

# THREE ESSAYS ON HARD SKILLS, SOFT SKILLS, RISK ATTITUDES AND ENTREPRENEURSHIP

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## Summary

This thesis studies the effects of hard skills and soft skills and risk attitudes on the likelihood of starting a company in the US. Hard skills are those skills that can be learned and trained. They are cognitive in nature. For example, a course in accounting will strengthen this hard skill in an individual. Soft skills are all those characteristics of the individual's character. They have to do with personality traits. Creativity, emotional stability or extraversion are some examples of soft skills. We use the National Longitudinal Study of Youth 1997 cohort (NLSY97). This is a panel data, which interviewed around 9000 individuals in 1997 when they were between 12 and 17. NLSY provides a unique set of variables, which allow us to directly measure the cognitive skills of individuals in the panel through Armed Service Vocational Aptitude Battery test (ASVAB). The soft skills are measured through the big five personality traits: openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. We work with the first 17 waves of the NLSY97 survey.

The first chapter of the thesis extracts the pure effect of the big five personality traits by interacting them with the three terciles of ASVAB. This way, we are able to estimate the effects of personality traits across the distribution of cognitive ability. Results show that there is not a universal personality traits that matter across the cognitive ability distribution. Openness to experience that is to be intellectually curious and interested in new experiences significantly increases the probability of starting a company at the bottom and top of the distribution. Conscientiousness that is to be self-disciplined also increases the probability, but for those at the middle of the distribution .

The second chapter elicits the differences between different terciles of cognitive capacity and the risk attitudes towards starting a company. We split risk attitudes and personality traits to observe if there are significant differences across the cognitive skills distribution for each of them separately. Results demonstrate that risk loving in general and work are the key domains that affect the probability of starting a new venture.

Finally, the third chapter provides a more comprehensive view of the probability to start a company in the NLSY97 sample. We continue including the interaction with the three terciles of cognitive ability. However, we also distinguish between novel entrepreneurs

who just created their first firm; serial entrepreneurs, who have previously created other firms and now create another one while no longer running any of the previous; and portfolio entrepreneurs who have previously started other ventures and are now creating another one while still running the previous firms. All these categories we compare to employees in a multinomial logit model for panel data. Results of this chapter confirm that openness to experience increases the likelihood of starting a firm for the first time, but in this case only for individuals in the lowest tercile. Agreeableness increases the odds in the lower and middle terciles of cognitive ability. For serial entrepreneurs, openness to experience matters only for higher terciles of cognitive ability. Extraversion also increases the likelihood for the individuals in the first tercile of cognitive ability. Moreover, for portfolio entrepreneurs, self-discipline (conscientiousness) is important for the lowest tercile, as well as openness to experience. These results indicate that it is complex to speak of universal characteristics for entrepreneurship, as there are variations depending on the cognitive level of individuals.

## Resumen

Esta tesis estudia los efectos de las habilidades duras y blandas y de las actitudes de riesgo en la probabilidad de crear una empresa en Estados Unidos. Las habilidades duras son aquellas que se pueden aprender y entrenar. Son de naturaleza cognitiva. Por ejemplo, un curso de contabilidad reforzará esta habilidad dura en un individuo. Las habilidades blandas son todas aquellas características del carácter del individuo. Tienen que ver con los rasgos de la personalidad. La creatividad, la estabilidad emocional o la extraversión son algunos ejemplos de habilidades blandas. Utilizamos la cohorte del National Longitudinal Study of Youth 1997 (NLSY97). Se trata de un panel de datos que entrevistó a unos 9.000 individuos en 1997, cuando tenían entre 12 y 17 años. El NLSY proporciona un conjunto único de variables, que nos permiten medir directamente las habilidades cognitivas de los individuos del panel a través del test de la Batería de Aptitud Vocacional del Servicio Armado (ASVAB). Las habilidades blandas se miden a través de los cinco grandes rasgos de personalidad: apertura a la experiencia, concienciación, extraversión, agradabilidad y neuroticismo. Trabajamos con las 17 primeras oleadas de la encuesta NLSY97.

El primer capítulo de la tesis extrae el efecto puro de los cinco grandes rasgos de personalidad al interactuarlos con los tres terciles del ASVAB. De este modo, podemos estimar los efectos de los rasgos de personalidad en toda la distribución de la capacidad cognitiva. Los resultados muestran que no hay un rasgo de personalidad universal que importe en toda la distribución de la capacidad cognitiva. La apertura a la experiencia, es decir, la curiosidad intelectual y el interés por las nuevas experiencias, aumenta significativamente la probabilidad de crear una empresa en la parte inferior y superior de la distribución. La concienciación, es decir, la autodisciplina, también aumenta la probabilidad, pero para los que se encuentran en la mitad de la distribución.

En el segundo capítulo, se muestran las diferencias entre los distintos terciles de capacidad cognitiva y las actitudes de riesgo hacia la creación de una empresa. Dividimos las actitudes de riesgo y los rasgos de personalidad para observar si existen diferencias significativas en la distribución de capacidades cognitivas para cada uno de ellos por separado. Los resultados demuestran que el amor al riesgo en general y el trabajo son los dominios clave que afectan a la probabilidad de iniciar una nueva empresa.



Por último, el tercer capítulo ofrece una visión más completa de la probabilidad de crear una empresa en la muestra de la NLSY97. Seguimos incluyendo la interacción con los tres terciles de capacidad cognitiva. Sin embargo, también distinguimos entre emprendedores noveles que acaban de crear su primera empresa; emprendedores en serie, que han creado previamente otras empresas y ahora crean otra mientras ya no dirigen ninguna de las anteriores; y emprendedores de cartera que han iniciado previamente otras empresas y ahora están creando otra mientras siguen dirigiendo las anteriores. Todas estas categorías las comparamos con los empleados en un modelo logit multinomial para datos de panel. Los resultados de este capítulo confirman que la apertura a la experiencia aumenta la probabilidad de crear una empresa por primera vez, pero en este caso sólo para los individuos del tercil inferior. La amabilidad aumenta las probabilidades en los terciles inferior y medio de la capacidad cognitiva. En el caso de los emprendedores en serie, la apertura a la experiencia sólo es importante para los terciles superiores de capacidad cognitiva. La extraversión también aumenta la probabilidad para los individuos del primer tercil de capacidad cognitiva. Además, en el caso de los emprendedores de cartera, la autodisciplina (concienciación) es importante para el tercil más bajo, así como la apertura a la experiencia. Estos resultados indican que es complejo hablar de características universales para el emprendimiento, ya que existen variaciones según el nivel cognitivo de los individuos.

## Resum

Aquesta tesi estudia els efectes de les habilitats dures i toves i de les actituds de risc en la probabilitat de crear una empresa als Estats Units. Les habilitats dures són aquelles que es poden aprendre i entrenar. Són de naturalesa cognitiva. Per exemple, un curs de comptabilitat reforçarà aquesta habilitat dura en un individu. Les habilitats toves són totes aquelles característiques del caràcter de l'individu. Tenen a veure amb els trets de la personalitat. La creativitat, l'estabilitat emocional o l'extraversió són alguns exemples d'habilitats toves. Utilitzem la cohort del National Longitudinal Study of Youth 1997 (NLSY97). Es tracta d'un panell de dades que va entrevistar uns 9.000 individus el 1997, quan tenien entre 12 i 17 anys. El NLSY proporciona un conjunt únic de variables, que ens permeten mesurar directament les habilitats cognitives dels individus del panell a través del test de la Bateria d'Aptitud Vocacional del Servei Armat (ASVAB). Les habilitats toves es mesuren a través dels cinc grans trets de personalitat: obertura a l'experiència, conscienciació, extraversió, agradabilitat i neuroticisme. Treballem amb les 17 primeres onades de l'enquesta NLSY97.

El primer capítol de la tesi extreu l'efecte pur dels cinc grans trets de personalitat en interactuar-los amb els tres tercils del ASVAB. D'aquesta manera, podem estimar els efectes dels trets de personalitat en tota la distribució de la capacitat cognitiva. Els resultats mostren que no hi ha un tret de personalitat universal que importi en tota la distribució de la capacitat cognitiva. L'obertura a l'experiència, és a dir, la curiositat intel·lectual i l'interès per les noves experiències, augmenta significativament la probabilitat de crear una empresa en la part inferior i superior de la distribució. La conscienciació, és a dir, l'autodisciplina, també augmenta la probabilitat, però per als que es troben en la meitat de la distribució.

En el segon capítol, es mostren les diferències entre els diferents tercils de capacitat cognitiva i les actituds de risc cap a la creació d'una empresa. Dividim les actituds de risc i els trets de personalitat per a observar si existeixen diferències significatives en la distribució de capacitats cognitives per a cadascun d'ells per separat. Els resultats demostren que l'amor al risc en general i el treball són els dominis clau que afecten la probabilitat d'iniciar una nova empresa.

Finalment, el tercer capítol ofereix una visió més completa de la probabilitat de crear una empresa en la mostra de la NLSY97. Continuem incloent la interacció amb els tres tercers de capacitat cognitiva. No obstant això, també distingim entre emprenedors novells que acaben de crear la seva primera empresa; emprenedors en sèrie, que han creat prèviament altres empreses i ara en creen una altra mentre ja no dirigeixen cap de les anteriors; i emprenedors de cartera que han iniciat prèviament altres empreses i ara n'estan creant una altra mentre continuen dirigint les anteriors. Totes aquestes categories les comparem amb els empleats en un model logit multinomial per a dades de panell. Els resultats d'aquest capítol confirmen que l'obertura a l'experiència augmenta la probabilitat de crear una empresa per primera vegada, però en aquest cas només per als individus del tercil inferior. L'amabilitat augmenta les probabilitats en els tercers inferior i mitjà de la capacitat cognitiva. En el cas dels emprenedors en sèrie, l'obertura a l'experiència només és important per als tercers superiors de capacitat cognitiva. L'extraversió també augmenta la probabilitat per als individus del primer tercil de capacitat cognitiva. A més a més, en el cas dels emprenedors de cartera, l'autodisciplina (conscienciació) és important per al tercil més baix, així com l'obertura a l'experiència. Aquests resultats indiquen que és complex parlar de característiques universals per a l'emprenedoria, ja que existeixen variacions segons el nivell cognitiu dels individus.

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# 1. General introduction

The major theme of this thesis is the effects of different variables on the probability to start a new company across the distribution of cognitive ability (hard skills). We use two different controls vastly studied in the literature as predictors of entrepreneurship: The big five personality traits (Zhao & Seibert, 2006) and risk attitudes (Caliendo et al., 2006, 2008).

Different authors have previously studied entry into entrepreneurship. In their research, it has been found that variables such as gender (Blanchflower, 2000; Bosma et al., 2012; Leoni & Falk, 2008), age (Lévesque & Minniti, 2006) and human capital (Poschke, 2013) are related to the decision to become an entrepreneur.

Some authors have explored the relationship between soft skills, risk attitudes and cognitive skills with entrepreneurship. Hard skills are those skills that can be measured, learned and trained. They have to do with cognitive skills that the individuals can develop through training and/or experience. Soft skills are inherent to the individual's character. They have to do with personality traits and predict success in life (Heckman & Kautz, 2012). Here we exploit the differences in the distribution of the hard skills in our sample and we expect to find differences in the effects of soft skills and risk attitudes on the probability of pursuing entrepreneurship. Previous research has not accounted for the heterogeneity in cognitive abilities among entrepreneurs when looking at soft skills and risk attitudes. This is precisely the gap we seek to fill with this research.

To do so, we use the National Longitudinal Study of Youth 1997 cohort (NLSY97). This is a panel data, which interviewed around 9000 individuals in 1997 when they were between 12 and 17. NLSY provides unique set of variables, which allow us to directly measure the cognitive skills of individuals in the panel through Armed Service Vocational Aptitude Battery test (ASVAB). The soft skills are measured through the big five personality traits (Costa & McCrae, 1992): openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. Risk attitudes are measured using the risk assessment battery included in NLSY97. These include questions for eight different risk

domains: general, financial, work, health, faith in people, romance, life change, and gambling. We work with the first 17 waves of the NLSY97 survey.

Entrepreneurship has been identified as an intentionally planned behavior (Bird, 1988). Hence, the relevance of entrepreneurial intention models in the existing literature. Although there are several of these models<sup>1</sup> with many of them being a complement or extension of others, two of the most widely used to explain entrepreneurship are Ajzen's (1991) Theory of Planned Behavior (TPB) and Shapero & Sokol's (1982) Entrepreneurial Event Model.

These competing models have been tested and statistical support has been found in favor of both (Krueger et al., 2000). However, the Theory of Planned Behavior, besides being relevant in many different contexts, is the dominant theory regarding entrepreneurial intentions (Schlaegel & Koenig, 2014). Therefore, throughout this thesis we rely on the latter to explain the differences in the effects of each of our variables of interest on the different levels of cognitive skills.

The first chapter of the thesis extracts the pure effect of soft skills by interacting them with the three terciles of the average score on the ASVAB. This way, we are able to estimate the effects of personality traits across the distribution of cognitive ability. In order to explore this effect, we rely on the Big Five Personality Dimensions.

These dimensions have been used in previous research to compare managers and entrepreneurs (Zhao & Seibert, 2006) and to study the entry and exit decision into entrepreneurship (Caliendo et al., 2011). Previous results suggest that entrepreneurs have lower levels of neuroticism and agreeableness, and higher levels of openness to experience and conscientiousness than managers (Zhao & Seibert, 2006). In addition, they indicate that openness to experience and extraversion matter when deciding to be an entrepreneur (Caliendo et al., 2011).

In this chapter we try to test the effects of personality traits on the decision to become an entrepreneur, considering entrepreneurs a heterogeneous group when it comes to

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<sup>1</sup> For an extended review see: Shapero (1975), Shapero & Sokol (1982), Bird (1988), Katz & Gartner (1988), Ajzen (1991), and Krueger (1993).

their cognitive ability (Mitchell et al., 2002).<sup>2</sup> For this, we rely on Ajzen's (1991) Theory of Planned Behavior to explain that each of these cognitive levels has an associated perceived behavioral control that influences the intention and subsequent decision to enterprise. Previous research has found that openness to new experiences is the key personal characteristic that affects the probability of starting a new firm. However, the previous papers have not reviewed if openness to experience matters uniformly across the cognitive ability distribution.

Our results show that there is no single characteristic of the five personality traits that significantly increases the probability of starting a business across the three cognitive ability terciles. We do find that openness to experience increases the likelihood of entrepreneurship for individuals at the bottom and top of the distribution. However, being intellectually curious is not statistically significant for those in the middle. These results suggest that it does not matter how smart the individual is but how much are they feeling that they could be comfortable with new experiences. This in turn could be interpreted as having sufficient perceived behavioral control as to open up to new experiences in terms of entrepreneurial activity.

The second chapter elicits the differences between different terciles of cognitive capacity and the risk attitudes towards starting a company. We split risk attitudes and personality traits to observe if there are significant differences across the cognitive skills distribution for each of them separately. This is the driving idea for the second chapter. We want to see whether different risk domains matter for the decision to start a new company across the ability distribution.

Although most studies agree that entrepreneurs should have low risk aversion, earlier empirical work has found mixed results. Caliendo, et al. (2006) found that having a high-risk tolerance increases the likelihood of becoming an entrepreneur for those individuals coming from another job. However, this result does not hold for individuals who are unemployed or inactive. Our contribution here lies in the fact that we split the cognitive

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<sup>2</sup> This is a rather trivial observation but surprisingly the literature has not paid much attention to the relative differences of cognitive ability across entrepreneurs.



ability distribution into three terciles and test which of the various risk domains matters for entry into entrepreneurship.

Once again, we rely on the Theory of Planned Behavior. Individuals with low perceived behavioral control of becoming entrepreneurs (i.e., at the bottom of the cognitive distribution) should adopt this behavior if they are risk prone. Similarly, those with high perceived behavioral control (i.e., up in the distribution) will need to be prone to risks to take on the variation in income involved in being an entrepreneur (Poschke, 2013; Rees & Shah, 1986) rather than receiving the steady income in a traditional job.

Results show that a good tolerance of risks in general and related to work are positively associated with starting a new firm across the distribution of cognitive ability. Risk in work has an obvious interpretation here. Developing and running a new firm requires significant amount of dedication and so individuals know that they will have to work hard to make their new businesses successful. The same applies to general risks. By starting a new company, individuals of all cognitive skill levels are taking risks of different kinds.

Additionally, results suggest that finances and life change risks are important at the bottom and top of the distribution. By deciding to enterprise, individuals with low perceived behavioral control are risking funds that might be difficult for them to get again and those with high perceived behavioral control are giving up a potential high salary from a stable job. Finally, starting a new firm is a life-transforming experience. This risk domain is more subtle though. According to the Theory of Planned Behavior, life-transforming experiences may alter the perception of behavioral control over the new venture. Being able to accept this risk seems important at the point of starting a new firm.

Building on the previous two chapters, the third chapter studies the effects of personality traits and risk attitudes (distinguishing between the same risk domains as in chapter 2) on the probability of different form of entrepreneurship. We continue dividing the sample into terciles of cognitive ability and interacting these terciles with our variables of interest. However, in this chapter we distinguish between novel, serial, and portfolio entrepreneurs. Novel entrepreneurs are those who start their firms for the

first time. Serial entrepreneurs, on the other hand, start a new venture but they have already a history of other companies in the account. Finally, portfolio entrepreneurs are those who start and run parallelly several ventures. Using a multinomial logit panel model<sup>3</sup>, we compare the likelihood of falling into any of these categories relative to other and relative to becoming an employee. We interact the personality traits with each of the three terciles of cognitive ability as predictors of the aforementioned types of entrepreneurship. Apart, in a separate analysis we regress risk domains on the types of entrepreneurship (without accounting for personality traits).

The Big Five personality traits and the individual's risk attitudes have been studied for different types of entrepreneurs (practicing, potential, maybe-entrepreneurs and non-entrepreneurs (Antoncic et al., 2015), necessity vs. opportunity (Block et al., 2015), serial vs. portfolio (Parker, 2014)). Previous research has found mixed results, which makes it necessary to continue studying these characteristics in sub-samples of entrepreneurs (Salmony & Kanbach, 2021). This justifies why we keep including the interactions with the terciles of cognitive ability.

To further justify the differences between novel, serial, and portfolio entrepreneurs, we turn again to the Theory of Planned Behavior (Ajzen, 1991). Starting with novel entrepreneurs, they are assumed to be in the category with the lowest perceived behavioral control of all three types of entrepreneurs. Consequently, serial entrepreneurs feel themselves capable of starting new businesses and therefore their perception of control in this role is higher than that of novel entrepreneurs. What distinguishes them from other types of entrepreneur types is their constant intention to start new business demonstrated through serial behavior (serial creation of new businesses). Furthermore, portfolio entrepreneurs, similarly to serial entrepreneurs are characterized by their high perceived control of the process of starting and building of a new firm, and by their consistently constant behavior of creating and running several parallel firms. Our results suggest that which soft skills and risk attitudes matter for becoming a certain type of entrepreneurship varies conditional on the level of hard skills the individual possesses.

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<sup>3</sup> We will use as synonyms the word “model” and “econometric specification” as is the common practice in the literature of empirical economics.

We summarize our results in General Conclusions, and the Appendix presents the complete tables of the models for the three chapters.

## 2. Chapter 1. The relative role of soft and hard skills predicting self-employment among young adults in the US

### Abstract

This chapter shows the effects of soft skills operationalized as the big five personality traits - openness to experience, conscientiousness, extraversion, agreeableness and neuroticism - defined by Costa & McRae (1992) as predictors of entrepreneurship among young adults from the National Longitudinal Study of Youth 1997 from the US. Our results show that openness to experience significantly augments the likelihood of enterprising defined as self-employment for those at the bottom and top of the distribution. Conversely, conscientiousness significantly reduces the likelihood for those in the middle.

## 2.1. Introduction

This chapter proposes to look at the skills that entrepreneurs<sup>4</sup> have from a two-dimension perspective: hard (cognitive) and soft (personality traits) skills. The relevance of this approach is that it acknowledges that both types of skills are important when explaining entrepreneurship. Specifically, identifying which particular traits are present in persons who decide to launch their own business considering the differences in cognitive ability (hard skills) is important because these explain why an individual chooses to start a business of his own instead of trying to get into the labor market (Kerr et al., 2017; Salmony & Kanbach, 2021; Simoes et al., 2015). Therefore, it gives a map route to those interested in creating educational programs on entrepreneurship.

Several well-established variables determine entrepreneurship entry in the economic literature. Among the ascribed characteristics, the most obvious candidates are gender and age. Regarding the first, men tend to enter into entrepreneurship more than women (Blanchflower, 2000; Bosma et al., 2012; Leoni & Falk, 2008). Concerning the latter, there has been identified an U-shaped relationship between age and the probability to enterprise (Lévesque & Minniti, 2006). Next, comes the human capital. Poschke (2013) finds that education, similarly to age, has a U-shaped effect on self-employment. This implies that individuals with high or low levels of education are more prone to enterprise than those with intermediate levels. However, education has been shown to be a problematic variable as it is highly correlated with cognitive ability (Martin et al., 2013, p. 214), which in turn is frequently unobserved in available data sets. For that matter, our present research covers an important gap in the literature by introducing cognitive ability explicitly tested through the scores obtained in the Armed Services Vocational Aptitude Battery (ASVAB).

Notwithstanding, cognitive ability is not the only source of unobserved heterogeneity plaguing the research on the determinants of entrepreneurship (Parker, 2018). Previous papers have also looked at personality traits in order to explain the entry to self-

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<sup>4</sup> We call entrepreneurs those individuals who are full-time self-employed. We use a generous definition entrepreneurship which allows us to maximize the sample size (Parker, 2009). In chapter 3 we refine this definition and distinguish between novel, serial and portfolio entrepreneurs.

employment. More optimistic, self-efficient, and creative individuals develop a higher alertness to identify business opportunities (Ardichvili et al., 2003). In addition, being self-confident increases the probability to start a business (Hogarth & Karelaia, 2012; Raposo et al., 2008).

There is a handful of papers that look at both, the hard and soft skills at once. Some look at big five personality traits (Zhao & Seibert, 2006) and their relative links to cognitive skills. Hartog et al. (2010) analyze the effect of cognitive and social abilities on earnings comparing entrepreneurs and employees. However, these do not exploit the within group variances in cognitive levels to analyze the link between personality traits and entrepreneurship. We aim at filling this gap to provide a systematic view on which are the key determinants of entrepreneurship.

The novelty of our approach is that we test what type of personality traits matter for the least cognitively able and what is important up the distribution. Dividing the distribution of cognitive ability into terciles allows us to see which exactly personality traits matter in each of the terciles.

Using data from the National Longitudinal Survey of Youth Data (NLSY97) from 1997 to 2016, we test the effect of soft skills on the probability of becoming an entrepreneur interacted with different levels of hard skills. Our findings suggest that this effect is not homogeneous. Actually, openness to experience significantly increases the odds of becoming an entrepreneur for all individuals in the sample but for those with medium hard skills, which suggest a U-shaped effect. The effect of conscientiousness is negative and significant for those in the middle of the distribution.

The rest of the chapter is organized as follows. In section 2.2, we present theories on hard, soft skills with respect to entrepreneurship. We also present the mechanisms that operate in the relation between these three. In section 2.3, we describe the data, as well as the econometric model. In section 2.4, we present the results before concluding in section 2.5.

## 2.2. Theoretical background

Our aim in this chapter is to examine entrepreneurial skills from a two-dimensional approach: hard and soft skills. Specifically, we seek to analyze the differences in personality traits considering the distribution of cognitive ability of entrepreneurs. Studying this distribution is relevant because it allows to explore if there are some specific personality traits that are important at some levels of cognitive ability while others are universal regardless of the hard skills.

Previous research has identified individual-level determinants of the entry into self-employment. Age has a positive influence on entrepreneurship because as individuals grow older, they have more access to resources such as knowledge, financial capital, or social networks to start a business of their own (Simoes et al., 2015; van Praag & Ophem, 1995). Nonetheless, after certain age, the probability to enterprise declines due to higher risk aversion levels, or lower capability to deal with stressful situations (Hintermaier & Steinberger, 2005) to grow again in the pre-retirement time. This gives us the aforementioned U-shape in age effect on starting a new firm. Concerning nationality, immigrants tend to move to self-employment more than nationals (Parker, 2009). Gender also plays an important role as a determinant of self-employment. Overall, women tend to have a lower probability to become entrepreneurs than men and they perceive themselves less favorably than men in an entrepreneurial environment (Langowitz & Minniti, 2007). There are three possible explanations for this. First, women's risk aversion is higher than the one of men (Parker, 2009). Second, the representation of men and women among sectors differs (Bates, 1995) which implies a different set of opportunities to become self-employed. Third, women tend to be more satisfied with their jobs than men (A. E. Clark, 1997) which makes them more reluctant to start their firms against being employees. Regarding marital status, literature on self-employment identifies a positive influence of being married because a spouse could increase wealth, thus financial resources (Borjas, 1986), and offers emotional support (Bosma et al., 2004). However, this effect might be different for men and women due to household responsibilities (Özcan, 2011).

Moving on the list of determinants of entrepreneurship, previous research on the influence of human capital on entrepreneurship is ambiguous. On the one hand, studies on the impact of education have not been conclusive in regards to the direction of the effect, nor its significance (Bates, 1995; K. Clark & Drinkwater, 2000; van Der Sluis et al., 2008). Some indicate a negative link between education and probability to enterprise, while other point towards a positive relationship between the two. Specifically, it has been found that there is an U-shaped relationship between education and entry into self-employment (Acs & Szerb, 2007; Blanchflower, 2000; Poschke, 2013).

With respect to cognitive abilities, Hartog et al. (2010) find that, assuming that people choose their occupation based on the expected earnings, those with high math, and technical skills are more prone to choose entrepreneurship, whereas those with language abilities choose regular employment. Hafer & Jones (2015) study the relationship between cognitive ability and entrepreneurship at the macro level finding that countries with higher cognitive abilities have a larger probability of generating high-quality entrepreneurs. According to the authors, a possible indirect effect explains the later. If individuals with higher cognitive skills have higher earnings (Bowles et al., 2001; Jones, 2011b, 2011a; Strenze, 2007), they are expected to have less capital constraints to enterprise.

Another branch of research focuses on non-cognitive traits. These traits, such as personality traits are also individual determinants of entrepreneurship. A vast research on personality has come together around the Big Five Personality Dimensions (Costa & McCrae, 1992; John & Srivastava, 1999). Their seminal paper identifies five constructs of personality: openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. According to the characterization developed by Costa & McCrae (1992), openness to experience, refers to intellectual curiosity. Conscientiousness refers to persistence, hard work, and motivation. The third refers to the extent to which a person is assertive, energetic or talkative. The fourth stands for caring about or trusting others, while the fifth compiles emotions such as anxiety, self-pitying or feeling tense. They have found a fertile ground as predictors of entrepreneurship (Zhao & Seibert, 2006).



Comparing managers and entrepreneurs, Zhao & Seibert (2006) found that when it comes to the Big Five personality traits, there are significant differences between the two groups. Their results suggest that entrepreneurs have lower levels of neuroticism and agreeableness, and higher levels of openness to experience and conscientiousness than managers do. The above authors found no significant differences concerning extraversion. Looking at entry and exit decisions from self-employment, Caliendo et al. (2011) found that not all factors affect the two types of decisions. As a matter of fact, and referring to the Big Five personality traits, openness to experience and extraversion affect the entry decision while agreeableness affects exit.

Following the previous research showing that personality traits matter for becoming an entrepreneur (Eren & Sula, 2012; Ferrante, 2005; Licht & Siegel, 2005; Oosterbeek et al., 2010), and the relevance of the Big Five for entrepreneurs compared to managers (Zhao & Seibert, 2006) we employ them in our analysis to compare the decision of becoming self-employed versus getting employed bearing in mind that entrepreneurs are not a homogeneous group (Mitchell et al., 2002).

Based on this, and following the Theory of Planned Behavior presented by Ajzen (1991), we expect the big five traits' effect to vary among different cognitive levels. According to Ajzen's theory, individuals engage in a behavior as a consequence of a motivation which is influenced by their attitudes towards the behavior, the subjective norms or perceived social pressure to engage in the behavior, and the self-perceived capabilities to accomplish the behavior. Assuming that people in the first tercile of the cognitive distribution hold low perceived behavioral control or perceived capabilities because they know little and learning might be difficult for them, they should be less prone to engage in entrepreneurship. Nonetheless, if they had intellectual curiosity (openness to experience), if they appeared more assertive, energetic or talkative (extraversion), and if they were persistent (conscientiousness), they would have a greater perceived behavioral control; therefore, they would be more prone to become entrepreneurs.

The hypotheses we want to test are:

H1: Openness to experience increases the likelihood of becoming an entrepreneur at the bottom of the distribution.

H2: Extraversion increases the likelihood of becoming an entrepreneur at the bottom of the distribution.

H3: Conscientiousness increases the likelihood of becoming an entrepreneur at the bottom of the distribution

Conversely, if the hypotheses H1, H2 and H3 get rejected, it will merely indicate that openness to experience, extraversion, and conscientiousness have no significant effect on the dependent variable.

The rest of the chapter is organized as follows. Next section presents the econometric methods used in the analyses. The following section discusses the results and finally section 2.5 concludes the chapter.

### 2.3. Data and econometric specification

In order to identify the skills of entrepreneurs, we work with the National Longitudinal Survey Data (NLSY) 1997-2016. The NLSY97 is an ongoing longitudinal survey on 8.984 individuals who were 12-18 years old when they were first interviewed in 1997. There are now 17 rounds available<sup>5</sup>. Regarding the types of information gathered in the survey, it includes data on employment, education, contextual variables, childhood, dating, income, health and attitudes among many others. The NLSY97 data is seldom used in the research on entrepreneurship due to its enormous complexity. We resort to NLSY97 precisely for its unmatched quality of data and contextual richness, which permits us to measure directly the effects of soft skills across the distribution of hard skills.

From a two-dimensional perspective, the aim of this chapter is to unveil what type of personality traits matter for the least cognitively able and what is important up the distribution. To do so, we define entrepreneurs as those individuals who are self-employed the week before the interview was conducted. This variable is constructed using each individual response to a question referring to their employment status.

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<sup>5</sup> Responses for each round are generally collected in an average of one and a half years.

We have two sets of independent variables. The first one refers to hard skills. We use the results in the Armed Services Vocational Aptitude Battery (ASVAB) that respondents took between the summer of 1997 and the spring of 1998. We use a summary percentile score variable from NLSY97 for the scores in math, verbal and paragraph comprehension tests. As we want to test the relevance of soft skills at different points of the cognitive distribution, we split this score into three terciles.

The second set of independent variables refers to soft skills. We use the self-ratings on the Ten-Item Personality Inventory Scale (TIPI) (Gosling et al., 2003) to measure the Big Five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism<sup>6</sup>. The respondents were asked to provide self-ratings for each of the 10 items that make up the TIPI scale in the twelfth round. Each dimension ranges from 1 (disagree strongly) to 7 (agree strongly). In addition, we control for sociodemographic variables such as female, age, marital status, race, industry, and educational level.

As for individuals in the sample, there are slightly more men than women. When it comes to race, white prevails (53%). Only about a quarter of the sample is married, which is not surprising given their relatively young age. All personality traits score rather medium levels.

For the model specification, let *Self* stand for self-employed taking the value 0 when the individual's is not a self-employed, and the value 1 when he is self-employed.

$$Self = \begin{cases} 0 & \text{if not self - employed} \\ 1 & \text{if self - employed} \end{cases}$$

Understanding self-employment as a function of the individual characteristics, we have:

$$Pr(Self = 1|X) = \frac{\exp(\alpha + \beta'(X_{it}) + \gamma'(Q_i))}{1 + \exp(\alpha + \beta'(X_{it}) + \gamma'(Q_i))}$$

---

<sup>6</sup> As in Gosling et al. (2003):

Openness to experience = open + conventional (reversed)/2  
 Conscientiousness= dependable + disorganized (reversed)/2  
 Extraversion= extraverted + reserved (reversed)/2  
 Agreeableness= sympathetic + critical (reversed)/2  
 Neuroticism = calm + anxious (reversed)/2

where  $\mathbb{X}$  is a vector of basic individual characteristics. Some of the regressors included in  $\mathbb{X}$  are time invariant (e.g., gender) while others change with time (e.g., age, education level). Our main controls refer to big five personality traits and their interactions with the three levels of cognitive ability. They are represented by the variable  $\mathbb{Q}_i$ . Note, that variable  $\mathbb{Q}_i$  has not time subscript as we assume that it is time-invariant<sup>7</sup> (Spinath et al., 2003). We use `xtlogit` in Stata software. Table 2.1 depicts all variables' definitions, while Table 2.2 shows the sample descriptive statistics.

**Table 2.1: Definition of variables**

Variable	Description
Self	Dummy variable for self-employment.
Age	Age of the respondent.
Female	Dummy variable for gender.
Educ	Highest degree completed by respondent.
Race	Race of the respondent.
Married	Marital status of the respondent.
Industry	Industry sector in which the respondent works.
<b>Soft skills</b>	
Extraversion	Extraverted vs. reserved.
Agreeableness	Sympathetic vs. critical.
Conscientiousness	Dependable vs. disorganized.
Neuroticism	Calm vs. anxious.
Openness to experience	Open vs. conventional.
<b>Hard skills</b>	
ASVAB terciles	Three categories of cognitive ability.

Source: NLSY97

**Table 2.2: NLSY97 sample descriptive statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Self	61,852	0.068	0.251	0.0	1.0
Age	61,852	25.262	4.183	18.0	35.0
Female	61,852	0.512	0.500	0.0	1.0
Educ	61,852	2.210	1.260	0.0	7.0
Race: White	61,852	0.533	0.499	0.0	1.0
Race: Black	61,852	0.249	0.432	0.0	1.0

<sup>7</sup> We assume the Big Five personality traits are time-invariant because the proper dataset (NLSY97) assumes so by measuring them at an early stage and never repeating the tests.

Race: Hispanic	61,852	0.208	0.406	0.0	1.0
Race: Mixed	61,852	0.009	0.097	0.0	1.0
Married	61,852	0.254	0.435	0.0	1.0
Industry: Agriculture, forestry, and fisheries	61,852	0.008	0.092	0.0	1.0
Industry: Mining	61,852	0.005	0.069	0.0	1.0
Industry: Utilities	61,852	0.002	0.047	0.0	1.0
Industry: Construction	61,852	0.067	0.250	0.0	1.0
Industry: Manufacturing	61,852	0.069	0.254	0.0	1.0
Industry: Wholesale trade	61,852	0.022	0.149	0.0	1.0
Industry: Retail trade	61,852	0.159	0.366	0.0	1.0
Industry: Transportation and warehousing	61,852	0.024	0.153	0.0	1.0
Industry: Information and communication	61,852	0.024	0.155	0.0	1.0
Industry: Finance, insurance, and real estate	61,852	0.063	0.243	0.0	1.0
Industry: Professional and related services	61,852	0.113	0.317	0.0	1.0
Industry: Educational, health, and social services	61,852	0.202	0.401	0.0	1.0
Industry: Entertainment, accommodations, and food	61,852	0.154	0.361	0.0	1.0
Industry: Other services	61,852	0.053	0.224	0.0	1.0
Industry: Public administration	61,852	0.031	0.173	0.0	1.0
Extraversion	61,852	5.497	0.863	2.5	7.0
Agreeableness	61,852	5.497	0.844	2.5	7.0
Conscientiousness	61,852	5.468	0.785	2.5	7.0
Neuroticism	61,852	5.984	0.868	2.5	7.0
Openness to experience	61,852	5.750	0.855	2.5	7.0
ASVAB terciles	61,852	1.999	0.816	1.0	3.0

## 2.4. Results

First, we run our model across the terciles of cognitive ability in order to test the influence of the big five traits on the probability to enterprise (Table A.2. in the Appendix). Table 2.3. summarizes our main results. The first four columns present the results including only one of the Big Five personality traits in the model. The final column of the table presents the results for the full model (i.e., with the five traits included in the estimation).

Estimates of the first four columns that include only one of the big five personality traits (extraversion, agreeableness, conscientiousness, and neuroticism respectively) do not suggest that there is a significant effect of these traits on the odds of undertaking. Results from column 5 that include only openness to experience as a personality trait suggest a statistically significant effect of this trait for individuals at the bottom and at the top of the cognitive ability distribution.

Our results for the full model suggest that being smart (top tercile) decreases the odds of enterprising over choosing to be an employee. Regarding the big five personality traits, an increase in conscientiousness decreases the odds of becoming an entrepreneur over an employee for those in the middle of the cognitive ability distribution compared to those at the bottom. Also, it seems to increase the likelihood for the smartest individuals, but this result is not statistically significant. Conversely, an increase in openness to experience increases the odds for those at the bottom as well as for those at the top of the hard skills distribution. The contrast test for the interaction of the cognitive ability terciles and conscientiousness is significant with a 90% confidence interval (p-value 0.06) meaning that we can reject the null hypothesis that the slopes for the three terciles of cognitive ability are all equal. The contrast test for openness to experience is not statistically significant.

**Table 2.3: Big Five personality traits for becoming an entrepreneur**

	<b>Extravert</b>	<b>Agreeable</b>	<b>Conscientious</b>	<b>Neurotic</b>	<b>Open</b>	<b>Full</b>
<b>Hard Skills: Cognitive ability terciles</b>						
Middle	0.565 (-0.74)	0.493 (-0.95)	3.592 (1.39)	0.645 (-0.56)	0.248 (-1.64)	0.521 (-0.50)
Top	0.385 (-1.21)	0.668 (-0.51)	0.603 (-0.54)	0.827 (-0.24)	<b>0.133**</b> <b>(-2.35)</b>	<b>0.062**</b> <b>(-2.07)</b>
<b>Soft Skills: Big Five Personality Traits</b>						
Extraversion	1.064 (0.69)					1.002 (0.03)
Agreeableness		1.107 (1.16)				1.073 (0.74)
Conscientiousness			1.036			0.976

			(0.38)			(-0.24)
Neuroticism				0.966		0.900
				(-0.37)		(-1.05)
Openness to experience					<b>1.240**</b>	<b>1.259**</b>
					<b>(2.34)</b>	<b>(2.26)</b>
<b>Interactions</b>						
Extraversion X Middle	1.086					1.028
	(0.60)					(0.19)
Extraversion X Top	1.189					1.105
	(1.24)					(0.67)
Agreeableness X Middle	1.114					1.103
	(0.80)					(0.68)
Agreeableness X Top	1.075					0.961
	(0.51)					(-0.27)
Conscientiousness X Middle			0.793			<b>0.746*</b>
			(-1.52)			<b>(-1.80)</b>
Conscientiousness X Top			1.091			1.121
			(0.57)			(0.71)
Neuroticism X Middle				1.062		1.052
				(0.43)		(0.34)
Neuroticism X Top				1.036		1.007
				(0.25)		(0.05)
Openness to experience X Middle					1.242	1.249
					(1.52)	(1.43)
Openness to experience X Top					<b>1.410**</b>	<b>1.344*</b>
					<b>(2.37)</b>	<b>(1.89)</b>
<i>AIC</i>	19970.12	19970.42	19973.56	19977.65	19927.9	19938.83
<i>BIC</i>	20376.59	20376.88	20380.02	20384.12	20334.3	20453.68
<i>N</i>	61852	61852	61852	61852	61852	61852

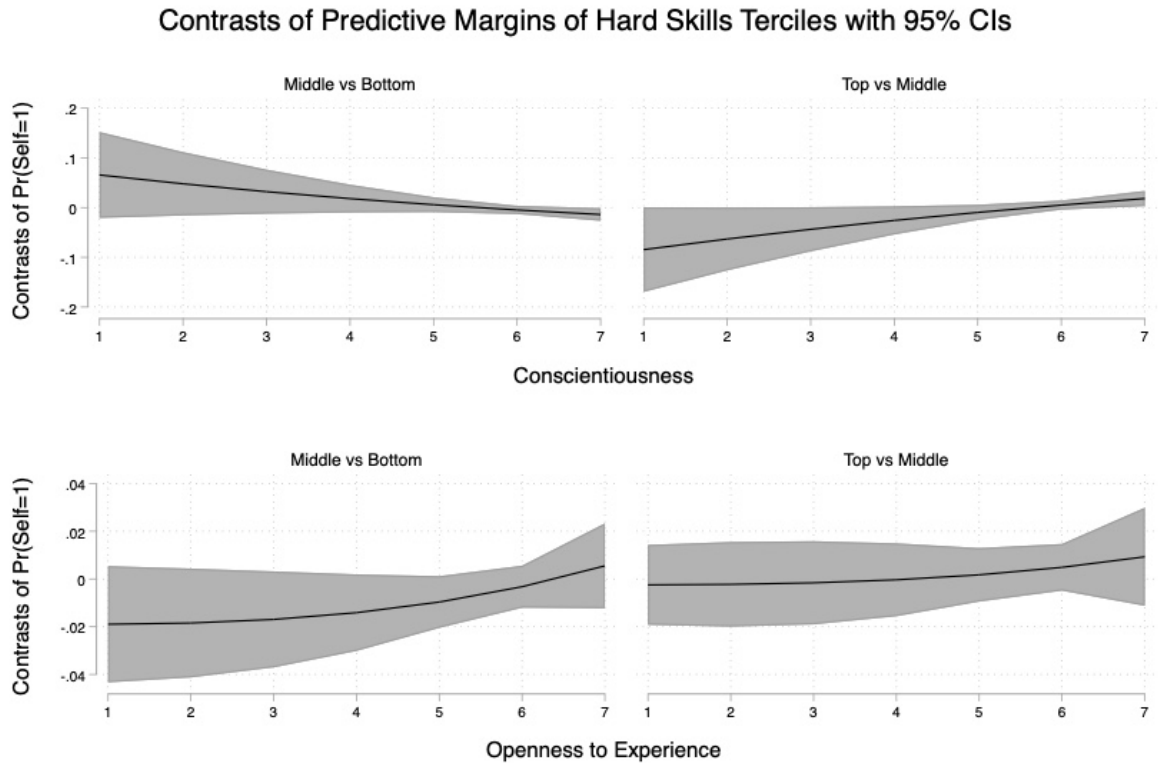
*T* statistics in parenthesis. Individual level Controls: age, gender, education, marital status, and race.

Industry controls: agriculture forestry and fisheries (reference category), mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health and social services, entertainment accommodations and food, other services, and public administration. Time Trends: Year. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Figure 2.1. illustrates the adjacent contrast of the predictive margins of hard skills by both conscientiousness and openness to experience. Looking at the figures for conscientiousness, we find that the difference in the adjusted means comparing individuals in the top of the cognitive distribution to those at the middle (top right panel)

is only significant at the 5% level for the contrast when the individual is at the maximum level of conscientiousness [0.0030,0.0336]. Moving onto the graph for openness to experience, all confidence intervals include zero, therefore, the difference is not significant at the 5% level.

**Figure 2.1.: Adjacent contrasts of predictive margins of Hard Skills by Conscientiousness and Openness to Experience with confidence intervals**



Based on the estimations of the model (Table 2.3), we find that openness to experience increases the probability of becoming an entrepreneur for individuals in the bottom tercile of the cognitive ability distribution. Furthermore, we also found that this same trait is relevant at the top of the distribution of cognitive skills. However, the contrast test of the interaction was not significant despite the margins for the interaction of top tercile with openness indicating a significant effect for the top tercile. Therefore, we cannot confirm our hypothesis 1 as the top tercile margin is not significantly different for all values of openness from the middle tercile. We do not find statistically significant results that support our hypothesis 2 on the relevance of extraversion at the bottom of the distribution of hard skills. The explanation is the same as above. The test for margins



between the bottom of the ASVAB distribution and the middle tercile is not statistically significant for all values of conscientiousness.

Regarding hypothesis 3, evidence suggests that although conscientiousness is relevant for those with middle hard skills level, the direction of the effect on entrepreneurship is negative and it does not seem there is a significant effect for individuals with less hard skills. Consequently, we cannot confirm our hypothesis 3 that conscientiousness increased the likelihood of becoming an entrepreneur for those at the bottom of the distribution of hard skills. It may be the case that despite being very persistent, in these individuals, the cautious and planning side of conscientiousness weighs more heavily and so they reduce the probability of entrepreneurship rather than increase it.

We find varying results for our control variables (Table A.1. in the Appendix). The effect of age is positive and statistically significant in all models. Regarding education, having at least the 9th grade decreases the probability to enterprise. It might be the case that as individuals have more years of schooling they find better opportunities in the traditional job market. Looking at race, being Hispanic decreases the probability of entrepreneurship, while being married has a positive and significant effect. Finally, controlling for different industries we find statistically significant and negative results for manufacturing, wholesale, retail trade, educational, health and social services, entertainment, accommodation and food services, as well as for public administration. The only industry that has a positive and significant effect is the other services industry with agriculture as the reference category.

## 2.5. Conclusions

The aim of this chapter was to study entrepreneurship from a two-dimensional perspective. Using a large panel, addressing an important previous methodological constraint, we run a series of models to test the influence of big five personality traits interacted with different levels of cognitive skills on enterprising. Previous research has shown that hard and soft skills matter for enterprising when comparing entrepreneurs with other individuals.

Controlling for socio-demographic and industry factors, we find supporting evidence for two of the Big Five personality traits. These results vary depending on the different levels of hard skills. While openness to experience is relevant for individuals at the bottom of the cognitive ability distribution and for those at the top, conscientiousness only matters for those in the second tercile.

Our empirical results are an import contribution to the idea that entrepreneurs are not an homogeneous group (Mitchell et al., 2002) either from a hard skills perspective, or from the soft skills perspective. The relevance of this is that it is a starting point to expand research within the entrepreneurial group, and from there create a map route that could be useful for those involved in the design, development and delivery of educational programs related to entrepreneurship. Since it could be considered to reinforce the soft skills based on the hard skills an individual has.

### 3. Chapter 2. Risk attitudes, hard skills and entrepreneurship among young adults in the US

#### Abstract

This chapter studies how various risk attitude domains affect the likelihood of becoming an entrepreneur across the distribution of cognitive skills. We interact hard skills terciles with risk attitudes and test the effect of different risk domains, conditional on the level of cognitive abilities, for starting up a new company. We test our general models and find that a resilience to risks in general and work increase the likelihood of becoming self-employed for all individuals in the sample. In addition, we find evidence that the slopes for risks in general, finances and life changes are indeed different at each level of cognitive abilities.

### 3.1. Introduction

This chapter proposes to complement the literature on determinants of entrepreneurship entry by considering the variation in risk aversion across levels of cognitive ability and gender. We use the terms cognitive ability and hard skills interchangeably to refer to skills that can be learned and trained through education and/or experience.

The probability of becoming an entrepreneur has been proven to be influenced by individual characteristics such as age, gender, or the educational level. Conversely, measures of cognitive ability are usually unobserved in available datasets. We aim at filling this gap, by including in our analyses the scores from the Armed Services Vocational Aptitude Battery (ASVAB) to gauge cognitive ability.

Focusing on personality traits, some authors have found that low risk aversion and social trust are also determinants of entrepreneurship (Caliendo et al., 2006, 2010, 2011; Caliendo & Kritikos, 2007). However, research on the influence of risk aversion on entrepreneurship suggest that there is mixed evidence about the direction and significance of the effect based on survey questions (Brockhaus, 1980; Miner & Raju, 2004; Stewart & Roth, 2001), observing the adoption of riskier lifestyles (Lindh & Ohlsson, 1996; Uusitalo, 2001; van Praag & Cramer, 2001), and lab-experiments (Elston et al., 2005). The aim of this chapter is to contribute to existent literature by exploiting the variation in cognitive ability to test the effect of risk aversion on entrepreneurship.

Using data from the National Longitudinal Survey Data (NLSY) from 1997 to 2016, we test the effect of risk aversion on the probability of becoming an entrepreneur interacted with different levels of hard skills. Our findings suggest that having low levels of risk aversion in general increases the probability to enterprise across the whole distribution of cognitive ability. The effect is homogenous across the cognitive ability distribution when looking at general and work domains, but not for all domains of risk aversion.

The rest of the chapter is organized as follows. In section 3.2, we present theories on hard skills and risk aversion with respect to entrepreneurship. We also present the

mechanisms that operate in the relation between these three. In section 3.3, we describe the data, as well as the econometric model. In section 3.4, we present the results before concluding in section 3.5.

### 3.2. Theoretical background

The main objective of this chapter is to analyze the differences in attitudes towards risk taking into account the distribution of cognitive ability. The relevance of this approach is that it acknowledges the heterogeneity that exists among entrepreneurs in order to explore if risk aversion matters universally for all regardless of their hard skills. The folk understanding of the risk concept dictates that entrepreneurs should be more risk loving than employees, as they have to subject their own financial and human capital to a venture without a guarantee of receiving any profits. However, it is not clear which exactly risk domains should matter for whom, when considering an intersection of cognitive ability distribution with risk domains.

Prior research on the individual level determinants of becoming an entrepreneur have found that age, gender, marital status, and education influence the decision to enterprise. First, age has a positive effect because older individuals have more human capital, financial, and social resources which makes it easier for them to enter into self-employment (Calvo & Wellisz, 1980; van Praag & Ophem, 1995). Another important determinant is gender. Overall, women tend to have a lower probability to become entrepreneurs than men because their representation among sectors differs (Bates, 1995; Leoni & Falk, 2008), and because they have a greater fear of failure than men (Koellinger et al., 2013). Regarding marital status, having a spouse could increase wealth, thus financial resources (Borjas, 1986), and emotional support (Bosma et al., 2004) which increases the probability to enterprise. Finally, the results on education are mixed (Bates, 1995; K. Clark & Drinkwater, 2000; Özcan, 2011; van Der Sluis et al., 2008). On the one hand, it may make less attractive entrepreneurship because of the option of paid employment (Le, 1999). On the other hand, it seems to be a matter of the shape rather than the direction of the effect. Specifically, it has been found that there is an U-

shaped relationship between education and entry to self-employment (Acs & Szerb, 2007; Blanchflower, 2000; Poschke, 2013). Nonetheless, most studies find a positive effect of education on probability to become an entrepreneur but mostly based on samples for the developed countries (Bae et al., 2014).

Looking at non-cognitive traits, risk aversion has come into the discussion on the determinants of becoming an entrepreneur. On the one side, some authors identify entrepreneurs as calculated risk-takers (Puri & Robinson, 2005) that do not perceive themselves as being more prone to risk, but as individuals that cognitively evaluate business opportunities as more positive than non-entrepreneurs (Busenitz, 1999; Palich & Bagby, 1995). Others have found that emerging entrepreneurs are more risk averse than non-entrepreneurs (Xu & Ruef, 2004). Caliendo et al. (2006, 2008) and Caliendo & Kritikos (2007) have dedicated a good deal of their research to explore the link between risk and entrepreneurship. Their findings indicate that having low levels of risk aversion increases the probability of self-employment for people who come from another job (Caliendo et al., 2006). Performing a sensitivity analysis, they find no effect if the person is unemployed or inactive. For these people, other variables than risk aversion, drive the decision to become entrepreneurs.

Taking into account the results of previous research concerning the link between entrepreneurship and risk aversion, the aim of this chapter is to introduce the variability in levels of cognitive ability to explain the direction of the effect, if there happens to be one. The relevance of doing so is that it has been shown that attitudes towards risk vary for different cognitive ability levels. As a matter of fact, studying the relationship between risk aversion and impatience with cognitive ability using a choice experiment, Dohmen et al. (2010) found that individuals with lower cognitive ability are more risk averse than those with higher cognitive ability.

Literature on risk attitudes and labor market has found that more risk averse people tend to self-select themselves as employees (Kihlstrom & Laffont, 1979; Landier, 2004; van Praag & Cramer, 2001). A possible explanation is that individuals maximize their utility before choosing an occupation taking into account their financial reward, their risk aversion and their abilities (Martiarena, 2013). It means, that individuals have at least some insights into how smart they are, what their choices are, and how much risk

are they willing to take. Therefore, since entrepreneurs tend to deal with a higher variance of earnings than employees (Poschke, 2013; Rees & Shah, 1986), the individual who chooses to enterprise should have lower levels of risk aversion than one who chooses to become an employee.

Based on this, and following the Theory of Planned Behavior presented by Ajzen (1991), we expect the risk aversion effect to vary among different cognitive levels. According to Ajzen's theory, individuals engage in a behavior because of their intention to perform the behavior. This intention is influenced by their attitudes towards the behavior, the perceived norms or perceived social pressure, beliefs about the behavior, and the self-perceived capabilities, or perceived behavioral control, to accomplish the behavior.

If we assume that individuals in the first tercile have a perception of low capabilities, i.e., low perceived behavioral control, to become entrepreneurs, then being more prone to risk should increase their probabilities to engage in this behavior because they might think their chances to succeed are higher than they really are (overconfidence (Koellinger et al., 2007; Salamouris, 2013; Svenson, 1981)). In addition, considering that those up in the cognitive distribution would have a more stable income by choosing to enter the traditional labor market because they have high capabilities, the individuals in the upper tercile should be more willing to take risk in order to decide to enterprise (opportunity entrepreneurship (Block et al., 2015)). Those in the middle of the cognitive distribution should not have a bad perceived behavioral control, but their ability to evaluate their relative position in the ability distribution may be difficult. They may have tendencies to either associate themselves with the lower ability and, thus, lower behavioral control (more likely to become employees), or higher than real behavioral control (over-estimating their capacities and, thus, being more likely to become entrepreneurs).

Overconfidence of entrepreneurs has attracted a large share of entrepreneurship literature. Koellinger et al. (2007) found that people who had a positive perception of their abilities were more likely to be entrepreneurs. Additionally, Salamouris (2013) found that it is precisely this positive perception of their abilities (overconfidence) that offsets any risk aversion they may have. Here, we assume that their risk tolerance will influence their level of confidence in their entrepreneurial skills thus making them

perceive that they have more or less perceived behavioral control than they actually have according to their hard skills.

The hypotheses we want to test are:

H1: Having low risk aversion increases the likelihood of becoming an entrepreneur at the bottom of the cognitive distribution.

H2: Having low risk aversion increases the likelihood of becoming an entrepreneur at the top of the cognitive distribution

If the hypotheses H1 and H2 get rejected, it will indicate that having low risk aversion does not significantly increase the likelihood of becoming an entrepreneur at the bottom and top of the cognitive distribution.

The rest of the chapter is organized as follows. Section 3.3 provides description of the sample and our economic strategy. Following that, section 3.4 describes the results, and section 3.5 concludes the chapter.

### 3.3. Data and econometric specification

In order to identify the skills of entrepreneurs, we work with the National Longitudinal Survey Data (NLSY) 1997-2016. The NLSY97 is an ongoing longitudinal survey on 8.984 individuals who were 12-18 years old when they were first interviewed in 1997. There are now 17 rounds available<sup>8</sup>. Regarding the types of information gathered in the survey, it includes data on employment, education, contextual variables, childhood, dating, income, health and attitudes.

The aim of this chapter is to unveil whether risk aversion matters for becoming an entrepreneur, and if this effect varies across the distribution of cognitive ability. To do so, we define entrepreneurs as those individuals who are self-employed the week before the interview was conducted. We use individual responses to a question on employment status to construct the self-employment variable.

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<sup>8</sup> Responses for each round are generally collected in an average of one and a half years.



We have two sets of independent variables. The first one refers to hard skills. We use the results in the Armed Services Vocational Aptitude Battery (ASVAB) that respondents took between the summer of 1997 and the spring of 1998. As in Chapter 1, we work with the joint percentile score of math, verbal, and paragraph comprehension tests to create the terciles of hard skills.

The second set of independent variables refers to risk attitudes. We use the NLSY97 battery on risk assessment. Respondents were asked to rate themselves on a 10 point scale their inclination to take risks in general, as well as specific types of risks, such as: driving, romance, finance, work, health, faith in people, life changes, and gambling. This battery was introduced during round 14 (2010), and it was repeated in round 15 (2011) for those that were not interviewed in round 14. We control for sociodemographic variables such as gender, age, marital status, race, and educational level. Additionally, we control by industry because there are differences across sectors in terms of the constraints that they represent for entrepreneurs. For instance, entry barriers are higher in sectors that demand more economic capital (Müller & Arum, 2009) such as manufacturing, or higher levels of education (Bates, 1995) such as the professional services sector.

As in the previous chapter, we see that the sample is balanced. The mean age is 25 years, and there are slightly more men than women in our analysis. White race predominates, followed by black and Hispanic. There is a residual number of mixed-race respondents in our sample. Roughly a quarter of the sample is married and around half of them have completed between 9<sup>th</sup> and 11<sup>th</sup> grade of education. Only about 3% had completed college and 16% had completed some college. Most of the risk domains score around the algebraic mean, but driving, finances, and health related risks which score below.

Table 3.1 depicts the variable definitions while Table 3.2 shows the descriptive statistics for the sample employed here.

We define the econometric model specification in the same way as in the previous chapter. We use `xtlogit` in Stata software. Again, the dependent variable is self-employment versus employee. We do not consider unemployment in this chapter,

which is clearly a limitation. Let *Self* stand for self-employed taking the value 0 when the individual's is not a self-employed, and the value 1 when he is self-employed.

$$Self = \begin{cases} 0 & \text{if not self - employed} \\ 1 & \text{if self - employed} \end{cases}$$

Understanding self-employment as a function of the individual characteristics, we have:

$$Pr(Self = 1|\mathbb{X}) = \frac{\exp(\alpha + \beta'(\mathbb{X}_{it}) + \gamma'(\mathbb{Z}_i))}{1 + \exp(\alpha + \beta'(\mathbb{X}_{it}) + \gamma'(\mathbb{Z}_i))}$$

where  $\mathbb{X}$  is a vector of individual characteristics, which some of them are time-invariant (gender), while other change across waves of the survey (age). Our main controls refer to risk orientations and their interactions with the three terciles of cognitive ability. These are represented by the variable  $\mathbb{Z}_i$ . In this chapter, we assume that risk attitudes do not vary with time, thus the variable  $\mathbb{Z}_i$  bears no time subscript.

**Table 3.1: Definition of variables**

Variable	Description
Self	Dummy variable for self-employment.
Age	Age of the respondent.
Female	Dummy variable for gender.
Educ	Highest degree completed by respondent.
Race	Race of the respondent
Married	Marital status of the respondent.
Industry	Industry sector in which the respondent works. Dummies for: agriculture forestry and fisheries, mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health and social services, entertainment accommodations and food, other services, and public administration
<b>Risk attitudes</b>	
Risk assessment	Willingness to take risks generally. Self-reported 0-10 scale
Risk assessment driving	Willingness to take risks driving. Self-reported 0-10 scale
Risk assessment finances	Willingness to take risks with finances. Self-reported 0-10 scale
Risk assessment work	Willingness to take risks with work. Self-reported 0-10 scale
Risk assessment health	Willingness to take risks with health. Self-reported 0-10 scale

Risk assessment faith in people	Willingness to take risks with faith in people. Self-reported 0-10 scale
Risk assessment romance	Willingness to take risks with romance. Self-reported 0-10 scale
Risk assessment life change	Willingness to take risks with life changes. Self-reported 0-10 scale
Risk assessment gambling	Willingness to take risks with gambling. Self-reported 0-10 scale
<b>Hard skills</b>	
ASVAB terciles	Three categories of cognitive ability.

Source: NLSY97

**Table 3.2: NLSY97 sample descriptive statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Self	61,852	0.068	0.251	0.0	1.0
Age	61,852	25.262	4.183	18.0	35.0
Female	61,852	0.512	0.500	0.0	1.0
Educ	61,852	2.210	1.260	0.0	7.0
Race: White	61,852	0.533	0.499	0.0	1.0
Race: Black	61,852	0.249	0.432	0.0	1.0
Race: Hispanic	61,852	0.208	0.406	0.0	1.0
Race: Mixed	61,852	0.009	0.097	0.0	1.0
Married	61,852	0.254	0.435	0.0	1.0
Industry: Agriculture, forestry, and fisheries	61,852	0.008	0.092	0.0	1.0
Industry: Mining	61,852	0.005	0.069	0.0	1.0
Industry: Utilities	61,852	0.002	0.047	0.0	1.0
Industry: Construction	61,852	0.067	0.250	0.0	1.0
Industry: Manufacturing	61,852	0.069	0.254	0.0	1.0
Industry: Wholesale trade	61,852	0.022	0.149	0.0	1.0
Industry: Retail trade	61,852	0.159	0.366	0.0	1.0
Industry: Transportation and warehousing	61,852	0.024	0.153	0.0	1.0
Industry: Information and communication	61,852	0.024	0.155	0.0	1.0
Industry: Finance, insurance, and real estate	61,852	0.063	0.243	0.0	1.0
Industry: Professional and related services	61,852	0.113	0.317	0.0	1.0
Industry: Educational, health, and social services	61,852	0.202	0.401	0.0	1.0
Industry: Entertainment, accommodations, and food	61,852	0.154	0.361	0.0	1.0

Industry: Other services	61,852	0.053	0.224	0.0	1.0
Industry: Public administration	61,852	0.031	0.173	0.0	1.0
Risk assessment	61,852	5.580	2.468	0	10
Risk assessment driving	61,852	2.840	3.023	0	10
Risk assessment finances	61,852	3.986	2.668	0	10
Risk assessment work	61,852	4.754	3.037	0	10
Risk assessment health	61,852	2.929	2.895	0	10
Risk assessment faith in people	61,852	4.373	2.780	0	10
Risk assessment romance	61,852	4.417	3.170	0	10
Risk assessment life change	61,852	5.076	2.773	0	10
Risk assessment gambling	61,852	5.498	3.442	0	10
ASVAB terciles	61,852	1.999	0.816	1.0	3.0

### 3.4. Results

We run our model for each risk domain (Table A.2. in the Appendix) interacted with the terciles of cognitive ability to test the effect of risk aversion in the full sample. Our main results (Table 3.3), in terms of odd ratios, show that in model for general, work and faith in people risk domains being in the middle of the cognitive ability distribution reduces the odds of enterprising. The same is true for the top tercile of hard skills in the models for general, finances, work and life change risk domains.

Moving on to the results for each domain, willingness to take risks in general and in work increase the odds of enterprising for all individuals regardless of the cognitive tercile they belong to. The direction of the effect of low risk aversion on entrepreneurship is consistent with the results found in previous research on risk aversion and entrepreneurship (Caliendo et al., 2006, 2008; Caliendo & Kritikos, 2007). Willingness to take risks in finances and with life changes increases the odds for individuals in the first and third tercile of hard skills. It is interesting that the effects that are relevant for most individuals are the ones related to finances, work, and life changes because these areas are the domains where individuals might find the greatest challenges when deciding to become entrepreneurs.

Looking at the domains of risk attitudes that vary conditional on the hard skills terciles, we find that for those down in the distribution being prone to take risks while driving

and risks involving their health increases their odds to enter into self-employment. Moving into the second tercile, the odds of enterprising are also increased by low risk aversion regarding faith in people. Lazear (2005) showed that entrepreneurs need to be Jacks of all trades. And that in turn, requires relying on plenty of people within their environment. Thus, faith in people may facilitate the entry into self-employment as the social capital is necessary to run a successful business (Davidsson & Honig, 2003; Light & Dana, 2013).

**Table 3.3: Risk assessment for becoming an entrepreneur**

	General	Driving	Finances	Work	Health	Faith	Romance	Life Change	Gambling
<b>Hard Skills: Cognitive ability terciles</b>									
Middle	<b>0.550**</b> (-1.99)	0.933 (-0.43)	0.716 (-1.56)	<b>0.626**</b> (-2.08)	0.921 (-0.50)	<b>0.569***</b> (-2.68)	0.838 (-0.87)	0.743 (-1.19)	0.710 (-1.58)
Top	<b>0.360***</b> (-3.01)	1.047 (0.25)	<b>0.561**</b> (-2.34)	<b>0.623*</b> (-1.80)	1.058 (0.29)	0.777 (-1.04)	1.049 (0.21)	<b>0.529**</b> (-2.24)	0.771 (-1.07)
<b>Risk assessment</b>									
General	<b>1.089***</b> (2.95)								
Driving		<b>1.044*</b> (1.85)							
Finances			<b>1.073***</b> (2.71)						
Work				<b>1.067***</b> (2.70)					
Health					<b>1.044*</b> (1.85)				
Faith in People						0.983 (-0.66)			
Romance							1.003 (0.13)		
Life Change								<b>1.077***</b> (2.92)	

Gambling					1.002 (0.11)
<b>Interactions</b>					
General X Middle	<b>1.086*</b> <b>(1.77)</b>				
General X Top	<b>1.188***</b> <b>(3.30)</b>				
Driving X Middle		0.990 (-0.28)			
Driving X Top		0.988 (-0.31)			
Finances X Middle			1.059 (1.33)		
Finances X Top			<b>1.132***</b> <b>(2.67)</b>		
Work X Middle				<b>1.075*</b> <b>(1.89)</b>	
Work X Top				<b>1.086*</b> <b>(1.94)</b>	
Health X Middle				0.996 (-0.09)	
Health X Top				0.985 (-0.36)	
Faith in People X Middle					<b>1.117***</b> <b>(2.69)</b>
Faith in People X Top					1.061 (1.35)

Romance X Middle								1.017		
								(0.46)		
Romance X Top								0.991		
								(-0.23)		
Life Change X Middle									1.043	
									(1.02)	
Life Change X Top									<b>1.129***</b>	
									<b>(2.67)</b>	
Gambling X Middle										1.045
										(1.29)
Gambling X Top										1.047
										(1.30)
<i>AIC</i>	19911.05	19972.64	19929.51	19927.81	19972.42	19967.02	19977.27	19927.66	19971.53	
<i>BIC</i>	20317.51	20379.1	20335.98	20334.27	20378.88	20373.48	20383.73	20334.13	20378	
<i>N</i>	61852	61852	61852	61852	61852	61852	61852	61852	61852	61852

*T* statistics in parenthesis. Individual level Controls: age, gender, education, marital status, and race. Industry controls: agriculture forestry and fisheries (reference category), mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health and social services, entertainment accommodations and food, other services, and public administration. Time Trends: Year. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

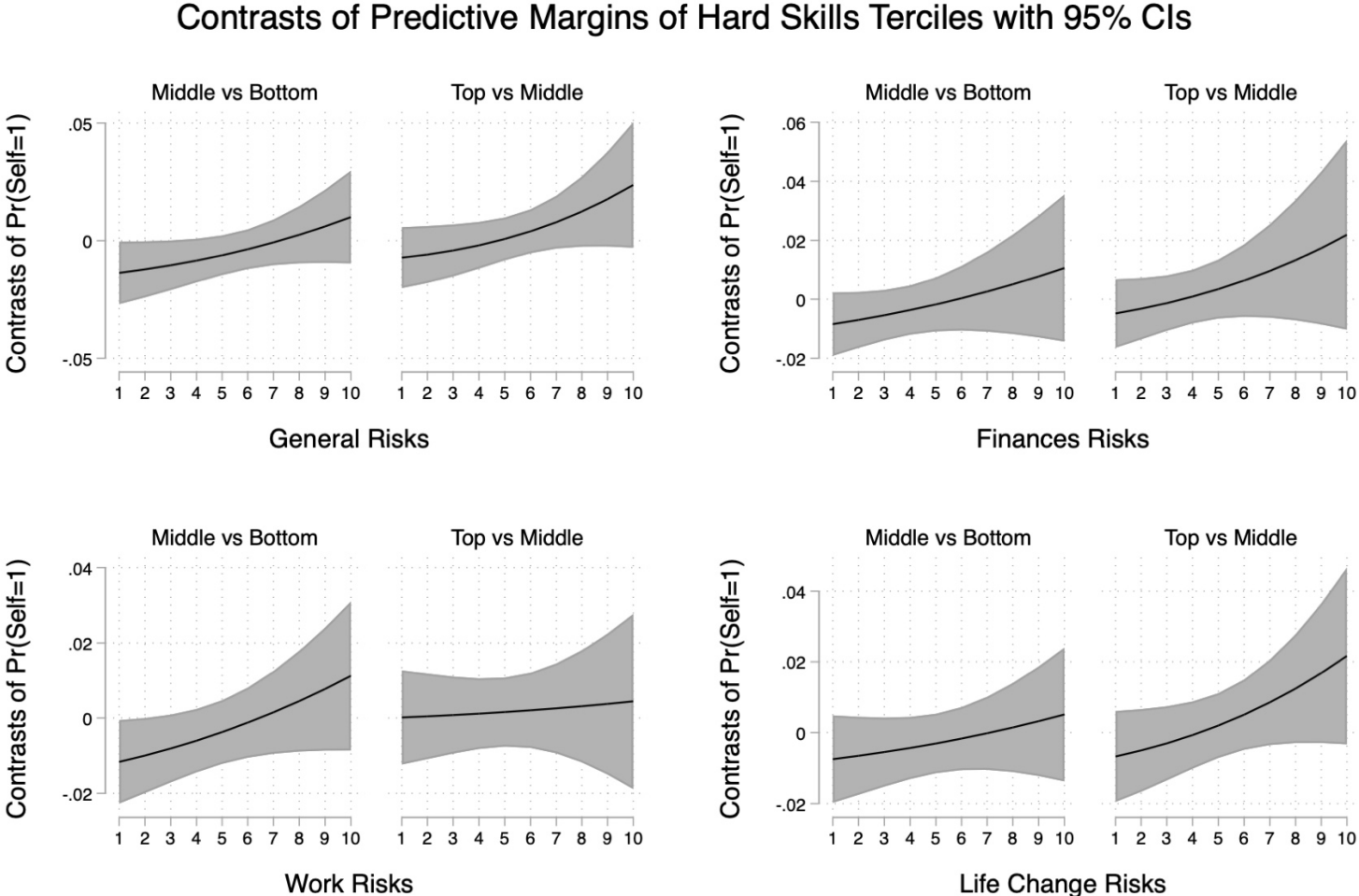


We run contrast tests of the interactions for each of the four domains that remain significant for most of the individuals in the sample (general, finances, work, and life change risks) with the three terciles of cognitive ability. For life change, finances, and general risks the interaction is significant with a 95% confidence interval and for work with a 90%. Based on these, we can reject the null hypothesis that the slopes for these domains at each level of cognitive ability are equal.

Figure 3.1. illustrates the adjacent contrast of predictive margins of hard skills by the aforementioned risk domains. Looking at the figures for general and work-related risks (left panel), we find that the difference in the adjusted means comparing individuals in the middle of the cognitive distribution to those in the bottom is only significant at the 5% level for the contrast when the individual has rather low levels of willingness to take these type of risks. Moving on to the right panel, for finances and life change risks all confidence intervals include zero, therefore, the difference is not significant at the 5% level.

Our estimation results suggest that having low levels of risk aversion (general, finances, life change and work domains) increased the probability of enterprising for individuals up and down of the distribution of cognitive ability which lends support to our hypotheses 1 and 2. However, this two of the domains that are relevant in these two aforementioned terciles are also relevant for those with medium hard skills. Additionally, after testing the interactions, we find that these differences are only significant for individuals with rather low willingness to take general and work-related risks. This suggests that the positive effect of low risk aversion on the decision to be entrepreneurial might hold across the distribution of cognitive abilities. The differences found come mostly from the specific domains being studied and the level of willingness to take the specific risks, so it may be interesting to explore them in depth in the future.

Figure 3.1.: Adjacent contrasts of predictive margins of Hard Skills by Risk Domains with confidence intervals



Looking further across our models (Table A.2 in the Appendix), we find varying results for the remaining control variables. Age has a positive statistically significant effect across models. Moving on to education, we find the same negative effect as in Chapter 1. Regarding race, being Hispanic decreases the odds of enterprising across models. In a different fashion than in the previous chapter, marital status has a positive and significant effect on the odds of becoming an entrepreneur. Finally, results for industries mimic the results for the big five personality traits with only other services having a significant and positive effect on enterprising. The reference category is agriculture.

### 3.5. Conclusions

The purpose of this chapter was to unveil whether risk aversion matters when it comes to becoming an entrepreneur, and whether its effect varies depending on the level of cognitive ability of individuals. We tested our model of the effect of risk aversion on the likelihood of becoming an entrepreneur in the U.S. using the National Longitudinal Survey Data (NLSY) 1997-2016.

We operationalized risk aversion using the battery on risk assessment in the NLSY97. This battery asked about respondents about their willingness to take risk in general, while driving, with romance, in finances, at work, with health, faith in people, life changes, and gambling. We assume, following the Theory of Planned Behavior (Ajzen, 1991), that willingness to take risks increase the likelihood of becoming an entrepreneur for those with lower perceived behavioral control (i.e. at the bottom of the cognitive ability distribution); as well for those with a higher perception of capabilities (i.e. top of the distribution) that would risk losing a more stable income.

Controlling for year and industry, we found that having low levels of risk aversion increases the likelihood of entrepreneurship when referring to willingness to take risks in general, finance, work and life change for individuals with low and high hard skills. This is relevant because these are the risk domains that are present when deciding to become an entrepreneur. Out of these four domains, general and work risks are also significant in the middle of the distribution. This suggests that although there are some

variations on the effect of risk domains conditional on hard skills, low risk aversion is necessary for individuals who want to engage in entrepreneurship. Their perceived behavioral control might make them believe that they have low or high capabilities, but they still need to have willingness to take risks in order to overcome the possible instability that is inherent to entrepreneurship and thus choose entrepreneurship over employment.

The relevance of this chapter is that it contributes to the existing literature on risk aversion and entrepreneurship that has found mixed results. Working with a large panel and analyzing the effect of risk aversion not on entrepreneurs as a peer group, but with differences in hard skills we establish some new results which bring open new avenues of research on risk perceptions and entrepreneurship relating it to the distribution of the hard skills.

#### 4. Chapter 3. Hard and soft skills, risk attitudes and the types of entrepreneurship: evidence from the NLSY97 sample

##### Abstract

This chapter applies the Theory of Planned Behavior to a study of the determinants of entrepreneurship assuming different roles of entrepreneurs across the distribution of cognitive skills while controlling for soft skills and risk attitudes. Resorting to the NLSY97 data for the US we study the determinants of becoming novel, serial or portfolio entrepreneurs compared to a gainful employment. Results show that tolerance to general, work, faith in people and life change risks increase the likelihood of novel entrepreneurship regardless of the level of hard skills. Furthermore, willingness to take general risks universally increases the chances of becoming portfolio entrepreneur. Although we did not find that any big five personality trait was universal for serial or portfolio entrepreneurship, we did find varying results depending on the level of hard skills. The same is true for risk domains when analyzing serial entrepreneurship.

## 4.1. Introduction

This chapter seeks to contribute to the entrepreneurship literature by analyzing the role of risk aversion and the big five personality traits, across different levels of cognitive ability, in the decision to become a novel, serial or a portfolio entrepreneur (Westhead et al., 2005). The relevance of this approach has to do with the need to understand entrepreneurs as a heterogeneous group in the types of their entrepreneurial behavior, as well as in their hard and soft skills.

Although the variables of entry into entrepreneurship have been studied from the perspective of hard skill (Poschke, 2013) and soft skills (Caliendo et al., 2011; Zhao & Seibert, 2006), our interest is to exploit the variation that exists within the group of entrepreneurs both in terms of cognitive levels and types of entrepreneurs. By types of entrepreneurs, we refer to whether they are novel, serial or portfolio entrepreneurs depending on the number of times they have made the decision to start a business. By novel entrepreneurs, we understand those who just start their first venture. Following that, we consider serial entrepreneurs those who keep creating viable startups and then sell or abandon them to start another one. Finally, by the name portfolio entrepreneurs we call those, who have created several companies in parallel and keep active roles in all of them at once. Under this perspective, an individual may have started a single venture, started several at different times in life, or run several in parallel.

Using data from the National Longitudinal Survey Data (NLSY) from 1997 to 2016, we test the effect of risk aversion and the big five personality traits on the probability of deciding to be a novel, serial, or portfolio entrepreneur conditional on different levels of hard skills. Our findings suggest that what matters for novel entrepreneurs is willingness to take general, work, faith in people, and life change risks regardless of their cognitive ability. As for the big five personality traits the effect varies depending on their level of hard skills. Regarding serial entrepreneurs, there is no universal big five personality trait or risk domain that matters. Once again, the effect varies depending on the hard skills of the individual. For portfolio entrepreneurs, only willingness to take general risks matters across the distribution of hard skills. Conscientiousness and openness to experience are relevant too, but only for those with low cognitive abilities.

This proves the importance of our approach here. Neither the personality traits, nor the risk aversion domains seem to be uniformly distributed across the cognitive ability space when it comes to their predictions for various types of entrepreneurship. In the following sections we intend to disentangle these peculiarities and interpret them in light of the Theory of Planned Behavior (Ajzen, 1991).

The rest of the chapter is organized as follows. In section 4.2, we present theories on hard and soft skills with respect to the different types of entrepreneurship. We also present the mechanisms that operate in the relation between these three. In section 4.3, we describe the data, as well as the econometric model. In section 4.4, we present the results before concluding in section 4.5.

## 4.2. Theoretical background

There are different kinds of entrepreneurs depending on how many times they decide to start a business. First, we have the novel entrepreneurs who are those who have a single venture. Then, we have the serial entrepreneurs who are those who create and sell or abandon new ventures in order to start another one. Finally, we have the portfolio entrepreneurs who run several ventures in parallel (Westhead et al., 2005).

Previous literature has explored the factors that influence the decision to become habitual entrepreneurs (i.e., serial and portfolio). The quality of the current business, the expectations of a new one, and the skills of the individual have been identified as influencing variables for moving from novel to habitual entrepreneur (Carbonara et al., 2020). Focusing on the division between serial and portfolio entrepreneurs, the above authors find that serial entrepreneurs are highly skilled, while portfolio entrepreneurs are medium to low skilled and therefore decide to invest in a new venture due to a decrease in productivity of the first venture.

Chen (2013) finds that the most important determinant of serial business formation is selection on ability and that learning by doing is relevant when the new business is closely related to the previous one. Past research on the impact of education has not been conclusive regarding its significance, or direction of the effect on the decision to

become an entrepreneur (Bates, 1995; K. Clark & Drinkwater, 2000; van Der Sluis et al., 2008). Nonetheless, Carbonara et al. (2020) found that higher levels of human capital (proxied by education, industry, management, and labor experience) are associated with higher probability of being a habitual entrepreneur.

On personality traits, Espiritu-Olmos & Sastre-Castillo (2015) found that what most influences entrepreneurial intention are personality characteristics, not an individual's work values. Regarding the differences between novel, serial, and portfolio entrepreneurs previous research has found that they are different in how much passion they express for their activity (Thorgren & Wincent, 2015). The highest levels of passion are present among portfolio entrepreneurs, with serial entrepreneurs also having high levels of passion. There are also differences in how much importance they place on creativity and innovation. Here again, portfolio entrepreneurs are the ones who assign greater relevance to these two characteristics (Westhead et al., 2005).

In the more traditional strand of literature, concentrated on predicting what determines individuals to become entrepreneurs versus employees without distinguishing between the types of entrepreneurships, the big five personality traits have been found to be an important predictor. Comparing entrepreneurs with managers, some authors have found that the former have higher levels of conscientiousness, openness to experience and extraversion, as well as lower levels of neuroticism and agreeableness than the latter (Brandstätter, 2011; Zhao & Seibert, 2006). As for differentiating between types of entrepreneurs, there are few studies that do so and there are variations in the results of the big five personality traits depending on the type of sample and the definition of entrepreneur (Salmony & Kanbach, 2021). Antoncic et al. (2015) study the difference between practicing, potential, maybe-entrepreneurs and non-entrepreneurs and find that the characteristic that differentiates real (practicing) entrepreneurs from others is their openness to experience.

Regarding risk aversion, although inconsistencies have been found in the results, most studies agree that a high level of risk tolerance is necessary to decide to become an entrepreneur (Cramer et al., 2002; Kerr et al., 2017). Studying necessity and opportunity entrepreneurs, Block et al. (2015) find that opportunity entrepreneurs are more willing to take risks, as are those who are motivated by creativity and the non-monetary aspects



of their work. Parker's work (2014) in serial and portfolio entrepreneurs explores the influence of risk aversion on being one or the other. Using an occupational choice model, he finds that individuals with a low level of risk aversion are more likely to become serial entrepreneurs because they are willing to take risks in order to secure more income. Those with an intermediate level of risk aversion are more likely to become portfolio as they seek to dilute risk, while those with a high level of risk aversion will pass up new opportunities and stick with what they currently have.

Risk aversion and personality traits influence the decision to be an entrepreneur and, according to the existing literature, these also seem to influence the decision of what kind of entrepreneur one wants to be. Our aim is to test this premise for different levels of cognitive ability separately for men and women. By doing so, we will be following Salmony & Kanbach's (2021) recommendation to use entrepreneur sub-samples to look for differences in traits between different types of entrepreneurs.

In order to further justify the differences between novel, serial and portfolio entrepreneurs, we resort to the Theory of Planned Behaviors (TPB). The Theory of Planned Behavior (Ajzen, 1991) states that performing a behavior is influenced by the intention to engage in this behavior. This intention, in turn, is determined by the individual's beliefs about the behavior (attitudes), the social pressure to perform the behavior, and the person's perception of control over the behavior. Based on this, we assume that both cognitive level (hard skills) and personality traits (soft skills) are determinants of both perceived behavioral control and attitudes towards entrepreneurship. It may also be the case that society chooses to put more or less pressure on an individual to choose entrepreneurship by looking at his or her hard and soft skills.

Specifically, when talking about the decision to be a novel, serial, or a portfolio entrepreneur, we see two main distinctions in terms of the planned behavior of individuals. First, those individuals who have already owned a business have some experience in starting and running one, even if the previous attempt was not necessarily successful. Therefore, their attitudes, the subjective norms they receive and the perceived behavioral control they have reflect this experience. Particularly, serial and portfolio entrepreneurs, due to this acquired experience, perceive that they are more in

control over what they can do than novel entrepreneurs who are just starting in the entrepreneurial world.

Among these entrepreneurs with more perceived behavioral control, we assume a second distinction, which has to do with intention. On the one hand, there are those who choose to be serial entrepreneurs because they have a stable intention to become entrepreneurs. On the other hand, there are those who choose to be portfolio entrepreneurs because their experience expands their perceived behavioral control adding to more possible dimensions in their intention, and this drives them to run several ventures simultaneously.

With the foregoing in mind, we expect individuals who are more open to new ideas and experiences (openness to experience) to be more likely to become entrepreneurs regardless of their cognitive abilities. As openness to experience gives individuals the curiosity to explore new business ideas, we expect this effect to be relevant for all types of entrepreneurs. In addition, we expect extraversion to be relevant for all types of entrepreneurs in the first and third terciles of cognitive. Being more assertive and energetic is useful for the former because they need to demonstrate that they have control (they may perceive they have it, but investors still have to feel it themselves). For the latter, because they need to be enthusiastic, outspoken and action-oriented to seek and convince investors to big stakes risky investments.

The hypotheses we want to test are the following:

H1: Openness to experience increases the likelihood of becoming a novel, serial or portfolio entrepreneur across all cognitive ability levels.

If hypothesis H1 gets rejected, it will indicate that openness to experience has no significant effect on the dependent variable across all cognitive ability levels.

H2: Extraversion increases the likelihood of becoming a novel, serial or portfolio entrepreneur at the bottom and top of the cognitive distribution.

Conversely, if the hypothesis H2 gets rejected, it will indicate that extraversion has no significant effect on the dependent variable at the bottom and top of the cognitive distribution.

Concerning risk aversion, as first-time entrepreneurs have less perceived behavioral control due to their lack of previous experience, low levels of risk aversion in general should be relevant when deciding to become a novel entrepreneur. Specifically, the willingness to take financial risks due to the uncertainty surrounding the entrepreneurship, particularly in the early stages.

H3: Willingness to take risks in finances increases the likelihood of becoming a novel entrepreneur across all cognitive ability levels.

Following Parker (2014), we expect individuals reentering to entrepreneurship after closing or selling a first venture (i.e., serial) to have a low level of risk aversion. Their previous experience in entrepreneurship could have gone one of two ways. On the one hand, they may have sold the company earning good profits that they may not want to lose in a new venture. On the other hand, they may have failed so they may be afraid of failing again. This is why we expect them to be financially risk tolerant as they need to be highly resilient to losing money in either case.

H4: Willingness to take risks with finances increases the likelihood of becoming a serial entrepreneur across all cognitive ability levels.

If we do not find empirical support for hypotheses H3 and H4, it will merely indicate that willingness to take risks in finances does not significantly increase the likelihood of becoming a novel or serial entrepreneur across all cognitive ability levels.

Portfolio entrepreneurs also have a high perceived control of enterprising and, in addition, a constant intention to be creating firms in parallel. For them, owning multiple companies may be a way to dilute risk (Parker, 2014). However, when compared to employees, we expect them to have low risk aversion at work as running several businesses in parallel implies hard work.

H5: Willingness to take risks with work increases the likelihood of becoming a portfolio entrepreneur across all cognitive ability levels.

If hypothesis H5 gets rejected, it will imply that willingness to take risks with work have no significant effect on our dependent variable.

The rest of the chapter is organized as follows. Next section presents our sample and econometric specification. Section 4.4 discusses the results, and section 4.5 concludes the chapter.

### 4.3. Data and econometric specification

To test our hypotheses, we use data from the National Longitudinal Survey Data (NLSY) 1997-2016. The NLSY97 is an ongoing longitudinal survey of 8,984 individuals who were 12 and 18 years old when first interviewed in 1997. There are 17 rounds available<sup>9</sup>. This survey collects data on employment, education, contextual variables, childhood, dating, income, health, and attitudes.

Our main variable of interest is the type of entrepreneur the individual becomes. For that, following Chen's (2013) work, we make use of the job record that NLSY offers in order to classify the entrepreneurs into novel, serial or portfolio categories. If it is the first time they report a job as self-employment or if the job code is the same as the previous report, they are classified as novel entrepreneurs. Serial entrepreneurs are those who have reported a job as self-employment in different rounds and the employment codes are different. Finally, those entrepreneurs who report more than one job as self-employment in the same round are classified as portfolio entrepreneurs. We compare these three categories of entrepreneurs to the employee category within the NLSY97 sample. We do not include unemployed in our research.

Turning to the independent variables, we have two classes of variables. First, we have hard skills. As in Chapters 1 and 2, we use the results in the Armed Services Vocational Aptitude Battery (ASVAB) that respondents took between the summer of 1997 and the spring of 1998. We focus on the information regarding the scores for math, verbal, and paragraph comprehension tests. We divide this score into terciles. The second group of variables refers to soft skills. Here we have two groups of variables: the level of risk aversion and the big five personality traits.

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<sup>9</sup> Responses for each round are generally collected in an average of one and a half years.

For risk aversion, we use the NLSY97 battery on risk assessment which distinguishes between the following risk domains: general, financial, work, health, faith in people, romance, life change, and gambling. Respondents were asked to rate themselves on a 10-point scale their inclination to take risks in general, as well as specific types of risks, such as: romance, finance, among others. This battery was introduced during round 14, and it was repeated in round 15 for those that were not interviewed in round 14. For the Big Five, we use the self-ratings on the Ten-Item Personality Inventory Scale (TIPI) (Gosling et al., 2003), as we did in Chapter 1, to measure each of the dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The respondents were asked to provide self-ratings during round 12. Additionally, we control for sociodemographic variables such as gender, age, marital status, race, industry, and educational level.

Regarding our sample, due to pairwise deletion of missing cases the sample reduced by some 10.000 observations compared to the previous chapters. In terms of the individuals in our sample, there are slightly more men than women. In regard to race, more than half are white, followed by blacks and Hispanics. Approximately a quarter of the sample are married and just over half have completed between 9<sup>th</sup> and 11<sup>th</sup> grade of education. As for the big five personality traits, all score around the algebraic mean. Regarding risk attitudes, all domains are also close to the mean with the exception of health and finances risks which score below. Table 4.1 depicts the variable definitions while Table 4.2 shows the descriptive statistics for the sample employed here.

For the model specification, let  $Y$  denote the state in which individuals find themselves at a given time  $t$ . We study a situation where respondents of the NLSY97 sample can either be employed, self-employed with one company for the first time (novel entrepreneur), self-employed with previous self-employment experience (serial entrepreneurs), or self-employed with several ongoing business endeavors (portfolio entrepreneurs). Therefore, in our case there are four possible realizations of  $Y=m$ . This leads to the following formula:

$$Pr(Y = m|\mathbb{X}) = \frac{1}{1 + \sum_{m=1}^4 \exp(\alpha + \beta'(\mathbb{X}_{it}) + \tau'(\mathbb{N}_i))}$$

whereas in previous chapters  $\mathbb{X}_{it}$  is a vector of basic controls and  $\mathbb{N}_i$  collects two previously introduced vectors of controls of interest:  $\mathbb{Q}_i$  denoting personality traits interacted with the terciles of hard skills<sup>10</sup>, and  $\mathbb{Z}_i$  representing the risk attitudes interacted with the terciles of hard skills<sup>11</sup>. Recall that both, personality traits and risk attitudes are time-invariant in our analysis. We use `xtmlogit` which is a Stata command for panel data multinomial logit model.

**Table 4.1: Definition of variables**

<b>Variable</b>	<b>Description</b>
Self-employment categories	Categorical variable for employee, novel, serial and portfolio entrepreneur
Age	Age of the respondent.
Female	Dummy variable for gender.
Educ	Highest degree completed by respondent.
Race	Race of the respondent
Married	Marital status of the respondent. 0= Never married, separated, divorced or widowed. 1= Married
Industry	Industry sector in which the respondent works. Dummies for: agriculture forestry and fisheries, mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health and social services, entertainment accommodations and food, other services, and public administration
<b>Soft skills</b>	
Extraversion	Extraverted vs. reserved
Agreeableness	Sympathetic vs. critical
Conscientiousness	Dependable vs. disorganized
Neuroticism	Calm vs. anxious
Openness to experience	Open vs. conventional
<b>Risk attitudes</b>	
Risk assessment	Willingness to take risks generally. Self-reported 0-10 scale
Risk assessment finances	Willingness to take risks with finances. Self-reported 0-10 scale
Risk assessment work	Willingness to take risks with work. Self-reported 0-10 scale
Risk assessment health	Willingness to take risks with health. Self-reported 0-10 scale
Risk assessment faith in people	Willingness to take risks with faith in people. Self-reported 0-10 scale

<sup>10</sup> In Chapter 1.

<sup>11</sup> In Chapter 2.

Risk assessment romance	Willingness to take risks with romance. Self-reported 0-10 scale
Risk assessment life change	Willingness to take risks with life changes. Self-reported 0-10 scale
Risk assessment gambling	Willingness to take risks with gambling. Self-reported 0-10 scale
<b>Hard skills</b>	
ASVAB terciles	Three categories of cognitive ability.

Source: NLSY97

**Table 4.2: NLSY97 sample descriptive statistics**

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Self categories	52,393	0.146	0.464	0.00	3.00
Age	52,393	25.272	4.189	18.00	35.00
Female	52,393	0.513	0.499	0.00	1.00
Educ	52,393	2.259	1.262	0.00	7.00
Race: White	52,393	0.552	0.497	0.00	1.00
Race: Black	52,393	0.245	0.430	0.00	1.00
Race: Hispanic	52,393	0.193	0.394	0.00	1.00
Race: Mixed	52,393	0.009	0.098	0.00	1.00
Married	52,393	0.255	0.436	0.00	1.00
Industry: Agriculture, forestry, and fisheries	52,393	0.010	0.092	0.00	1.00
Industry: Mining	52,393	0.005	0.068	0.00	1.00
Industry: Utilities	52,393	0.002	0.045	0.00	1.00
Industry: Construction	52,393	0.066	0.248	0.00	1.00
Industry: Manufacturing	52,393	0.068	0.252	0.00	1.00
Industry: Wholesale trade	52,393	0.022	0.146	0.00	1.00
Industry: Retail trade	52,393	0.159	0.365	0.00	1.00
Industry: Transportation and warehousing	52,393	0.024	0.152	0.00	1.00
Industry: Information and communication	52,393	0.025	0.156	0.00	1.00
Industry: Finance, insurance, and real estate	52,393	0.065	0.246	0.00	1.00
Industry: Professional and related services	52,393	0.113	0.317	0.00	1.00
Industry: Educational, health, and social services	52,393	0.202	0.402	0.00	1.00
Industry: Entertainment, accommodations, and food	52,393	0.154	0.361	0.00	1.00
Industry: Other services	52,393	0.052	0.222	0.00	1.00
Industry: Public administration	52,393	0.031	0.175	0.00	1.00
Risk assessment	52,393	5.597	2.442	0.00	10.00
Risk assessment finances	52,393	3.996	2.658	0.00	10.00
Risk assessment work	52,393	4.792	3.018	0.00	10.00
Risk assessment health	52,393	2.921	2.867	0.00	10.00

Risk assessment faith in people	52,393	4.396	2.764	0.00	10.00
Risk assessment romance	52,393	4.415	3.142	0.00	10.00
Risk assessment life change	52,393	5.067	2.757	0.00	10.00
Risk assessment gambling	52,393	5.510	3.436	0.00	10.00
Extraversion	52,393	5.496	0.863	2.5	7
Agreeableness	52,393	5.476	0.844	2.5	7
Conscientiousness	52,393	5.981	0.777	2.5	7
Neuroticism	52,393	5.541	0.868	2.5	7
Openness to experience	52,393	5.752	0.849	2.5	7
ASVAB terciles	52,393	1.999	0.82	1	3

#### 4.4. Results

Our aim with this chapter is to test whether risk aversion and personality traits are determinants of the decision to become a novel, serial or portfolio entrepreneur. To test this, we ran our model including the interaction of our variables of interest with the three terciles of cognitive ability. Below we present the most relevant results in multinomial log-odds (Table A.3 and Table A.4 in the Appendix).

##### 4.4.1. The big five personality traits for being novel, serial, or portfolio entrepreneur

To begin with, Table 4.3 shows the results of the Big Five personality traits for becoming a novel, serial, or a portfolio entrepreneur. The first five columns include only one of the traits in the model whereas the full model includes the five traits. Looking at the results of the first five columns, agreeableness seems to have a positive effect on being a first-time entrepreneur for individuals in the middle of the hard skills distribution. The same is true for openness to experience for those with lower cognitive skills. Extraversion and openness to experience also have a positive effect on becoming an entrepreneur again after closing or selling a first venture-i.e. on serial entrepreneurship-for the bottom and top tercile respectively. The estimate for conscientiousness suggests that this trait is relevant to being a portfolio entrepreneur for those in the bottom tercile of the distribution.



From the results for the full model, we can say that for those who decide to become entrepreneurs for the first time over choosing to be employees, being open to experiences has a positive and statistically significant effect for individuals at the bottom of the cognitive ability distribution. Agreeableness has a positive effect for those at the bottom and for those in the middle of the distribution. These results are contrary to the findings of Brandstätter (2011) and Zhao & Seiberg (2006) when comparing entrepreneurs and managers. Our results suggest that less capable individuals, as well as those with medium hard skills would benefit from having high levels of agreeableness.

After an individual has closed or sold a business, extraversion increases the likelihood of the person becoming a serial entrepreneur. This is true for individuals in the first tercile. Openness to experience is again relevant but this time only for those with the highest level of hard skills. This implies that the higher the cognitive ability the more relevant the openness to experience when analyzing serial entrepreneurs. On the one hand, being more intellectually curious allows them to identify new business opportunities. In the same vein, their cognitive abilities allow them to process these opportunities and create an action plan to carry them out.

Finally, when choosing to be a portfolio entrepreneur, the variables that become relevant are the tendency to show self-discipline (conscientiousness) for those at the bottom of the cognitive ability distribution. These individuals, who originally would have a low perceived behavioral control due to their cognitive level, see it enhanced because they already have experience in entrepreneurship. If, in addition, they intend to expand their experience, they need a high level of discipline to be able to run several ventures in parallel.

As for openness to experience, this trait is relevant for individuals at the bottom of the cognitive distribution. One possible explanation is that these individuals have a low perceived behavioral control prior to deciding to become entrepreneurs for the first time. Thus, they need to have a high level of curiosity to expand a behavior they have learned to control thanks to their previous experience in entrepreneurship.

**Table 4.3: Big Five personality traits for becoming a novel, serial, and portfolio entrepreneur**

	Extravert	Agreeable	Conscientious	Neurotic	Open	Full
<b>Novel</b>						
<b>Hard Skills: Cognitive ability terciles</b>						
Middle	0.669 (-0.65)	0.390 (-1.57)	2.932 (1.41)	2.038 (1.10)	0.585 (-0.76)	0.480 (-0.67)
Top	0.957 (-0.07)	0.804 (-0.36)	2.462 (1.24)	<b>4.097**</b> <b>(2.23)</b>	0.616 (-0.71)	0.689 (-0.36)
<b>Soft Skills: Big Five Personality Traits</b>						
Extraversion	1.047 (0.62)					0.986 (-0.18)
Agreeableness		0.946 (-0.77)				<b>0.860**</b> <b>(-1.93)</b>
Conscientiousness			1.112 (1.31)			1.036 (0.39)
Neuroticism				1.095 (1.14)		1.051 (0.57)
Openness to experience					<b>1.272***</b> <b>(2.99)</b>	<b>1.303***</b> <b>(2.99)</b>
<b>Interactions</b>						
Extraversion X Middle	1.125 (1.06)					1.092 (0.75)
Extraversion X Top	1.090 (0.80)					1.078 (0.65)
Agreeableness X Middle		<b>1.245**</b> <b>(2.01)</b>				<b>1.293**</b> <b>(2.25)</b>
Agreeableness X Top		1.127 (1.09)				1.132 (1.05)
Conscientiousness X Middle			0.873 (-1.08)			0.878 (-0.97)
Conscientiousness X Top			0.925 (-0.64)			1.003 (0.02)
Neuroticism X Middle				0.921 (-0.71)		0.885 (-1.00)
Neuroticism X Top				0.838 (-1.56)		0.823 (-1.61)
Openness to experience X Middle					1.144 (1.13)	1.098 (0.73)
Openness to experience X Top					1.169 (1.35)	1.145 (1.08)
<b>Serial</b>						

<b>Hard Skills: Cognitive ability terciles</b>						
Middle	4.064 (1.35)	0.471 (-0.71)	2.497 (0.81)	4.320 (1.35)	0.261 (-1.18)	1.137 (0.08)
Top	3.601 (1.30)	1.230 (0.21)	2.556 (0.87)	2.987 (1.06)	0.249 (-1.28)	0.761 (-0.17)
<b>Soft Skills: Big Five Personality Traits</b>						
Extraversion	<b>1.488***</b> <b>(3.21)</b>					<b>1.505***</b> <b>(3.06)</b>
Agreeableness		1.048 (0.36)				0.922 (-0.60)
Conscientiousness			0.956 (-0.36)			0.832 (-1.40)
Neuroticism				1.219 (1.43)		1.180 (1.03)
Openness to experience					1.117 (0.80)	1.031 (0.20)
<b>Interactions</b>						
Extraversion X Middle	0.826 (-1.06)					0.753 (-1.48)
Extraversion X Top	0.901 (-0.60)					0.799 (-1.22)
Agreeableness X Middle		1.216 (1.03)				1.329 (1.41)
Agreeableness X Top		1.092 (0.49)				1.069 (0.35)
Conscientiousness X Middle			0.906 (-0.53)			0.947 (-0.27)
Conscientiousness X Top			0.957 (-0.25)			1.022 (0.11)
Neuroticism X Middle				0.817 (-1.06)		0.777 (-1.20)
Neuroticism X Top				0.930 (-0.40)		0.911 (-0.47)
Openness to experience X Middle					1.328 (1.49)	1.098 (0.73)
Openness to experience X Top					<b>1.424*</b> <b>(1.93)</b>	<b>1.462*</b> <b>(1.94)</b>
<b>Portfolio</b>						
<b>Hard Skills: Cognitive ability terciles</b>						
Middle	0.734 (-0.15)	1.361 (0.15)	1.806 (0.28)	1.500 (0.20)	1.254 (0.10)	0.926 (-0.02)

Top	0.571 (-0.29)	1.118 (0.06)	0.788 (-0.11)	3.155 (0.59)	0.242 (-0.69)	0.107 (-0.71)
<b>Soft Skills: Big Five Personality Traits</b>						
Extraversion	0.904 (-0.40)					0.827 (-0.72)
Agreeableness		1.64 (0.25)				1.094 (0.33)
Conscientiousness			<b>0.614**</b> <b>(-2.05)</b>			<b>0.509***</b> <b>(-2.75)</b>
Neuroticism				0.945 (-0.23)		1.023 (0.09)
Openness to experience					1.360 (1.18)	<b>1.731*</b> <b>(1.93)</b>
<b>Interactions</b>						
Extraversion X Middle	1.155 (0.40)					1.215 (0.53)
Extraversion X Top	1.267 (0.68)					1.182 (0.48)
Agreeableness X Middle		1.032 (0.09)				0.996 (-0.01)
Agreeableness X Top		1.118 (0.31)				0.993 (-0.02)
Conscientiousness X Middle			0.977 (-0.06)			1.132 (0.33)
Conscientiousness X Top			1.172 (0.45)			1.393 (0.93)
Neuroticism X Middle				1.014 (0.04)		0.961 (-0.11)
Neuroticism X Top				0.929 (-0.21)		0.867 (-0.40)
Openness to experience X Middle					1.042 (0.11)	0.834 (-0.47))
Openness to experience X Top					1.438 (1.05)	1.156 (0.39)
<i>AIC</i>	34835.56	34852.17	34846.45	34855.02	34777.92	34800.07
<i>BIC</i>	36059.14	36075.75	36070.03	36078.6	36001.5	36342.85
<i>N</i>	52393	52393	52393	52393	52393	52393

*T* statistics in parenthesis. Individual level Controls: age, gender, education, marital status, and race.

Industry controls: agriculture forestry and fisheries (reference category), mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health

and social services, entertainment accommodations and food, other services, and public administration.  
Time Trends: Year. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

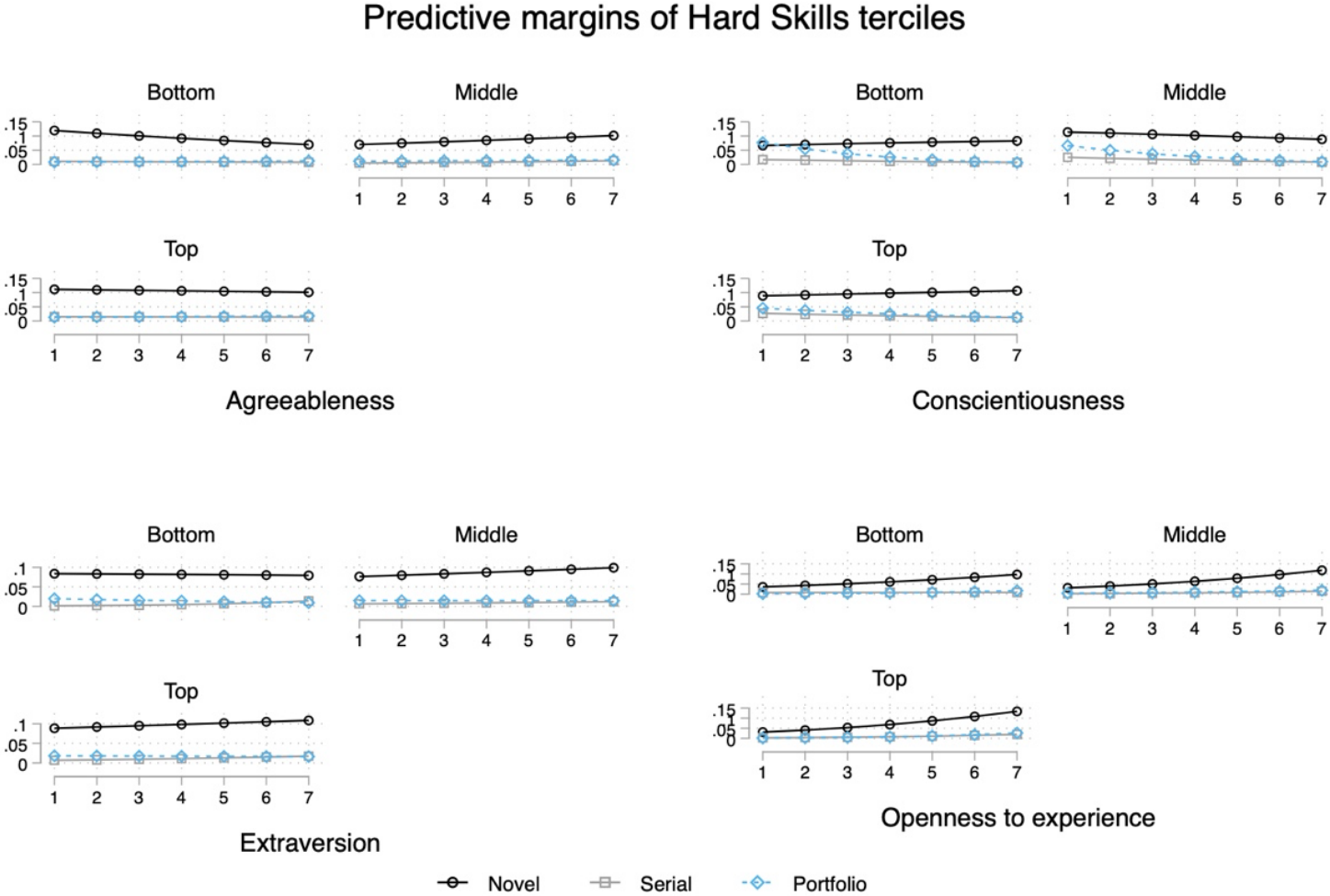
Figure 4.1. illustrates the predictive marginal probability of being novel, serial, or portfolio entrepreneur for those with different levels of agreeableness, conscientiousness, extraversion, and openness to experiences (from 1 to 7). The predictive marginal probability of being a novel entrepreneur is greater and more stable than that of being serial or portfolio for all levels of agreeableness and extraversion. It is also interesting to highlight that the predictive marginal probabilities for serial and portfolio follow very similar patterns. Nonetheless, for individuals with low hard skills and ranking low in agreeableness the predictive marginal probability of being a novel entrepreneur is 0.11 while for those ranking high is of about 0.07.

The graph for individuals with medium hard skills, illustrates an increase of about 0.03 in the predictive marginal probability of being a novel entrepreneur when comparing low and high levels of agreeableness. Regarding extraversion, we observe a subtle increase in the predictive marginal probabilities when moving from low to high levels of extraversion.

For conscientiousness and openness to experience we observe also greater predictive marginal probabilities of being novel entrepreneurs, but we detect different patterns on the trend of the lines. In the graph for conscientiousness, we see a decrease from the predictive marginal probability of 0.08 for individuals with low levels of conscientiousness to one of 0.01 for those with the highest level when the individuals belong to the first tercile of hard skills.

The graph for openness to experience illustrates an increase in the predictive marginal probability of being novel entrepreneur of 0.07 for individuals at the bottom of the cognitive ability distribution. The predictive marginal probabilities of being serial entrepreneur increase by 0.02 for individuals with high hard skills. The predictive marginal probabilities of being portfolio increase by the same magnitude, but for individuals at the bottom of the cognitive ability distribution.

Figure 4.1.: The predictive marginal probability of being novel, serial, or portfolio entrepreneur by big five personality traits and terciles of cognitive ability



To test whether the abovementioned differences are significant, we present the results in terms of relative-risk ratios for the pairwise comparisons among the three cognitive ability terciles for each of the big five personality traits. Focusing on the first contrast for agreeableness, in Table 4.4., the odds of choosing to be an entrepreneur for the first time is 1.92 times greater for those who belong to the middle of the cognitive distribution versus those at the bottom. Regarding openness to experience, the odds of deciding to become a serial entrepreneur is 1.46 times greater for individuals with high hard skills than for those with low (second contrast). The contrasts for other big five personality traits are not significant.

**Table 4.4: Pairwise comparisons of the Big Five personality traits among the three terciles of hard skills.**

	<b>Novel</b>	<b>Serial</b>	<b>Portfolio</b>
<b>Extraversion</b>			
2 vs 1	1.092 (0.13)	0.752 (0.14)	1.215 (0.45)
3 vs 1	1.078 (0.12)	0.799 (0.15)	1.182 (0.41)
3 vs 2	0.987 (0.12)	1.062 (0.20)	0.973 (0.34)
<b>Agreeableness</b>			
2 vs 1	<b>1.293**</b> <b>(0.15)</b>	1.329 (0.27)	0.996 (0.38)
3 vs 1	1.132 (0.13)	1.069 (0.20)	0.993 (0.38)
3 vs 2	0.875 (0.11)	0.804 (0.16)	0.997 (0.38)
<b>Conscientiousness</b>			
2 vs 1	0.878 (0.12)	0.947 (0.19)	1.132 (0.42)
3 vs 1	1.003 (0.129)	1.022 (0.19)	1.393 (0.50)
3 vs 2	1.142 (0.15)	1.079 (0.22)	1.231 (0.47)
<b>Neuroticism</b>			
2 vs 1	0.885 (0.11)	0.777 (0.16)	0.961 (0.36)
3 vs 1	0.823	0.911	0.867

	(0.10)	(0.18)	(0.31)
3 vs 2	0.930	1.173	0.902
	(0.11)	(0.21)	(0.33)
<b>Openness to experience</b>			
2 vs 1	1.098	1.388	0.834
	(0.14)	(0.29)	(0.33)
3 vs 1	1.145	<b>1.462*</b>	1.156
	(0.14)	<b>(0.29)</b>	(0.43)
3 vs 2	1.043	1.053	1.386
	(0.13)	(0.20)	(0.50)

RRR. Standard error in parenthesis. \*p<0.10, \*\*p<0.05, \*\*\*p<0.01.

These results partially support our hypothesis 1. We expected openness to experience to increase the likelihood of becoming a novel, serial, and a portfolio entrepreneur across all cognitive ability levels. However, we only found supporting evidence for the first tercile when referring to novel and portfolio entrepreneurs, and for the third one for being serial entrepreneurs.

Individuals with low behavioral control, due to their lack of experience and low cognitive skills, need curiosity to undertake an entrepreneurial endeavor. Once they have the experience in entrepreneurship and have closed or sold their first venture, if they also have very high hard skills, they need to be open to experiences to decide to start a new venture when they may be presented with very good job opportunities. Finally, if in addition to already having experience and therefore more perceived behavioral control, they have low cognitive skills and the constant intention to expand this control, they need curiosity to overcome the belief that they are not capable enough to run more than one business in parallel.

As for the second hypothesis, we only find evidence that being an extrovert increases the probability of being a serial entrepreneur at the bottom of the hard skills distribution. Individuals who have had previous entrepreneurial experience and intend to start a new business will need to be assertive and energetic to feel in control and also convince potential investors that they have what it takes to do it again regardless of their hard skills.



#### 4.4.2. Risk attitudes for being novel, serial, or portfolio entrepreneur

Table 4.5. summarizes the results of the analysis for the level of risk aversion. In this case, we find that for those who decide to become novel entrepreneurs, a higher tolerance to work risks, risks in general, and life change risks is statistically significant and positive for all terciles of the distribution of cognitive ability.

Individuals with high tolerance to risks in finances have a higher relative probability of deciding to become novel entrepreneurs over choosing to be employees. This is true for individuals with low and high cognitive abilities. For those at the bottom, they might be enterprising out of necessity more than opportunity. For those at the top, they need to be willing to risk the potential high wages they would get, thanks to their capabilities, in the job market. A high tolerance to risks associated with faith in people is also positive and significant

Turning to the results for serial entrepreneurs, we find that having low levels of risk aversion in general is relevant at the top of the distribution. With respect to risks at work and finances, the relative probability of being a serial entrepreneur over being an employee increases for individuals in the first tercile of hard skills. A high tolerance to life change risks is statistically significant for individuals in the highest tercile of the cognitive distribution. Faith in people risks tolerance is statistically significant and positive for individuals with medium hard skills.

The fact that there is no type of risk that is transversally significant for serial entrepreneurs, as was the case for novel entrepreneurs with general, finances and life change risks, seems to imply that having sold or closed their first venture may have changed the individuals' perceptions of the behavior. For instance, it may be the case that being resilient to losing money is no longer so important because they are more confident in their entrepreneurial skills and believe they can do it again.

Moving on to portfolio entrepreneurs, low risk aversion in general is relevant regardless of the cognitive ability level. Regarding finances and faith in people risks, willingness to take risks in these areas is significant for individuals in the second and third terciles of the hard skills distribution. Work risks' tolerance is only significant up in the distribution.

This is relevant because running a business requires hard work and by having more cognitive abilities you can identify and assume this risk. Life change risks seem to matter only for individuals with low hard skills

**Table 4.5: Risk aversion for becoming a novel, serial, and portfolio entrepreneur**

	General	Finances	Work	Health	Faith	Romance	Life Change	Gambling
<b>Novel</b>								
<b>Hard Skills: Cognitive ability</b>								
<b>terciles</b>								
Middle	0.683 (-1.52)	1.116 (0.62)	0.880 (-0.68)	1.144 (0.97)	<b>0.712*</b> <b>(-1.95)</b>	0.908 (-0.58)	0.794 (-1.12)	1.230 (1.16)
Top	0.799 (-0.83)	0.986 (-0.07)	1.039 (0.18)	<b>1.507***</b> <b>(2.63)</b>	1.125 (0.60)	<b>1.391*</b> <b>(1.84)</b>	0.825 (-0.84)	<b>1.471**</b> <b>(1.98)</b>
<b>Risk assessment</b>								
General	<b>1.068***</b> <b>(2.72)</b>							
Finances		<b>1.058**</b> <b>(2.53)</b>						
Work			<b>1.055***</b> <b>(2.60)</b>					
Health				1.014 (0.72)				
Faith in People					<b>0.958*</b> <b>(-1.94)</b>			
Romance						0.979 (-1.06)		
Life Change							<b>1.038*</b> <b>(1.73)</b>	

Gambling					1.016 (0.86)
<b>Interactions</b>					
General X Middle	<b>1.117***</b> <b>(2.83)</b>				
General X Top	<b>1.119***</b> <b>(2.71)</b>				
Finances X Middle		1.038 (1.07)			
Finances X Top		<b>1.102***</b> <b>(2.60)</b>			
Work X Middle			<b>1.082**</b> <b>(2.48)</b>		
Work X Top			<b>1.071**</b> <b>(2.01)</b>		
Health X Middle			1.048 (1.47)		
Health X Top			1.009 (0.28)		
Faith in People X Middle				<b>1.155***</b> <b>(4.24)</b>	
Faith in People X Top				<b>1.079**</b> <b>(2.20)</b>	
Romance X Middle				<b>1.085***</b> <b>(2.76)</b>	
Romance X Top				1.024 (0.77)	

Life Change X Middle							<b>1.104***</b>	
							<b>(2.95)</b>	
Life Change X Top							<b>1.125***</b>	
							<b>(3.23)</b>	
Gambling X Middle								1.009
								(0.32)
Gambling X Top								1.006
								(0.23)

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**Serial**

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**Hard Skills: Cognitive ability**

**terciles**

Middle	1.047 (0.11)	<b>1.909**</b> <b>(2.22)</b>	1.361 (1.02)	1.235 (0.92)	0.749 (-0.97)	1.079 (0.27)	1.307 (0.77)	1.468 (1.26)
Top	0.976 (-0.05)	1.567 (1.40)	1.200 (0.52)	<b>2.295***</b> <b>(3.36)</b>	1.352 (0.92)	<b>1.831**</b> <b>(2.05)</b>	1.123 (0.30)	<b>2.081**</b> <b>(2.25)</b>

**Risk assessment**

General	1.061 (1.35)							
Finances		<b>1.095**</b> <b>(2.40)</b>						
Work			<b>1.068*</b> <b>(1.87)</b>					
Health				1.022 (0.65)				
Faith in People					0.994			



Faith in People X Middle					<b>1.154**</b>			
					<b>(2.57)</b>			
Faith in People X Top					1.090			
					(1.49)			
romance X Middle						1.060		
						(1.17)		
Romance X Top						1.020		
						(0.39)		
Life Change X Middle							1.019	
							(0.33)	
Life Change X Top							<b>1.114*</b>	
							<b>(1.82)</b>	
Gambling X Middle								0.991
								(-0.20)
Gambling X Top								0.991
								(-0.21)

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**Portfolio**

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**Hard Skills: Cognitive ability**

**terciles**

Middle	0.319	0.673	0.898	1.569	<b>0.368*</b>	1.195	0.881	1.738
	(-1.53)	(-0.74)	(-0.20)	(1.04)	<b>(-1.84)</b>	(0.33)	(-0.20)	(0.97)
Top	0.378	0.714	0.503	1.859	0.817	1.764	0.914	1.959
	(-1.29)	(-0.56)	(-1.12)	(1.32)	(-0.32)	(0.96)	(-0.13)	(1.12)

**Risk assessment**

General	<b>1.142*</b> <b>(1.75)</b>						
Finances		1.074 (1.01)					
Work			1.091 (1.40)				
Health				1.052 (0.79)			
Faith in People					0.901 (-1.42)		
Romance						1.036 (0.56)	
Life Change							<b>1.178**</b> <b>(2.37)</b>
Gambling							1.067 (1.07)
<b>Interactions</b>							
General X Middle	<b>1.301**</b> <b>(2.33)</b>						
General X Top	<b>1.312**</b> <b>(2.48)</b>						
Driving X Middle							
Driving X Top							
Finances X Middle		<b>1.223*</b> <b>(1.91)</b>					
Finances X Top		<b>1.246**</b>					





<i>BIC</i>	35950.14	35996.96	35974.88	36072.55	36032.25	36070.21	35969.89	36076.07
<i>N</i>	52393	52393	52393	52393	52393	52393	52393	52393

*T* statistics in parenthesis. Individual level Controls: age, gender, education, marital status, and race. Industry controls: agriculture forestry and fisheries (reference category), mining, utilities, construction, manufacturing, wholesale trade, retail trade, transportation and warehousing, information and communication, finance insurance, and real estate, professional and related services, educational health and social services, entertainment accommodations and food, other services, and public administration. Time Trends: Year. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

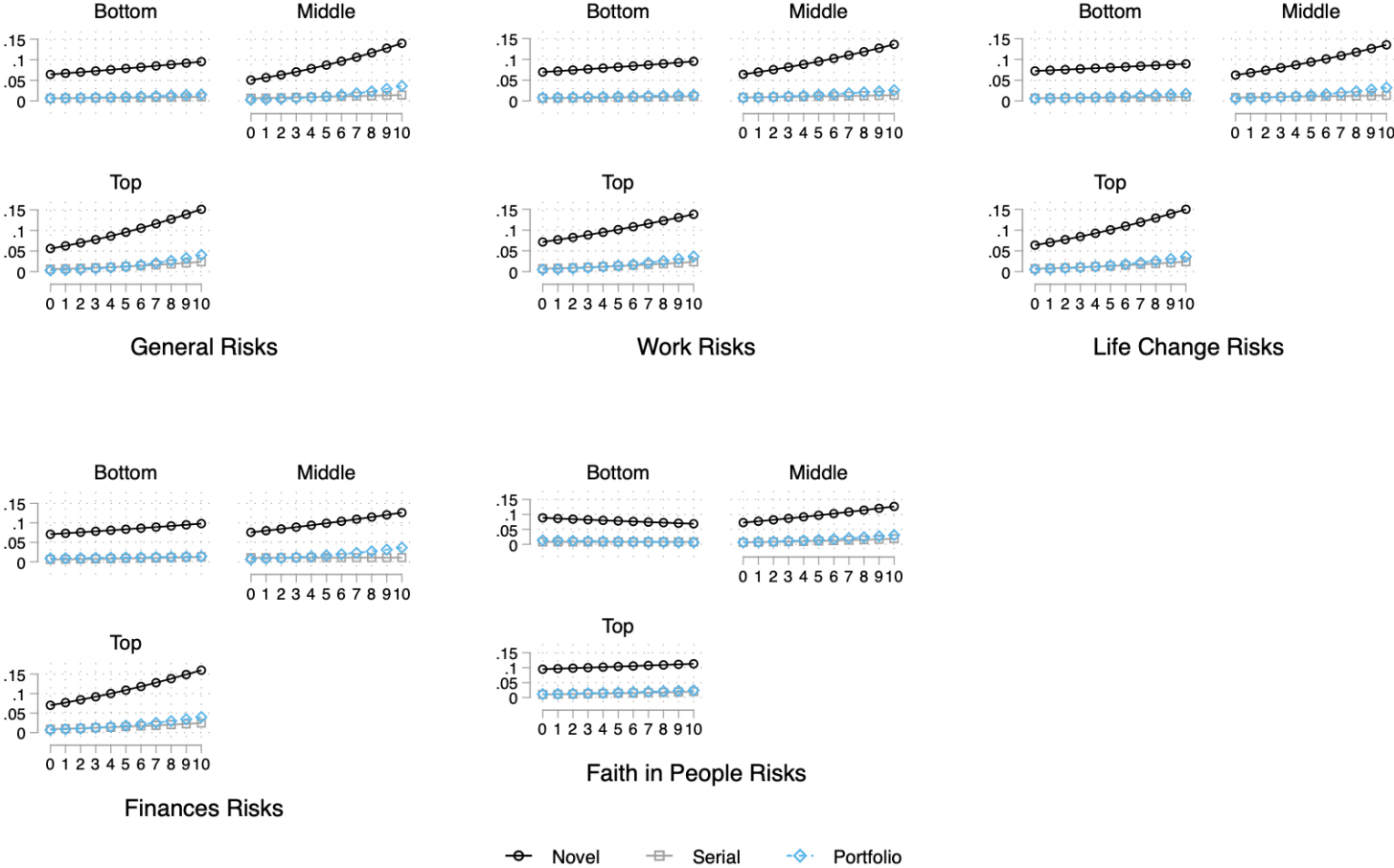
Figure 4.2. illustrates the predictive marginal probability of being novel, serial, or portfolio entrepreneur for those with different levels of willingness to take risks in general, with finances, at work, with faith in people and life changes (from 0 to 10) which are the domains that resulted statistically significant in the estimation.

Looking at the graphs, it can be seen that in general, as the tolerance to these types of risks increases, the predictive marginal probability of entrepreneurship increases. This is especially visible for the lines representing the probability of being a novel entrepreneur. The exception is the line for the risk domain faith in people, which decreases from a predictive marginal probability of 0.09 for being novel entrepreneur to 0.06.

In general, the predictive marginal probabilities for serial and portfolio entrepreneurs follow similar patterns to each other. However, some small differences are seen especially when individuals have more willingness to take risks (i.e., at the top of the risk assessment scale). For example, looking at the graphs for finances and general risk domains for individuals in the middle of the cognitive ability distribution, when risk aversion is high the predictive marginal probability of being serial or portfolio entrepreneur is close to 0, while the predictive marginal probability of being portfolio entrepreneur is of 0.04 and the one of being serial entrepreneur is 0.01 when individuals are completely willing to take these types of risks.

Figure 4.2.: The predictive marginal probability of being novel, serial, or portfolio entrepreneur by risk domains and terciles of cognitive ability

### Predictive margins of Hard Skills terciles



Additionally, in Table 4.6., we present the pairwise comparisons among the three hard skills terciles for the same five risk domains: General, finances, work, faith in people and life change. Results are presented in terms of relative-risk ratios.

Focusing on the first column, the odds of choosing to be a novel entrepreneur are greater for individuals in the middle and top terciles of hard skills versus those at the bottom when analyzing general, work and life change risks. Regarding finances risks, the odds are greater for those at the top compared to individuals at the bottom of the distribution. Looking at faith in people risks, the odds are also greater for individuals in the middle and top of the distribution. However, individuals in the middle have greater odds of being a novel entrepreneur versus those at the top.

Looking at the pairwise comparisons for serial entrepreneurs, individuals with more hard skills have greater odds of enterprising again than those with less hard skills for general and life change risks. If we compare the smartest individuals to those with medium hard skills, the domain that is significant is finances. Finally, analyzing faith in people risks, the odds of being a serial entrepreneur are 1.154 greater for people in the middle compared to those at the bottom.

Lastly, the third column presents the results for portfolio entrepreneurs. In this case individuals in the middle and top of the distribution of hard skills have greater odds of running businesses in parallel than those at the bottom when analyzing general, finances, and faith in people risks. For work risks, the odds are 1.262 greater for individuals with high hard skills versus individuals with low.

**Table 4.6: Pairwise comparisons of risk domains among the three terciles of hard skills.**

	<b>Novel</b>	<b>Serial</b>	<b>Portfolio</b>
<b>General</b>			
2 vs 1	<b>1.117***</b> <b>(0.04)</b>	1.052 (0.07)	<b>1.301**</b> <b>(0.15)</b>
3 vs 1	<b>1.119***</b> <b>(0.05)</b>	<b>1.128*</b> <b>(0.08)</b>	<b>1.312**</b> <b>(0.14)</b>
3 vs 2	1.002 (0.05)	1.073 (0.07)	1.008 (0.11)
<b>Finances</b>			

2 vs 1	1.038 (0.04)	0.929 (0.05)	<b>1.223*</b> <b>(0.13)</b>
3 vs 1	<b>1.103***</b> <b>(0.04)</b>	1.052 (0.06)	<b>1.246**</b> <b>(0.12)</b>
3 vs 2	1.061 (0.04)	<b>1.132*</b> <b>(0.07)</b>	1.018 (0.11)
<b>Work</b>			
2 vs 1	<b>1.082**</b> <b>(0.03)</b>	1.007 (0.05)	1.120 (0.10)
3 vs 1	<b>1.071**</b> <b>(0.04)</b>	1.090 (0.06)	<b>1.262**</b> <b>(0.12)</b>
3 vs 2	0.990 (0.04)	1.082 (0.06)	1.127 (0.11)
<b>Faith in people</b>			
2 vs 1	<b>1.155***</b> <b>(0.04)</b>	<b>1.154**</b> <b>(0.06)</b>	<b>1.415***</b> <b>(0.15)</b>
3 vs 1	<b>1.079**</b> <b>(0.04)</b>	1.090 (0.06)	<b>1.251**</b> <b>(0.14)</b>
3 vs 2	<b>0.935*</b> <b>(0.3)</b>	0.945 (0.06)	0.884 (0.10)
<b>Life change</b>			
2 vs 1	<b>1.104***</b> <b>(0.04)</b>	1.020 (0.06)	1.131 (0.11)
3 vs 1	<b>1.125***</b> <b>(0.04)</b>	<b>1.114*</b> <b>(0.07)</b>	1.156 (0.12)
3 vs 2	1.019 (0.04)	1.094 (0.07)	1.023 (0.11)

RRR. Standard error in parenthesis. \*p<0.10, \*\*p<0.05, \*\*\*p<0.01.

Although our results suggest that willingness to take financial risks has a significant effect on being a novel or serial entrepreneur, we only find partial support for our hypotheses 3 and 4. Although financial risks are significant for individuals with low and high skills for being a novel entrepreneur, for those with middle hard skills, financial risks are not significant. Maybe for them this domain is not important because they have a little more perceived behavioral control than the low skilled and they are not risking a potential salary as high as would the more skilled ones. For being serial entrepreneur, financial risk are not relevant at the bottom of the cognitive distribution. Maybe, these individuals have such low perceived behavioral control, despite their experience, that it dismisses any potential effect of willingness to take financial risks.

We expected that willingness to take risks at work would increase the probability of being a portfolio entrepreneur for all cognitive ability terciles (hypothesis 5). The results suggest that although the expected direction of the effect was correct, it is only relevant for those with higher cognitive skills. It seems that being willing to take on the hard work involved in running several businesses in parallel is worthwhile only if, in addition to believing that you have the necessary skills (thanks to the experience previously acquired), you have the necessary hard skills to run more than one business at the same time.

As regards other control variables, we find mixed results across our models (Tables A.3 and A.4 in the Appendix). In general, age has a positive effect on the probability of being a novel, serial, and a portfolio entrepreneur. Education is relevant from early schooling to become a novel and a serial entrepreneur. However, only having a professional degree has a significant effect on being a portfolio entrepreneur.

Looking at marital status, being married increases the odds of being a novel entrepreneur but it has no effect on being a serial or a portfolio entrepreneur. It may be the case that having a partner with whom to share the household burden can leave more hours to try to enterprise for the first time. In terms of race, the likelihood of being a novel or a portfolio entrepreneur increases for individuals who identify as Hispanic. It may be that being part of a minority pushes these individuals to seek opportunities.

After controlling for different industries, we found statistically significant and positive results for most of the industries for being novel, serial, or portfolio entrepreneurs. It is striking that in none of the models, regardless of whether the outcome was novel, serial, or portfolio entrepreneurship, was gender statistically significant. In our sample, we find no evidence that being female reduces the likelihood of entrepreneurship.

#### 4.5. Conclusions

The objective of this chapter was to contribute to the literature on entrepreneurship by analyzing the role of soft (Big Five and Risk Aversion) and hard (Cognitive Ability) skills when deciding to become novel, serial or portfolio entrepreneur. To do so, we ran our

models interacting the variables of interest with the three terciles of cognitive ability in the U.S. using the National Longitudinal Survey Data (NLSY) 1997-2016.

Controlling for socio-demographic and industry factors, we find that for first-time entrepreneurs, willingness to take risks in general, with work, faith in people and life changes are universal characteristics that positively influence this decision. Being willing to assume the uncertainties of a first venture allows to carry out the action of entrepreneurship for all individuals in the sample. Although there is not a universal big five personality trait across cognitive terciles for novel entrepreneurs, openness to experience has a positive effect on the decision of enterprising for those with less hard skills. Agreeableness is also relevant in this tercile, as well as in the middle one.

Once the individual has some experience in entrepreneurship, so he or she has greater perceived behavioral control, openness to experience continues to be relevant to serial entrepreneurship for those with more capabilities, and to be portfolio entrepreneur for those with less. This reinforces the importance of openness to experience as a necessary characteristic in entrepreneurship. As for the risk domains that were universal for being novel entrepreneur, willingness to take risks in general continues to be universal, but only for portfolio entrepreneurs.

In accordance with previous research, we find that extraversion and conscientiousness are relevant for enterprising. When looking at the different types of entrepreneurship, we find that the former is relevant for being a serial entrepreneur, and the latter for running businesses in parallel. Contrary to previous research, we find that high levels of agreeableness increase the odds of becoming novel entrepreneur. As for risk domains different to general risks, work, faith in people, and life changing risks prove to be relevant whether it is the first time undertaking or not. Most of the differences found among cognitive ability terciles prove significant for agreeableness, openness to experiences, and almost all of the tested risk domains.

This chapter contributes to the gap in the literature regarding the analysis of subgroups of entrepreneurs. However, there is a need for further studies of this type to test the results with different samples of entrepreneurs. Our results are an important contribution to the study of different samples of entrepreneurs (Salmony & Kanbach,



2021) shading light on the effect of the personality traits and risk attitudes not only for different cognitive levels, but also with different classes of entrepreneurs.

## 5. General conclusions

The aim of this thesis was to study the effects of hard and soft skills on the probability of becoming an entrepreneur in the US. To do so, we tested the effects of two variables that have been used as predictors of entrepreneurship: big five personality traits and risk attitudes across the distribution of cognitive skills (hard skills). In addition, we also tested the effects of these same variables on the probability of being a novel, serial, or portfolio entrepreneur.

To carry out this analysis, we relied on Ajzen's Theory of Planned Behavior (1991). According to his theory, the execution of a behavior is determined by the intention to carry it out. At the same time, this intention is determined by the individual's attitude towards the behavior, the subjective norm associated with the behavior and the individual's perceived behavioral control. As the distribution of cognitive skills of entrepreneurs is not homogeneous, the perceived behavioral control of entrepreneurs should be different as not all of them will consider that they have what it takes to be an entrepreneur. Thus, the effects of both the big five personality traits and risk attitudes should vary across the distribution of hard skills.

First, we tested the effects of the big five personality traits across the distribution of hard skills in our sample (Chapter 1). We find that openness to experience increases the likelihood of entrepreneurship for the more and less cognitively skilled. This is relevant because being intellectually curious allows individuals to approach behaviors that are not necessarily close to them. By opening themselves to new experiences, in this case exploring entrepreneurship, they can change their attitude towards it and thus their intention to become entrepreneurs for the first time. Similarly, we find that the personality trait that increases the odds for those with medium hard skills is conscientiousness.

Next, we looked at the effects of risk attitudes across the same distribution of cognitive skills (Chapter 2). The results suggest that the key risk domains affecting the likelihood of entrepreneurship are good tolerance to risks in general and with work. These types of risks are inherent to entrepreneurship, so they are relevant regardless of hard skills.

In addition, we found variant results for the risk domains of finance and life changes, which are also directly related to the act of entrepreneurship. This provides support for the idea that the perceived behavioral control that each cognitive tercile has is different and therefore the effects of risk attitudes are different.

Finally, we wanted to focus on what happens once you had some experience in entrepreneurship and wanted to do it again. We expected to find differences as first-time entrepreneurs have the attitude, depending on their personality traits (openness to experience), and may perceive entrepreneurship as a desirable behavior, however, they have no control (yet) over the behavior of entrepreneurship. Once they gain experience, they will have a better attitude towards entrepreneurship because their soft skills will be more developed and they will also have a greater perception of control, which reinforces their intentions to continue pursuing entrepreneurship.

In Chapter 3, we tested the effects of the big five personality traits and risk attitudes interacted with the terciles of cognitive ability. This analysis was performed for novel, serial, and portfolio entrepreneurs. The results of this chapter confirm the findings of Chapter 1: openness to experiences increases the probability of being an entrepreneur for the first time, but in this case this is true only for those with less hard skills. We also confirm that general and work risk tolerance increases the likelihood of becoming a novel entrepreneur, as well as life change risks. For serial entrepreneurs, openness to experience matters only for higher terciles of cognitive ability. Extraversion is also a desirable characteristic for individuals in the first tercile of hard skills. Finally, for portfolio entrepreneurs, self-discipline (conscientiousness) and openness to experience are important for the lowest tercile of hard skills.

Throughout the chapters and models, we find that the results of the big five personality traits and risk attitudes vary depending on the level of cognitive abilities of the individuals. This is true both when analyzing the probability of entrepreneurship and the differences between a novel, serial, and a portfolio entrepreneurship. Previous literature had found mixed results regarding the relevance of risk aversion for entrepreneurship. Our results provide support for the line that argues that it does have a positive effect on entrepreneurship. Similarly, we find that the big five personality traits also have a positive effect.

This thesis contributes to the existing literature by testing two variables that have been widely used as predictors of entrepreneurship across the distribution of hard skills: the big five personality traits and risk attitudes, using a large panel. In addition, it contributes to studies of different groups of entrepreneurs to help clarify the mixed results that have been found when testing these variables. The relevance of this perspective is that it is a starting point so that, with more research, educational programs can better prepare those who wish to follow the path of entrepreneurship. Consequently, it can serve as a basis for developing tools that allow private investors to reduce some degree of uncertainty in choosing which start-ups to invest in depending on the characteristics of their entrepreneurs. In this way, their investments and in turn the construction of the entrepreneurial fabric would be energized.

We cannot overlook the fact that the gender variable was not significant in our models. Notwithstanding, research and statistics tell us that women are less likely to be entrepreneurs. It would be important then to explore whether, in addition to differences in the effect of soft skills conditional on hard skills, there are also differences conditional on gender. This is a clear path for future research.

Considering that our sample is from the United States and that its culture around entrepreneurship is probably different from that of countries with a larger welfare state or countries with different economies, it is necessary to continue testing the big five personality traits, risk attitudes and hard skills with different samples in order to test whether the results hold up in socially and economically different contexts.

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## Appendix

### A.1. Big Five personality traits for becoming an entrepreneur

	(1) Extravert	(2) Agreeable	(3) Conscientious	(4) Neurotic	(5) Open	(6) Full
Age	1.092** (2.45)	1.089** (2.38)	1.092** (2.45)	1.094** (2.47)	1.102*** (2.69)	1.100*** (2.65)
Female	1.003 (0.03)	0.954 (-0.44)	1.014 (0.13)	1.013 (0.12)	1.023 (0.22)	0.979 (-0.19)
1st grade- 8th grade	0.765 (-1.50)	0.766 (-1.49)	0.767 (-1.48)	0.767 (-1.48)	0.748 (-1.62)	0.748 (-1.62)
9th grade-11th grade	0.443*** (-5.92)	0.442*** (-5.93)	0.447*** (-5.84)	0.446*** (-5.85)	0.443*** (-5.91)	0.444*** (-5.87)
12th grade	0.396*** (-3.77)	0.395*** (-3.78)	0.399*** (-3.73)	0.399*** (-3.74)	0.392*** (-3.81)	0.393*** (-3.79)
Some college	0.343*** (-5.75)	0.341*** (-5.78)	0.346*** (-5.70)	0.346*** (-5.70)	0.341*** (-5.79)	0.342*** (-5.76)
College degree	0.323*** (-3.50)	0.319*** (-3.54)	0.324*** (-3.49)	0.325*** (-3.47)	0.313*** (-3.58)	0.312*** (-3.59)
Some grad school	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Grad/prof degree	0.514 (-1.28)	0.506 (-1.31)	0.511 (-1.29)	0.513 (-1.28)	0.521 (-1.25)	0.523 (-1.24)
Married	1.326*** (2.96)	1.326*** (2.96)	1.331*** (2.99)	1.330*** (2.99)	1.353*** (3.17)	1.358*** (3.20)
Black	0.921 (-0.66)	0.935 (-0.53)	0.944 (-0.46)	0.938 (-0.51)	0.860 (-1.21)	0.887 (-0.96)
Hispanic	0.728** (-2.36)	0.740** (-2.24)	0.734** (-2.29)	0.733** (-2.30)	0.712** (-2.52)	0.719** (-2.45)
Mixed	0.781 (-0.45)	0.775 (-0.46)	0.796 (-0.41)	0.799 (-0.40)	0.779 (-0.46)	0.769 (-0.49)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H. S.	0.565 (-0.74)	0.493 (-0.95)	3.592 (1.39)	0.645 (-0.56)	0.248 (-1.64)	0.521 (-0.50)
Top H.S.	0.385 (-1.21)	0.668 (-0.51)	0.603 (-0.54)	0.827 (-0.24)	0.133** (-2.35)	0.0619** (-2.07)
Extraversion	1.064 (0.69)					1.002 (0.03)

Extraversion X Bottom	1 (.)		1 (.)
Extraversion X Middle	1.086 (0.60)		1.028 (0.19)
Extraversion X Top	1.189 (1.24)		1.105 (0.67)
Agreeableness		1.107 (1.16)	1.073 (0.74)
Agreeableness X Bottom		1 (.)	1 (.)
Agreeableness X Middle		1.114 (0.80)	1.103 (0.68)
Agreeableness X Top		1.075 (0.51)	0.961 (-0.27)
Conscientiousness		1.036 (0.38)	0.976 (-0.24)
Conscientiousness X Bottom		1 (.)	1 (.)
Conscientiousness X Middle		0.793 (-1.52)	0.746* (-1.80)
Conscientiousness X Top		1.091 (0.57)	1.121 (0.71)
Neuroticism		0.966 (-0.37)	0.900 (-1.05)
Neuroticism X Bottom		1 (.)	1 (.)
Neuroticism X Middle		1.062 (0.43)	1.052 (0.34)
Neuroticism X Top		1.036 (0.25)	1.007 (0.05)
Openness to experience			1.240** (2.34)
Openness to experience X Bottom			1 (.)
			1.259** (2.26)

Openness to experience X Middle					1.242 (1.52)	1.249 (1.43)
Openness to experience X Top					1.410** (2.37)	1.344* (1.89)
Industry controls:	Yes	Yes	Yes	Yes	Yes	Yes
Year controls:	Yes	Yes	Yes	Yes	Yes	Yes
AIC	19970.12	19970.42	19973.56	19977.65	19927.9	19938.83
BIC	20376.59	20376.88	20380.02	20384.12	20334.3	20453.68
Insig2u	6.810*** (37.37)	6.809*** (37.44)	6.818*** (37.61)	6.827*** (37.53)	6.735*** (37.00)	6.709*** (37.03)
N	61852	61852	61852	61852	61852	61852

Exponentiated coefficients; *t* statistics in parentheses

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

## A.2. Risk attitudes for becoming an entrepreneur

	(1) General	(2) Driving	(3) Finances	(4) Work	(5) Health	(6) Faith	(7) Romance	(8) Life Change	(9) Gambling
Age	1.090** (2.41)	1.094** (2.48)	1.089** (2.35)	1.093** (2.47)	1.093** (2.46)	1.094** (2.48)	1.093** (2.47)	1.100*** (2.63)	1.095** (2.52)
Female	1.157 (1.39)	1.054 (0.50)	1.140 (1.25)	1.088 (0.81)	1.042 (0.38)	1.012 (0.11)	1.014 (0.13)	1.085 (0.77)	1.050 (0.46)
1st grade- 8th grade	0.759 (-1.54)	0.772 (-1.44)	0.770 (-1.46)	0.764 (-1.50)	0.773 (-1.44)	0.761 (-1.52)	0.766 (-1.48)	0.772 (-1.44)	0.767 (-1.48)
9th grade-11th grade	0.447*** (-5.86)	0.443*** (-5.91)	0.440*** (-5.97)	0.434*** (-6.07)	0.446*** (-5.87)	0.443*** (-5.92)	0.446*** (-5.86)	0.446*** (-5.88)	0.443*** (-5.91)
12th grade	0.393*** (-3.81)	0.397*** (-3.75)	0.392*** (-3.81)	0.384*** (-3.91)	0.399*** (-3.73)	0.392*** (-3.80)	0.398*** (-3.75)	0.397*** (-3.76)	0.395*** (-3.78)
Some college	0.339*** (-5.83)	0.343*** (-5.75)	0.330*** (-5.95)	0.325*** (-6.05)	0.346*** (-5.71)	0.339*** (-5.81)	0.346*** (-5.72)	0.339*** (-5.82)	0.342*** (-5.78)
College degree	0.319*** (-3.52)	0.322*** (-3.50)	0.314*** (-3.57)	0.303*** (-3.70)	0.326*** (-3.47)	0.319*** (-3.54)	0.325*** (-3.48)	0.314*** (-3.57)	0.323*** (-3.49)
Some grad school	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Grad/prof degree	0.532 (-1.21)	0.508 (-1.30)	0.497 (-1.34)	0.508 (-1.29)	0.516 (-1.27)	0.508 (-1.30)	0.512 (-1.29)	0.503 (-1.32)	0.510 (-1.29)
Married	1.364*** (3.25)	1.336*** (3.04)	1.351*** (3.15)	1.345*** (3.11)	1.333*** (3.02)	1.329*** (2.97)	1.331*** (3.00)	1.361*** (3.23)	1.338*** (3.05)

Black	0.896 (-0.88)	0.955 (-0.36)	0.901 (-0.82)	0.920 (-0.67)	0.970 (-0.24)	0.971 (-0.23)	0.939 (-0.50)	0.868 (-1.12)	0.950 (-0.41)
Hispanic	0.720** (-2.45)	0.736** (-2.27)	0.705*** (-2.60)	0.723** (-2.41)	0.734** (-2.29)	0.746** (-2.17)	0.734** (-2.29)	0.699*** (-2.66)	0.731** (-2.32)
Mixed Age	0.796 (-0.42)	0.810 (-0.38)	0.750 (-0.53)	0.763 (-0.49)	0.766 (-0.48)	0.818 (-0.37)	0.796 (-0.41)	0.756 (-0.51)	0.773 (-0.46)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H. S.	0.550** (-1.99)	0.933 (-0.43)	0.716 (-1.56)	0.626** (-2.08)	0.921 (-0.50)	0.569*** (-2.68)	0.838 (-0.87)	0.743 (-1.19)	0.710 (-1.58)
Top H.S.	0.360*** (-3.01)	1.047 (0.25)	0.561** (-2.34)	0.623* (-1.80)	1.058 (0.29)	0.777 (-1.04)	1.049 (0.21)	0.529** (-2.24)	0.771 (-1.07)
General	1.089*** (2.95)								
General X Bottom	1 (.)								
General X Middle	1.086* (1.77)								
General X Top	1.188*** (3.30)								
Driving		1.044* (1.85)							
Driving X Bottom		1 (.)							
Driving X Middle		0.990 (-0.28)							
Driving X Top		0.988 (-0.31)							
Finances			1.073*** (2.71)						
Finances X Bottom			1 (.)						
Finances X Middle			1.059 (1.33)						
Finances X Top			1.132***						

(2.67)

Work	1.067*** (2.70)	
Work X Bottom	1 (.)	
Work X Middle	1.075* (1.89)	
Work X Top	1.086* (1.94)	
Health	1.044* (1.85)	
Health X Bottom	1 (.)	
Health X Middle	0.996 (-0.09)	
Health X Top	0.985 (-0.36)	
Faith in People		0.983 (-0.66)
Faith in People X Bottom		1 (.)
Faith in People X Middle		1.117*** (2.69)
Faith in People X Top		1.061 (1.35)
Romance		1.003 (0.13)
Romance X Bottom		1 (.)
Romance X Middle		1.017 (0.46)
Romance X Top		0.991 (-0.23)



Life Change								1.077 <sup>***</sup>	
								(2.92)	
Life Change X Bottom								1	
								(.)	
Life Change X Middle								1.043	
								(1.02)	
Life Change X Top								1.129 <sup>***</sup>	
								(2.67)	
Gambling									1.002
									(0.11)
Gambling X Bottom									1
									(.)
Gambling X Middle									1.045
									(1.29)
Gambling X Top									1.047
									(1.30)
Industry controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	19911.05	19972.64	19929.51	19927.81	19972.42	19967.02	19977.27	19927.6	19971.53
BIC	20317.51	20379.1	20335.98	20334.27	20378.88	20373.48	20383.7	20334.1	20378
Insig2u	6.690 <sup>***</sup>	6.828 <sup>***</sup>	6.738 <sup>***</sup>	6.738 <sup>***</sup>	6.828 <sup>***</sup>	6.821 <sup>***</sup>	6.830 <sup>***</sup>	6.749 <sup>***</sup>	6.809 <sup>***</sup>
	(36.96)	(37.50)	(37.06)	(37.19)	(37.48)	(37.58)	(37.53)	(37.02)	(37.49)
N	61852	61852	61852	61852	61852	61852	61852	61852	61852

Exponentiated coefficients; *t* statistics in parentheses

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

### A.3. Big Five personality traits for becoming a novel, serial, or portfolio

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(1) (2) (3) (4) (5) (6)

	Extravert	Agreeable	Conscientious	Neurotic	Open	Full
<b>Novel</b>						
Age	1.117 <sup>***</sup> (3.82)	1.117 <sup>***</sup> (3.82)	1.114 <sup>***</sup> (3.76)	1.113 <sup>***</sup> (3.72)	1.124 <sup>***</sup> (4.04)	1.123 <sup>***</sup> (4.01)
Female	0.913 (-1.10)	0.902 (-1.22)	0.919 (-1.03)	0.917 (-1.05)	0.925 (-0.95)	0.912 (-1.07)
1st grade- 8th grade	0.701 <sup>**</sup> (-2.23)	0.704 <sup>**</sup> (-2.21)	0.699 <sup>**</sup> (-2.24)	0.703 <sup>**</sup> (-2.21)	0.689 <sup>**</sup> (-2.34)	0.685 <sup>**</sup> (-2.38)
9th grade-11th grade	0.501 <sup>***</sup> (-5.91)	0.504 <sup>***</sup> (-5.88)	0.504 <sup>***</sup> (-5.87)	0.505 <sup>***</sup> (-5.86)	0.502 <sup>***</sup> (-5.92)	0.506 <sup>***</sup> (-5.85)
12th grade	0.483 <sup>***</sup> (-3.80)	0.485 <sup>***</sup> (-3.78)	0.486 <sup>***</sup> (-3.78)	0.487 <sup>***</sup> (-3.76)	0.478 <sup>***</sup> (-3.86)	0.482 <sup>***</sup> (-3.82)
Some college	0.458 <sup>***</sup> (-4.95)	0.461 <sup>***</sup> (-4.92)	0.461 <sup>***</sup> (-4.90)	0.462 <sup>***</sup> (-4.89)	0.456 <sup>***</sup> (-4.99)	0.461 <sup>***</sup> (-4.90)
College degree	0.530 <sup>***</sup> (-2.70)	0.531 <sup>***</sup> (-2.69)	0.534 <sup>***</sup> (-2.66)	0.535 <sup>***</sup> (-2.65)	0.519 <sup>***</sup> (-2.78)	0.525 <sup>***</sup> (-2.73)
Some grad school	0.966 (-0.05)	0.956 (-0.06)	0.960 (-0.06)	0.969 (-0.04)	0.922 (-0.12)	0.952 (-0.07)
Grad/prof degree	0.464 <sup>*</sup> (-1.81)	0.465 <sup>*</sup> (-1.80)	0.465 <sup>*</sup> (-1.80)	0.467 <sup>*</sup> (-1.79)	0.466 <sup>*</sup> (-1.80)	0.472 <sup>*</sup> (-1.76)

Married	1.205** (2.37)	1.205** (2.38)	1.207** (2.40)	1.208** (2.41)	1.225*** (2.58)	1.230*** (2.63)
Black	0.873 (-1.29)	0.879 (-1.24)	0.874 (-1.28)	0.878 (-1.23)	0.819* (-1.90)	0.813* (-1.96)
Hispanic	0.747*** (-2.65)	0.752*** (-2.58)	0.746*** (-2.66)	0.746*** (-2.66)	0.737*** (-2.76)	0.734*** (-2.78)
Mixed	0.799 (-0.54)	0.801 (-0.54)	0.804 (-0.53)	0.815 (-0.50)	0.798 (-0.56)	0.807 (-0.53)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H. S.	0.669 (-0.65)	0.390 (-1.57)	2.932 (1.41)	2.038 (1.10)	0.585 (-0.76)	0.480 (-0.67)
Top H.S.	0.957 (-0.07)	0.804 (-0.36)	2.462 (1.24)	4.097** (2.23)	0.616 (-0.71)	0.689 (-0.36)
Extraversion	1.047 (0.62)					0.986 (-0.18)
Extraversion X Bottom	1 (.)					1 (.)
Extraversion X Middle	1.125 (1.06)					1.092 (0.75)

Extraversion X Top	1.090 (0.80)		1.078 (0.65)
Agreeableness	0.946 (-0.77)		0.860* (-1.93)
Agreeableness X Bottom	1 (.)		1 (.)
Agreeableness X Middle	1.245** (2.01)		1.293** (2.25)
Agreeableness X Top	1.127 (1.09)		1.132 (1.05)
Conscientiousness		1.112 (1.31)	1.036 (0.39)
Conscientiousness X Bottom		1 (.)	1 (.)
Conscientiousness X Middle		0.873 (-1.08)	0.878 (-0.97)
Conscientiousness X Top		0.925	1.003

	(-0.64)		(0.02)
Neuroticism	1.095 (1.14)		1.051 (0.57)
Neuroticism X Bottom	1 (.)		1 (.)
Neuroticism X Middle	0.921 (-0.71)		0.885 (-1.00)
Neuroticism X Top	0.838 (-1.56)		0.823 (-1.61)
Openness to experience		1.272*** (2.99)	1.303*** (2.99)
Openness to experience X Bottom		1 (.)	1 (.)
Openness to experience X Middle		1.144 (1.13)	1.098 (0.73)
Openness to experience X Top		1.169 (1.35)	1.145 (1.08)

Serial						
Age	1.092** (1.99)	1.091** (1.99)	1.092** (2.01)	1.091** (1.98)	1.104** (2.25)	1.099** (2.16)
Female	0.940 (-0.45)	0.918 (-0.62)	0.983 (-0.13)	0.993 (-0.06)	0.967 (-0.25)	0.969 (-0.23)
1st grade- 8th grade	1.206 (0.79)	1.219 (0.84)	1.234 (0.89)	1.235 (0.89)	1.180 (0.71)	1.203 (0.80)
9th grade-11th grade	0.554*** (-2.77)	0.567*** (-2.65)	0.578** (-2.57)	0.569*** (-2.65)	0.570*** (-2.67)	0.565*** (-2.72)
12th grade	0.521** (-2.18)	0.529** (-2.13)	0.535** (-2.09)	0.527** (-2.14)	0.520** (-2.19)	0.525** (-2.18)
Some college	0.424*** (-3.39)	0.432*** (-3.30)	0.448*** (-3.15)	0.435*** (-3.28)	0.433*** (-3.33)	0.437*** (-3.31)
College degree	0.710 (-1.02)	0.717 (-0.98)	0.755 (-0.83)	0.729 (-0.93)	0.691 (-1.09)	0.708 (-1.02)
Some grad school	0.000000156*** (-45.21)	0.000000149*** (-45.65)	0.000000153*** (-45.13)	0.000000145*** (-45.28)	0.000000146*** (-45.62)	0.000000156*** (-44.65)
Grad/prof degree	0.192** (-2.14)	0.191** (-2.16)	0.198** (-2.10)	0.191** (-2.16)	0.195** (-2.13)	0.206** (-2.06)
Married	1.025	1.029	1.046	1.028	1.067	1.067

	(0.19)	(0.21)	(0.34)	(0.21)	(0.50)	(0.50)
Black	0.853	0.875	0.898	0.868	0.829	0.836
	(-0.95)	(-0.79)	(-0.64)	(-0.83)	(-1.13)	(-1.06)
Hispanic	0.773	0.797	0.791	0.778	0.785	0.774
	(-1.45)	(-1.27)	(-1.32)	(-1.40)	(-1.36)	(-1.44)
Mixed	1.061	1.083	1.105	1.077	1.130	1.091
	(0.10)	(0.14)	(0.17)	(0.13)	(0.21)	(0.15)
Bottom H.S.	1	1	1	1	1	1
	(.)	(.)	(.)	(.)	(.)	(.)
Middle H. S.	4.064	0.471	2.497	4.320	0.261	1.137
	(1.35)	(-0.71)	(0.81)	(1.35)	(-1.18)	(0.08)
Top H.S.	3.601	1.230	2.556	2.987	0.249	0.761
	(1.30)	(0.21)	(0.87)	(1.06)	(-1.28)	(-0.17)
Extraversion	1.488***					1.505***
	(3.21)					(3.06)
Extraversion X Bottom	1					1
	(.)					(.)
Extraversion X Middle	0.826					0.753
	(-1.06)					(-1.48)

Extraversion X Top	0.901  (-0.60)		0.799  (-1.22)
Agreeableness	1.048  (0.36)		0.922  (-0.60)
Agreeableness X Bottom	1  (.)		1  (.)
Agreeableness X Middle	1.216  (1.03)		1.329  (1.41)
Agreeableness X Top	1.092  (0.49)		1.069  (0.35)
Conscientiousness		0.956  (-0.36)	0.832  (-1.40)
Conscientiousness X Bottom		1  (.)	1  (.)
Conscientiousness X Middle		0.906  (-0.53)	0.947  (-0.27)
Conscientiousness X Top		0.957  (-0.25)	1.022  (0.11)



Neuroticism	1.219 (1.43)		1.180 (1.03)
Neuroticism X Bottom	1 (.)		1 (.)
Neuroticism X Middle	0.817 (-1.06)		0.777 (-1.20)
Neuroticism X Top	0.930 (-0.40)		0.911 (-0.47)
Openness to experience		1.117 (0.80)	1.031 (0.20)
Openness to experience X Bottom		1 (.)	1 (.)
Openness to experience X Middle		1.328 (1.49)	1.388 (1.56)
Openness to experience X Top		1.424* (1.93)	1.462* (1.94)

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**Portfolio**

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Age	1.282*** (2.76)	1.277*** (2.72)	1.279*** (2.76)	1.280*** (2.72)	1.291*** (2.91)	1.289*** (2.93)
Female	0.781 (-0.97)	0.752 (-1.09)	0.840 (-0.69)	0.768 (-1.03)	0.792 (-0.94)	0.824 (-0.75)
1st grade- 8th grade	0.782 (-0.54)	0.788 (-0.53)	0.782 (-0.55)	0.782 (-0.55)	0.753 (-0.63)	0.753 (-0.64)
9th grade-11th grade	0.795 (-0.66)	0.793 (-0.67)	0.818 (-0.58)	0.803 (-0.64)	0.793 (-0.68)	0.813 (-0.60)
12th grade	0.832 (-0.37)	0.826 (-0.38)	0.845 (-0.33)	0.836 (-0.35)	0.815 (-0.41)	0.823 (-0.39)
Some college	1.370 (0.75)	1.361 (0.73)	1.428 (0.85)	1.384 (0.77)	1.343 (0.70)	1.395 (0.80)
College degree	0.946 (-0.08)	0.935 (-0.10)	1.000 (0.00)	0.954 (-0.07)	0.907 (-0.14)	0.954 (-0.07)
Some grad school	3.162 (0.71)	3.030 (0.69)	3.276 (0.74)	3.149 (0.71)	3.010 (0.66)	3.228 (0.71)
Grad/prof degree	0.000000212*** (-25.13)	0.000000208*** (-25.24)	0.000000227*** (-25.21)	0.000000209*** (-25.37)	0.000000216*** (-25.07)	0.000000235*** (-25.06)
Married	0.857 (-0.80)	0.856 (-0.81)	0.874 (-0.70)	0.862 (-0.77)	0.884 (-0.64)	0.909 (-0.50)

Black	0.638 (-1.37)	0.642 (-1.36)	0.709 (-1.06)	0.654 (-1.29)	0.589 (-1.63)	0.658 (-1.31)
Hispanic	0.514* (-1.82)	0.518* (-1.80)	0.516* (-1.83)	0.519* (-1.79)	0.500* (-1.92)	0.509* (-1.91)
Mixed	1.328 (0.34)	1.275 (0.29)	1.380 (0.38)	1.382 (0.38)	1.320 (0.33)	1.327 (0.34)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H. S.	0.734 (-0.15)	1.361 (0.15)	1.806 (0.28)	1.500 (0.20)	1.254 (0.10)	0.926 (-0.02)
Top H.S.	0.571 (-0.29)	1.118 (0.06)	0.788 (-0.11)	3.155 (0.59)	0.242 (-0.69)	0.107 (-0.71)
Extraversion	0.904 (-0.40)					0.827 (-0.72)
Extraversion X Bottom	1 (.)					1 (.)
Extraversion X Middle	1.155 (0.40)					1.215 (0.53)
Extraversion X Top	1.267					1.182

	(0.68)		(0.48)
Agreeableness	1.064 (0.25)		1.094 (0.33)
Agreeableness X Bottom	1 (.)		1 (.)
Agreeableness X Middle	1.032 (0.09)		0.996 (-0.01)
Agreeableness X Top	1.118 (0.31)		0.993 (-0.02)
Conscientiousness		0.614** (-2.05)	0.509*** (-2.75)
Conscientiousness X Bottom		1 (.)	1 (.)
Conscientiousness X Middle		0.977 (-0.06)	1.132 (0.33)
Conscientiousness X Top		1.172 (0.45)	1.393 (0.93)
Neuroticism			0.945 1.023

					(-0.23)	(0.09)	
Neuroticism X Bottom					1	1	
					(.)	(.)	
Neuroticism X Middle					1.014	0.961	
					(0.04)	(-0.11)	
Neuroticism X Top					0.929	0.867	
					(-0.21)	(-0.40)	
Openness to experience						1.360	1.731*
						(1.18)	(1.93)
Openness to experience X Bottom						1	1
						(.)	(.)
Openness to experience X Middle						1.042	0.834
						(0.11)	(-0.47)
Openness to experience X Top						1.438	1.156
						(1.05)	(0.39)
Industry controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes

AIC	34835.56	34852.17	34846.45	34855.02	34777.92	34800.07
BIC	36059.14	36075.75	36070.03	36078.6	36001.5	36342.85
var(u1)	156.3*** (19.72)	156.9*** (19.69)	158.2*** (19.76)	158.5*** (19.73)	145.4*** (19.69)	142.6*** (19.70)
var(u2)	18.77*** (8.73)	19.55*** (8.96)	19.57*** (9.00)	19.37*** (9.02)	18.07*** (8.84)	17.22*** (8.64)
var(u3)	10762.5*** (13.00)	10599.9*** (12.98)	10972.4*** (12.89)	10659.4*** (12.98)	10373.8*** (13.12)	10645.5*** (13.06)
<i>N</i>	52393	52393	52393	52393	52393	52393

Exponentiated coefficients; *t* statistics in parentheses

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

#### A.4. Risk attitudes for becoming a novel, serial, or portfolio entrepreneur

	(1) General	(2) Finances	(3) Work	(4) Health	(5) Faith People	(6) Romance	(7) Life Change	(8) Gambling
<b>Novel</b>								
Age	1.116*** (3.82)	1.114*** (3.73)	1.115*** (3.78)	1.116*** (3.79)	1.115*** (3.79)	1.115*** (3.77)	1.120*** (3.94)	1.117*** (3.83)
Female	1.037 (0.44)	1.014 (0.17)	0.992 (-0.10)	0.951 (-0.60)	0.920 (-1.02)	0.926 (-0.94)	0.983 (-0.21)	0.944 (-0.69)
1st grade- 8th grade	0.697** (-2.28)	0.703** (-2.22)	0.701** (-2.23)	0.707** (-2.18)	0.695** (-2.28)	0.703** (-2.21)	0.708** (-2.18)	0.704** (-2.20)
9th grade-	0.501***	0.497***	0.491***	0.503***	0.500***	0.507***	0.503***	0.502***

11th grade								
	(-5.94)	(-6.00)	(-6.10)	(-5.91)	(-5.94)	(-5.83)	(-5.91)	(-5.91)
12th grade	0.473 <sup>***</sup>	0.476 <sup>***</sup>	0.466 <sup>***</sup>	0.483 <sup>***</sup>	0.480 <sup>***</sup>	0.490 <sup>***</sup>	0.480 <sup>***</sup>	0.482 <sup>***</sup>
	(-3.92)	(-3.88)	(-4.00)	(-3.81)	(-3.84)	(-3.73)	(-3.85)	(-3.81)
Some college	0.450 <sup>***</sup>	0.443 <sup>***</sup>	0.435 <sup>***</sup>	0.459 <sup>***</sup>	0.453 <sup>***</sup>	0.463 <sup>***</sup>	0.453 <sup>***</sup>	0.457 <sup>***</sup>
	(-5.08)	(-5.16)	(-5.29)	(-4.94)	(-5.03)	(-4.89)	(-5.04)	(-4.96)
College degree	0.521 <sup>***</sup>	0.516 <sup>***</sup>	0.500 <sup>***</sup>	0.532 <sup>***</sup>	0.523 <sup>***</sup>	0.536 <sup>***</sup>	0.519 <sup>***</sup>	0.530 <sup>***</sup>
	(-2.77)	(-2.81)	(-2.95)	(-2.68)	(-2.75)	(-2.65)	(-2.78)	(-2.69)
Some grad school	0.947	0.956	0.892	0.962	0.946	0.966	0.936	0.956
	(-0.08)	(-0.06)	(-0.16)	(-0.05)	(-0.08)	(-0.05)	(-0.09)	(-0.06)
Grad/prof degree	0.468 <sup>*</sup>	0.452 <sup>*</sup>	0.460 <sup>*</sup>	0.466 <sup>*</sup>	0.462 <sup>*</sup>	0.468 <sup>*</sup>	0.457 <sup>*</sup>	0.463 <sup>*</sup>
	(-1.79)	(-1.85)	(-1.81)	(-1.80)	(-1.82)	(-1.79)	(-1.84)	(-1.81)
Married	1.234 <sup>***</sup>	1.222 <sup>**</sup>	1.220 <sup>**</sup>	1.209 <sup>**</sup>	1.204 <sup>**</sup>	1.212 <sup>**</sup>	1.230 <sup>***</sup>	1.211 <sup>**</sup>
	(2.67)	(2.55)	(2.53)	(2.42)	(2.37)	(2.44)	(2.64)	(2.44)
Black	0.849	0.861	0.871	0.916	0.914	0.890	0.838 <sup>*</sup>	0.893
	(-1.56)	(-1.42)	(-1.31)	(-0.83)	(-0.85)	(-1.11)	(-1.67)	(-1.08)
Hispanic	0.742 <sup>***</sup>	0.737 <sup>***</sup>	0.745 <sup>***</sup>	0.750 <sup>***</sup>	0.759 <sup>**</sup>	0.759 <sup>**</sup>	0.722 <sup>***</sup>	0.747 <sup>***</sup>
	(-2.70)	(-2.76)	(-2.66)	(-2.61)	(-2.50)	(-2.50)	(-2.95)	(-2.65)

Mixed	0.812	0.785	0.794	0.786	0.844	0.807	0.774	0.793
Age	(-0.51)	(-0.59)	(-0.56)	(-0.59)	(-0.42)	(-0.52)	(-0.63)	(-0.57)
Bottom H.S.	1	1	1	1	1	1	1	1
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Middle H.S.	0.683	1.116	0.880	1.144	0.712*	0.908	0.794	1.230
	(-1.52)	(0.62)	(-0.68)	(0.97)	(-1.95)	(-0.58)	(-1.12)	(1.16)
Top H.S.	0.799	0.986	1.039	1.507***	1.125	1.391*	0.825	1.471**
	(-0.83)	(-0.07)	(0.18)	(2.63)	(0.60)	(1.84)	(-0.84)	(1.98)
General	1.068***							
	(2.72)							
General X Bottom	1							
	(.)							
General X Middle	1.117***							
	(2.83)							
General X Top	1.119***							
	(2.71)							
Finances		1.058**						
		(2.53)						



Finances  
X Bottom

1

(.)

Finances  
X Middle

1.038

(1.07)

Finances  
X Top

1.102\*\*\*

(2.60)

Work

1.055\*\*\*

(2.60)

Work X  
Bottom

1

(.)

Work X  
Middle

1.082\*\*

(2.48)

Work X  
Top

1.071\*\*

(2.01)

Health

1.014

(0.72)

Health X  
Bottom

1

	(.)	
Health X Middle	1.048 (1.47)	
Health X Top	1.009 (0.28)	
Faith in People	0.958* (-1.94)	
Faith in People X Bottom	1 (.)	
Faith in People X Middle	1.155*** (4.24)	
Faith in People X Top	1.079** (2.20)	
Romance		0.979 (-1.06)
Romance X Bottom		1

	(.)	
Romance X Middle	1.085 <sup>***</sup>	
	(2.76)	
Romance X Top	1.024	
	(0.77)	
Life Change		1.038 <sup>*</sup>
		(1.73)
Life Change X Bottom		1
		(.)
Life Change X Middle		1.104 <sup>***</sup>
		(2.95)
Life Change X Top		1.125 <sup>***</sup>
		(3.23)
Gambling		1.016
		(0.86)
Gambling X Bottom		1

(.)

Gambling  
X Middle

1.009

(0.32)

Gambling  
X Top

1.006

(0.23)

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**Serial**

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Age 1.093\*\* 1.091\*\* 1.093\*\* 1.093\*\* 1.095\*\* 1.093\*\* 1.100\*\* 1.095\*\*

(2.02) (1.98) (2.03) (2.02) (2.06) (2.00) (2.16) (2.05)

Female

1.065 1.041 1.023 0.990 0.967 0.971 1.024 0.997

(0.47) (0.30) (0.17) (-0.08) (-0.25) (-0.21) (0.17) (-0.02)

1st grade-  
8th grade

1.195 1.225 1.203 1.238 1.180 1.228 1.237 1.222

(0.75) (0.85) (0.78) (0.90) (0.70) (0.87) (0.90) (0.85)

9th  
grade-  
11th  
grade

0.560\*\*\* 0.557\*\*\* 0.549\*\*\* 0.568\*\*\* 0.550\*\*\* 0.573\*\*\* 0.566\*\*\* 0.563\*\*\*

(-2.73) (-2.75) (-2.82) (-2.65) (-2.79) (-2.61) (-2.69) (-2.71)

12th  
grade

0.504\*\* 0.518\*\* 0.498\*\* 0.523\*\* 0.501\*\* 0.535\*\* 0.518\*\* 0.519\*\*

(-2.29) (-2.20) (-2.36) (-2.17) (-2.31) (-2.09) (-2.22) (-2.19)

Some  
college

0.417\*\*\* 0.412\*\*\* 0.399\*\*\* 0.435\*\*\* 0.411\*\*\* 0.437\*\*\* 0.422\*\*\* 0.428\*\*\*

(-3.45) (-3.48) (-3.62) (-3.27) (-3.48) (-3.26) (-3.39) (-3.35)

College degree	0.694 (-1.08)	0.693 (-1.08)	0.651 (-1.27)	0.722 (-0.96)	0.680 (-1.14)	0.734 (-0.91)	0.687 (-1.11)	0.720 (-0.97)
Some grad school	0.000000150*** (-45.49)	0.000000150*** (-45.38)	0.000000138*** (-45.35)	0.000000146*** (-45.37)	0.000000145*** (-45.34)	0.000000150*** (-45.43)	0.000000145*** (-44.23)	0.000000147*** (-45.59)
Grad/prof degree	0.200** (-2.09)	0.181** (-2.23)	0.196** (-2.10)	0.191** (-2.14)	0.189** (-2.17)	0.194** (-2.14)	0.186** (-2.17)	0.189** (-2.17)
Married	1.074 (0.54)	1.051 (0.38)	1.059 (0.43)	1.038 (0.28)	1.025 (0.18)	1.045 (0.33)	1.071 (0.52)	1.045 (0.33)
Black	0.859 (-0.91)	0.858 (-0.91)	0.873 (-0.81)	0.919 (-0.50)	0.943 (-0.35)	0.889 (-0.70)	0.845 (-1.00)	0.893 (-0.67)
Hispanic	0.791 (-1.32)	0.769 (-1.47)	0.783 (-1.37)	0.795 (-1.29)	0.813 (-1.16)	0.797 (-1.28)	0.773 (-1.44)	0.785 (-1.36)
Mixed Age	1.137 (0.22)	0.994 (-0.01)	1.116 (0.18)	1.109 (0.18)	1.144 (0.24)	1.107 (0.17)	1.069 (0.11)	1.065 (0.11)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H.S.	1.047 (0.11)	1.909** (2.22)	1.361 (1.02)	1.235 (0.92)	0.749 (-0.97)	1.079 (0.27)	1.307 (0.77)	1.468 (1.26)

Top H.S.	0.976 (-0.05)	1.567 (1.40)	1.200 (0.52)	2.295*** (3.36)	1.352 (0.92)	1.831** (2.05)	1.123 (0.30)	2.081** (2.25)
General	1.061 (1.35)							
General X Bottom	1 (.)							
General X Middle	1.052 (0.80)							
General X Top	1.128* (1.77)							
Finances		1.095** (2.40)						
Finances X Bottom		1 (.)						
Finances X Middle		0.929 (-1.25)						
Finances X Top		1.052 (0.86)						

Work	1.068*	
	(1.87)	
Work X Bottom	1	
	(.)	
Work X Middle	1.007	
	(0.14)	
Work X Top	1.090	
	(1.57)	
Health	1.022	
	(0.65)	
Health X Bottom	1	
	(.)	
Health X Middle	1.047	
	(0.90)	
Health X Top	0.961	
	(-0.76)	
Faith in People		0.994

		(-0.15)	
Faith in People X Bottom	1		
		(.)	
Faith in People X Middle	1.154**		
		(2.57)	
Faith in People X Top	1.090		
		(1.49)	
Romance		0.995	
		(-0.16)	
Romance X Bottom		1	
		(.)	
Romance X Middle		1.060	
		(1.17)	
Romance X Top		1.020	
		(0.39)	
Life Change			1.053



							(1.34)	
Life Change X Bottom							1	
							(.)	
Life Change X Middle							1.019	
							(0.33)	
Life Change X Top							1.114*	
							(1.82)	
Gambling								1.036
								(1.04)
Gambling X Bottom								1
								(.)
Gambling X Middle								0.991
								(-0.20)
Gambling X Top								0.991
								(-0.21)

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**Portfolio**

Age	1.273***	1.263***	1.264***	1.278***	1.281***	1.278***	1.285***	1.282***
	(2.87)	(2.73)	(2.74)	(2.73)	(2.82)	(2.73)	(2.93)	(2.78)

Female	1.032 (0.13)	0.982 (-0.07)	0.888 (-0.49)	0.830 (-0.73)	0.785 (-0.98)	0.795 (-0.91)	0.898 (-0.44)	0.831 (-0.73)
1st grade- 8th grade	0.758 (-0.63)	0.774 (-0.57)	0.771 (-0.58)	0.795 (-0.51)	0.750 (-0.64)	0.777 (-0.56)	0.785 (-0.55)	0.780 (-0.55)
9th grade- 11th grade	0.813 (-0.61)	0.791 (-0.69)	0.786 (-0.71)	0.800 (-0.65)	0.768 (-0.77)	0.800 (-0.65)	0.815 (-0.61)	0.785 (-0.70)
12th grade	0.808 (-0.43)	0.811 (-0.42)	0.794 (-0.46)	0.837 (-0.35)	0.803 (-0.44)	0.845 (-0.33)	0.832 (-0.37)	0.814 (-0.41)
Some college	1.341 (0.72)	1.281 (0.60)	1.250 (0.54)	1.376 (0.77)	1.276 (0.59)	1.358 (0.73)	1.352 (0.73)	1.343 (0.70)
College degree	0.927 (-0.12)	0.892 (-0.17)	0.849 (-0.25)	0.960 (-0.06)	0.876 (-0.20)	0.936 (-0.10)	0.907 (-0.15)	0.932 (-0.10)
Some grad school	3.167 (0.71)	3.224 (0.74)	2.594 (0.60)	3.242 (0.72)	2.994 (0.67)	3.166 (0.70)	2.967 (0.66)	3.005 (0.69)
Grad/prof degree	0.000000247 *** (-25.18)	0.000000 211 *** (-24.70)	0.000000 244 *** (-24.51)	0.000000 0217 *** (-25.13)	0.000000 212 *** (-24.88)	0.000000 214 *** (-24.99)	0.000000 214 *** (-25.32)	0.000000 207 *** (-25.29)

Married	0.909 (-0.50)	0.884 (-0.65)	0.884 (-0.65)	0.862 (-0.77)	0.853 (-0.83)	0.876 (-0.70)	0.897 (-0.57)	0.866 (-0.75)
Black	0.579* (-1.79)	0.616 (-1.55)	0.625 (-1.51)	0.678 (-1.18)	0.721 (-1.02)	0.648 (-1.33)	0.555* (-1.88)	0.647 (-1.34)
Hispanic	0.516* (-1.89)	0.498** (-1.99)	0.505* (-1.94)	0.513* (-1.84)	0.552* (-1.65)	0.520* (-1.78)	0.474** (-2.11)	0.505* (-1.87)
Mixed Age	1.323 (0.34)	1.233 (0.26)	1.328 (0.35)	1.233 (0.25)	1.492 (0.47)	1.396 (0.39)	1.138 (0.16)	1.251 (0.26)
Bottom H.S.	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)	1 (.)
Middle H. S.	0.319 (-1.53)	0.673 (-0.74)	0.898 (-0.20)	1.569 (1.04)	0.368* (-1.84)	1.195 (0.33)	0.881 (-0.20)	1.738 (0.97)
Top H.S.	0.378 (-1.29)	0.714 (-0.56)	0.503 (-1.12)	1.859 (1.32)	0.817 (-0.32)	1.764 (0.96)	0.914 (-0.13)	1.959 (1.12)
General	1.142* (1.75)							
General X Bottom	1 (.)							
General X	1.301**							

Middle	(2.33)	
General X Top	1.312**	
	(2.48)	
Finances	1.074	
	(1.01)	
Finances X Bottom	1	
	(.)	
Finances X Middle	1.223*	
	(1.91)	
Finances X Top	1.246**	
	(2.09)	
Work	1.091	
	(1.40)	
Work X Bottom	1	
	(.)	
Work X Middle	1.120	
	(1.22)	

Work X Top	1.262**	
	(2.52)	
Health	1.052	
	(0.79)	
Health X Bottom	1	
	(.)	
Health X Middle	1.016	
	(0.16)	
Health X Top	1.034	
	(0.32)	
Faith in People	0.901	
	(-1.42)	
Faith in People X Bottom	1	
	(.)	
Faith in People X Middle	1.415***	
	(3.29)	
Faith in People X	1.251**	

Top	(2.03)	
Romance		1.036
		(0.56)
Romance X Bottom		1
		(.)
Romance X Middle		1.069
		(0.71)
Romance X Top		1.033
		(0.34)
Life Change		1.178**
		(2.37)
Life Change X Bottom		1
		(.)
Life Change X Middle		1.131
		(1.24)
Life Change X		1.156

Top							(1.42)	
Gambling								1.067 (1.07)
Gambling X Bottom								1 (.)
Gambling X Middle								0.985 (-0.17)
Gambling X Top								1.003 (0.03)
Industry controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	34726.56	34773.38	34751.3	34848.9	34808.67	34808.67	34746.31	34852.49
BIC	35950.14	35996.96	35974.88	36072.5	36032.25	36070.21	35969.89	36076.07
var(u1)	140.4 <sup>***</sup> (19.73)	147.0 <sup>***</sup> (19.61)	143.7 <sup>***</sup> (19.64)	157.3 <sup>***</sup> (19.69)	153.4 <sup>***</sup> (19.77)	157.8 <sup>***</sup> (19.74)	144.3 <sup>***</sup> (19.63)	157.7 <sup>***</sup> (19.72)
var(u2)	18.04 <sup>***</sup> (8.74)	18.93 <sup>***</sup> (8.86)	18.82 <sup>***</sup> (8.90)	19.48 <sup>***</sup> (8.97)	18.44 <sup>***</sup> (8.79)	19.60 <sup>***</sup> (8.93)	18.51 <sup>***</sup> (8.78)	19.49 <sup>***</sup> (8.95)
var(u3)	9644.7 <sup>***</sup> (13.06)	9855.0 <sup>***</sup> (12.98)	10116.6 <sup>**</sup> * (12.91)	10536.0 <sup>***</sup> *** (12.91)	10602.7 <sup>**</sup> * (12.92)	10986.6 <sup>**</sup> * (13.00)	10225.3 <sup>**</sup> * (12.82)	10743.2 <sup>**</sup> * (12.94)
N	52393	52393	52393	52393	52393	52393	52393	52393

Exponentiated coefficients;  $t$  statistics in parentheses

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