our research design therefore isolates variation in market returns that comes from random realizations of the idiosyncratic component of portfolio holdings across portfolios with the same *ex ante* characteristics.

Our analysis shows strong evidence that greater stock market wealth increases entrepreneurship. Pooling across all observations, a 20 percentage point higher return increases entry into entrepreneurship by 2.5 basis points, which is approximately 1/8th of the sample average rate. This overall effect masks important underlying heterogeneity: individuals with sufficiently high initial wealth exhibit essentially no effect of higher wealth on entrepreneurship, while for lower wealth individuals the marginal effect is essentially doubled, with a 20 percentage point higher return increasing the entry rate by around 5.3 basis points. We also find that the positive marginal effect comes only from years when the overall stock market does well. We demonstrate robustness of these results along several dimensions, including controlling for initial wealth and labor income and in placebo exercises where we replace the realized stock return with a future realized return.

Our second set of results applies the selection correction implied by our model to study the causal effect of wealth on firm outcomes. After accounting for selection and ex ante differences between entrepreneurs using our fixed effects specification, we find that a firm started by a "high return" entrepreneur, with a return above 25%, is on average about twice as large at foundation in terms of assets, sales, and employment compared to a firm started by a "low return" entrepreneur with a return of between -5% and 5%. Moreover, these initial effects are persistent and also imply a higher likelihood of survival 3 years after firm start, as well as higher employment growth and profitability conditional on survival. Therefore, our selection-corrected firm-level comparisons show a clear pattern of entrepreneurs with higher returns on their stock portfolios opening larger, faster growing and more robust and profitable firms.

Together, our results provide direct evidence that stock market wealth increases entrepreneurship and results in larger firms at creation. While we use stock market windfalls as a laboratory to study wealth effects primarily because they admit such clean causal inference, this setting raises the question of whether stock market wealth is special. Of course, we cannot directly address this question of external validity. Even so, the fact that the stock market drives around one-half of aggregate financial wealth fluctuations in Norway makes our setting macroeconomically relevant. Moreover, by definition stock market wealth rises when the stock market does well, which our evidence shows is also exactly when such wealth matters most to entrepreneurship.

Related literature. Our paper makes a direct contribution to the literature on wealth and entrepreneurship and in particular to the academic debate on the importance of liquidity constraints for business creation.[1] In two early seminal contributions Evans and Jovanovic (1989) and Evans and Leighton (1989) find a positive association between individual wealth and the propensity to start a business using data from the National Longitudinal Survey of Youth (NLSY). Using a structural approach, Evans and Jovanovic (1989) argue that this relationship is likely causal. Similar correlational findings have been reported in Blanchflower

[1]Parker (2018) provides a comprehensive treatment of the economics of entrepreneurship including the link between wealth and entrepreneurship. See also Kerr and Nanda (2011). In addition to empirical studies, the idea of financial constraints impacting entry into entrepreneurship has also been explored theoretically and quantitatively in Banerjee and Newman (1993), Aghion and Bolton (1997), Piketty (1997), Buera and Shin (2013), and Moll (2014), among others. See Buera et al. (2015) for a review of that literature.

and Oswald (1998), Fairlie (1999), Quadrini (1999), and Gentry and Hubbard (2004) among others.

On the other hand, using data from the 1989 and 1994 waves of the PSID, Hurst and Lusardi (2004) find a non-linear relationship between wealth and entry into entrepreneurship, with a flat relationship for most of the wealth distribution and a strong positive relationship only at the top. In addition, they find no evidence that individual wealth matters more for entry in high starting-capital industries and argue that any association between wealth and entrepreneurs is likely confounded by unobserved heterogeneity along other dimensions such as risk tolerance. More recently, Bhandari et al. (2022) use administrative data from the IRS and Social Security Administration that circumvents the issue with top-coding, which has been a problem for studies using survey data, and draw a comprehensive picture of the decision to start a business. One of their findings is that entrants into self-employment have *lower* asset incomes prior to entry, which is consistent with no role for liquidity constraints in entrepreneurship decisions.

The lack of consensus on the relationship between wealth and entrepreneurship has spurred a literature that looks at exogenous shocks to wealth and how those impact entrepreneurship decisions. One such wealth shock that has been widely used in the literature is inheritances (Holtz-Eakin et al. (1994), Lindh and Ohlsson (1996), Blanchflower and Oswald (1998), Hurst and Lusardi (2004), Andersen and Nielsen (2012), Fairlie and Krashinsky (2012)). Hurst and Lusardi (2004) challenge this approach by showing that both past and *future* inheritances predict entry into entrepreneurship, making inheritance a poor instrument for current constraints. For these reasons Andersen and Nielsen (2012) focus on inheritances due to sudden death of legal parents using Danish administrative data and show that unexpected inheritances raise entrepreneurship.

Another variation in wealth that has been used in the literature is lottery winnings or other cash windfalls. For example, Lindh and Ohlsson (1996) study the effects of lottery winnings in Sweden and find a positive effect on firm creation. Bermejo et al. (2022) examine the effects of the Spanish Christmas lottery using regional data and also find a positive effect on regional firm creation, which they additionally argue is mediated via a credit constraint channel. Finally, Bellon et al. (2021) find a positive effect on incorporated business creation from cash windfalls due to shale oil exploration contracts in Texas.

Another prominent wealth shock considered in this literature is a shock to housing wealth (Hurst and Lusardi (2004), Adelino et al. (2015), Corradin and Popov (2015), Schmalz et al. (2017), Jensen et al. (2022), Kerr et al. (2022)). With the prominent exception of Hurst and Lusardi (2004) most of this literature finds that housing wealth increases business creation. However, since variation in housing wealth is mostly regional there are inherent difficulties in establishing whether these effects are driven by local economic shocks, by higher wealth or by higher collateral values. Schmalz et al. (2017) use local housing price appreciation across French regions to study the collateral channel hypothesis for entrepreneurship. To achieve identification they compare local homeowners vs. renters using a difference-in-differences strategy. They find that local homeowners are more likely to start a business compared to renters after a local house price appreciation. Moreover, these effects are driven by full owners who can pledge their house as collateral.[2]

Relative to this large existing literature, and to the best of our knowledge, we are the first to propose and implement an empirical design featuring stock market windfalls and how those impact business creation. Also our use of rich administrative data which contains the near-universe of households and firms over a long time period circumvents issues of top-coding, non-observability of assets, self-reporting errors and small samples that have been an issue for much of the existing literature. Our main findings point to a robust causal and economically significant effect of stock market wealth on business creation.

However, even if there is a causal relationship between wealth changes and entrepreneurship these need not necessarily be due to liquidity constraints. One channel that can lead to such a relationship is that higher wealth makes individuals more risk tolerant and, hence, also more likely to start businesses, given the substantial amount of non-diversified risk that small business ownership entails (Kihlstrom and Laffont (1979), Moskowitz and Vissing-Jørgensen (2002) and Hall and Woodward (2010)). A complementary explanation for such a relationship, especially at the top of the wealth distribution, which also accounts for the substantial holding of non-diversified risk by entrepreneurs, is of a non-pecuniary benefit from firm ownership, that is business ownership being a *luxury good*.[3] In this spirit, Hamilton (2000) finds a "self-employment" discount showing that entrepreneurship tends to persist despite lower earnings growth compared to paid employment (see also Pugsley and Hurst (2011) and Catherine (2022)).

The notion that entry into entrepreneurship is due to increased risk tolerance or is a luxury good has implications for the types of firms that are created by higher-wealth households. Using data on start-ups from Norway over the period 1994-2002, Hvide and Møen (2010) find a negative relationship between wealth and start-up profitability at the top of the wealth distribution. Similarly, Andersen and Nielsen (2012) find that on average the firms created with unexpected inheritances are of lower quality based on survival and profitability

[2] In addition to collateral shocks some papers have considered the effects of credit market shocks on entrepreneurship (Black and Strahan (2002), Kerr and Nanda (2009), Fracassi et al. (2013), among others).

[3] An alternative explanation for entrepreneurs investing substantial equity and thus holding substantial non-diversified risk in their firms focuses on signaling incentives to lenders under asymmetric information, see Leland and Pyle (1977), Ross (1977), and Nenov (2017), among others.

compared to firms created by a matched sample of observationally similar entrepreneurs that do not receive an inheritance.

These negative findings contrast strongly with those of other papers in this literature. In an early contribution Holtz-Eakin et al. (1994) show that firms whose owners receive inheritances tend to survive longer. More recently, Schmalz et al. (2017) find that firms created by homeowners when house prices increase are significantly larger at the time of creation (in terms of assets, sales, employment, and value added), compared to those started by renters and that these effects are persistent over time. Furthermore, they show that such firms tend to survive longer, and are therefore not "riskier" in the sense of having a higher probability of failure. McKenzie (2017) uses the random allocation of grants to business start-ups in Nigeria to show that both potential and existing entrepreneurs that receive a grant are both more likely to operate a business three years after the grant allocation and more likely to operate firms with ten or more workers.[4] Jensen et al. (2022) also examine the survival of firms created with higher housing wealth and also find a positive effect. Bermejo et al. (2022) find a positive and significant effect on firm size, proxied by total assets and employment and firm quality proxied by profitability (ROA) and survival using the Spanish Christmas lottery. Finally, Bhandari et al. (2022) find no "self-employment" discount when examining non top-coded U.S. register data.

Our empirical findings that stock market windfalls matter less for entrepreneurship decisions of high-financial wealth households point to the importance of liquidity constraints over the "risk taking" or "luxury good" explanations for explaining the link between wealth and entrepreneurship. This conclusion is additionally supported by our firm-level results. Similar to Holtz-Eakin et al. (1994), McKenzie (2017), Schmalz et al. (2017), and Jensen et al. (2022) we find that after, accounting for selection effects, firms created after a stock market windfall are more likely to survive three years after founding. Like McKenzie (2017), and Schmalz et al. (2017) we also find that, accounting for selection effects, firms started with higher windfalls are larger and that the effects persist over time. These firms are also more capital-intensive, are more likely to grow faster in terms of employment, and have high future profitability.

Our focus on understanding the effect of stock market wealth shocks for the real economy bring our paper close to recent work by Di Maggio et al. (2020), Chodorow-Reich et al. (2021) and Ring (2022), among others. Unlike these papers, we consider the effects of stock market wealth for entrepreneurship and business creation rather than the effects on consumer spending (Di Maggio et al. (2020), Chodorow-Reich et al. (2021)) or the effects of

[4]See also De Mel et al. (2008) who show that wealth shocks are important for the performance of microenterprises in Sri Lanka.

business owner wealth on firm employment and investment during the 2008-2009 financial crisis (Ring (2022)). In terms of methodology our approach to exploit the idiosyncratic component of stock portfolios for identification relates our paper to both Di Maggio et al. (2020) and Ring (2022). We innovate relative to these papers by explicitly taking into account the econometric issues arising from non-random exposure to the plausibly random stock market shocks raised by Borusyak and Hull (2021). As explained later in the paper this issue is of first-order importance when it comes to identifying the effects of wealth on business creation and imposes stronger requirements on the portfolio heterogeneity that can be used for statistical inference.

2 The model and testable hypotheses

We start by presenting a simple but general model of endogenous entry into entrepreneurship. We use the model to illustrate the hypotheses that we test in the empirical analysis. We also highlight how the endogenous entry into entrepreneurship introduces selection on unobserved productivity, and we describe a procedure to correct for this selection effect.

The model has a single period (we abstract from dynamics). There is a continuum of individuals denoted by i with mass normalized to one. Individuals differ in two dimensions: Potential business productivity $z_i \in Z \subset R_+$, and initial wealth $a_i \in A \subset R_+$ are distributed according to the CDF $F_{za}(z_i, a_i)$ and the corresponding continuous PDF $f_{za}(z_i, a_i)$. In the empirical analysis, we assume $a_i = a_{i,t-1} r_{i,t}$ and focus on quasi-random fluctuations in $r_{i,t}$. Therefore, in the model we assume z_i and a_i are independent. Let $F_z(z_i)$ and $F_a(a_i)$ denote the (marginal) CDFs for z_i and a_i with corresponding continuous PDFs $f_z(z_i)$ and $f_a(a_i)$.

An individual i chooses whether to enter into business, $E_i \in \{0, 1\}$. If she does not enter, $E_i = 0$, she earns the outside option (reservation wage) $W(z_i)$. The reservation wage can depend on z_i, but we require this dependence to be relatively small in a sense that we formalize below.[5] If instead the individual enters, $E_i = 1$, she runs a business with size $k_i = k(z_i, a_i)$ and earns potential profits $\pi_i = \tilde{\pi}(z_i, a_i, k_i) = \pi(z_i, a_i)$. An individual enters into business if her potential profits exceed her potential wage

$$\pi_i = \pi(z_i, a_i) \geq W(z_i).$$

To characterize the solution, we impose a mild monotonicity condition on the size, profit,

[5] Our empirical research design generates quasi-randomization in assets, which implies the distribution of reservation wages is also the same, and we also report specifications that directly control for labor income (before entry).

and wage functions.
Assumption (M). $\frac{d\pi(z_i,a_i)}{da_i} \geq 0$, and $\frac{dk(z_i,a_i)}{dz_i} > 0$, $\frac{d\pi(z_i,a_i)}{dz_i} > 0$, $\frac{d(\pi(z_i,a_i)-W(z_i))}{dz_i} > 0$.

A greater wealth level (weakly) increases profits and a greater productivity (strictly) increases size and profits. Additionally, we require that a greater productivity (strictly) increases profits net of the reservation wage. The first three conditions hold under a variety of models with financial frictions. The last one says that we can allow for wages to increase with productivity, as long as the effect of productivity on wages is smaller than its effect on profits (so that the net gain from entry is increasing in productivity). In the appendix, we describe an example model that satisfies (M). In that model, the reservation wage is fixed and the entrepreneur needs to obtain financing to pay for the fixed cost of starting a business and for the capital expenditures. The entrepreneur can borrow funds from outside financiers, but outside financing is costly and these costs are increasing in the amount that the entrepreneur borrows. A greater initial wealth (internal funds) reduces the need for outside financing, which in turn raises the entrepreneur's profits. Naturally, a greater business productivity also increases profits and size—financial frictions do not undo these standard effects.

Our first goal is to understand how initial wealth affects the entrepreneur's propensity to enter into business. To this end, we define the fraction of individuals with wealth a that enter into business,

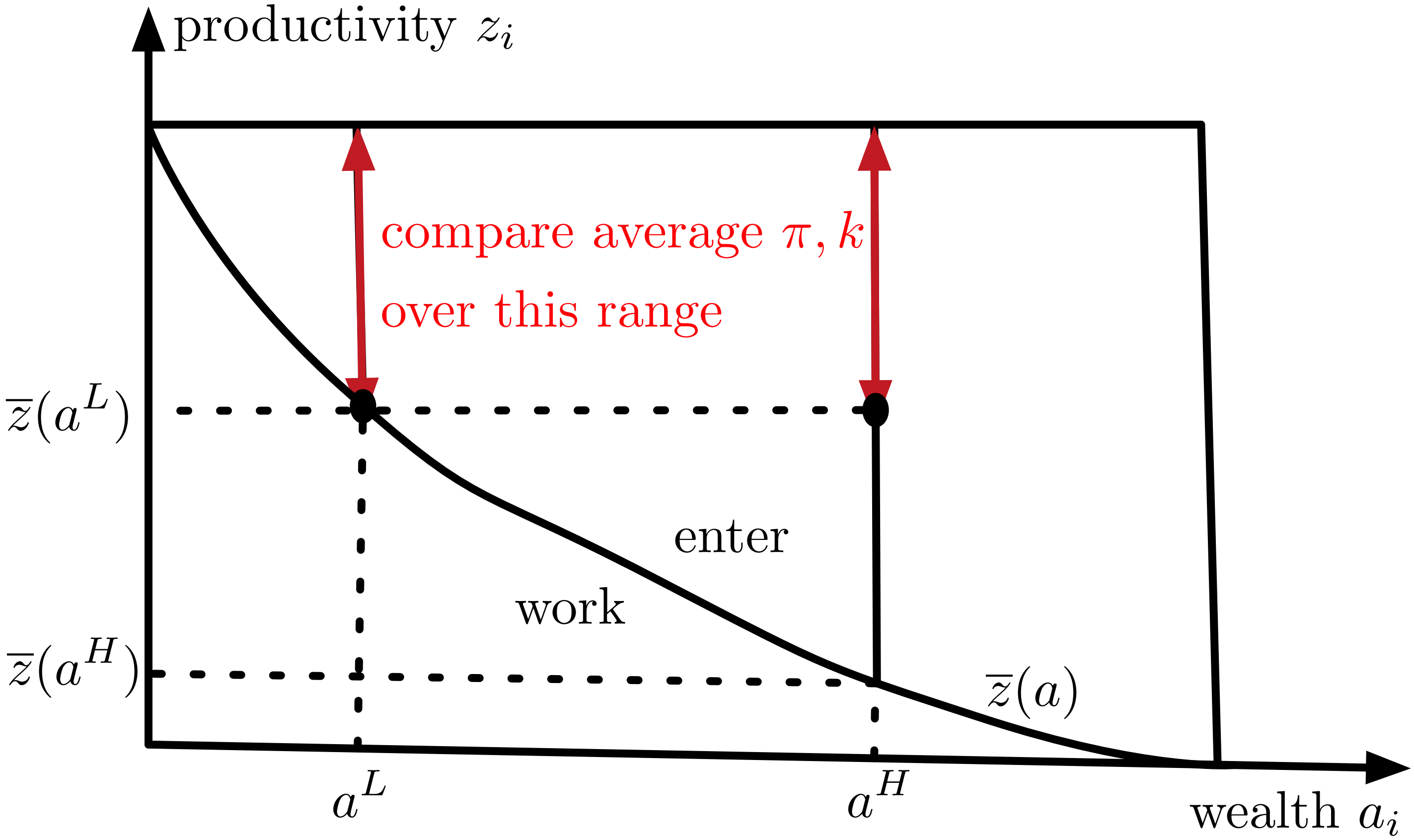
$$e(a) = \int_{(z_i,a)} E_i dF_{za}(z_i, a).$$

Our first result shows this fraction is increasing in initial wealth: greater wealth increases the propensity to enter. This is the first hypothesis that we test in our empirical analysis.

Proposition 1 (Causal effect of initial wealth on entry)**.** *Consider the entry model with Assumption (M). For each a, there exists a threshold productivity level $\overline{z}(a)$ such that an individual enters iff $z \geq \overline{z}(a)$. The threshold productivity $\overline{z}(a)$ is* weakly decreasing *in initial wealth. Greater wealth induces greater entry into business: that is, the fraction of entrants $e(a)$ is given by $\int_{z_i \geq \overline{z}(a)} dF_z(z_i)$ and it is weakly* increasing *in initial wealth a.*

Under Assumption (M), individuals enter only if they have either sufficiently high wealth or sufficiently high productivity. Thus, there is a threshold productivity $\overline{z}(a)$, *decreasing in wealth*, such that individuals enter only if their productivity exceeds this level. This also implies that greater wealth increases the propensity to enter. Intuitively, greater wealth reduces outside financing costs and increases the profitability of starting a business relative to wage work. This induces a greater mass of individuals (including some with lower productivity) to enter. Figure 1 illustrates the threshold function $\overline{z}(a)$ and the region of entry in a particular example.

Figure 1: A model of endogenous entry into business



Notes: Individuals above the curved line, $\overline{z}(a)$, enter into business. We identify the causal effect of wealth on profits and capital by comparing the outcomes for individuals that would have entered both with low wealth a_L and with high wealth a_H.

Our second goal is to understand how initial wealth affects the profits and the size of an entrepreneur's business conditional on entry: $\frac{d\pi(z_i,a)}{da}$ and $\frac{dk(z_i,a)}{da}$. This exercise is more complicated because entry into business induces selection on *unobserved* productivity. To see this, consider the *average* profits given wealth *conditional on entry*,

$$\begin{aligned}\pi(a) &= \mathbb{E}[\pi_i | a_i = a, E_i = 1] \\ &= \frac{\int_{z_i \geq \overline{z}(a)} \pi(z_i, a)\, dF_z(z_i)}{e(a)} \text{ where } e(a) = \int_{z_i \geq \overline{z}(a)} dF_z(z_i).\end{aligned}$$

Suppose we empirically estimate $\frac{d\pi(a)}{da}$. This does not necessarily identify $\frac{d\pi(z_i,a)}{da}$, because changing wealth a also affects the average productivity of entrants. In our model, increasing a *reduces* the average productivity of entrants (see Figure 1).

Since we do not directly observe productivity, we cannot address this selection problem by controlling for productivity z. Instead, we observe the initial wealth a for all individuals and profits π and capital k for the individuals that enter. Our second result shows how to use these *observed* outcomes to match individuals by productivity.

To state the result, we define the fraction of individuals with wealth a that enter into business *and whose profits exceed a cutoff level* $\overline{\pi}$:

$$e(a, \pi \geq \overline{\pi}) = \int_{z_i \geq \overline{z}(a), \pi(z_i, a) \geq \overline{\pi}} dF_z(z_i).$$

Analogously, we define $e\left(a, k \geq \overline{k}\right)$. We observe these fractions for any a and thresholds $\overline{\pi}, \overline{k}$.

Proposition 2 (Rank preservation and the causal effect of assets on profits/size)**.** *Consider a particular entrant with initial wealth a^L and profits and capital π^L, k^L, with corresponding productivity $z \geq \overline{z}\left(a^L\right)$ (that we do* not *observe). Let $a^H > a^L$ denote a higher level of wealth and $\overline{\pi} \geq \pi^L$ denote the unique solution to the following equation:*

$$e\left(a^L, \pi \geq \pi^L\right) = e\left(a^H, \pi \geq \overline{\pi}\right). \tag{1}$$

Then, $\overline{\pi} = \pi\left(z, a^H\right)$: that is, $\overline{\pi}$ is the profit that the agent would have made if she had higher wealth (and the same productivity). Thus, the difference

$$\overline{\pi} - \pi^L = \pi\left(z, a^H\right) - \pi\left(z, a^L\right)$$

identifies the causal effect of initial wealth on profits with productivity $z \geq \overline{z}\left(a^L\right)$.

Likewise, let $\overline{k}$ denote the unique solution to the following equation:

$$e\left(a^L, k \geq k^L\right) = e\left(a^H, k \geq \overline{k}\right). \tag{2}$$

Then, $\overline{k} = k^H\left(z, a^H\right)$ is the capital the agent would have chosen if she had higher wealth and

$$\overline{k} - k^L = k\left(z, a^H\right) - k\left(z, a^L\right)$$

identifies the causal effect of initial wealth on capital with productivity $z \geq \overline{z}\left(a^L\right)$.

We refer to conditions (1) and (2) as *rank preservation*. To understand these conditions, consider an entrant with wealth a^L and unobserved productivity z, and suppose we increase her wealth from a^L to a^H. In view of assumption (M), this change would leave the entrant's *relative rank for profits* unchanged. Intuitively, with either a^L and a^H, the individuals with productivity $\tilde{z} \geq z$ would enter and make greater profits than the entrant (and the individuals with $\tilde{z} < z$ would either not enter, or they would enter and make smaller profits than the entrant). Importantly, since we observe the profits by rank for each asset level (captured by the functions $e\left(a, \pi \geq \overline{\pi}\right)$), we can solve (1) and calculate the profit that the entrant would have made if she had higher initial wealth. This enables us to estimate the causal effect of initial wealth on profits for this entrant. A similar logic applies for capital.

Proposition 2 shows how to estimate the causal effect for a particular entrant (with a specific productivity). In the empirical analysis, we focus on the *average* causal effect over all entrants with some initial wealth. To calculate this average, fix some a^L and consider the *lowest-profit* entrant among all entrants with a^L. This entrant is indifferent to enter so her productivity is equal to the threshold, $z = \overline{z}\left(a^L\right)$. In this case, $e\left(a^L, \pi \geq \pi^L\right) = e\left(a^L\right)$ is equal to the fraction of entrepreneurs with assets a^L. Hence, Eq. (1) becomes:

$$e\left(a^H, \pi \geq \pi^H\left(a^L\right)\right) = e\left(a^L\right).$$

In particular, among the entrants with higher level of assets a^H, we find the lowest-profit entrant that would have entered also with the lower level of assets a^L. Once we find the cutoff $\pi^H\left(a^L\right)$, we can further calculate the average profits for high-asset entrants *with profits above the cutoff*,

$$\pi\left(a^H, \pi \geq \pi^H\left(a^L\right)\right) = \mathbb{E}\left[\pi_i | a_i = a^H, E_i = 1, \pi \geq \pi^H\left(a^L\right)\right].$$

Comparing this with $\pi\left(a^L\right)$ (average profits with low assets) identifies the average causal effect:

$$\pi\left(a^H, \pi \geq \pi^H\left(a^L\right)\right) - \pi\left(a^L\right) = \frac{\int_{z_i \geq \overline{z}(a^L)} \left(\pi\left(z_i, a^H\right) - \pi\left(z_i, a^L\right)\right) dF_z\left(z_i\right)}{e\left(a^L\right)}. \tag{3}$$

Figure 1 illustrates the comparison in (3). By considering the high-wealth entrants with profits above the cutoff $\pi^H\left(a^L\right)$, we select individuals with relatively high productivity $z_i \geq \overline{z}\left(a^L\right)$. These individuals enter regardless of whether they start with wealth a^L or a^H: they are not subject to the selection effect we mentioned earlier. Therefore, comparing their average profits across low and high wealth identifies the causal effect of wealth on profits.

A similar equation identifies the *average* causal effect of wealth on size, that is:

$$\mathbf{k}\left(a^H, k \geq k^H\left(a^L\right)\right) - \mathbf{k}\left(a^L\right) = \frac{\int_{z_i \geq \overline{z}(a^L)} \left(k\left(z_i, a^H\right) - k\left(z_i, a^L\right)\right) dF_z\left(z_i\right)}{e\left(a^L\right)} \tag{4}$$

where the threshold $k^H\left(a^L\right)$ is defined similar to $\pi^H\left(a^L\right)$. In our empirical analysis, we calculate the empirical counterparts of $(3-4)$ and report the average causal effects.

3 Data

We combine a number of administrative data sets from Norway which are matched using unique personal and firm identification numbers as well as the unique ISINs of publicly traded shares. We start with household balance sheet and income information from the official tax records, which are combined with demographic information including education and age of the household members, family status and municipality of residence. Of note is the detailed household balance sheet information, including total financial wealth, which is based on third-party reporting to the Norwegian tax authority with the exception of ownership of foreign assets. This data is combined with the employer-employee register to get information on the NACE sector of primary employment.[6]

We merge this data set with the shareholder register, which records information on ownership of shares in Norwegian limited liability firms (both publicly traded and privately held), and the book value of those shares at the end of each calendar year starting in 2004. This information is collected by the Norwegian tax authority and is also third-party reported by financial intermediaries. Using the unique ISIN numbers for publicly traded stocks we can in turn merge the stock ownership data with price and returns data on all publicly traded stocks on the Oslo stock exchange (OSE). The data is comparable to the CRSP data for the USA in that it accounts for stock splits and other similar events when computing returns.[7] The data is available until 2019, which is the last year in our sample. In addition, we use the shareholder register to obtain information on private firm ownership which we use for our entrepreneurship definition below.

Turning to our firm-level data we start with data on all limited liability firms in Norway from 2004 onward, which among other things includes the exact foundation date, closing date (if the firm is dissolved), primary sector, the total number of shareholders for different classes of shares, and the book value of outstanding shares for each firm. We then combine with information on employment as well as annual firm balance sheets and income statements.[8] We use the employment in the subsequent year in the cases when employment in year of foundation is missing.

In terms of sample selection, we restrict attention to households with a household head between 20 and 65 years old. We also drop household-year observations with no earnings and zero financial wealth, as well as observations with (lagged) real gross financial wealth below

[6] We use the educational level and NACE sector of the household head who is defined as the oldest individual in the household.

[7] See Ødegaard (2013) for details.

[8] We deflate all nominal values and returns to 2010 Norwegian kroner. Throughout our sample period the dollar-kroner exchange rate fluctuates between 4.9 and 9.3, with a mean of 6.8.

50 thousand and above 5 million Norwegian kroner. We also drop observations of direct stock owners with less than 1% (lagged) exposure to domestic publicly traded stocks. Furthermore, we drop from our sample households after they are observed to become entrepreneurs as per our definition (see next).

3.1 Entrepreneur definition

We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm, which has less than 3 stock owners, and which has at least one employee in the year of foundation or subsequent year. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household is dropped from our sample.

The restrictions on who constitutes an entrepreneur in terms of ownership share and number of other stock owners and who transitions to entrepreneur are placed for several reasons. First of all, we want to rule out situations where households take investment positions in private firms. Since we will be considering the effects of stock wealth changes on entrepreneurship, attributing such investments to business creation might overstate the importance of stock wealth changes for entrepreneurship. Second, since our focus is on the process of entry into entrepreneurship for the first time, we do not consider serial entrepreneurs in our empirical analysis.[9]

The employment restriction we place for our entrepreneurship definition is to ensure that we only consider business creation where the firm is economically active. Moreover, during our sample period in Norway owners of public stocks may have incentives to create inactive firms to store unrealized capital gains or losses for tax simplification purposes. Indeed, as we show in the Appendix (Figure A.7), not restricting on positive initial employment implies that both large positive *and* negative returns increase firm creation and that these effects are particularly strong for households with high levels of financial wealth.

To put our entrepreneurship definition into perspective, in Table 1 we report shares of business ownership and transitions to different types of business ownership both among the owners of publicly traded Norwegian stocks ("Stock owners"), as well as for our whole sample ("Population"). The first row includes both owners of at least 1/3 of the book value of any incorporated firm as well as households that receive non-incorporated business or farm income. We then progressively tighten the definition until we arrive at the definition

[9] See Brandt et al. (2022) for an analysis of the differences between serial and non-serial entrepreneurs using detailed firm-level data from China.

of entrepreneurship we use.[10]

In addition to this summary statistics table, in the Appendix we also include additional descriptive statistics (Table A.1) for the groups of entrepreneurs and non-entrepreneurs, as well as the groups of direct owners of Norwegian public stocks and the rest. Entrepreneurs (which constitute around 0.22% of our sample) tend to be younger, with similar earnings and slightly lower financial wealth and lower holdings of publicly traded stocks compared to non-entrepreneurs. Turning to direct owners of domestic publicly traded stocks, these constitute around 12.4% of our sample. Moreover, these households tend to be older, have higher income and higher level of financial wealth than the rest of our sample.

Table 1: Business owners descriptive statistics

	Stock owner (in %)	Population (in %)
(I) owns $\geq \frac{1}{3}$ book value (BV) of an incorporated firm or receives business/farm/forestry income	19.07	17.93
(II) owns $\geq \frac{1}{3}$ BV of an incorporated firm ("owns a business")	6.13	5.04
(III) owns a business with ≤ 3 shareholders	5.00	4.28
(IV) AND is non-financial firm	4.42	3.88
(V) AND has employees	2.33	2.29
(VI) transitions to a business such as in (V)	0.89	0.84
(VII) transitions to a business such as in (V) that is newly created	0.18	0.22

Notes: The table reports shares of business ownership and transitions to different types of business ownership both among the owners of publicly traded Norwegian stocks ("Stock owners") as well as for our whole sample ("Population"). The first row includes both owners of at least 1/3 of the book value of any incorporated firm as well as households that receive non-incorporated business or farm income. Subsequent rows progressively narrow this group as described in the first column of the table. Note that our baseline definition for entrepreneurs includes those in (VII) but for whom the transition happens for the first time. Therefore, in principle the definition in (VII) and our baseline definition of entrepreneurship do not overlap exactly because of serial entrepreneurship with breaks in the data. In practice, however, the difference is negligible as a share of the population and the shares in row (VII) essentially coincide with the shares of entrepreneurs as per our baseline definition.

4 Econometric Methodology

This section presents our baseline specification and explains how it addresses the main threats to causal identification. Let $E_{i,t}$ denote an indicator for individual i becoming an en-

[10] Strictly speaking our baseline definition for entrepreneurs includes those in (VII) but for whom the transition happens for the first time. Therefore, in principle the definition in (VII) and our baseline definition of entrepreneurship do not overlap exactly because of serial entrepreneurship with breaks in the data. In practice, however, the difference is negligible as a share of the population, and so the shares in row (VII) essentially overlap with the shares of entrepreneurs according to our definition.

trepreneur in year t. We model $E_{i,t}$ as a function of the return on financial wealth $r^*_{i,t}$, other *ex ante* observed characteristics $X_{i,t-1}$, and unobserved characteristics $\epsilon_{i,t}$. The terms $X_{i,t-1}$ and $\epsilon_{i,t}$ include determinants discussed in Section 2 such as baseline financial wealth, the wage if remaining in paid employment, and entrepreneurial ability, as well as other factors such as preferences.

We do not observe $r^*_{i,t}$, because while we observe total financial wealth at the end of each year we do not observe all transactions during the year. Instead, we construct the potential portfolio return $r_{i,t}$ as the buy-and-hold return on the stock part of the wealth portfolio scaled by the share of initial wealth in stocks. Formally, we define $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. Below, we explain how we isolate quasi-random variation in the stock return component $\mathbf{s}'_{i,t-1}\mathbf{r}_t$ by including a suitable array of fixed effects. Under this condition, a regression of the total wealth return $r^*_{i,t}$ (after removing contemporaneous buying or selling that may be correlated with $\epsilon_{i,t}$) on $r_{i,t}$ and the same fixed effects would yield a coefficient of one, reflecting the restriction to variation in $r_{i,t}$ from quasi-random portfolio choices uncorrelated with returns in the non-stock part of the portfolio. We therefore impose this "first stage" coefficient of one and directly model outcomes in terms of $r_{i,t}$.

Two main threats to causal identification remain. To frame them, it helps to decompose the stock portfolio return into systematic and idiosyncratic components: $\mathbf{s}'_{i,t-1}\mathbf{r}_t = r^f_t + \beta_{i,t-1} \times r^m_t + \nu_{i,t}$, where r^f_t is the risk-free rate, r^m_t is the market excess return in year t, $\beta_{i,t-1}$ is the portfolio "beta" for stock holdings at end of $t-1$, and $Var(\nu_{i,t}) = \sigma^2_{i,t}$. The first threat arises because the *realized* idiosyncratic component $\nu_{i,t}$ may be correlated with unobserved determinants of entrepreneurship $\epsilon_{i,t}$. For example, home bias in portfolio choice (Coval and Moskowitz, 1999) could result in households experiencing better stock market returns in periods when their current industry or local area is booming. We address such concerns by including sector×time and municipality×time fixed effects in all specifications.

The second threat arises because *expected* returns may vary across households in a manner correlated with the entrepreneurship decision. For example, a more risk-tolerant individual might choose a stock portfolio with a higher market beta, implying higher expected returns, and risk tolerant individuals might also be more likely to transition to entrepreneurship for other reasons. Or individuals likely to become entrepreneurs might hold more or less of their wealth in domestic stocks. Borusyak and Hull (2021) term this "non-random exposure" and show that it suffices to control for the *ex ante* expected realization. In our setting, variation in exposure comes from portfolio characteristics. Specifically, the expected total potential portfolio return is $\mathbb{E}_{t-1}r_{i,t} = \omega_{i,t-1} \times \mathbb{E}_{t-1}\left[r^f_t + \beta_{i,t-1} \times r^m_t\right]$. We control flexibly for different expected returns by creating bins of $\omega_{i,t-1}$, $\beta_{i,t-1}$, and $\sigma_{i,t-1}$ and including interactions of these bins and time fixed effects, where the interactions with time accommodate unrestricted time-variation in the risk-free rate or expected market return and the inclusion of $\sigma_{i,t-1}$ is necessary for non-linear or non-parametric specifications. Effectively, we compare entrepreneurship rates across two individuals in the same year with the same allocation to domestic stocks and the same portfolio beta but different realized returns. The variation in $r_{i,t}$ thus comes from random realizations on portfolios with the same *ex ante* characteristics, where the randomness arises as the result of the idiosyncratic component of the portfolio holdings $\nu_{i,t}$ purged of industry or location characteristics.[11]

To summarize, our baseline specification for the effect of the stock market on transitioning to entrepreneurship takes the form:

$$E_{i,t} = b \times r_{i,t} + \alpha_{\text{sector}\times t}(i) + \alpha_{\text{munic.}\times t}(i) + \alpha_{\beta\times\sigma\times\omega\times t}(i) + \epsilon_{i,t}, \tag{5}$$

where $\alpha_{y\times z}(i)$ denotes a fixed effect for observation i belonging to group $y \times z$. In some specifications we also control for additional covariates, with wealth and the lagged wage being the most important. These covariates are not necessary for obtaining an unbiased estimate of the causal effect. Rather, we include them to absorb residual variation in the likelihood of becoming an entrepreneur.

We measure the portfolio characteristics $\beta_{i,t-1}$ and $\sigma_{i,t-1}$ using daily returns over the year $t-1$. Specifically, for each observation we form the time series of daily returns $\mathbf{s}_{i,t-1}\mathbf{r}_{t-1+\Delta}$, where $\mathbf{r}_{t-1+\Delta}$ gives the vector of individual stock returns on day $t-1+\Delta$ and we fix the weights at their value at the end of the year. We obtain $\beta_{i,t-1}$ as the OLS regression coefficient from a regression of $\mathbf{s}_{i,t-1}\mathbf{r}_{t-1+\Delta}$ on $r^m_{t-1+\Delta}$ (which we proxy by the OSE OBX stock market index) and $\sigma_{i,t}$ as the variance of $\mathbf{s}_{i,t-1}\mathbf{r}_{t-1+\Delta}$.[12]

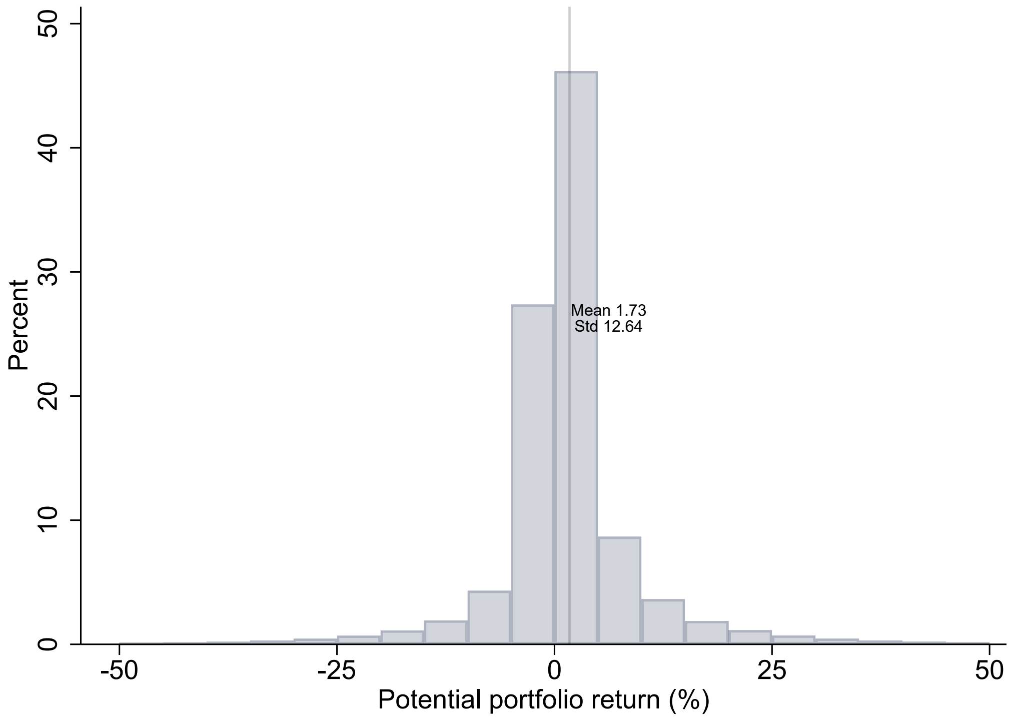
Figure A.4 plots the unconditional distribution of potential portfolio returns among the direct owners of publicly traded stocks in our sample.[13] Potential portfolio returns tend to be small on average with a standard deviation of around 12%. However, there is also a substantial share of relatively large potential portfolio return realizations of above 25%. As we will see below, these relatively large windfalls lead to a substantial increase in the propensity to start a business as per our definition from Section 3.1. Moreover, the distribution

[11] As we motivate this specification with a CAPM representation of stock returns, we report robustness to allowing for up to three portfolio factors. Furthermore, when constructing bins for ω, β, and σ we aim to have a relatively constant number of observations in each bin and relatively low within-bin dispersion. This necessitates truncating the distributions of (lagged) ω, β and σ. For our baseline results we truncate these distributions at around the 2nd and 98th percentiles and report robustness in Table 3 to not truncating.

[12] Figures A.1-A.3 in the Appendix plot the distribution of the β, σ and ω constructed as described here.

[13] For non-direct owners potential portfolio returns will be set to zero, and these households will be treated as a separate category in our regressions.

Figure 2: Potential portfolio return distribution

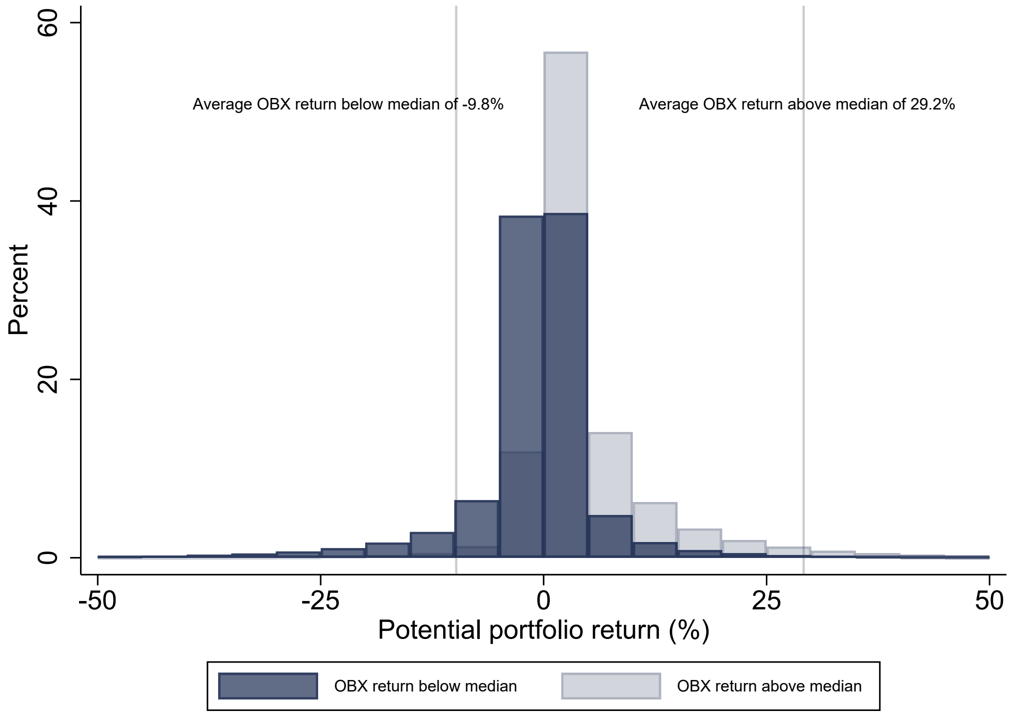


Notes: Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t.

of potential portfolio returns is right-skewed. This skewness reflects the in-sample positive mean return on the aggregate stock market, which we decompose in Figure A.5 by splitting potential portfolio returns in two groups based on whether the average return on the OSE OBX stock market index is above or below the 2004-2019 median.[14] Given this clustering of positive vs. negative potential portfolio returns, and since the propensity to start a firm may differ depending on the aggregate stock market return (because of different returns to entrepreneurship in good vs. bad stock market years), in our empirical analysis below we will also examine the heterogeneous effects of higher potential portfolio returns in years with above vs. below median aggregate stock market returns, which we will refer to as "good" vs. "bad" stock market years.

[14]See also Figure A.6 for the distribution of potential portfolio returns for each year in the period 2004-2019.

Figure 3: Potential portfolio returns: good vs. bad stock market years



Notes: Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. The figure plots the distributions of potential portfolio returns for two groups of years: years in which the aggregate OBX return is above the median value in the period 2004-2019 and years in which the OBX return is below the median value.

5 Results on the propensity to start a business

In this section we present our main results on the effects of stock market windfalls on the propensity to start a business. We start with a non-parametric approach. We partition the space of financial wealth and potential portfolio returns into several bins and estimate the average effect from being in a particular bin on the propensity to start a business relative to a specific base bin. Our specification includes the fixed effect controls described in Section 4. We split financial wealth in two groups: below 600k ("moderate wealth") and above 600k ("high wealth"). For potential portfolio returns we have 7 bins with potential return bins of (-5%, 0%] serving as base.[15]

The first row of Figure 4 presents the estimated relative effects for each wealth bin. There is a notable positive effect of having a relatively high potential return of 25% or above for the moderate wealth group. The estimated relative effect is around 17 to 24 basis points for

[15]We also include an additional bin for non-direct domestic stock owners.

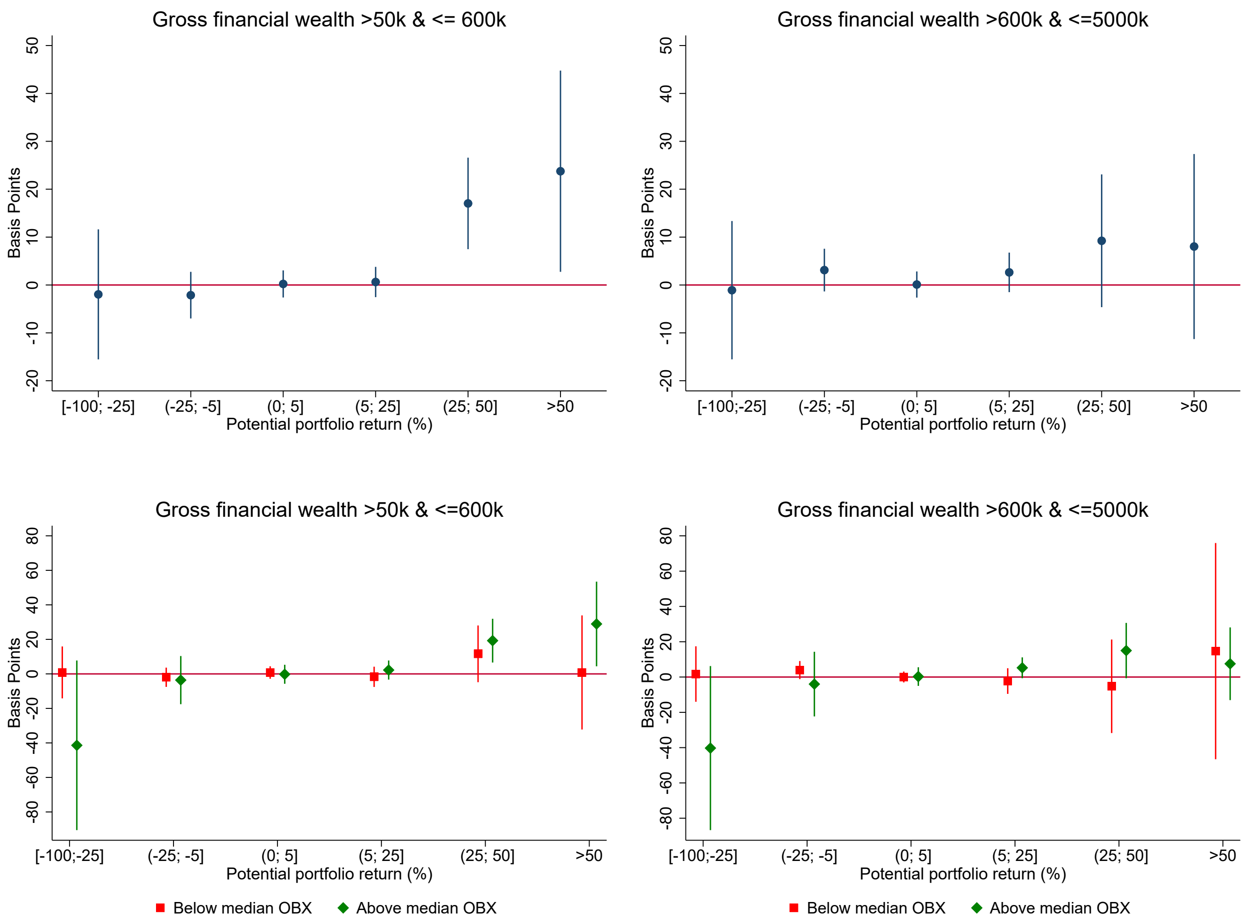
the two highest return bins. In contrast the effects for high wealth are much smaller.

Given the clustering of positive vs. negative potential returns in good vs. bad stock market years documented in Section 4, we also examine aggregate return heterogeneity by interacting each of the wealth-by-potential return bin with whether the aggregate stock return is above or below its median. The second row of Figure 4 shows the estimated relative effects (again with the (-5%, 0%] bin serving as base) There is a clear heterogeneity across good vs. bad stock market years. Specifically, in bad stock market years the effect of potential returns is fairly flat and close to zero. In contrast, in good stock market years the propensity to start a business is increasing in potential return bins, particularly for the moderate wealth stock owners. For example, having a potential portfolio return in the lowest potential return bin of [-100% to -25%] lowers the propensity to start a firm by around 40 basis points (but quite imprecisely estimated), while having a potential portfolio return in the highest two return bins increases the propensity by around 19 to 29 basis points. Given that the unconditional average propensity to start a business is only 22 basis points these constitute very sizable effects.

To get a sense of the kroner change that generates these effects, note that the median financial wealth for the moderate wealth group of direct stock owners is around 180k NOK (and the mean is around 220k NOK). Therefore, a potential return of around 50% corresponds to an increase in wealth for a household in the moderate wealth group with median financial wealth of around 90k NOK, or approximately 13k USD based on the sample average exchange rate.

Table 2 reports regression coefficients. Column (1) pools the full sample and all years. The coefficient of 0.13 translates into a 2.6 basis point higher transition rate into entrepreneurship following a 20% stock return. Motivated by the evidence in Figure 4, column (2) restricts the sample to households with less than 600k, and column (3) allows the coefficient to vary between the moderate and high wealth groups. The coefficient estimate is larger for the sample excluding high wealth households and is also larger when comparing moderate to high wealth households. In particular, a two sided t-test rejects equality of the coefficients for moderate vs. high wealth households at a significance level of the 1%. Furthermore, column (4) shows that the effects are significantly larger for good stock market years compared to bad stock market years. A two-sided t-test rejects equality of the coefficient estimates for a good vs. bad stock market year in column (4) at a significance level of 5%. In terms of magnitudes, the estimated effect in column (4) implies that a 20 p.p. increase in potential portfolio returns increases the propensity to start a business in a good stock market year by around 7.5 basis points, which is around 1/3 of the baseline entrepreneurship rate.

Figure 4: Non-parametric results



Notes: We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm with less than 3 stock owners. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household is dropped from our sample. Effects in each return bin are relative to a base potential portfolio return between -5% and 0%. The second row shows effects in years when the OBX index return is above or below the median for the period 2004-2019. Controls include age group indicators (for 3 age groups), municipality-by-year fixed effects, primary employment sector-by-year fixed effects, and a set flexible controls given by a four-way interactions between interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of betas for the observed part of the portfolio, 7 bins of volatility for the observed part of the portfolio and year. Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. The bars represent 95% confidence intervals computed with clustering on the level of the municipality.

5.1 Robustness

We perform a number of robustness exercises and specification tests. Table 3 collects these exercises, focusing on the specification in column (2) of Table 2 as the baseline for concreteness. Column (1) adds 9 bins of financial wealth interacted with year to absorb any correlation between *ex ante* wealth and the propensity to start a firm. Our estimated coeffi-

Table 2: Baseline Entry Results

	Dep. var.: becomes entrepreneur ($E_{i,t}$)			
	(1)	(2)	(3)	(4)
$r_{i,t}$	0.126*	0.266**		
	(0.052)	(0.090)		
$r_{i,t}$, gross fin. wealth $> 600k$ NOK			−0.005	
			(0.049)	
$r_{i,t}$, gross fin. wealth $\leq 600k$ NOK			0.215**	
			(0.074)	
$r_{i,t}$, $r_{OBX,t} \leq r_{OBX,median}$				0.014
				(0.128)
$r_{i,t}$, $r_{OBX,t} > r_{OBX,median}$				0.374**
				(0.114)
Sample	All	$\leq 600k$	All	$\leq 600k$
Age group FE	Yes	Yes	Yes	Yes
Location-year FE	Yes	Yes	Yes	Yes
Primary sector-year FE	Yes	Yes	Yes	Yes
Portfolio-year FE	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
R^2	0.003	0.003	0.003	0.003
Clusters	422	422	422	422
Observations	12,245,697	9,484,681	12,245,697	9,484,681
Median fin. wealth	248.7	174.1	248.7	174.1
Median fin. wealth $\leq 600k$ NOK			174.1	
Median fin. wealth $> 600k$ NOK			1101.3	

Notes: The flexible controls in all specifications include a four-way interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of betas for the observed part of the stock portfolio, 7 bins of volatility for the observed part of the stock portfolio and year. Specifications (2) and (4) are restricted to gross financial wealth of up to 600k real NOK. We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm with less than 3 stock owners. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household is dropped from our sample. Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. All coefficient estimates are scaled by 100 for easier interpretation. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

cients are not impacted by the addition of these controls. Column (2) controls for lagged log labor earnings, since as shown in Section 2 labor market earnings serve as an opportunity cost in the business creation decision of a potential entrepreneur. Again, the estimated coefficient is very similar. Next, we consider a set of flexible controls based on the Fama-French three factor model (Fama and French, 1993). Specifically we have a 6-way interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of market betas from a Fama-French 3-factor model, 7 bins of volatility for the observed part of the portfolio, 2 bins for loading on the SMB factor, 2 bins for loading on the HML factor and year. The results are mostly unchanged. In column (4) we consider the effects of trimming our sample for extreme realizations of exposure and stock portfolio characteristics. The estimates are slightly lower but still significant at 5% significance. In column (5), we illustrate the importance of our flexible controls for *ex ante* portfolio heterogeneity by removing them altogether. The estimated coefficient is now substantially reduced and less significant. This points to ex ante portfolio heterogeneity being indeed an important confounder for the link between stock returns and entrepreneurship. Finally, we perform a placebo exercise where rather than using the stock returns in year t we instead use the stock returns in year $t+1$. The estimated coefficient is near zero (and slightly negative) in that case, bolstering the causal interpretation of our main effect.

Table 3: Robustness results – linear model (in basis points)

	Dep. var.: becomes entrepreneur ($E_{i,t}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
$r_{i,t}$	0.268**	0.245**	0.222*	0.155*	0.081+	
	(0.090)	(0.091)	(0.109)	(0.063)	(0.044)	
placebo return						−0.002
						(0.072)
Age group FE	Yes	Yes	Yes	Yes	Yes	Yes
Location-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Primary sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Financial wealth-year FE	Yes	No	No	No	No	
Portfolio-year FE	ω-β-σ	ω-β-σ	3-factor model	ω-β-σ	None	ω-β-σ
R^2	0.003	0.003	0.004	0.003	0.003	0.003
Clusters	422	422	422	422	422	422
Observations	9,484,681	9,422,997	9,433,774	9,560,078	9,560,194	9,484,681

Notes: Flexible controls in specifications (1), (2), and (4) and (6) include a four-way interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of betas for the observed part of the portfolio, 7 bins of volatility for the observed part of the portfolio and year. Flexible controls in specification (3) include a 6-way interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of market betas from a Fama-French 3-factor model (Fama and French, 1993) for the observed part of the portfolio, 7 bins of volatility for the observed part of the portfolio, 2 bins for exposure to the SMB factor, 2 bins for exposure to the HML factor and year. Additional controls in specification (2) include lagged labor market income. Specification (3) includes results without trimming extreme realizations of ω, β, and σ. The placebo regressor in specification (6) is the potential portfolio return using annual stock returns in period $t+1$. We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm with less than 3 stock owners. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household is dropped from our sample. Potential portfolio returns in specifications (1)-(5) $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. All specifications are restricted to gross financial wealth of up to 600k real NOK. All coefficient estimates are scaled by 100 for easier interpretation. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

6 Results on firm-level outcomes

We now investigate the characteristics of firms started by entrepreneurs who have received a stock market windfall. For simplicity of exposition, we compare outcomes across two return bins, denoted $\{r\}^L$ and $\{r\}^H$, with the maximum return in $\{r\}^L$ strictly less than the minimum return in $\{r\}^H$. We continue to assume that the distributions of individuals who realize returns in each bin are *ex ante* identical after including the covariates discussed in Section 4. Following the notation in Section 2, for $n \in \{L, H\}$, let $e_n = \mathbb{E}[E_i | r_i \in \{r\}^n]$ denote the entrepreneurship rate among individuals in bin n, $g_n(x)$ the density distribution among entrepreneurs in bin n for an outcome x (e.g. assets in year of founding), and $x_n(q)$ the value of x at the qth quantile of $g_n(x)$.

As we discuss in Section 2, the *ex post* distributions of firm outcomes may differ because of two effects, selection into entrepreneurship and the causal effect of starting a business with higher wealth. To correct for the selection effect, we apply the procedure we describe after Proposition 2. Recall that, under Assumption (M), the productivity distribution of the entrepreneurs with return in $\{r\}^L$ coincides with the productivity distribution of entrepreneurs in $\{r\}^H$ *after* removing the left tail of firms that would not exist had the founder received a return in $\{r\}^L$ instead of in $\{r\}^H$. Let $g_H(x|x > x_H((e_H - e_L)/e_H))$ denote this truncated density distribution. The difference $F(g_H(x|x > x_H((e_H - e_L)/e_H))) - F(g_L(x))$ then isolates the causal effect of wealth, where F is the mean or a quantile of the distribution.

We implement the selection adjustment procedure described above using the following three-step procedure. First, we estimate the propensity to become an entrepreneur for four potential return groups: [-100%, -5%], (-5%, 5%), [5%, 25%], and > 25% by controlling for the fixed effects from our baseline specification from Section 4. This step gives us e_n, the entrepreneurship rate for different return bins. Second, given the set of start-up firms, for each of a number of firm outcomes among these firms, which we describe below, we partial out the same set of fixed effects as in our baseline specification, namely age group fixed effects, sector-by-year and municipality-by-year fixed effects and the 4-way interaction of exposure, beta, volatility, and year.[16] Finally we take the distributions of the residualized firm outcomes for entrepreneurs in two return groups, namely the "low return group" (with potential portfolio return in (-5%, 5%)) and the "high return" group (>25%) and truncate the "high return" distribution at the $100 \times (e_H - e_L)/e_H)$)-th percentile. This final step is the adjustment for selection given the monotonicity assumption from Section 2. We then compare the means of these two distributions and report the difference in means below for

[16] Here we use the start-up's primary sector rather than the entrepreneur's past sector of employment. Furthermore given the smaller number of observations at the firm level we use a coarser partitioning of the exposure, beta, and volatility compared to the household-level specifications.

outcomes at year of foundation (Table 4) as well as for several outcomes three years after foundation (Table 5).[17]

Table 4 compares a number of firm outcomes at foundation, including sales, the wage bill, employment, value added and labor productivity (value added per worker), as well as balance sheet items including total assets, fixed assets, and working capital. The estimated coefficients represent the difference between the means of the distributions of each respective outcome for high versus low return entrepreneurs, so that scaling the coefficient by 100 gives approximately a percent difference in means. At foundation, a high return results in a larger firm in terms of assets, sales, and employment and a more productive firm in terms of value added per worker. The effects are sizable, with most outcomes, such as sales, the wage bill, and assets, being approximately twice as large following high return.

Next, Table 5 compares the likelihood of survival, above median employment growth and above median profitability (based on return on assets or ROA) 3 years after foundation. A high return increases the 3-year survival rate by around 20p.p. and the likelihood of above median 3-year employment growth and ROA by 35 and 46 p.p. respectively.[18] Therefore, our selection-corrected firm-level comparisons show a clear pattern of entrepreneurs with higher returns on their stock portfolios opening larger, faster growing and more robust and profitable firms.

7 Conclusion

In this paper we provide strong causal evidence in support of the hypothesis that wealth matters for business creation by looking at the effects of stock market wealth on entrepreneurship. We find that these effects tend to be concentrated among moderate financial wealth individuals and in years when aggregate stock returns are high. This points to an important role of stock market wealth in that it increases precisely when the returns to entrepreneurship are high and liquidity constraints are binding.

At the firm level we show that after accounting for selection into entrepreneurship, firms that are started by households with high returns on their portfolios of directly-held domestic stocks tend to start larger, are more likely to survive and grow compared to firms started by households with low returns on their stock portfolios.

Given that initial firm size is a key determinant of long-run firm size and performance

[17]Table A.3 in the Appendix presents the firm-outcome comparisons between the low and high return groups without the selection adjustment.

[18]Overall there is persistence in firm outcome differences across the two return groups as we show in Table A.2, which shows a comparison of the same firm outcomes as those from Table 4 only in year 3 after the foundation year.

Table 4: Firm outcomes in year of foundation

	Sales	Wage bill	Empl.	Value Added	VA/worker
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	1.032**	1.313**	0.734**	0.960**	0.919**
	(0.111)	(0.132)	(0.071)	(0.086)	(0.077)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	22,393	21,229	31,082	22,163	22,163
N	1,370	1,268	2,012	1,353	1,353
Clusters	235	229	271	235	234
Mean	1980.98	622.488	3.139	1084.721	476.877
Median	933.708	396.711	2	677.846	331.769

	Tot. assets	Fixed assets	Working Cap.	Equity	Tot. Liab.
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	0.984**	1.217**	1.114**	0.999**	1.075**
	(0.078)	(0.118)	(0.082)	(0.120)	(0.103)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	24,654	15,958	17,405	20,490	23,880
N	1,560	861	1,168	1,346	1,504
Clusters	244	211	204	228	239
Mean	881.799	387.236	246.664	234.354	729.025
Median	472.592	136.249	121.561	126.65	365.304

Notes: All outcome variables are in natural logs. Working capital is defined as the difference between current assets and current liabilities. The results are based on the selection correction procedure described in Section 6. In a first stage we partial out the fixed effects described in each specification from the respective firm outcomes. In a second stage we compare the mean outcomes for two groups of entrepreneurs: a "high return" group and a "low return" group, whereby we truncate the outcome distribution of the "high return" group at the $100 \times (e_H - e_L)/e_H)$-th percentile. Flexible controls include: a four-way interaction between 6 bins of portfolio exposure, 4 bins of household stock portfolio beta, 4 bins of household stock portfolio volatility and year. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

(Sterk et al., 2021) our firm-level findings point to important effects of liquidity constraints for business creation and growth. Moreover, to the extent that stock market wealth in the medium term is a function of economic growth and profitability of the corporate sector, our results point to potentially important long-run effects of stock market shocks on economic

Table 5: Firm outcomes three years after entry (in percent)

	Survival	Above median empl. gr.	Above median ROA
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	20.237**	35.021**	46.279**
	(2.584)	(4.438)	(3.669)
Additional controls	No	No	No
Age group FE	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	24,531	21,944	18,916
N	1,667	1,515	1,319
Clusters	251	245	236

Notes: Each outcome is an indicator for the respective event and the estimated coefficients are scaled by 100 for easier interpretation. The results are based on the selection correction procedure described in Section 6. In a first stage we partial out the fixed effects described in each specification from the respective firm outcomes. In a second stage we compare the mean outcomes for two groups of entrepreneurs: a "high return" group and a "low return" group, whereby we truncate the outcome distribution of the "high return" group at the $100 \times (e_H - e_L)/e_H)$-th percentile. Flexible controls include: a four-way interaction between 6 bins of portfolio exposure, 4 bins of household stock portfolio beta, 4 bins of household stock portfolio volatility and year. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

growth via a business creation channel.[19] We consider this channel and its policy implications to be important for future research on the macroeconomic effects of stock market fluctuations.

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[19]There is a small but growing literature on permanent or “hysteresis” effects of business cycle frequency shocks. See, for example, Blanchard and Summers (1986), Cerra and Saxena (2008), Benigno and Fornaro (2018), Fatás and Summers (2018), Yagan (2019), Furlanetto et al. (2021), Galí (2022), and Cerra et al. (2023).

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Stock Market Windfalls and Entrepreneurship

Online Appendix

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A Data Appendix

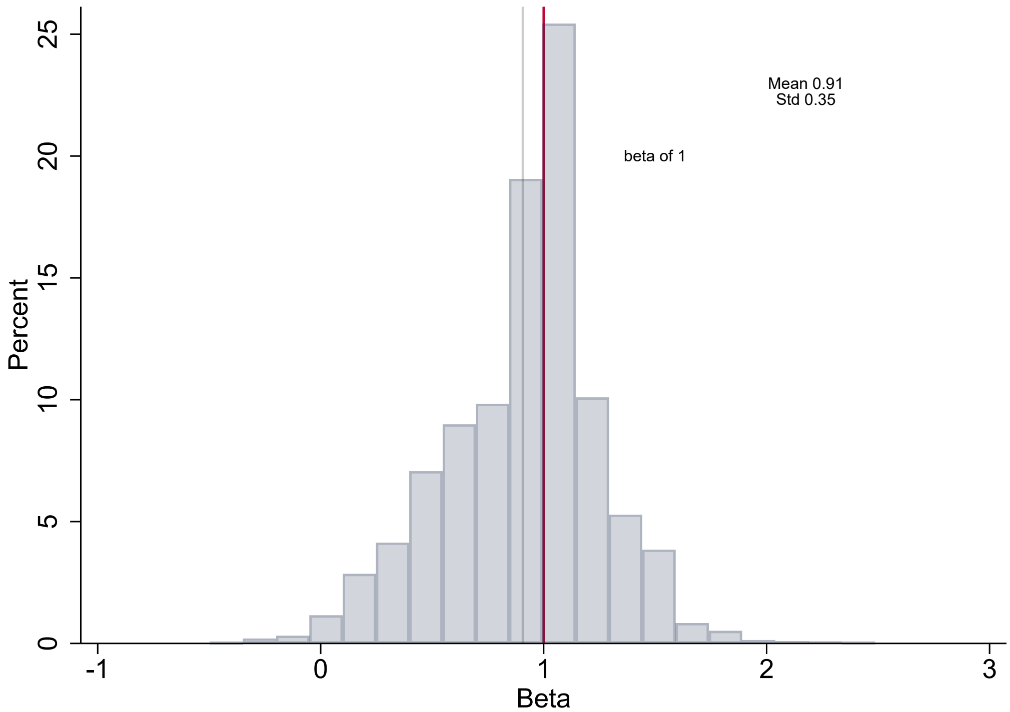
A.1 Summary statistics

Table A.1: Descriptive statistics

	Non-Entrepreneur					Entrepreneur				
	Mean	**p25**	**p50**	**p75**	**Share**	**Mean**	**p25**	**p50**	**p75**	**Share**
Age	46	36	46	56		42	34	41	49	
Earnings	655.9	343.6	604.1	922.2		652.6	357.2	605.5	874.1	
Financial Wealth	563.4	117.2	261.3	614.9		527.4	142.5	290.0	603.5	
Directly held stocks	141.9	13.3	46.1	136.3		110.4	6.2	28.9	98.3	
Share	–	–	–	–	**99.78**	–	–	–	–	**0.22**
	(Direct) Stock owner					**Other**				
	Mean	**p25**	**p50**	**p75**	**Share**	**Mean**	**p25**	**p50**	**p75**	**Share**
Age	48	40	49	57		43	33	44	54	
Earnings	903.8	518.6	857.2	1192.9		620.9	325.1	571.0	883.3	
Financial Wealth	1009.1	269.8	583.2	1258.2		500.5	108.1	234.2	537.2	
Directly held stocks	153.7	18.6	54.1	150.1		–	–	–		
Share	–	–	–	–	**12.4**	–	–	–	–	**87.6**

*Monetary amounts are in 1000s of 2010 Norwegian kroner.

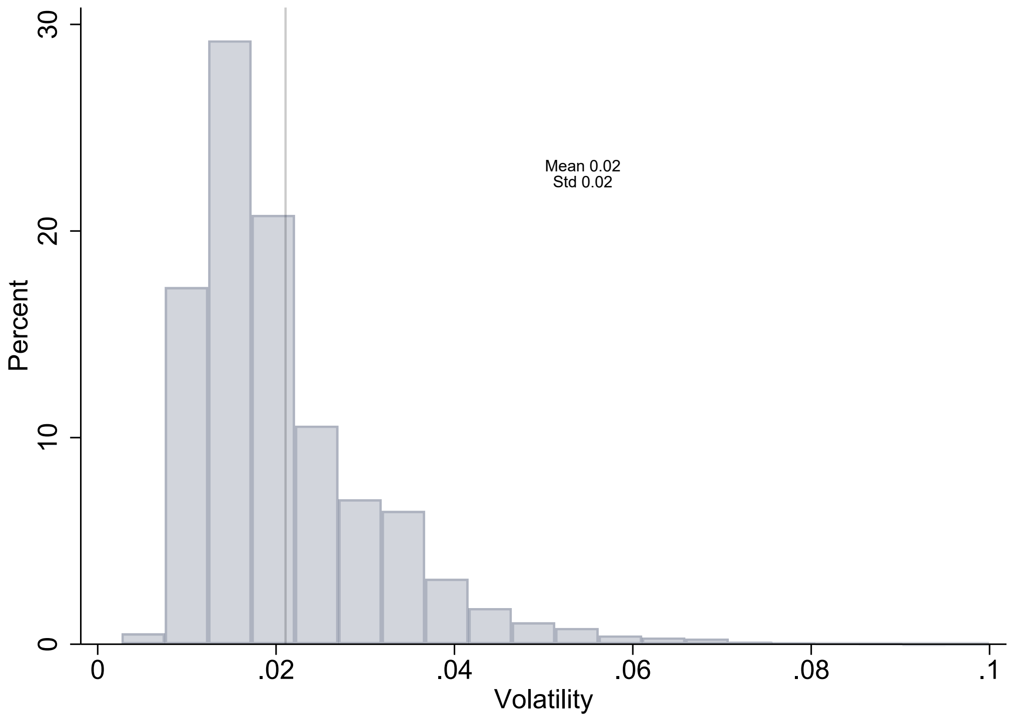
Figure A.1: Beta of portfolio of directly held domestic stocks



Notes: We measure the portfolio characteristics $\beta_{i,t-1}$ and $\sigma_{i,t-1}$ using daily returns over the year $t-1$. Specifically, for each observation we form the time series of daily returns $\tilde{r}_{i,t-1+\Delta} = \omega_{i,t-1}^{-1}\mathbf{s}_{i,t-1}\mathbf{r}_{t-1+\Delta}$, where $\tilde{r}_{i,t-1+\Delta}$ gives the return on day $t-1+\Delta$ of a portfolio with weights fixed at their value at the end of the year. We obtain $\beta_{i,t-1}$ as the OLS regression coefficient from a regression of $\tilde{r}_{i,t-1+\Delta}$ on $r_{t-1+\Delta}^{m}$ less the risk-free rate and $\sigma_{i,t}$ as the variance of $\tilde{r}_{i,t-1+\Delta}$.

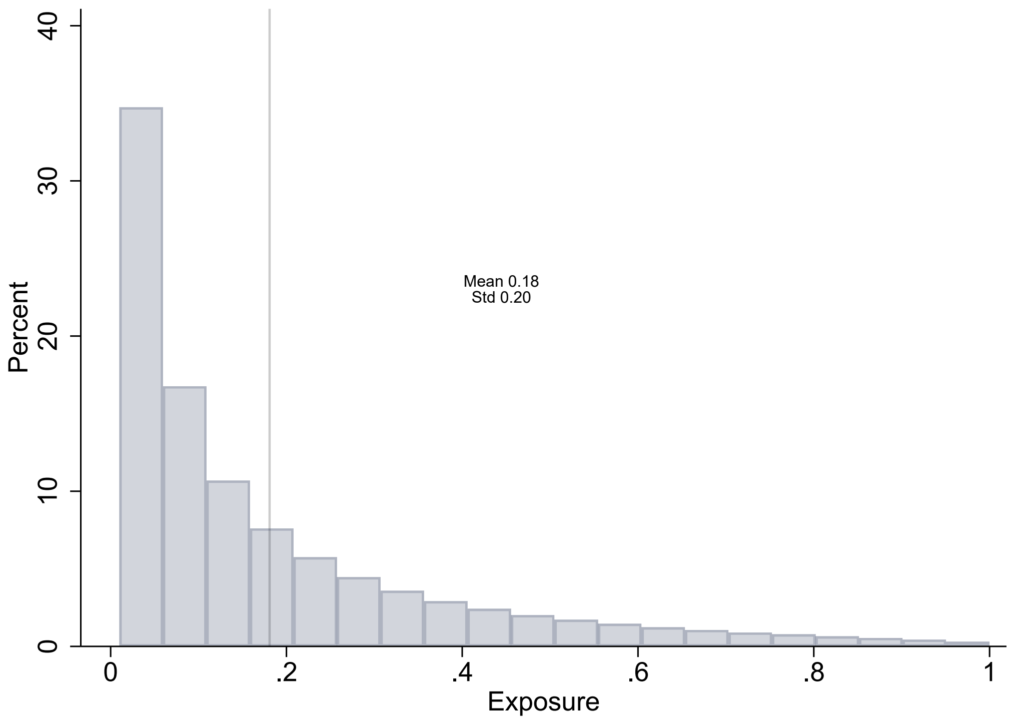
A.2 Distributions

Figure A.2: Volatility of portfolio of directly held domestic stocks



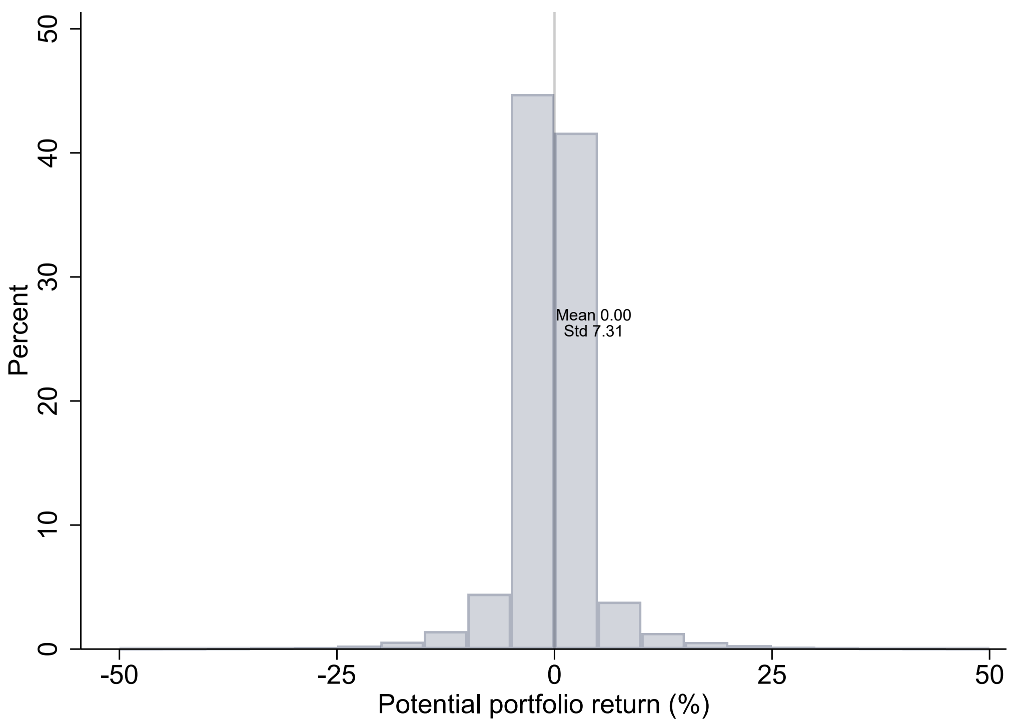
Notes: We measure the portfolio characteristics $\beta_{i,t-1}$ and $\sigma_{i,t-1}$ using daily returns over the year $t-1$. Specifically, for each observation we form the time series of daily returns $\tilde{r}_{i,t-1+\Delta} = \omega_{i,t-1}^{-1} \mathbf{s}_{i,t-1} \mathbf{r}_{t-1+\Delta}$, where $\tilde{r}_{i,t-1+\Delta}$ gives the return on day $t-1+\Delta$ of a portfolio with weights fixed at their value at the end of the year. We obtain $\beta_{i,t-1}$ as the OLS regression coefficient from a regression of $\tilde{r}_{i,t-1+\Delta}$ on $r^m_{t-1+\Delta}$ less the risk-free rate and $\sigma_{i,t}$ as the variance of $\tilde{r}_{i,t-1+\Delta}$.

Figure A.3: Exposure to domestic stocks



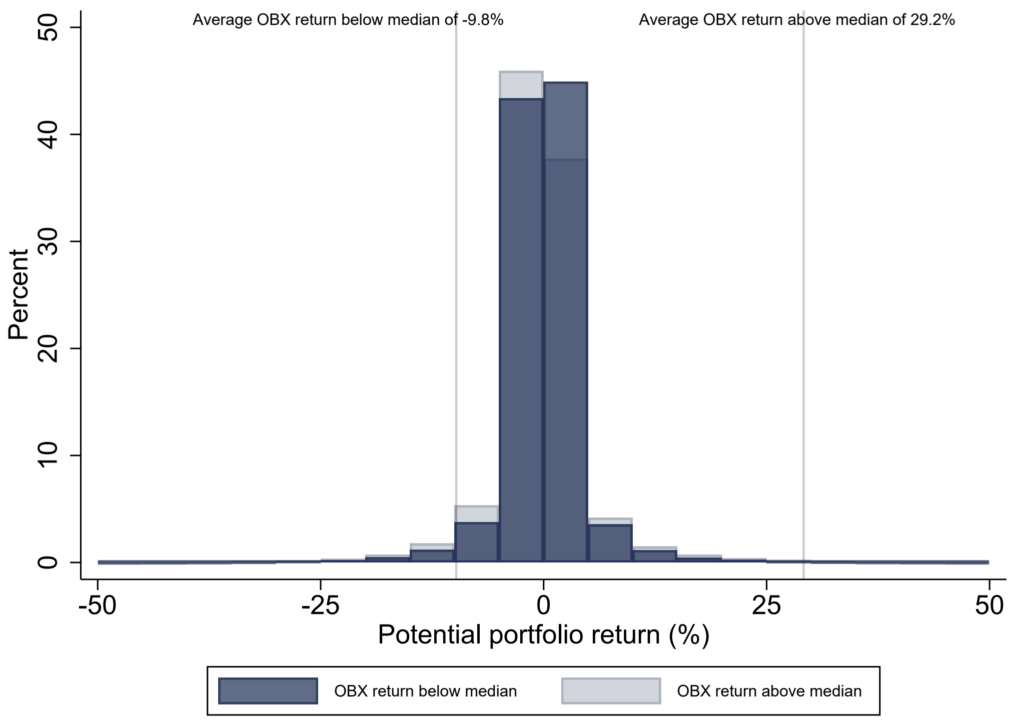
Notes: $\omega_{i,t}$ denotes the share of financial wealth held in domestic stocks at the end of year t.

Figure A.4: Potential portfolio return distribution (residualized)



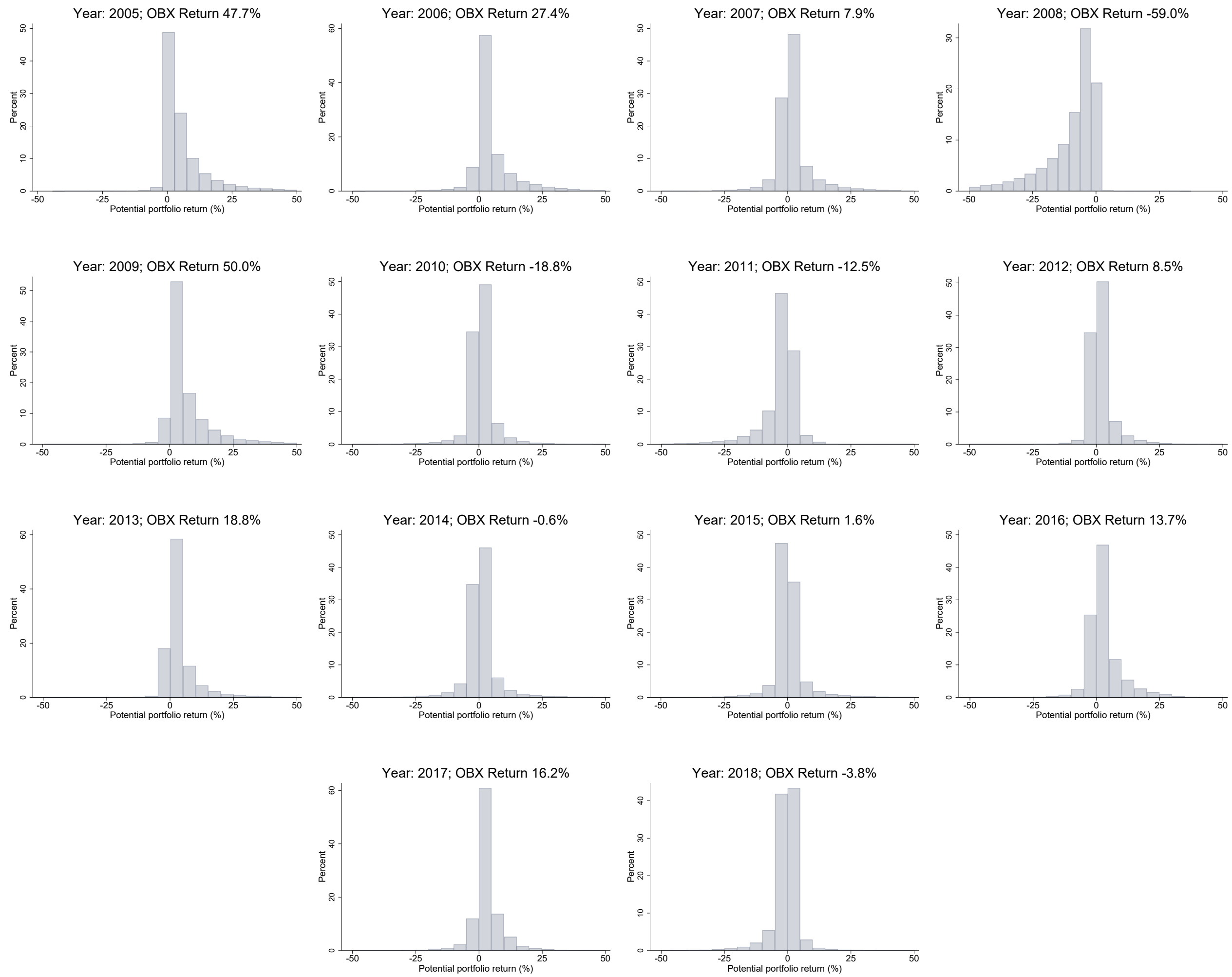
Notes: Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. The figure plots the distribution of residualized potential portfolio returns after partialling out the fixed effects from the baseline specification.

Figure A.5: Potential portfolio returns: good vs. bad stock market years (residualized)



Notes: Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t. The figure plots the distributions of potential portfolio returns for two groups of years: years in which the aggregate OBX return is above the median value in the period 2004-2019 and years in which the OBX return is below the median value. The figure plots the distribution of residualized potential portfolio returns after partialling out the fixed effects from the baseline specification.

Figure A.6: Potential portfolio returns by year



Notes: Potential portfolio returns $r_{i,t}$ are defined as $r_{i,t} = \omega_{i,t-1}\mathbf{s}'_{i,t-1}\mathbf{r}_t$, where $\omega_{i,t-1}$ denotes the share of financial wealth held in domestic stocks at the end of year $t-1$, $\mathbf{s}_{i,t-1}$ the weight in the stock portfolio of each domestic stock, and $\mathbf{r}_t$ the vector of realized returns of domestic stocks in year t.

Table A.2: Firm outcomes three years after entry

	Sales	Wage bill	Empl.	Value Added	VA/worker
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	1.030**	1.109**	1.013**	0.996**	0.554**
	(0.106)	(0.081)	(0.119)	(0.109)	(0.069)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	18,124	17,895	18,600	1,7963	16,293
N	1,210	1,218	1,245	1,194	1,064
Clusters	233	231	226	232	220
Mean	4519.851	1430.457	4.378	2459.906	756.418
Median	2239.371	914.9	3	1561.361	607.217

	Tot. assets	Fixed assets	Working Cap.	Equity	Tot. Liab.
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	1.036**	2.319**	0.938**	1.217**	1.022**
	(0.130)	(0.116)	(0.145)	(0.154)	(0.114)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	18,897	15,509	12,699	14,922	18,622
N	1,316	974	933	1,067	1,282
Clusters	237	218	194	210	233
Mean	1760.884	650.801	579.933	651.997	1319.195
Median	909.623	194	276.275	322.128	632.745

Notes: All outcome variables are in natural logs. Working capital is defined as the difference between current assets and current liabilities. The results are based on the selection correction procedure described in Section 6. In a first stage we partial out the fixed effects described in each specification from the respective firm outcomes. In a second stage we compare the mean outcomes for two groups of entrepreneurs: a "high return" group and a "low return" group, whereby we truncate the outcome distribution of the "high return" group at the $100 \times (e_H - e_L)/e_H)$)-th percentile. Flexible controls include: a four-way interaction between 6 bins of portfolio exposure, 4 bins of household stock portfolio beta, 4 bins of household stock portfolio volatility and year. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

A.3 Additional empirical results

A.3.1 Alternative entrepreneurship definitions

In this section we present results based on an alternative entrepreneurship definition that does not restrict newly created firm to having positive employment. Specifically, as in Section 3.1, we

Table A.3: Firm outcomes in year of foundation – no selection adjustment

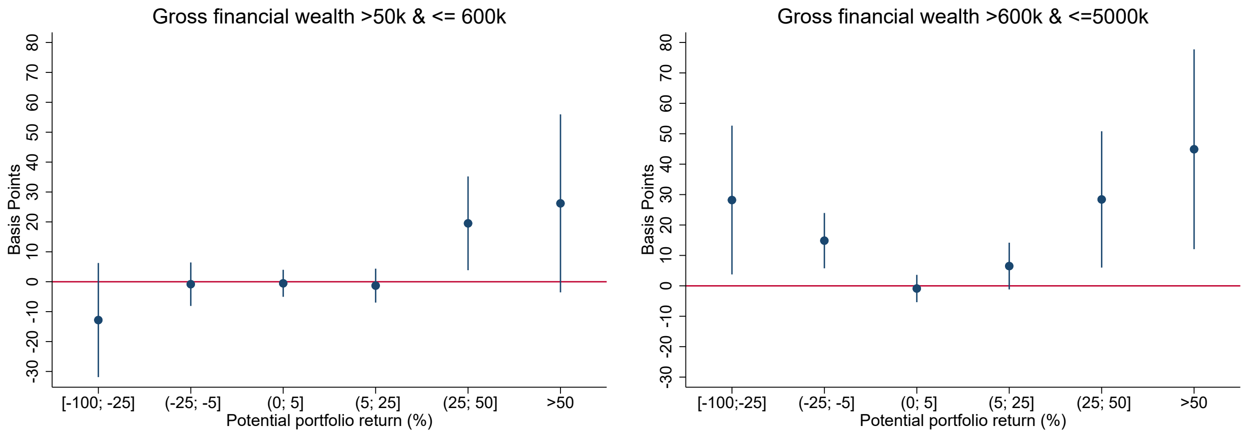
	Sales	Wage bill	Empl.	Value Added	VA/worker
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	0.170	0.165	0.119	0.163	0.096
	(0.122)	(0.170)	(0.078)	(0.110)	(0.114)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	22,393	21,229	31,082	22,163	22,163
N	1,398	1,297	2,050	1,380	1,380
Clusters	239	232	273	238	238
Mean	1980.98	622.488	3.139	1084.721	476.877
Median	933.708	396.711	2	677.846	331.769

	Tot. assets	Fixed assets	Working Cap.	Equity	Tot. Liab.
$\mathbb{1}_{\{r_{i,t}>25\%\}} - \mathbb{1}_{\{r_{i,t}\in(-5\%,5\%)\}}$	0.210*	0.072	0.275*	0.193+	0.227*
	(0.106)	(0.183)	(0.112)	(0.112)	(0.109)
Additional controls	No	No	No	No	No
Age group FE	Yes	Yes	Yes	Yes	Yes
Location-by-year FE	Yes	Yes	Yes	Yes	Yes
Sector-by-year FE	Yes	Yes	Yes	Yes	Yes
Non-parametric controls	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ	ω-β-σ
N - first stage	24,654	15,958	17,405	20,490	23,880
N	1,591	883	1,194	1,374	1,534
Clusters	247	214	207	231	243
Mean	881.799	387.236	246.664	234.354	729.025
Median	472.592	136.249	121.561	126.65	365.304

Notes: All outcome variables are in natural logs. Working capital is defined as the difference between current assets and current liabilities. The results are based on the selection correction procedure described in Section 6. In a first stage we partial out the fixed effects described in each specification from the respective firm outcomes. In a second stage we compare the mean outcomes for two groups of entrepreneurs: a "high return" group and a "low return" group, whereby we truncate the outcome distribution of the "high return" group at the $100 \times (e_H - e_L)/e_H)$)-th percentile. Flexible controls include: a four-way interaction between 6 bins of portfolio exposure, 4 bins of household stock portfolio beta, 4 bins of household stock portfolio volatility and year. Standard errors in parentheses are clustered at the municipality level. + denotes significance at the 10% level, * denotes significance at the 5% level, and ** denotes significance at the 1% level.

define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm with less than 3 stock owners. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household

Figure A.7: Alternative entrepreneurship definition: non-parametric specification



Notes: We define an entrepreneur as an individual that owns more than 1/3 of the book value of stocks in an incorporated non-financial firm with less than 3 stock owners. When considering the transition to entrepreneurship we only consider newly-created firms and households who have not owned stocks in any private firm in the past. Furthermore, upon transitioning to entrepreneurship a household is dropped from our sample. Effects in each return bin are relative to a base potential portfolio return between -5% and 0%. Controls include age group indicators (for 3 age groups), municipality-by-year fixed effects, primary employment sector-by-year fixed effects, and a set flexible controls given by a four-way interactions between interaction between 8 bins of exposure to directly-held domestic stocks, 7 bins of betas for the observed part of the portfolio, 7 bins of volatility for the observed part of the portfolio and year. The bars represent 95% confidence intervals computed with clustering on the level of the municipality.

is dropped from our sample.

Figure A.7 shows the non-parametric plots with the effects of different potential portfolio returns on the propensity to start such a firm for low and high levels of financial wealth, similar to Figure **??**. For low levels of wealth the effects are broadly as those for our baseline definition. However, for high levels of wealth there are strong effects of both large positive *and* large negative potential portfolio returns on the propensity to start a firm. Therefore, households with large values of financial wealth tend to create more inactive firms given both positive and negative potential portfolio returns.

B Model Details: An Example Economy

Consider the entry model described in the main text. Specifically, there is a continuum of individuals i that differ in productivity z_i and initial assets a_i. Conditional on entry, individuals' profits and capital are given by functions that depend on their productivity and assets, $\pi_i = \pi(z_i, a_i)$ and $k_i = k(z_i, a_i)$. Individuals enter if their profits satisfy $\pi_i = \pi(z_i, a_i) \geq W(z_i)$. In the main text, we show that if $\pi(\cdot), k(\cdot)$ and $W(\cdot)$ satisfy Assumption (M), then the model satisfies a rank preservation property that enables us to match entrants by productivity (without directly observing productivity). In this appendix, we describe an example economy that satisfies Assumption (M).

First,suppose the reservation wage does not depend on productivity, $W(z_i) = W$. This is a mild assumption because in the empirical analysis we control for the labor income before entry (see Footnote 5).

Second, if individual i starts a business, she produces according to the Cobb-Douglas technology

$$f(k;z_i) = z_i k^{\alpha} - rk - \kappa.$$

Here, r is the rent of capital and $\kappa(z_i)$ is a fixed entry cost. We assume entry costs are weakly decreasing in productivity $\kappa'(z_i) \leq 0$ (more productive individuals are able to reduce the fixed costs). For now, we assume capital is the only factor of production, which simplifies the algebra. The analysis can be extended to to include labor.[1]

We capture financial constraints with a working capital channel. Specifically:, the costs, $rk + \kappa(z_i)$, must be paid up front. Individual can use internal resources, a_i, to cover some of this cost. Therefore, the individual's financing need is $f = \max(0, rk + \kappa(z_i) - a_i)$. Individuals can obtain costly outside financing. Borrowing $f \geq 0$ costs $C_i(f)$ where $C_i(0) = 0, C_i'(f) > 0$ and $C_i''(f) > 0$. For simplicity, we work with the quadratic function, $C_i(f) = c(z_i)\frac{f^2}{2}$ where $c(z_i)$ is a constant. The quadratic functional form is not necessary for the qualitative results. Importantly, we assume the cost of financing, $c(z_i)$, is *weakly decreasing* in z_i. More productive entrepreneurs obtain financing at a lower cost. This can be microfounded with a model in which there is default due to ex-post productivity shocks and outside financing costs depend on the likelihood of default (e.g., a costly-state verification model). In that type of model, a higher ex-ante productivity translates into a lower probability of default and therefore lower outside financing costs.[2]

With these assumptions, an entrepreneur that chooses to enter with capital k makes profits

$$\Pi(k;a_i,z_i) = z_i k^{\alpha} - rk - \kappa(z_i) - c(z_i)\frac{\max(0, rk + \kappa(z_i) - a_i)^2}{2}.$$

[1]If the labor bill is not subject to the working capital constraint (that we describe below), then labor is straightforward to incorporate. Specifically, suppose the production function is $\tilde{z}_i k^{\tilde{\alpha}} l^{\theta} - \kappa(z_i)$ and labor is supplied at a competitive wage w. Then, the entrepreneur always chooses the optimum amount of labor conditional on the other factors: that is

$$l^{opt} = \arg\max_{l} \tilde{z}_i k^{\tilde{\alpha}} l^{\theta} - \kappa(z_i) - rk - wl.$$

The solution is given by $l^{opt} = \left(\frac{\tilde{z}_i \theta k^{\tilde{\alpha}}}{w}\right)^{1/1-\theta}$. Substituting this back into the production function, we obtain

$$\begin{aligned} f(k;z_i) &= z_i k^{\alpha} - \kappa(z_i) - rk \\ \text{where } z_i &= \tilde{z}_i \left(\frac{\tilde{z}_i \theta}{w}\right)^{\theta/1-\theta} \quad \text{and } \alpha = \tilde{\alpha}\frac{\theta}{1-\theta}. \end{aligned}$$

If labor is also subject to a working capital constraint, then incorporating labor would leave the results qualitatively unchanged but the algebra would be more complicated, since the firm would be optimizing over two factors.

[2]We abstract away from asymmetric information on the ex-ante productivity z_i.

The entrepreneur's optimal profit and size (conditional on entry) are given by

$$\begin{aligned}\pi\left(a_i, z_i\right) &= \max_k \Pi\left(k; a_i, z_i\right)\\ k\left(a_i, z_i\right) &= \arg\max_k \Pi\left(k; a_i, z_i\right).\end{aligned}$$

The following result, along with the assumption that the reservation wage is constant, $W(z_i) = W$, implies that this model satisfies Assumption (M).

Lemma 1. $\frac{d\pi(z_i,a_i)}{dz_i} > 0$, $\frac{dk(z_i,a_i)}{dz_i} > 0$. *In addition, we also have* $\frac{d\pi(z_i,a_i)}{da_i} \geq 0$, $\frac{dk(z_i,a_i)}{da_i} \geq 0$ *with strict inequality as long as the constraint binds.*

Proof of Lemma. First, consider the problem with $c\left(z_i\right) = 0$: the first-best case without financial constraints. Denote the solution for this case with $\pi^*\left(z_i\right), k^*\left(z_i\right)$ (note that assets do not affect the solution in this case). Note that $\frac{d\pi^*(z_i)}{dz_i} > 0$, $\frac{dk^*(z_i)}{dz_i} > 0$.

Now consider the original problem. Let

$$\overline{a}\left(z_i\right) = rk^*\left(z_i\right) + \kappa\left(z_i\right).$$

There are two cases to consider. If $a_i > \overline{a}\left(z_i\right)$, the entrepreneur is effectively unconstrained and the problem is the same as the first-best case. If $a_i < \overline{a}\left(z_i\right)$, the entrepreneur is constrained. At an optimum point, the constraint binds and her profits are given by

$$\Pi\left(k; a_i, z_i\right) = z_i k^{\alpha} - rk - \kappa\left(z_i\right) - \frac{c\left(z_i\right)}{2}\left(rk + \kappa\left(z_i\right) - a_i\right)^2.$$

First consider the comparative statics of the optimal size, $k\left(a_i, z_i\right)$. The first order condition implies that $k\left(a_i, z_i\right)$ solves:

$$\frac{\partial \Pi\left(k; a_i, z_i\right)}{\partial k} = 0 \Longrightarrow z_i \alpha k^{\alpha-1} = r + c\left(z_i\right)\left(rk + \kappa\left(z_i\right) - a_i\right). \tag{B.1}$$

Implicitly differentiating with respect to a_i, we obtain

$$\frac{dk}{da_i} = -\frac{\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k \partial a_i}}{\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k^2}} > 0. \tag{B.2}$$

Here, the inequality follows since $\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k \partial a_i} = c\left(z_i\right) > 0$ and Π is a concave function. Likewise, we have

$$\frac{dk}{dz_i} = -\frac{\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k \partial z_i}}{\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k^2}} > 0, \tag{B.3}$$

since $\frac{\partial^2 \Pi(k;a_i,z_i)}{\partial k \partial z_i} = -c'\left(z_i\right)\left(rk + \kappa - a_i\right) - c\left(z_i\right)\kappa'\left(z_i\right) > 0$.

Next consider the comparative statics of the optimal profit, $\pi(a_i, z_i)$. Using the Envelope Theorem, we obtain

$$\begin{aligned}
\frac{d\pi(z_i, a_i)}{dz_i} &= \frac{\partial \Pi(k; a_i, z_i)}{\partial z_i}|_{k=k(z_i,a_i)} \\
&= k^\alpha - \frac{c'(z_i)}{2}(rk + \kappa - a_i)^2 > 0 \\
\frac{d\pi(z_i, a_i)}{da_i} &= \frac{\partial \Pi(k; a_i, z_i)}{\partial a_i}|_{k=k(z_i,a_i)} \\
&= c(z_i)(rk + \kappa - a_i) > 0.
\end{aligned}$$

This completes the proof. $\square$