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URPP Equality of Opportunity

Born to Create and Lead? The Role of Cognitive Skills and Personality Traits for Entrepreneurship and Management

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Born to Create and Lead? The Role of Cognitive Skills and Personality Traits for Entrepreneurship and Management

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Abstract

Founders exert large influence over their business ventures. Their cognitive skills and personality could explain management decisions and firm performance. Existing research suggests that while founders are selected on highly remunerated human capital, they often perform poorly in managing companies. There is little evidence for the mechanism behind this pattern. We investigate the role of cognitive and personality traits in determining who becomes an entrepreneur and how they manage their companies. We test for the presence of conflicting traits that both drive selection into founding and hinder managerial performance. Using comprehensive longitudinal data from Finnish administrative records combined with unique military data on cognitive skills and personality scores covering 80% of the male population, we first document how entrepreneurs stand out as intelligent and extroverted risk-takers. We confirm these findings in an event study on easing of financial constraints. Furthermore, we explore the descriptive and causal relationships between owner disposition and HR policy. This project has the potential to broaden our understanding of entrepreneurship dynamics and can inform the design of policies to encourage entrepreneurship.

□

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1 Introduction

A growing literature documents that entrepreneurs are positively selected on highly remunerated human capital (Rubinstein and Levine 2020; Hvide and Oyer 2020; Ng and Stuart 2016). By and large, successful founders display higher than average cognitive skills that translate in creativity, analytical flexibility, and generalized problem solving abilities (Levine and Rubinstein, 2017). However, there is both anecdotal and empirical evidence suggesting that founders often perform poorly managing their own ventures. First, the media are replete with anecdotes of founder-CEOs' misdeeds, from Travis Kalanick to Elon Musk. Second, venture capital firms and private equity firms frequently replace founders with professional managers, underlying that they believe founders might not be suited to scale businesses (Hellmann and Puri, 2002). Third, direct empirical evidence shows that founder-CEOs have systematically lower managerial ability than externally hired managers (Bennett et al. 2016; Bennedsen et al. 2007). These strands of literature pose a puzzle: how can we reconcile that founders are positively selected on cognitive skills, and yet they are so poor at managing their ventures?

We suggest that the apparent disconnect can be rationalized by looking at entrepreneurship as a two-stage process: selection into entrepreneurship, and subsequent management of the venture. In particular, the traits that predict self-selection into entrepreneurship might not be the most useful when it comes to managing the business. Even if entrepreneurs are positively selected on cognitive skills, it could be that other traits are more important in the second stage, i.e., for managing the venture. We suggest that after founding, a crucial skill becomes the ability of managing human resources: coordinating the activities of the firm, communicating the vision to employees, and attracting and retaining key personnel. All these tasks are not a function of mathematical ability, but rather require traits like verbal intelligence, that is the ability to carry out language-based reasoning while reading, writing, and communicating with others. Insofar as entrepreneurs are positively selected on quantitative problem solving but not on verbal skills or other "soft" personality traits, our results might help solve the apparent paradox of cognitively well-endowed entrepreneurs that are nonetheless unsuitable to manage their personnel.

In this paper, we investigate two related research questions: How are cognitive skills and personalities associated with selection into entrepreneurship? Do the same characteristics also predict managerial success conditional on selection into entrepreneurship? Existing research has very little to say on either of these stages, and are based mostly on surveys with very limited samples or study self-employment, which is fundamentally different from growth oriented entrepreneurship. We approach these questions empirically using unique data on cognitive skills and personality tests conducted by the Finnish defence forces, covering almost 80 % of the male population¹ linked with comprehensive longitudinal data from Finnish administrative records

¹Military service is mandatory for all men fit to serve in Finland and voluntary for females. While we are limited to analysis mostly on the male population (and hence unable to reliably capture differences based on gender), a small selected sample of the female population is also covered.

including data on the ownership of companies.

Our first step will be to document the patterns of individual traits and self-selection into entrepreneurship descriptively. In a similar fashion, conditional on entry, we explore the association between the traits and managerial decisions. We employ simple cross-sectional OLS analyses to explore the basic correlations.

We then move beyond correlational analyses by utilizing exogenous determinants of selection into entrepreneurship and the panel dimension of the data. One approach is to identify exogenous events that change the likelihood of entry into entrepreneurship at the individual level and to test for heterogeneity in responses across levels of cognitive skill and personality types. We study inheritance shocks (Blanchflower and Oswald, 1998), which can remove binding financial constraints related to entry or on the other hand could discourage further efforts to work or found a company at all. We hypothesize that different personalities might react very differently to such shocks and different kinds of businesses might be founded as a consequence. The results could either validate our cross-sectional findings or even reveal new patterns. To carry out this analysis, we estimate an event study difference-in-differences specification, where the inheritance treatment is interacted with cognitive skills and personality traits.

We also make use of entrepreneur deaths as a source of exogenous variation after the firm has been founded. Becker and Hvide (2022) estimate drastic negative effects of entrepreneur death to multiple firm performance outcomes. We instrument for changes in the personality composition of a founding team by using deaths among them. We make move beyond the previous literature by interacting the death dummy with measures of the person’s cognitive skills and personality and predict the composition of these traits among the remaining team, and focus on HR outcomes.

Our paper stands out in two ways that help advance and expand the literature. First, we tackle empirical challenges involved in measuring cognitive skills and personality traits. For instance, verbal intelligence is a construct that can easily be conflated with non-cognitive personality traits, such as sociability. We leverage exceptionally rich data to hold other individual-level characteristics constant in order to isolate the effects of cognitive skills and personality traits separately, eliminating many of the potential confounders that have hindered previous research. Second, we focus on one crucial channel through which founder-CEOs might hurt the growth of their venture, namely the management of its human resources. Past research has shown the crucial impact that human resources management can have on corporate performance (Ichniowski et al., 1997), but this body of work has not yet been integrated with the literature on founder-CEOs or their personalities.

Finally, our paper has multiple potential implications to research and practice. Many theories have been proposed to explain who becomes an entrepreneur and why, but they mostly do not consider the personal characteristics and behavioral inclinations. The omission is potentially consequential given the central role that entrepreneurship has in driving economic growth and introducing new goods and services. Based on the limited theoretical understand-

ing of entrepreneurial mechanisms, governments around the world have enacted policies to improve entrepreneurial dynamism, acting on the assumption that by removing specific constraints (e.g. lack of entrepreneurial training) or compensating for market failures (e.g. access to credit) they could encourage entry by promising entrepreneurs. However, such policies could fall short of expectations if the most responsive individuals are temperamentally unsuited for entrepreneurship. Gaining a better understanding of these mechanisms would provide useful guidance to craft more effective policy interventions.

2 Related literature

Despite its centrality for economic theory, it is only very recently that empirical research has shed light on entrepreneurship and its nuances (Hurst and Pugsley 2011; Akcigit and Kerr 2018). The literature has established the necessity of distinguishing self-employment from proper entrepreneurship (Hamilton 2000; Fairlie and Fossen 2019). Focusing on the latter, Levine and Rubinstein (2017) find that founders of the most promising businesses stand out by their cognitive and non-cognitive traits, suggesting one can better understand the entrepreneurial process by focusing on founders' personal characteristics. Another inspiration is the high quality of evidence on the personality traits of politicians (Dal Bó et al. 2017) and especially top managers (Adams et al. 2018; Harrison et al. 2019).

Recent research in entrepreneurship has been concerned with empirically identifying high-potential ventures and understanding the mechanisms that generate such ventures. As the entrepreneur plays a crucial role in the beginning of a firm's life (Becker and Hvide, 2020), her personality traits should shape the venture and directly affect its performance through several channels. On the one hand, the founder's personality might have a direct effect on firm success – albeit a complicated one, with some traits being conducive for founding a business but others for managing it in the post-start-up phase, consistent with the finding that founder CEOs are worse managers (Bennett et al. 2016). On the other hand, the entrepreneur's personality could have an indirect effect through determining who joins the company after founding (Roach and Sauermann 2015). Start-ups are small, collaborative environments; high-quality personal match between entrepreneurs and their employees are crucial (Ruef et al. 2003). The founders' significance is heightened by reluctance to relinquish control of the company, risking lower value creation (Wasserman, 2017).

Influential studies of the 1980s and 1990s failed to document any connection between personality and entrepreneurship (Gartner 1988; Blanchflower and Oswald 1998), contributing to skepticism toward this research avenue (Kerr et al. 2018). This changed only quite recently, after a handful of studies documented that cognitive skills, and multiple personality factors are positively associated with entry (Uusitalo 2001; Caliendo et al. 2014; Rubinstein and Levine 2020; Hvide and Oyer 2020; Ng and Stuart 2016; Levine and Rubinstein 2017) as well as some other entrepreneurial decisions (Zhao and Seibert 2006; Kerr et al. 2019). Crucially, most of

these studies rely on ad hoc surveys plagued by the usual problems of low response rates and sample selection (Kerr et al. 2018). A noteworthy exception was the early study by Uusitalo (2001), which combined personality assessments carried out by the Finnish armed forces during compulsory drafts with comprehensive longitudinal data. However, the paper does not fully exploit the richness of Finnish administrative data and contents with documenting the association between self-employment status and certain personality traits. Jokela et al. (2017) showed that leadership motivation, achievement-striving and other personality scores are robustly associated with high income at age 30-34, but did not specifically explore the connection with success at entrepreneurial jobs. None of these studies investigate how specific cognitive skills and personality traits relate to chosen management practices and later success of the firm.

Consistent with existing research, we hypothesize that people with different cognitive skills and personality traits will enter entrepreneurship at different rates, even controlling for other individual-level determinants of entrepreneurship such as risk aversion. However, we go beyond the existing literature by positing that personality traits could also predict and explain subsequent performance of the firm. We contend that cognitive capacity and personality is especially related to how entrepreneurs manage the human resources of their newly founded organizations. Traits that are useful to found a business might not be the best suited for management beyond the start-up phase. Findings in this empirically uncharted territory is potentially helpful in advancing theorizing of the mechanisms at play.

3 Data

3.1 Data sources

We provide novel empirical evidence on how personality traits are related to entrepreneurial outcomes by using multiple high-quality data sources. First, by leveraging the comprehensive longitudinal data from Finnish administrative records, we obtain a full description of the population, their education and work trajectories, earnings, and wealth. We link these data to the owners of joint-stock ownership during years 2007-2020, excluding portfolio owners with more than 8 firms, and defining founders as owners with initial share of at least 33%. Our focus on “founding owners” is justified by these people being more likely to be growth-oriented founder-entrepreneurs (Levine and Rubinstein, 2017), but we also utilize information on self-employed individuals as an alternative comparison group. In total, we have 234,392 people who were founders at least once during 2007-2020, roughly constituting 3% of the population of individuals. The founder data is further linked to firm balance sheet- and hiring data from the same source to assess firm performance and management decisions such as how many and what kind of people they hire (e.g. their education level).

Second, we use unique data from the Finnish Defense Forces’ records to examine cognitive skills and personality traits at around age 19 of founders, self-employed, and the general pop-

ulation. The data come from the tests that the Finnish military carries out to examine the cognitive and non-cognitive characteristics of all conscripts to assess whether they are fit to serve in the military and to identify potential leaders for promotion or specialist positions. The respondents are presented with hundreds of multiple-choice questions or statements and have to either mark down the correct answer (in questions on cognitive skills) or to what extent they agree with a statement (in personality questions). Based on the tests, three cognitive measures (visual-, arithmetic-, and verbal intelligence) and eight main personality measures (leadership motivation, activity-energy, achievement-striving, self-confidence, deliberation, sociability, dutifulness, and masculinity) are formed². Military service was (and still is) mandatory in Finland during our sample period, so the relevant test pool for our sample includes virtually all Finnish men, covering roughly 80% of men born in Finland between 1962 and 1979 ($n = 590,030$). Importantly for our research design, the timing of the measurement of the traits happens before individuals have accumulated substantial leadership experience or professional and/or educational specialization, which helps to avoid problems of reverse causality. Some estimates using similar data from Sweden show that 66% - 93% of the variation in the traits we examine can be attributed to genetic and environmental factors up to the age of 18 (i.e., “nature” and “nurture”, see [Beauchamp et al. \(2011\)](#)). Moreover, [Jokela et al. \(2017\)](#) showed that the traits measured by the Finnish Defense Forces’ tests capture economically valuable characteristics and are predictive of labor market outcomes.

Third, we complement the data on additional measures that might be confounding with personality. We have obtained data on speeding tickets for the years 1987-2019. This is a useful behavioral proxy for individual risk aversion, which might be correlated with some personality measures, hence important to control for when studying the role of cognitive skills and personality in self-selection into entrepreneurship. Also, in collaboration with Statistics Finland we have constructed an index measuring individualism using data on individuals’ own and their children’s names ([Beck Knudsen, 2019](#)). Less common names within a rolling time window count for higher values of individualism.

Fourth, in our on-going work we are utilizing external variation in the likelihood of entering and subsequently in the management of the firm. We have complemented our data with (i) inheritance taxation data, which provides a wealth shock at the individual level and (ii) untimely entrepreneur deaths, which are expected to have an exogenous effect to firm performance. Alternative data sources under consideration are wealth shocks in individual asset prices, mass layoffs, shocks in real estate prices, and the 2011 reform changing the social insurance mandate.³

²Moreover, the military calculates additional measures to capture e.g. truthfulness and potential personality disorders. We treat these complementary measures as additional controls rather than variables of interest.

³The reform lowered the ownership-share threshold under which the firm has discretion over how much social insurance contributions to pay.

3.2 Reduction to three dimensions of cognitive and personality traits

As working with 11 individual cognitive and personality traits makes both the analysis itself and the interpretation of results challenging, we follow [Izadi and Tuhkuri \(2023\)](#) in reducing the dimensionality to three variables. We form three measures: a unified cognitive skill score, a measure of extroversion, and a measure of conscientiousness.

We use factorization to capture the principal-component factor of multiple variable to form these three measures. The cognitive skills score incorporates the three cognitive skill measures. Extroversion is based on sociability, activity-energy, self-confidence, and leadership motivation. Conscientiousness incorporates achievement striving, deliberation, and dutifulness.

The factorization provides us with three easily interpretable measures of cognitive ability and personality traits. The aim of the extroversion factor is to capture interpersonal skills, while the conscientiousness factor focuses on the ability of the person to operate in isolation. The two personality measures correspond with two of the widely recognized Big Five personality model. While the alignment with the Big Five traits may not be perfect, the findings of [Jokela et al. \(2017\)](#) provide empirical support for this association. We exclude the masculinity measure from these composites as it doesn't convincingly map on to the Big Five traits.

4 Results

4.1 Comparison of trait distributions

We begin by exploring the cross-sectional variation in our data. Figure 1 plots the distributions of cognitive scores standardized by birth cohort among founders, external managers in companies, self-employed people who are not classified as founders, and the rest of the population (Others). A few interesting patterns emerge. First, self-employed workers show a distribution remarkably close to that of the general population. Second, founders are instead scoring higher on all measures of cognitive skills. Third, remarkably, external managers do even better on these dimensions than founders. Figure 2 plots distributions for personality traits, showing similar patterns across most of them. Founders are especially positively selected in terms of leadership motivation, achievement striving and sociability. Since these graphs plot cross-sectional distributions, the fact that founders show higher values than the rest of the population but lower than external managers, is consistent with the idea that there might be two types of founders: those with high values in desirable traits who might then prove to be good managers, and those with low values, that might then prove inadequate at managing the company when trying to scale up a business. Combining these two subgroups leaves the founders' trait distributions between the population and managers. Figure 3 illustrates the distributions of the two post-dimensionality-reduction personality measures, extroversion and conscientiousness, showing clear positive selection on both measures for founders and especially for managers.

4.2 Descriptive analysis of selection

Next we conduct descriptive, multivariate regressions to control for the cross-correlations between the cognitive and personality traits and for potential confounders giving us a more accurate picture of the drivers of selection. We do so according to the following specification:

$$\begin{aligned} Selection_i = & \alpha + \beta_1 * VisuoSpa_i + \beta_2 * Arithm_i + \beta_3 * Verbal_i + \\ & + \sum_x^8 \beta_{4x} * Personal_{xi} + \beta_5 * Individ_i + \beta_6 * Speeding_i + \lambda_y + \epsilon_i \end{aligned} \quad (1)$$

where i denotes individuals, x the different dimensions of personality and y years of birth. The LHS variables $Selection_i$ denotes the individual i selecting into becoming a founder-entrepreneur, self-employed or a non-founder manager. $VisuoSpa_i$ is a measure of visuospatial ability. $Arithm_i$ is a measure of arithmetic ability. $Verbal_i$ is a measure of verbal ability. $\sum_x Personal_{ix}$ are the eight measures of personality traits. $Individ_i$ denotes an index measuring the uniqueness of the person's given name, a proxy for individualism inherited from one's

Standardized IQ measures by status

Founder with 33% share

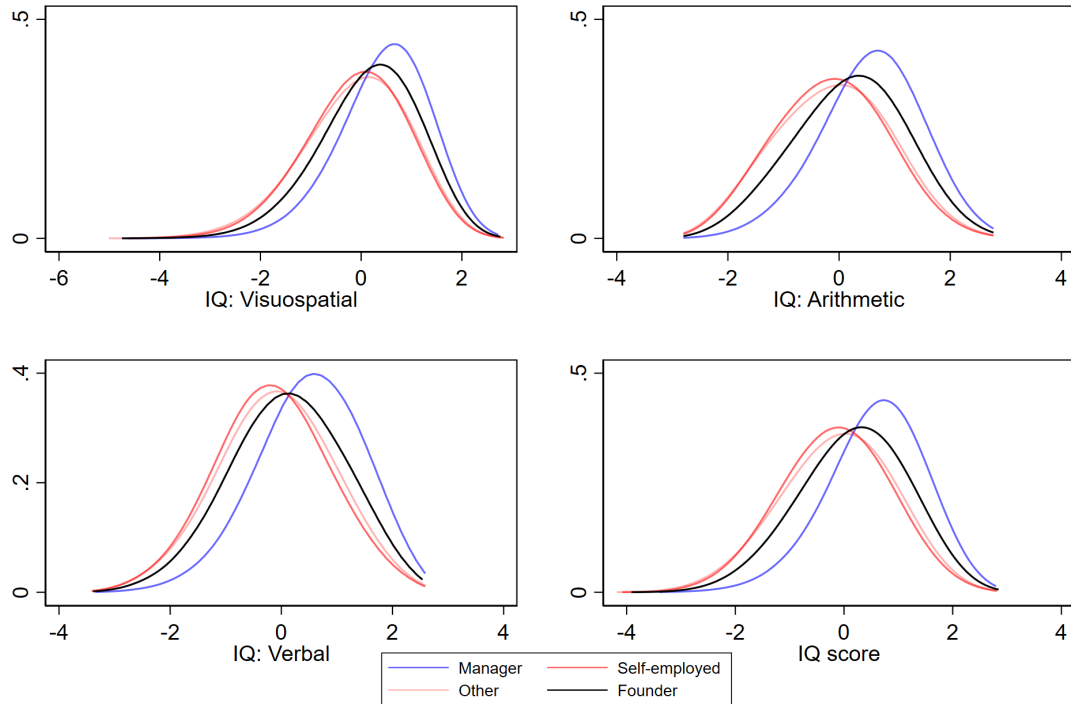


Figure 1: Distributions of cognitive skills

parents. $Speeding_i$ is a dummy for having received speeding tickets. λ_y is the birth-year fixed effect. ϵ_i is the error term.

The results of these regressions show that standardized personality and cognitive skills strongly predict self-selection into entrepreneurship.⁴ Figure 4 shows that, compared to the rest of the Finnish male population and keeping all other traits and personality proxies fixed, founders of joint-stock companies have higher arithmetic ability, leadership motivation, activity-energy, and propensity for risk (as captured by speeding tickets), but lower amount of verbal intelligence and deliberation (i.e. how much an individual thinks before he/she acts), while not being particularly selected based on other traits like self-confidence, sociability, dutifulness or masculinity. Our findings on negative selection based on verbal intelligence and deliberation are especially interesting, because the unconditional distributions and regressions without controls (see Appendix A) show positive and null selection on these traits, but when compared to similar individuals otherwise (as in Figure 4) the selection is strongly negative. Our findings are robust across different specifications and additional controls (e.g. education and municipality FEs, see. Appendix A).

To make a comparison to self-employed, we run a separate multivariate regression on the

⁴The interpretation of the coefficients on the standardized cognitive skill scores and personality measures: percentage point change in the probability of becoming a founder associated with a standard deviation increase in a trait conditional on other traits. Speeding fines is a binary measure of any fines.

Standardized personality measures by status

Founder with 33% share

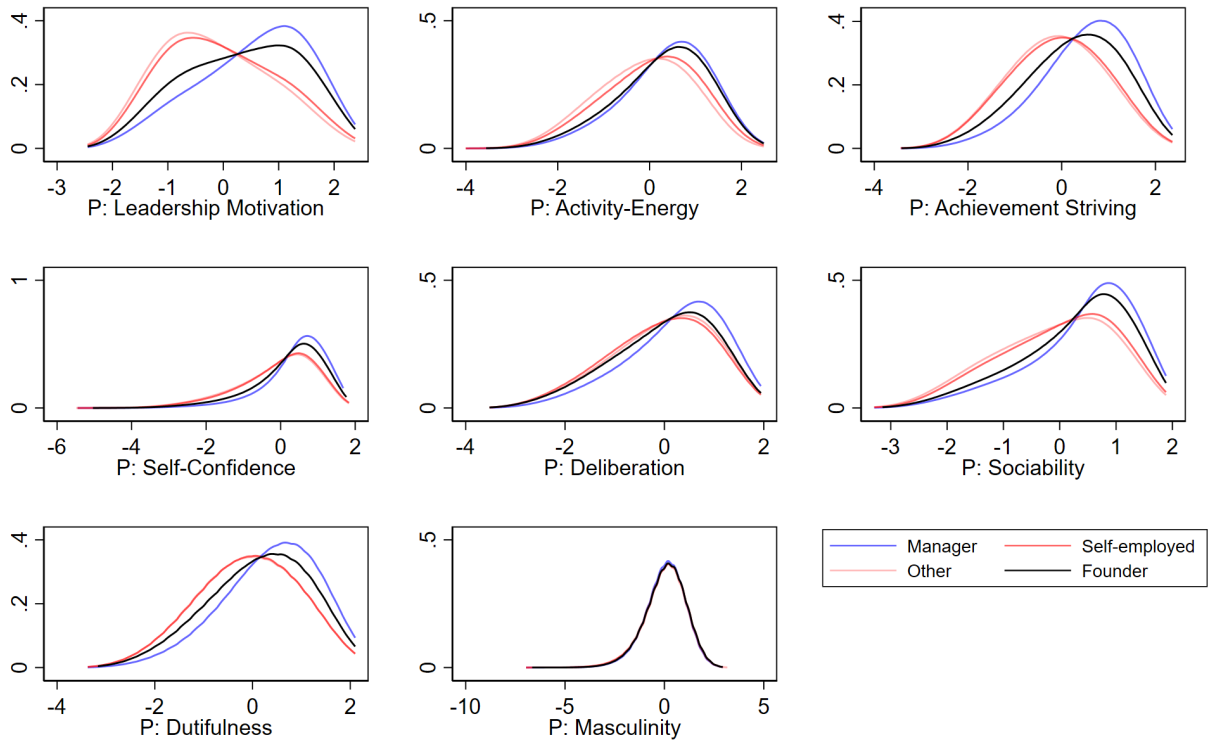


Figure 2: Distributions of personality traits

Standardized personality measures by status

Founder with 33% share



Figure 3: Distributions of factorized personality traits

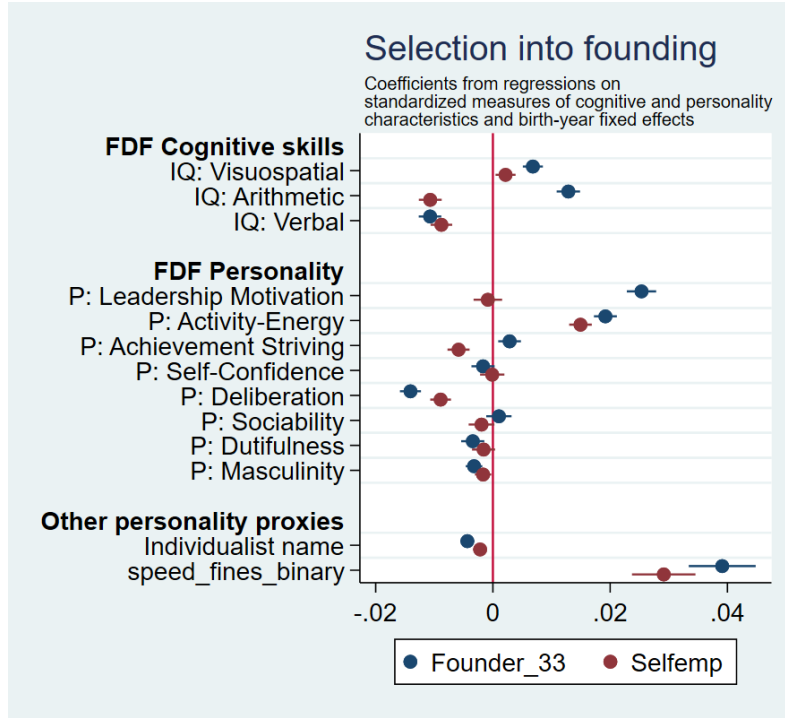


Figure 4: Coefficients from regression of self-selection into entrepreneurship and self-employment on personal characteristics

same sample but predicting the self-employed status. The results show rather similar conditional selection patterns, but self-employed score significantly lower on arithmetic skills and leadership motivation. Our results confirms the existing literature showing that entrepreneurs are positively selected and self-employed workers are negatively selected on highly remunerated human capital (Rubinstein and Levine 2020; Ng and Stuart 2016). Our findings are also roughly in line with Uusitalo (2001) using similar data, while their definition of the outcome variable does not make a clear distinction between growth-oriented and self-employed entrepreneurs, which means their findings are not directly comparable to ours. Notably, according to our results both groups show a lower-than-average values of verbal intelligence and deliberation, suggesting that these traits do not determine self-selection into founding a business of any kind, if not negatively so.

Figure 5 shows a similar pattern for the model with reduced dimensions of cognitive and personality traits. Founders are positively selected on general cognitive skills, extroversion and risk taking. On the other hand, having high conscientiousness or individualism predicts a lower probability of founding a joint-stock company. For the self-employed is qualitatively similar apart from the cognitive skill score on which they are negatively selected.

We also compare founders and managers by running a multivariate regression predicting founder status on a sample of founders and external managers (who have been managers in the same pool of companies founded between 2007-2019) only. The results are illustrated in Figure 6, which confirm that even controlling for other traits, founders score significantly worse on

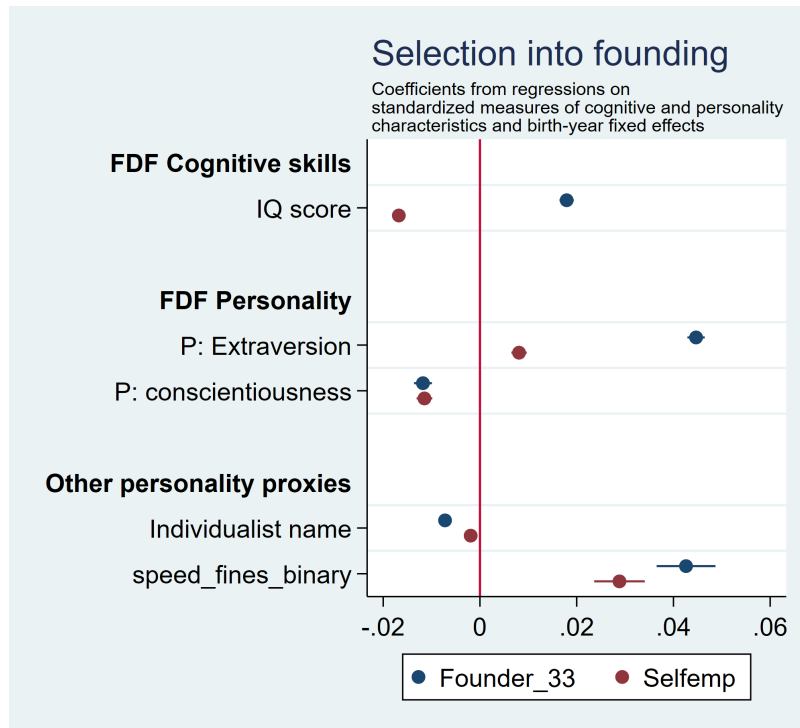


Figure 5: Coefficients from regression of self-selection into entrepreneurship and self-employment on personal characteristics: Reduced dimensionality

most traits except for having more energy and taste for risk. Again, these descriptive patterns are suggestive evidence for the notion that typical founders might not be most suitable for managing the company (Bennett et al., 2016).

4.3 Event-study with inheritance shock

Next, we attempt to provide more causal evidence on self-selection by studying how cognitive and personality traits determine individual responses to a shock that could prompt founding, an easing of financial constraints. Receiving additional funds through inheritance can serve as a catalyst for individuals to embark on the path of entrepreneurship and establish their own firm. Access to new financial resources can alleviate the financial barriers that impede the creation of a new business venture. The extra capital can help with handling startup costs, investing in necessary infrastructure, and navigating initial operational expenses. Furthermore, the inheritance windfall can provide a financial safety net, allowing individuals to take calculated risks and pursue innovative ideas.

Selection into entrepreneurship in general and selection as a response to an unexpected improvement in financial resources are distinct and it is possible that an inheritance windfall can change who is selected. While some individuals who were already inclined towards entrepreneurship may seize the opportunity and use the financial boost to realize their entrepreneurial ambitions, it can also attract individuals who may not have initially considered

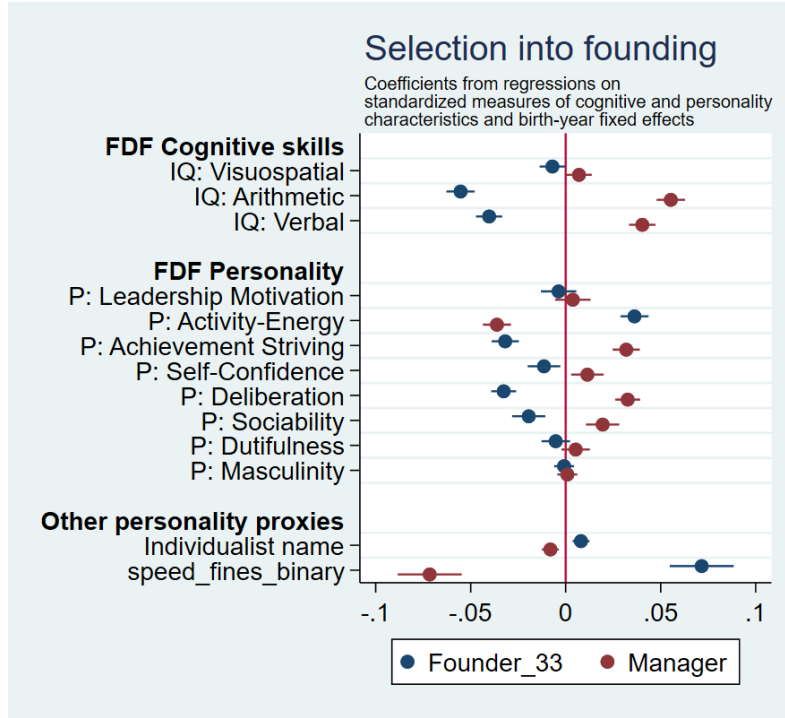


Figure 6: Coefficients from regression of self-selection into entrepreneurship on personal characteristics on a sample of founders and managers

entrepreneurship due to financial risks. The injection of extra capital could particularly affect individuals with low risk tolerance, previously hesitant to take the entrepreneurial leap.

We explore whether the same people who are generally more likely to have selected into entrepreneurship are also disproportionately affected by factors that promote business creation. The reaction to an inheritance shock can vary depending on an individual's cognitive and personality traits, although the heterogeneity in responses is unclear a priori. For instance, individuals high in conscientiousness may exhibit careful and deliberate financial planning and thus be more inhibited by financial risks in the absence of inherited liquidity. They might therefore react more strongly to an inheritance shock. On the other hand, individuals high in extroversion may be more inclined to take risks and seize immediate opportunities, potentially using the inheritance as a springboard to launch a business venture without extensive planning. Additionally, a certain level of intelligence might be necessary to identify and take advantage of the opportunities for entrepreneurship.

We conduct an event-study analysis using the timing of received inheritances as an easing of financial constraints. Despite the fact that, on average, receiving an inheritance does not increase the likelihood of founding a company in a statistically significant way (see Appendix [A](#)), we explore the heterogeneity in the responses across traits. Focusing on inheritances of at least 50,000 euros and on the reduced-dimension set of cognitive and personality traits, we

estimate

$$\begin{aligned}
Founding_{it} = & \alpha + \sum_{k=-2}^{-3} \kappa_k * Treat_{ik} + \sum_{k=0}^6 \kappa_k * Treat_{ik} + \\
& \sum_{k=-2}^{-3} \beta_k * Treat_{ik} * CognScore_i + \sum_{k=0}^6 \beta_k * Treat_{ik} * CognScore_i + \\
& \sum_{k=-2}^{-3} \delta_k * Treat_{ik} * Extrov_i + \sum_{k=0}^6 \delta_k * Treat_{ik} * Extrov_i + \\
& \sum_{k=-2}^{-3} \gamma_k * Treat_{ik} * Conscient_i + \sum_{k=0}^6 \gamma_k * Treat_{ik} * Conscient_i + \\
& \pi_i + \zeta_t + \theta_b + \xi_{it}
\end{aligned} \tag{2}$$

where i denotes individuals, t years, and b years of birth. π_i , ζ_t , θ_b capture individual, year and year-of-birth fixed effects respectively. $Treat_{ik}$ equals 1 if the observation's periods relative to the individual i 's first treated period is the same value as k ; 0 otherwise. $CognScore_i$, $Extrov_i$ and $Conscient_i$ are dummies for the individual placing in the top quartile of a ranking based on each trait.

Figure 7 shows how the response to an inheritance shock depends on having a top-quartile cognitive score, extroversion, or conscientiousness. Individuals with high extroversion, and to a lesser extent high cognitive skills, are more likely to found a company in the years after receiving a sizable inheritance. While these results should be interpreted with caution due to the visible pre-trends for the two measures, both the slope over time and the observable upward jump in the likelihood of founding directly after inheritance support the idea that reducing financial constraints affects people differentially depending on their cognitive and personality traits, and that extroverted people are most likely to be pushed into entrepreneurship in consequence.

This selection pattern matches the one observed in the purely descriptive analysis above. The traits that predict self-selection in the whole sample are also associated with stronger responses to an inheritance shock. The results can provide valuable insights for policy as well. For government wanting to promote entrepreneurship, it is crucial to be able to predict which individuals will be affected by a policy. If easing financial constraints pushes people to start business who are temperamentally unsuited for it, such a policy program might be counterproductive and lead to the creation of firms with low chances of success.

Event-study of founding and inheritance

Full specification

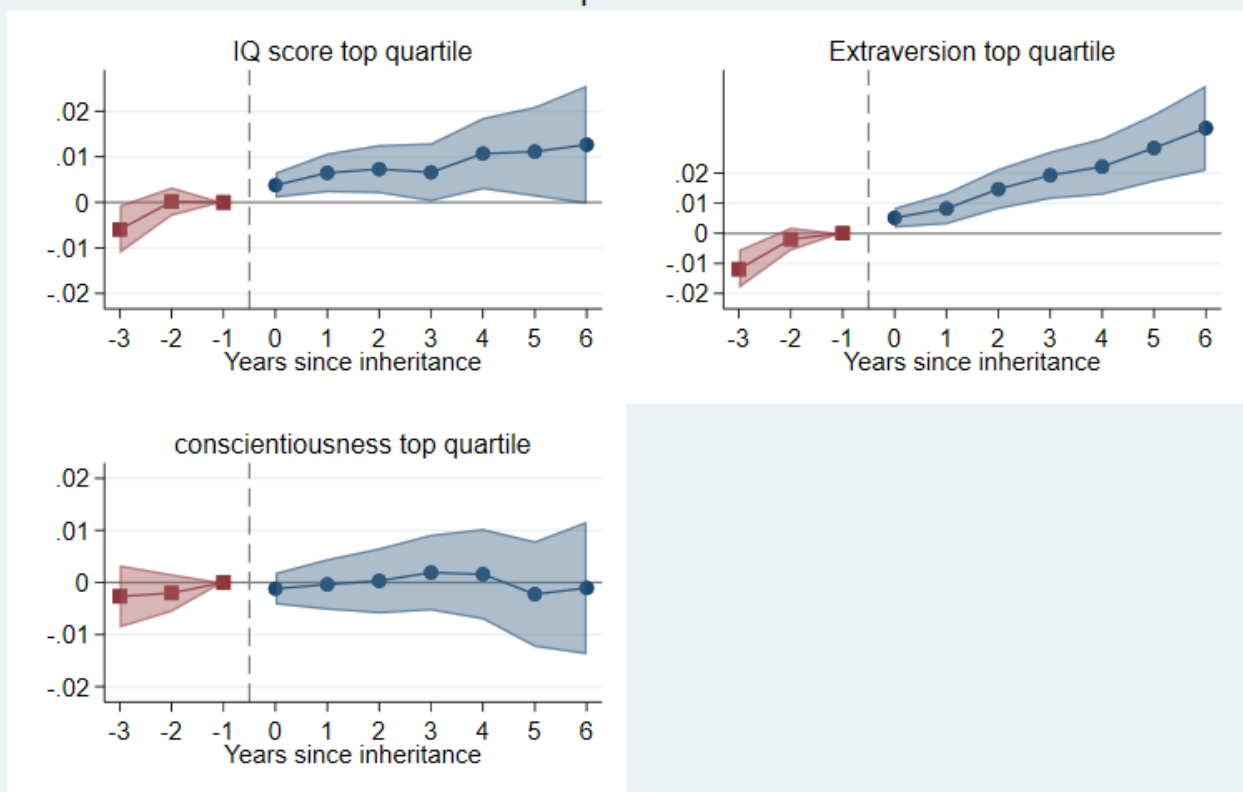


Figure 7: Event-study: Heterogeneous responses to inheritance shock by traits

4.4 Founder traits and firm outcomes

Next, we focus on the relationship between founders' traits and firm performance; our focus is on human resources policy and outcomes. Founders exert a large influence over the early phases of their ventures, and their traits could potentially explain hiring patterns, which consequently are considered to have a major role in further firm performance. The analysis is restricted to founders for whom there is personality data available and whose companies are founded during 2007-2019, giving us a sample of roughly 50,000 companies. We estimate OLS regressions similar to equation [1](#), but with the reduced-dimension set of traits on the right-hand side and firm-level outcomes on the left-hand side. Figures [8](#), [9](#), [10](#) and [11](#) illustrate the results from cross-sectional multivariate regressions of founder characteristics on the hiring of salaried employees, the mean education years of personnel, the cognitive skill scores of the employed and hiring of external managers during the first five years of the firms' existence.

For the binary measure of employing any salaried employees we are unable to detect statistically significant associations with the five traits included in the analysis. Nonetheless, a few interesting observations stand out in the other three analyses that might help explain why some entrepreneurs do better than others. Firstly, high founder cognitive scores on the hand are associated with successful human resources management, as they predict the hiring of more educated employees, of more intelligent employees and of external managers. Secondly, founder extroversion and individualism predict the hiring of intelligent employees and the bringing in of external managers. Founder conscientiousness on the other hand predicts the hiring of educated employees. One possible interpretation of these results is that extroverted founders evaluate potential employees based on direct interaction and are thus able to select the most intelligent applicants, whereas conscientious founders care more about resumes and hire based on the applicants' educational background. Whether one strategy is better or worse than the other is still an open question.

In future research, we will seek to establish how the differences in hiring patterns drive the financial success of the companies. What we have established here is that founders with typical traits tend to manage their companies' human resources differently compared to those with less common traits. While the patterns displayed here are only descriptive, subject to possible endogeneity issues and do not yet reveal the underlying mechanisms, they provide preliminary guidance as to why some founders might not make successful managers.

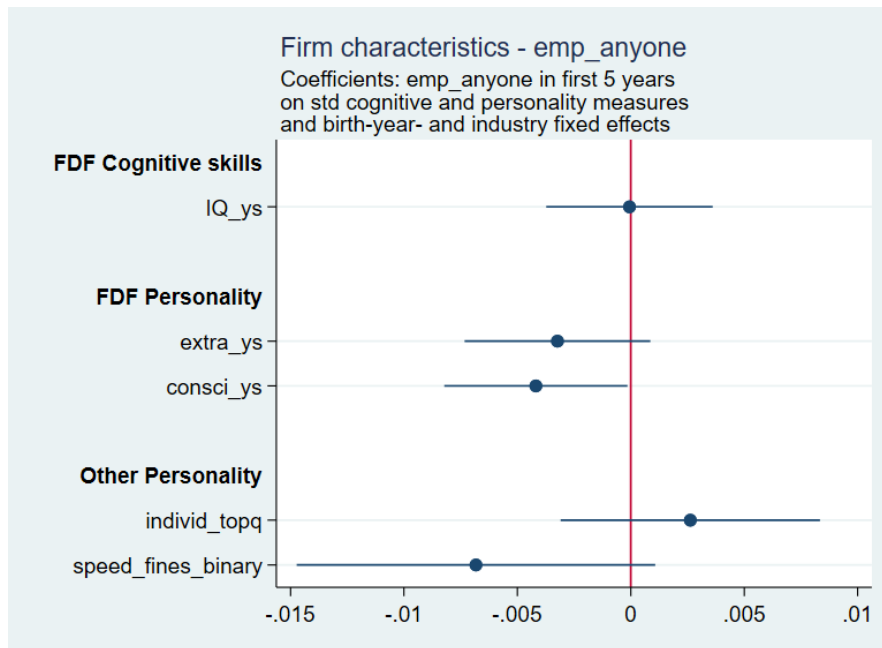


Figure 8: Coefficients from OLS regression of the founder characteristics on the number of personnel hired.

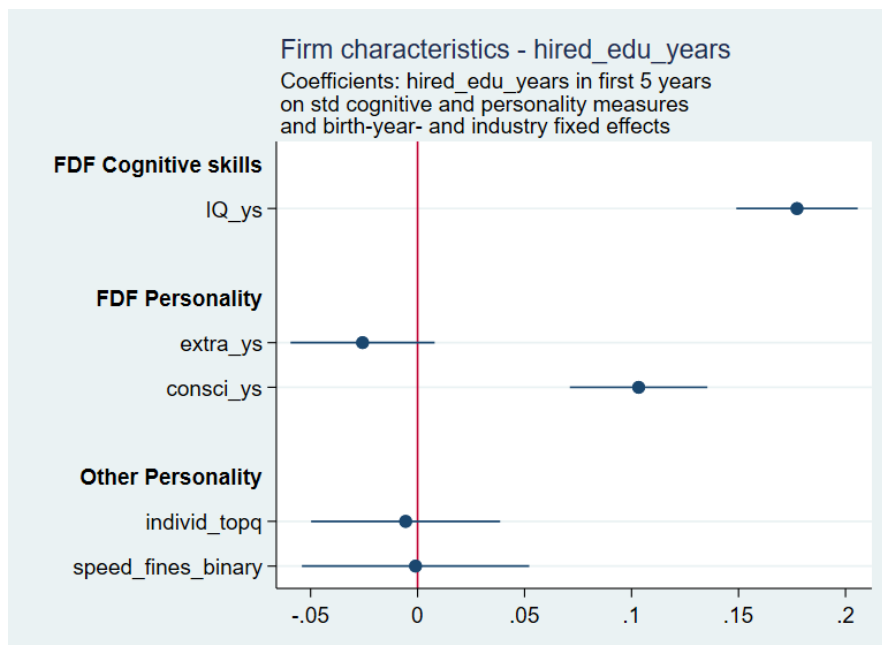


Figure 9: Coefficients from OLS regression of the founder characteristics on the average years of education of hired personnel.

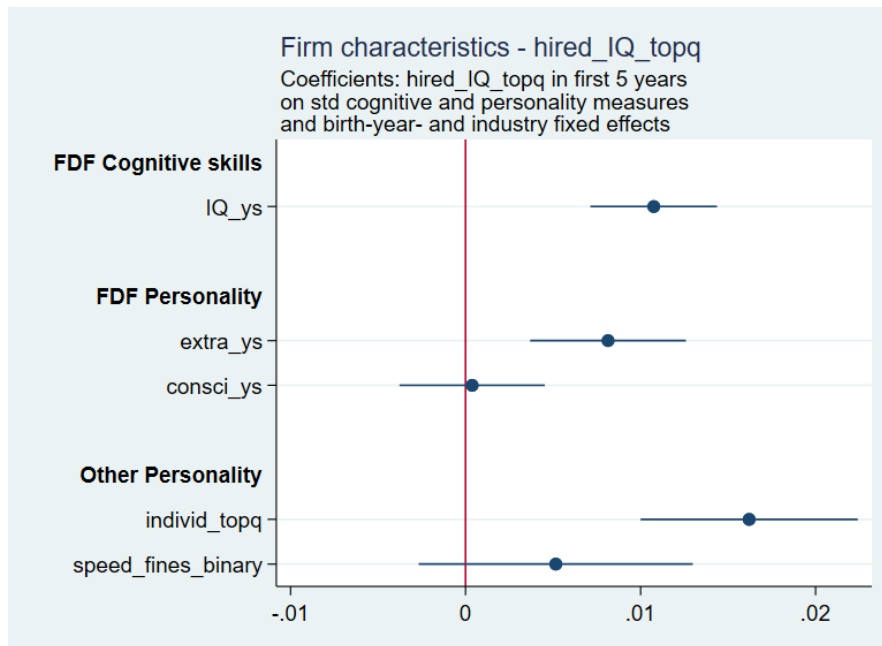


Figure 10: Coefficients from OLS regression of the founder characteristics on whether firm hires employees with high cognitive skills.

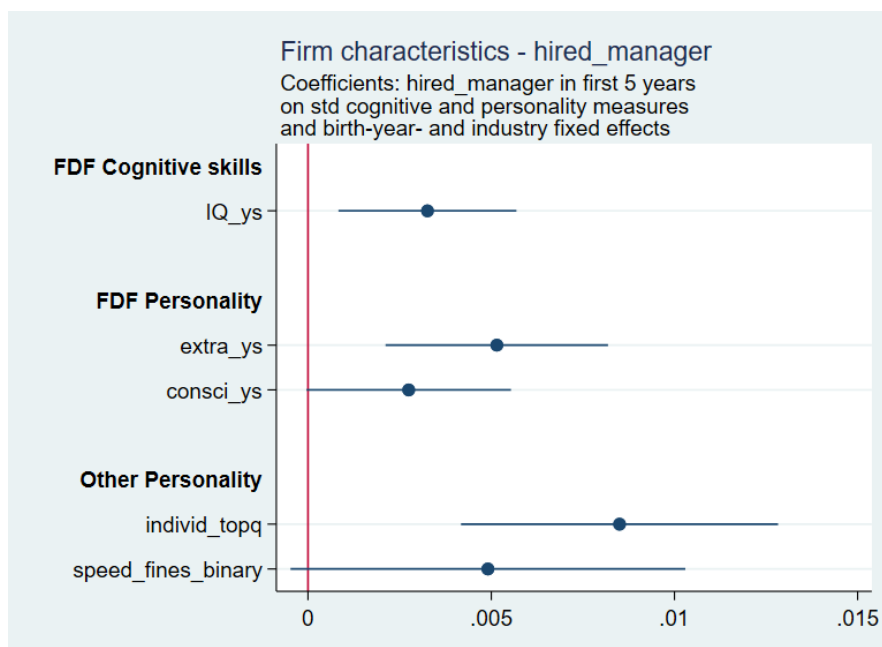


Figure 11: Coefficients from OLS regression of the founder characteristics on whether firm hires external manager.

4.4.1 Causal estimation with instrumental variables

While the OLS results above are suggestive, there is a severe risk of potential confounding factors and endogeneity issues. Leaders with specific characteristics may self-select into certain types of organizations, making it challenging to disentangle causal effects. We tackle this problem with a two-stage least squares analysis where we instrument the cognitive and personality traits among firm leadership with deaths among the team of founders.

In this context, deaths within a company’s leadership team can plausibly be considered exogenous events as they are beyond the control of individuals or organizations and often occur unexpectedly for working age adults. Studying this variation provides insights into the causal impact of leader characteristics on HR policy. As such, they provide a quasi-natural experiment. Studying this variation provides insights into the causal impact of leader characteristics on HR policy.

In a two-stage least squares analysis, we instrument for owner extroversion and conscientiousness and evaluate their effects on HR policy while holding owner intelligence, time-invariant firm characteristics and firm age constant. We estimate the following regression:

$$FirmOutcome_{fg} = \chi + \iota * Cognitive_{fg} + \eta * \widehat{Extroversion}_{fg} + \rho * \widehat{Conscientiousness}_{fg} + \psi_f + \nu_g + \mu_{fg} \quad (3)$$

where f denotes firm and g years since firm’s founding, i.e. firm-years. ψ_f and ν_g captures firm and firm-year fixed effects respectively. $\widehat{Extroversion}_{fg}$ and $\widehat{Conscientiousness}_{fg}$ are the instrumented versions of owner extroversion and conscientiousness.

The results of the estimation are presented in Table [1](#). The first two panels from top down illustrate the first stage results. In the first of these we can see that the extroversion of the remaining owners is significantly predicted by the deaths of fellow owners with top quartile extroversion or conscientiousness. Depending on the ultimate outcome variable the F-values vary from 4 to 41, just about sufficient for reasonable 2SLS estimation. In the second panel we see an analogous set of results for predicting owner conscientiousness. The F-values now vary between 1 and a hearty 63430. Based on the F-values, we should find the second stage results most credible for columns 1 and 4 as both instrumented variables are formed relatively precisely.

The third panel presents the second stage results. When we consider column 1, we find that neither owner extroversion or conscientiousness has a significant causal effect on dummy variable for hiring salaried employees in the observable years since the company’s founding. The second column suggests that high extroversion leads to the hiring of less educated employees. The results in column 3 point to owner conscientiousness causing the firm to hire more intelligent people. We would be cautious in reading too much into these two findings due to the low F-statistics values in the first stage regressions. Column 4 is concerned with the effect on hiring

an external manager. Owner conscientiousness increases this likelihood by around 9 percentage points.

To the extent that the IV estimates should be relied upon, there are some interesting reversals compared to the results from previous section. Conscientiousness is now found to be a significant driver of employing intelligent people. The presence of conscientious owners also make it more likely that the firm brings in help from external managers. This is perhaps not surprising once we consider that the measure incorporates aspects of dutifulness, the tendency to follow rules, dot the i's and cross the t's. Extroversion comes across as having less of an effect on HR policy than the OLS results suggested, only the negative effect on the employee level of education survives the causal analysis.

Table 1: 2SLS analysis

HR outcome	(1)	(2)	(3)	(4)
	Any hire	Education, hired	High IQ hire	Manager hire
First stage: Owner extroversion				
Owner death X extroversion	-0.763*** (0.0751)	-0.925*** (0.161)	-0.772*** (0.00376)	-0.763*** (0.0751)
Owner death X conscientiousness	0.267*** (0.102)	0.360 (0.261)	0.00448 (0.00410)	0.267*** (0.102)
F-Stat	40.942	11.900	3.999	40.942
First stage: Owner conscientiousness				
Owner death X extroversion	-0.0630 (0.0569)	0.0167 (0.0824)	0.00685* (0.00359)	-0.0630 (0.0569)
Owner death X conscientiousness	-0.388*** (0.0977)	-0.306 (0.194)	-0.992*** (0.00371)	-0.388*** (0.0977)
F-Stat	9.628	0.9334	63430.614	9.628
N	294,263	63,231	16,872	294,263
Second stage results				
High extroversion	-0.0316 (0.0811)	-0.729** (0.318)	0.0915 (0.391)	0.0223 (0.0177)
High conscientiousness	-0.148 (0.121)	0.0862 (1.082)	0.0481*** (0.0128)	0.0892** (0.0353)
Firm FE	Yes	Yes	Yes	Yes
Firm-year FE	Yes	Yes	Yes	Yes
N (firm X year)	294,263	63,231	16,872	294,263
Y mean	0.237	12.64	0.249	0.0514

Standard errors in parentheses. Clustering at firm level.

Instruments are dummies indicating the deaths of owners of different personalities; whether they have top quartile extroversion or conscientiousness. We consider the effect of a death on all the following years.

Owner cognitive scores are controlled for in first stage regressions.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Discussion

In this paper we provide novel empirical evidence on how cognitive and personality traits are related to entrepreneurial activity by using Finnish administrative data allowing us to observe financial, professional, and human capital information in the entire population. In particular, we exploit the unique availability of both personality and cognitive skill test scores for all men conscripted into mandatory military service.

We find that founder-entrepreneurs are selected on high extroversion, intelligence and risk tolerance, but have lower than average conscientiousness, which our results suggest might hinder them in human resource management. Our analysis reveals potential conflicts between traits that predict entry into entrepreneurship and those predict subsequent firm success, which speaks for why founders might not be the best managers of their companies. Besides documenting how cognitive and personality traits relate to entry into entrepreneurship and to the management of the new business, we isolate sources of exogenous variation to validate our findings and uncover some of the underlying mechanisms.

First, we explore how the response to a financial shock of receiving an inheritance, which helps ameliorate some the individual-level constraints in starting a business, depends on the founders' characteristics. By using this within-individual variation, we are able to validate our finding that entrepreneurial self-selection is driven by extroversion. Second, we exploit turnover among founder-owners caused by deaths to show that owner characteristics have a causal effect on the company's HR policy.

In future research, we will consider the position of CEO explicitly and study turnovers from a founder-CEO to a external CEO. More specifically, we will examine whether firms that were initially managed by their founder and experienced a change in CEOs (e.g. due to a death of the founder) saw an improvement in their management of human resources, and whether this is due to the particular cognitive or personality characteristics of the new CEO. We will also explore the broader performance of the company its dependence on owner characteristics.

Our results help to guide further theorizing on the under-explored links between entrepreneurs' cognitive skills and personality, self-selection and company performance, but also be informative on the effectiveness and channels through which policies can enhance entrepreneurial business formation.

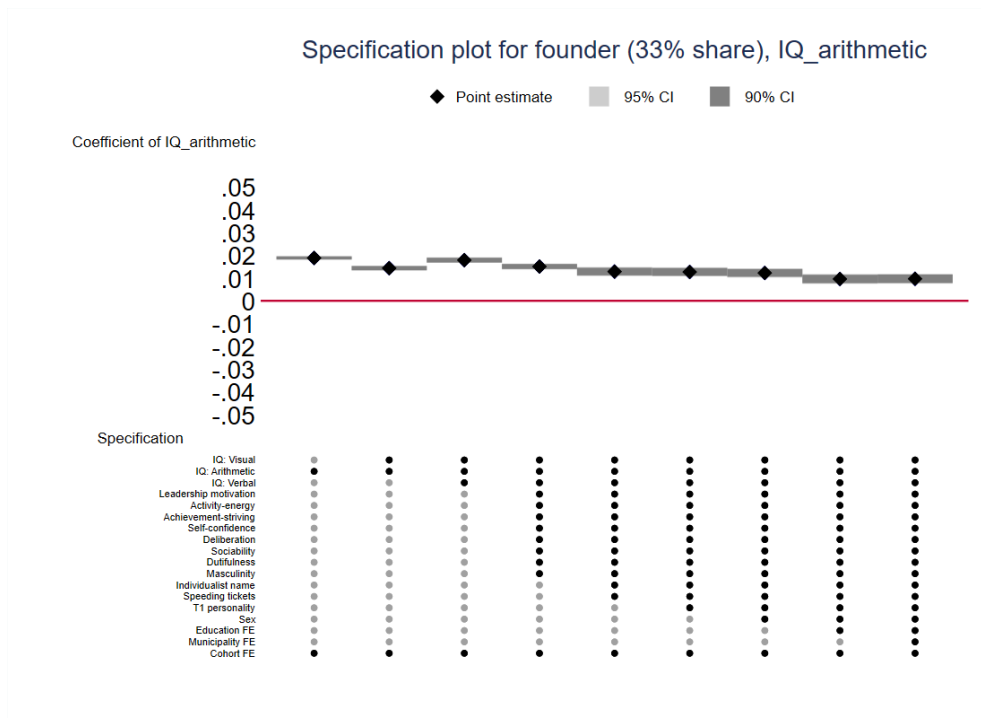
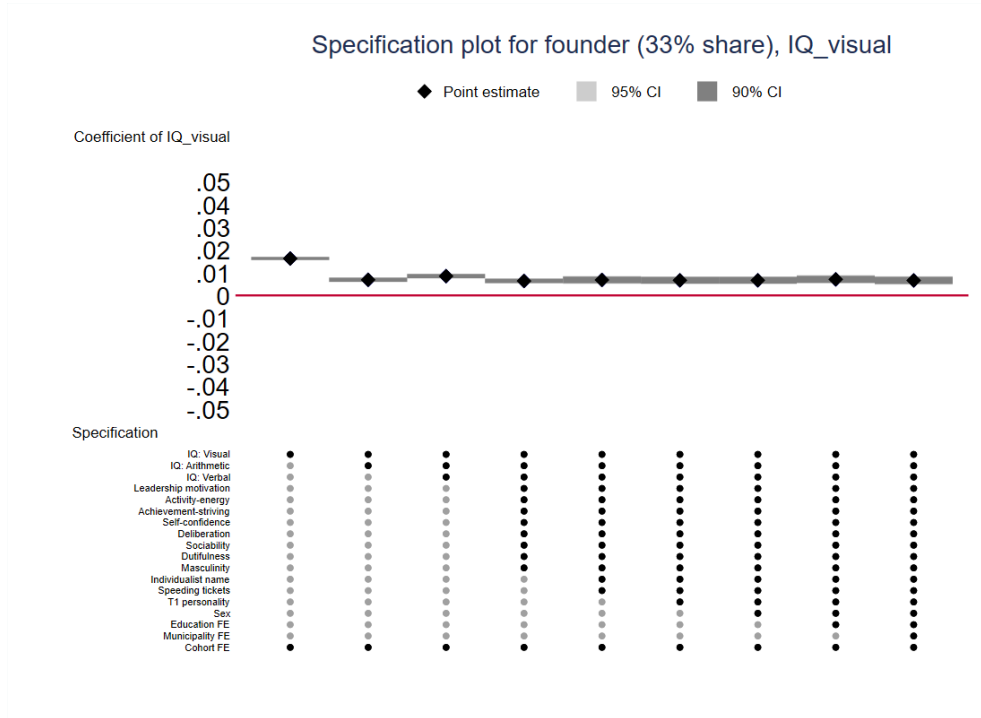
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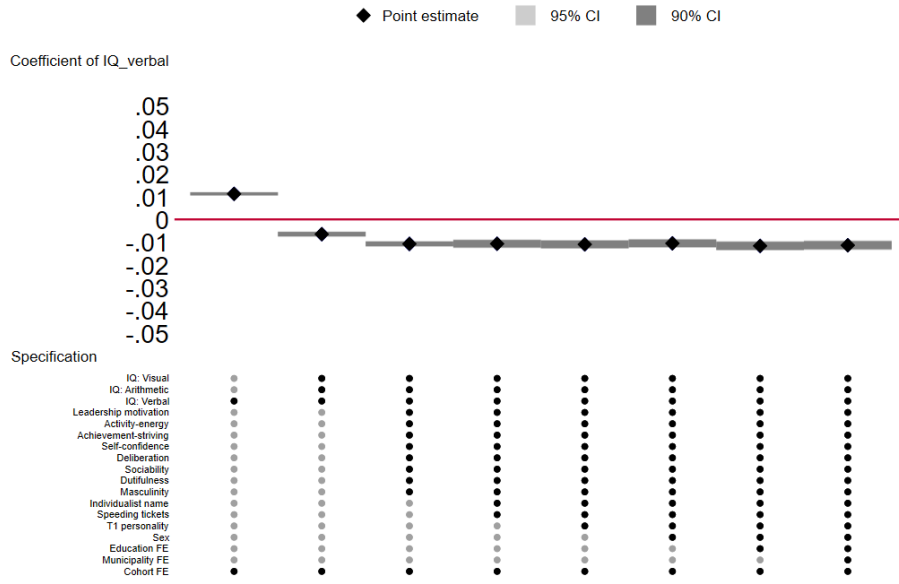
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Appendix

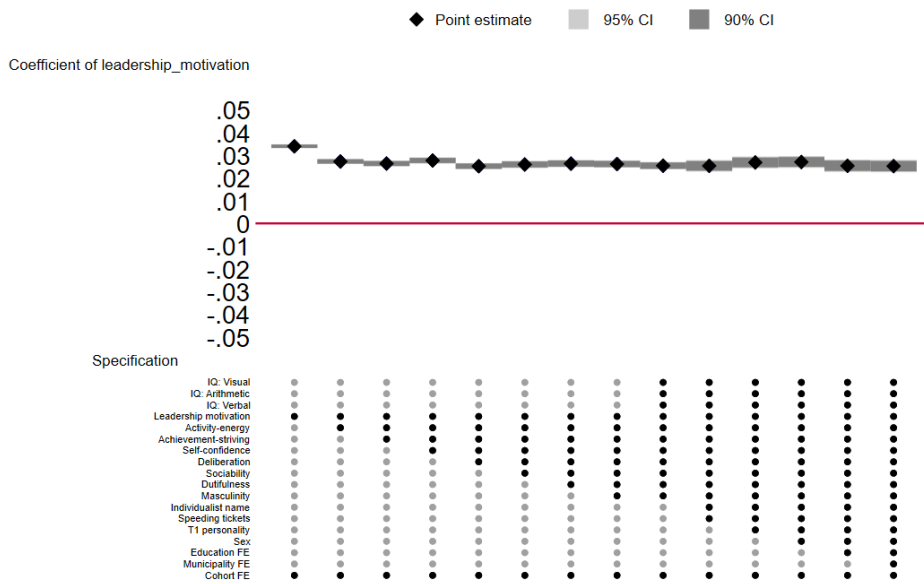
A Robustness



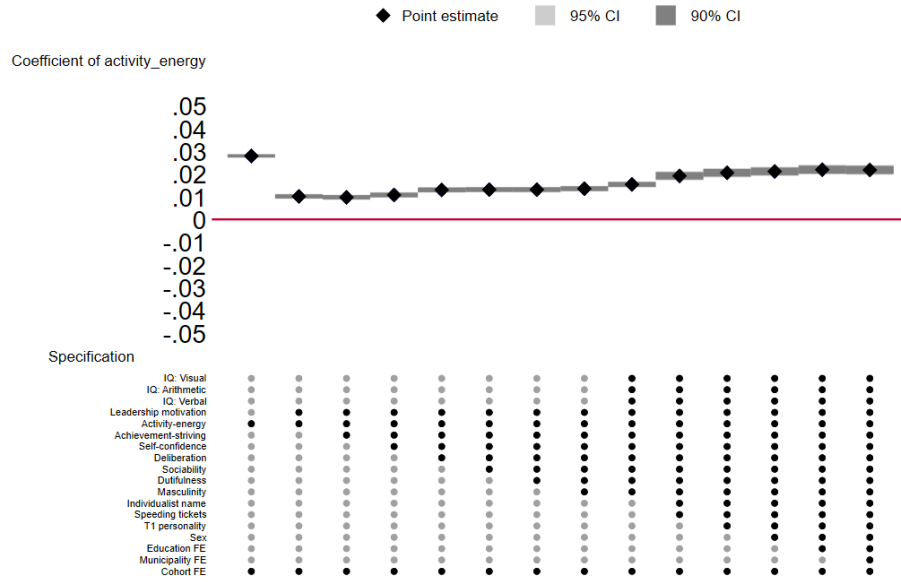
Specification plot for founder (33% share), IQ_verbal



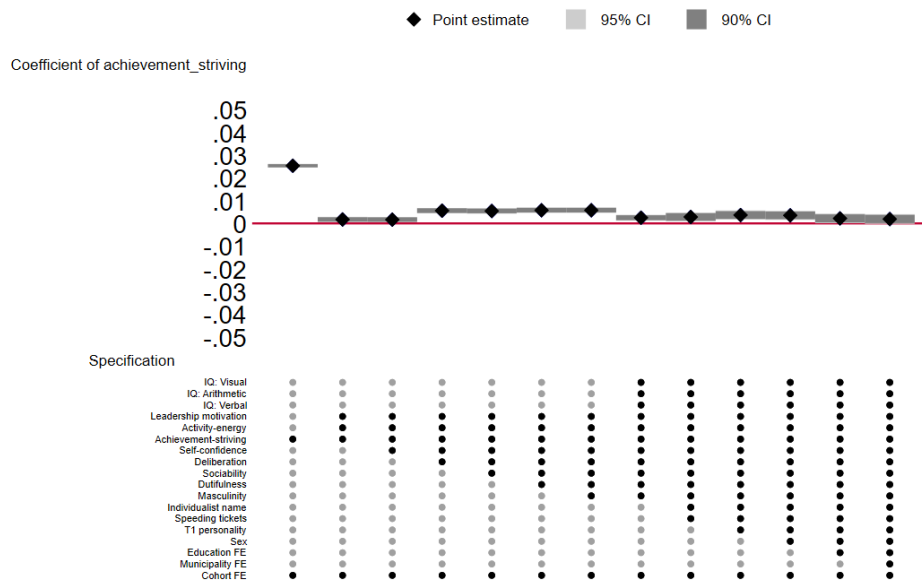
Specification plot for founder (33% share), leadership_motivation



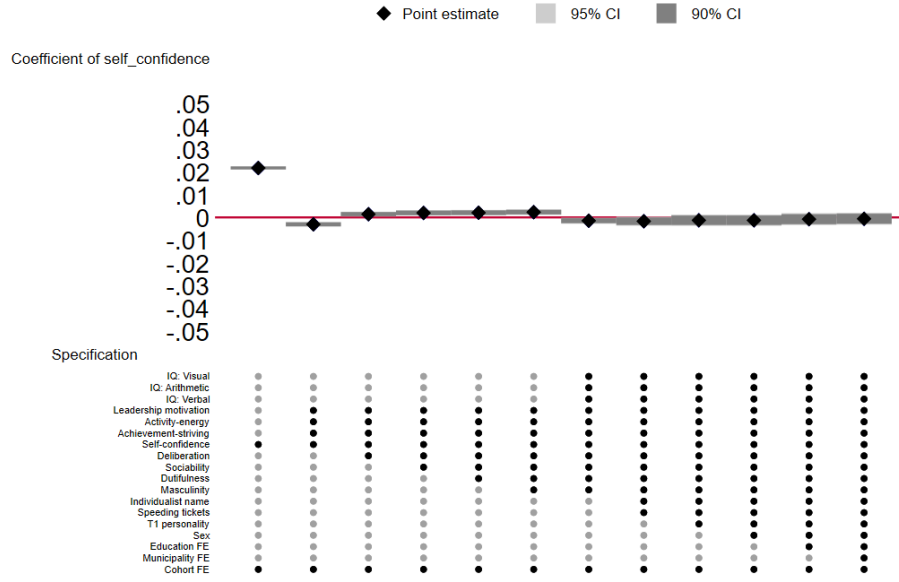
Specification plot for founder (33% share), activity_energy



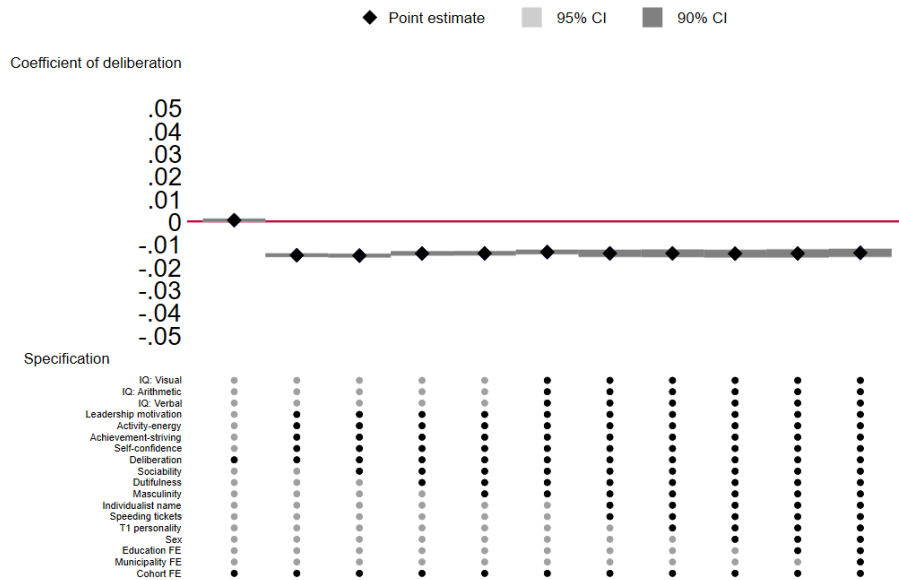
Specification plot for founder (33% share), achievement_striving



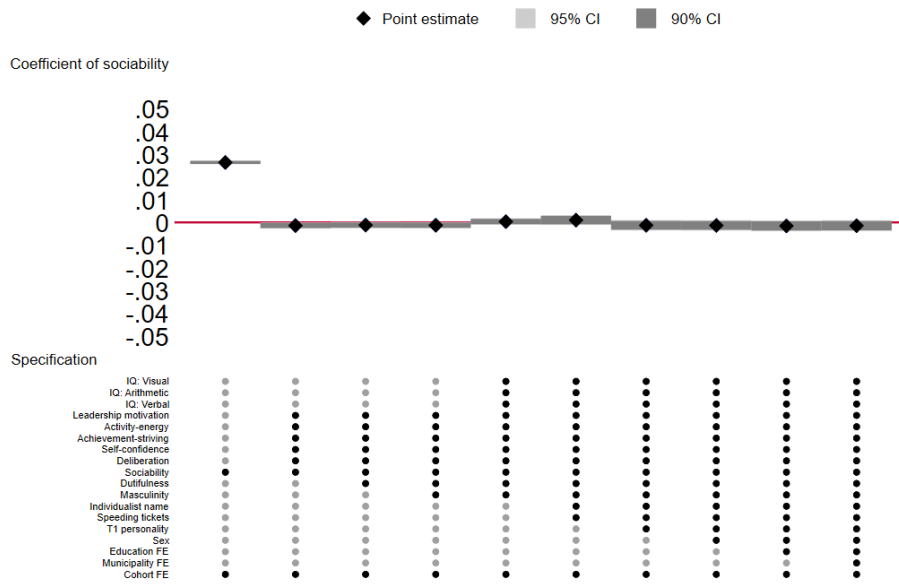
Specification plot for founder (33% share), self_confidence



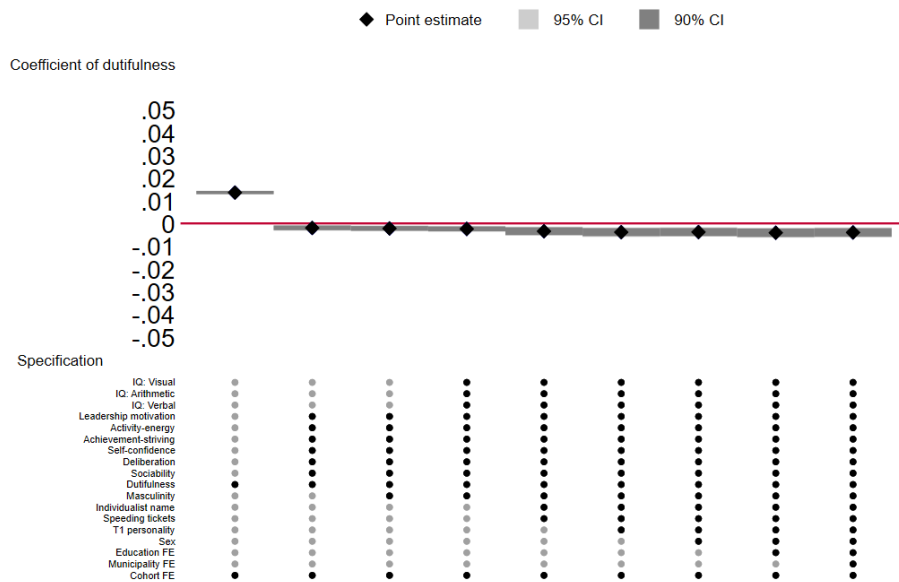
Specification plot for founder (33% share), deliberation



Specification plot for founder (33% share), sociability



Specification plot for founder (33% share), dutifulness



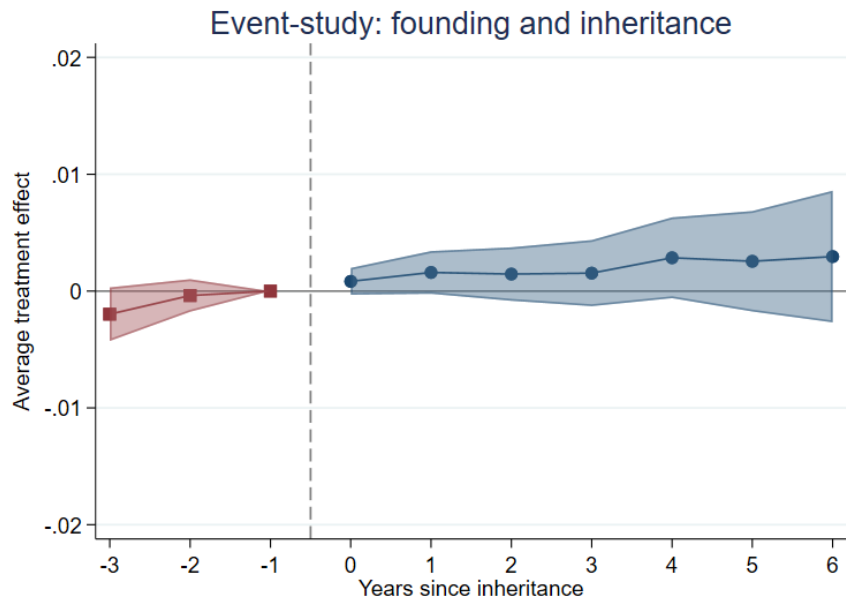
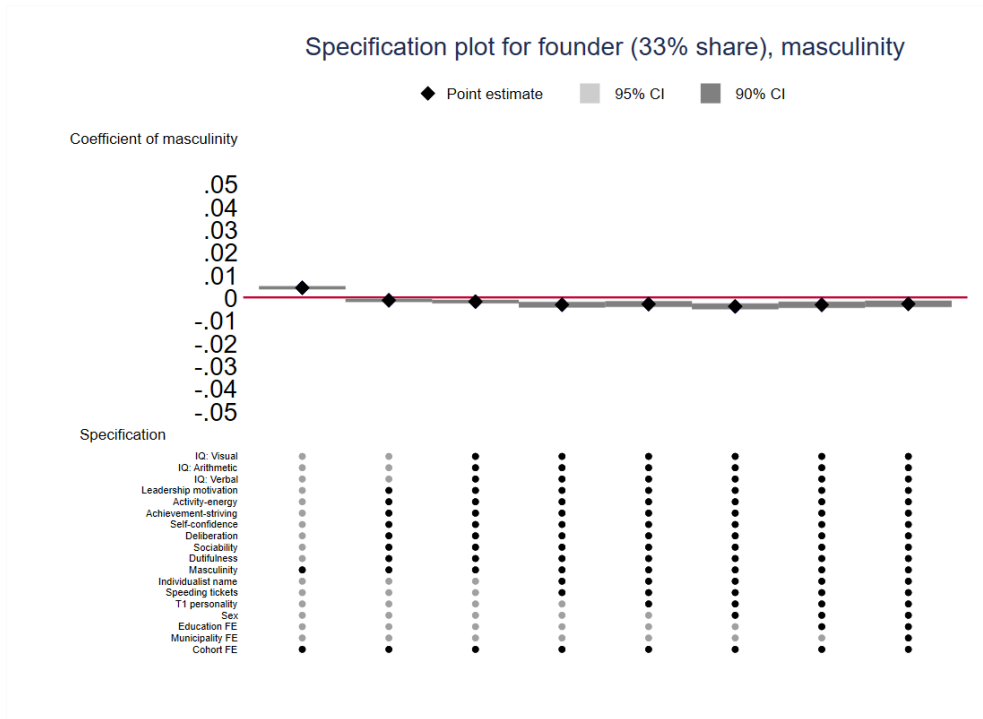


Figure 12: Event study: average effect of receiving an inheritance on founding a firm.