

ERASMUS UNIVERSITY ROTTERDAM

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## **Linking Anxiety to Entrepreneurial Performance**

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The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

## Abstract

This paper explores the influence of anxiety on entrepreneurial performance. As developed countries experience an organisational shift towards entrepreneurial economies, entrepreneurs and drivers of their success are becoming increasingly important research topics (Thurik, Stam, & Audretsch, 2013). With success also comes failure, entrepreneurs may experience severe mental issues, with anxiety being one of them, while engaged in the uncertain entrepreneurial business environment. The data from the Health and Retirement Study (HRS) in the US is used to see if entrepreneurs have more anxiety than non-entrepreneurs. Results from a t-test suggest that anxiety levels of entrepreneurs are lower than anxiety levels of non-entrepreneurs. HRS data is also used for testing if entrepreneurs who have a higher level of anxiety, have lower performance. Results from a multivariate regression show insignificance for the anxiety variable but evidence is found for the role of gender, age and ancestry in explaining entrepreneurial performance.

## Introduction

Society is changing rapidly. In developed economies the pressure to survive is less as food and water are more easy to come by so our problems are becoming more complex. More people are living alone and social pressure via social media is high (Newman, 2018). Anxiety is lurking around the corner.

After the second world war, policy and funding in developed economies was largely appointed to large firms rather than small firms. US policy quickly shifted its attention to the important role of small and medium sized businesses. Europe however, took until 1970 to 1980 to change policy from large to medium and smaller sized businesses (Rothwell, 1989). Developed economies experienced an organisational change towards entrepreneurial economies, also characterised as dynamic capitalism (Thurik, Stam, & Audretsch, 2013). In the rules of today's developed economy, entrepreneurs need to be innovative and flexible to survive (Wennekers & Thurik, 1999). While the course of our modern day developed economy depend on them, entrepreneurs face great uncertainty. Not only can this take a mental toll, entrepreneurs also face the modern day issues of our society; increasing anxiety levels being one of them. In modern day societies there is a shift from intrinsic goals, such as community,

meaning in life and affiliation, towards extrinsic goals, such as materialism and status (Twenge, et al., 2010). Combining the individualism with the increased rates of people living alone and the rise of social pressure via social media, entrepreneurs are exposed to a lot of potential sources of anxiety (Newman, 2018).

Before existing studies can be assessed, it is important to have a clear definition of the concepts of 'entrepreneurs', 'performance' and 'anxiety'. Entrepreneurs in this paper are defined as self-employed people with a business that consists of less than 250 employees. The performance of entrepreneurs is conceptualised as the measure to which entrepreneurs are successful in creating business value. Anxiety is defined as an emotion which may give feelings of tension, worried thoughts and physical changes such as increased blood pressure (Kowalski, 2000).

Anxiety can influence entrepreneurs in the following way. Entrepreneurs work in a uncertain environment which creates many opportunities for innovating products and processes (Alvarez & Barney, 2005). These opportunities for innovation make entrepreneurs vital for economic growth (Wennekers, Stel, Thurik, & Reynolds, 2005; Stel, Carree, & Thurik, 2005). However, not all entrepreneurs succeed, recent data shows high failure rates (Singh, Corner, & Pavlovich, 2007). Entrepreneurial failure may have severe consequences such as feelings of anger, guilt or depression, especially when social stigma is high and supporting institutions are absent (Vaillant & Lafuente, 2007). Therefore anxiety may lurk for people that fear failure and its consequences. Anxiety is found to decrease performance when the approach to a certain problem is unclear (Eysenck, Derakshan, Santos, & Calvo, 2007). Anxiety is also found to decrease overall concentration and attention control (Eysenck & Calvo, 1992). Individuals who cannot tolerate uncertainty, may find themselves more anxious relative to the individuals that are more able to tolerate uncertainty (Carleton, et al., 2012). As the route to entrepreneurial success is shrouded in uncertainty, anxiety may come into play and disrupt the focus and attention control of entrepreneurs. This way, anxiety can hamper the performance of entrepreneurs in their search for innovation and success.

As we rely more on entrepreneurs for our economic growth, it is important to characterise the entrepreneur and research what drives, and withholds its success. Therefore, in this paper the relationship between one of these characteristics, anxiety, and the performance of entrepreneurs is chosen.

The aim of this study is to explore the relationship between anxiety and the performance of entrepreneurs, more specifically whether anxiety influences the performance of entrepreneurs in the US in 2012. This research question will be tackled by first discussing existing studies, and constructing a framework in which two hypotheses are embedded. First, the hypothesis that entrepreneurs have higher levels of anxiety than non-entrepreneurs is examined with a two sample t-test, to test the differences between means of these two groups. Thereafter, hypothesis two claims that entrepreneurs who have higher anxiety levels, have lower entrepreneurial performance. Hypothesis two will be tested with a multivariate regression. Next, results are discussed per hypothesis and merged to answer the research question. Finally, I will review the data, methods and results in the discussion and conclude by answering the research question and naming several implications of this study.

## Theoretical Framework

In this section, existing studies will be discussed concerning entrepreneurial performance and anxiety. Relevant economic literature is reviewed and connected to genetic, psychological, and psychiatric insights. First, the importance of entrepreneurship and what factors constitute to successful entrepreneurship are discussed. Next, literature regarding anxiety and its effects on performance are laid out. Last, the topics of anxiety and entrepreneurship are synergised and used to formulate the research question and hypotheses.

Researchers have found a relationship between genetic factors and entrepreneurial intentions (Nicolaou, Shane, Adi, Mangino, & Harris, 2011; Nicolaou, Shane, Cherkas, Hunkin, & Spector, 2008). Genetic factors have produced significant results not only when explaining variation in entrepreneurial intentions, but also in job satisfaction (Arvey, Bouchard, Segal, & Abraham, 1989) and work values (Keller, Bouchard, Arvey, Segal, & Dawis, 1992). Seeing as genetic factors can have significant explanatory power for business-related outcomes, it is valuable to use genetics for researching variation in entrepreneurial performance.

## Entrepreneurship

Entrepreneurship is becoming more important for developed economies in the so-called dynamic capitalism (Thurik, Stam, & Audretsch, 2013). Especially since the ICT-

revolution, the business environment in modern developed economies has become rather dynamic, requiring businesses to be innovative and flexible to survive (Wennekers & Thurik, 1999). Moreover, recent research shows a U-shaped relation between economic development and entrepreneurial dynamics (Wennekers, Stel, Thurik, & Reynolds, 2005; Stel, Carree, & Thurik, 2005). Countries with low development show a negative effect of entrepreneurship on GDP, while well-developed countries show a positive effect of entrepreneurship on GDP. The difference in effects of entrepreneurship between the two categories of countries may be due to the type of entrepreneurship, out of necessity, or out of opportunity (Wennekers, Stel, Thurik, & Reynolds, 2005). When you live in a less developed country where educational quality is low and job quality is low, may be necessary to start your own business and become an entrepreneur out of necessity. However, when you live in a developed country where educational quality is higher and jobs are plentiful, there is little gain in starting your own business unless you see an opportunity to be more successful as an entrepreneur rather than an employee. Therefore, developing countries have a high rate of entrepreneurship out of necessity, while developed countries have a high rate of entrepreneurship out of opportunity.

Entrepreneurs are not always successful. Recent data show high failure rates (Singh, Corner, & Pavlovich, 2007). Low success rates make it interesting to investigate what factors do constitute to the success of entrepreneurs. These factors can be education or geographical location, or factors that come from within individuals, such as genetics or personality traits. Regarding the latter, moderate relations are present between several personality traits and entrepreneurial success (Rauch & Frese, 2007). These traits are need for achievement, generalized self-efficacy, innovativeness, stress tolerance, need for autonomy, and proactive personality. More empirical evidence is found for the effect of the need for achievement on entrepreneurial success (McClelland, 1965). Not only personality traits may influence entrepreneurial performance. From a different perspective, broad social and inter-organizational strategic networks increase success rates (Butler & Hansen, 1991). Education also plays an important role in the success of entrepreneurs (Dickson, Solomon, & Weaver, 2008; Ronstadt, 1987). Entrepreneurs know better what they want and how they can reach this goal when they are highly educated (Ronstadt, 1987).

## Anxiety

Entrepreneurial failure can have severe consequences for entrepreneurs, such as depression, anger, guilt or the development of phobias (Singh, Corner, & Pavlovich, 2007). Also, social stigma and a lack of supporting institutions may increase the fear of failure (Vaillant & Lafuente, 2007). It is likely that entrepreneurs feel some form of anxiety knowing they potentially must undergo the consequences of business failure.

Extreme anxiety levels may lead to different disorders and or phobias. Anxiety may also be defined as an aversive emotional state in which the perceived threat to the individual is high, and where worry about reaching a certain goal is high (Derakshan & Eysenck, 2009). How large the proportion of people is that have anxiety for their whole life, is captured in the prevalence rate. For anxiety this rate 28% (Kessler et al., 2005). So, the prevalence rate of 28% shows that 28% of all people that are anxious, remain anxious their whole life. This indicates the stability and time invariant characteristic of anxiety.

Literature has predominantly highlighted the negative effects of anxiety. Negative effects of anxiety have been observed on attention control and concentration through different psychological models (Eysenck & Calvo, 1992; Eysenck, Derakshan, Santos, & Calvo, 2007). The processing efficiency theory (PET) identifies two effects of anxiety on performance. Namely, performance effectiveness and processing efficiency. Performance effectiveness is the quality of the outcomes. Processing efficiency is the number of resources needed to reach the preferred outcomes. The PET concludes that worry and self-preoccupation, which are aspects of anxious people, mainly decrease the processing efficiency. However, performance effectiveness is not necessarily decreased, as anxious individuals compensate for the adverse effects of anxiety on outcomes by using extra resources in the process. PET thus identifies similar performance effectiveness, but lower processing efficiency for people with more anxiety. (Eysenck & Calvo, 1992). Furthermore, building on the PET is the attentional control theory (ACT). The motivation for developing the ACT is the imprecise assumption that anxiety decreases the efficiency of the working memory of the brain. The ACT model concludes that anxiety reduces attentional focus on concurrent task demands (Eysenck, Derakshan, Santos, & Calvo, 2007). In other words, when there is uncertainty in how one should approach a certain task, anxiety reduces the attentional focus on that task.

### Linking anxiety & entrepreneurship

Entrepreneurs work in a dynamic environment where a high level of uncertainty is present (Alvarez & Barney, 2005). Whatever choice entrepreneurs make, the outcomes of their actions are uncertain. Making choices under uncertainty rather than under risk differentiates entrepreneurs from employees (Alvarez & Barney, 2005). In summary, entrepreneurs find themselves in a psychologically tough environment. The uncertain aspect of the entrepreneurial environment may lead to trouble focussing on tasks, according to the attentional control theory. Therefore, anxiety can harm the process towards entrepreneurial success. However, this negative effect will not be too large, as the processing efficiency theory states that the effect on outcomes is compensated for by using extra resources. Therefore, anxiety mainly influences the efficiency of processes but less so the outcomes of entrepreneurs. These outcomes lead to following research question:

*How does anxiety influence entrepreneurial performance in the US?*

To answer the research question, two hypotheses are set up. Hypothesis one tests whether entrepreneurs experience higher levels of anxiety than non-entrepreneurs. Process and outcomes of entrepreneurs are shrouded in uncertainty. Social stigma, fear, anger and more may lead entrepreneurs to become more anxious than non-entrepreneurs. In addition, entrepreneurs are often situated in small and medium sized businesses and thus often have small margins or a small number of clients, which decreases market power, and decreases income stability. Employees on the other hand, often have a contract which entitles them to wages and other benefits, such as social security. For most entrepreneurs, opportunity costs are high, and giving up wages, social security and other benefits makes the impact of their occupational choice ever more crucial. Therefore I suspect that entrepreneurs have a higher level of anxiety than non-entrepreneurs. The term non-entrepreneurs refers to the labour active part of society; but who do not engage in entrepreneurial activity. Hypothesis one is constructed as follows:

*H1. Entrepreneurs have higher levels of anxiety than non-entrepreneurs*

Hypothesis two tests whether the entrepreneurs with more anxiety have lower performance than entrepreneurs with less anxiety. Entrepreneurial performance indicates the extent to which business value is created and entrepreneurial success is reached. According to the PET and the ACT individuals who are more anxious have lower processing efficiency, which means that their focus on tasks with an uncertain approach will be lower. Thus, entrepreneurs work in an uncertain environment which decreases the focus and processing efficiency. Following this line of thinking, entrepreneurs who are more anxious, have lower performance. This leads to hypothesis two:

*H2. Entrepreneurs who have a higher level of anxiety, have lower entrepreneurial performance.*

## Data

### Data Source

In the search for effects of anxiety on entrepreneurial performance, this paper uses data from the Health and Retirement Study (HRS) by the University of Michigan. The HRS is a panel study that surveys approximately 20.000 people in the US. The data gathering started in 1990 through an act of Congress and has provided data about the health and economic situation of US citizens ever since.

More precisely, this paper uses the RAND longitudinal version of the HRS for data about entrepreneurial performance and characteristics of the entrepreneurs. Also, this paper uses the Polygenic Scores (PGS) dataset for genetic data regarding anxiety. The advantages of the PGS dataset are the comprehensive genetic data and literature to back the validity of the variables. Data regarding the RAND longitudinal file is gathered through surveys of the health and retirement study. Data regarding the PGS data is gathered through DNA-collection of respondents and single, genome-wide association studies (GWAS).

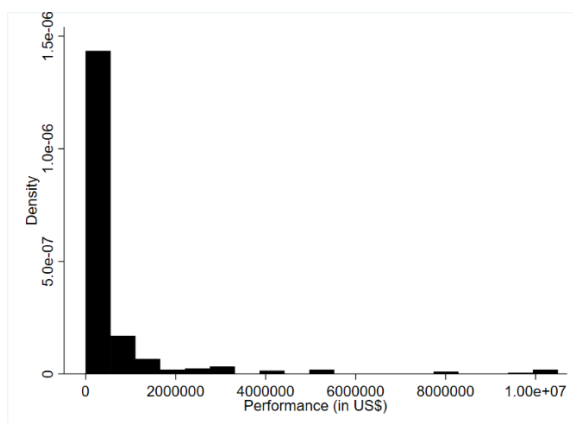
This paper uses the year 2012 as this is the most recent year where RAND and PGS data are available. DNA was gathered from the period 2006 until 2012, where in 2016 a GWAS paper was published which transformed the raw data of anxiety in a polygenic score. As individual genetic markers often do not achieve significance in an association study, a polygenic score is created to summarise a genetic effect on the basis of multiple genetic



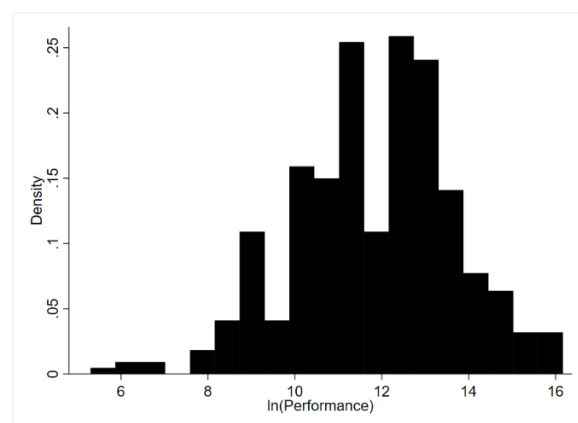
markers (Dudbridge, 2013). The result is a risk score that predicts associations between subject genetics and formalised genetics of complex traits, such as anxiety.

### Sample selection

From the total sample, individuals who are self employed and work in a firm with a size of at least 1 and at most 249 employees are selected. The criteria mentioned above are based on the definition of small and medium size enterprises of the European Commission (EuropeanCommission, 2003). With these criteria only entrepreneurs are selected. Entrepreneurial performance is measured as the self-reported net business value and from now on be called Performance. Observations with a net business value of under 50 dollars are removed, as these observations are likely to be measurement errors. Figure 1 shows how the Performance variable is distributed after selecting the sample. The variable Performance seems to suffer from skewness to the right. Taking the natural logarithm of Performance solves the skewness, and creates a more normally distributed sample. The result of this logarithmic transformation can be seen in Figure 2.



*Figure 1 Histogram of Net Business Value after selecting the sample*



*Figure 2 Histogram of Net Business Value after a logarithmic transformation*

In Figure 2 we can see a dip between the values 9 and 10. Furthermore, data shows a large dip around the value 12. These dips are likely caused by the self-reported nature of the variable Performance. When people report their business value, they have the tension to round it to a whole number. Most valuations are therefore in round values such as \$50,000, rather than for example \$48,907.

Respondents of the HRS have different ancestries with different genetics. In the US there are people with ancestors mostly from Europe and Africa. Different ancestries of modern day US citizens can be genetically heterogeneous in some aspects (Bryc, Durand, Macpherson, Reich, & Mountain, 2015). This makes it interesting to see if different results are

obtained if a dummy variable of the African ancestry is used when investigating the effect of anxiety on entrepreneurial performance.

## Methods

The first topic this paper tests, states that entrepreneurs have higher anxiety levels than non-entrepreneurs. The difference in anxiety levels is examined with a two sample t-test. The two sample t-test can analyse the difference between two population means. The variables in this method are the anxiety scores for the European and African ancestry. The results show if entrepreneurs have different anxiety levels than non-entrepreneurs.

Hypothesis two is tested with a linear regression model. Moreover, control variables are added to account for observable differences in characteristics. In this method the dependent variable will be net value of the business in both regressions. The independent variable is the polygenic score for anxiety. A dummy is added to show what the effect is of having a European ancestry rather than an African ancestry. The first control variable is gender. Gender can influence the PGS of anxiety as well as the entrepreneurial performance. Women are born and often raised differently than men, sometimes also treated differently than men in societies. Therefore it may prove valuable to add the gender control variable. Secondly, age may influence entrepreneurial performance because older people generally have more experience as an entrepreneur. Also, older people may know more people and have broader networks, which can help with entrepreneurial performance. Age can also slightly influence anxiety, as older people can get more anxious when they have children or an important job; such that more is at stake. Thirdly, education is added as control. Higher educated entrepreneurs may increase entrepreneurial performance because education increases knowledge and skills that are useful for entrepreneurs. Education may also influence anxiety because more knowledge may lead to less uncertainty for entrepreneurs, and therefore less anxiety.

### The mathematical model

The linear multivariate regression is stated mathematically below in Equation 1.

*Equation 1 The regression equation for testing hypothesis two*

$$Performance = \alpha + \beta_1 Anxiety + \beta_2 Male + \beta_3 Age + \beta_4 Education + \beta_5 EA + \varepsilon$$

In Equation 1 performance is the dependent variable, Anxiety is the variable of interest and Male, Age, Education and European Ancestry (EA) are control variables. The  $\epsilon$  depicts the error term, which measures the unexplained part of the dependent variable. Alpha represents the constant term. This is the base from which the Performance is influenced by the betas.

### Variables of interest

The independent variable is named Performance in this paper. Performance is defined as the monetary value that an entrepreneur has created through his business. The variable is based on observations regarding the net business value of respondents of the HRS. Performance is operationalised as the natural logarithm of the net business value. The reason for taking a natural logarithm is to reduce skewness of the data and to simplify interpretation of the results.

The variable of interest is Anxiety. This variable is conceptualised as the degree of anxiety a person inherently has. The variable Anxiety is based on the polygenic score of anxiety for European and African ancestries which is obtained via GWAS (Otowa, et al., 2016). Anxiety is operationalised as a polygenic score that scores the degree of anxiety between the range of -5 to 5. The value 0 indicates the mean of the population. Negative values represent lower anxiety levels relative to the mean of the population and positive values represent higher anxiety levels relative to the mean of the population.

The first control variable is called Male. This variable represents the gender of the respondent. The variable is a dummy. Male takes the value 1 if the respondent is a male, and the value 0 if the respondent is a female.

The second control variable is age. Age is conceptualised as the age of the respondent at the time the interview began. Age is measured in years. The control variable is based on the age of respondents reported in the HRS.

The third control variable is education. Education is defined as the amount of education a respondent has had in his life. The variable is based on the years of education as well as the highest degree the respondent has. Education is a categorical variable with values 1 to 5. Table 1 displays the different categories and the distribution of values. In the regression there are 4 dummies and a reference group, to which the dummies will be compared to.

Finally, the dummy variable European Ancestry is added to illustrate differences between the African and European ancestries in the regression. The dummy variable gets the

value 1 if the respondent stems from a European ancestry and the value 0 if the respondent stems from an African ancestry.

## Descriptive statistics

*Table 1 Summary table for the categories of education*

Education cat.	Freq.	Percent	Cum.
1. Less than High School	22	6%	6%
2. GED*	11	3%	9%
3. High School Graduate	97	25%	34%
4. Some College	117	30%	64%
5. College and Above	138	36%	100%
Total	385	100%	

\*Note that GED stands for: has received the General Educational Development credential.

*Table 2 Descriptive statistics for all variables of interest*

Variable	N	Mean	Std. Dev.	Min	Max
Performance*	385	11.87	1.87	5.30	16.17
Anxiety	385	-0.11	0.97	-2.97	2.64
Age	385	64.23	9.13	41	88
EU Ancestry	385	0.92	0.28	0	1
Male	385	0.64	0.48	0	1
Education	385	3.88	1.11	1	5

\*Note that Performance is measured as the natural logarithm of the self-reported net business value of respondents.

The descriptive statistics of all variables of interest are displayed in

Table 2 shows an N of 385 for the sample, which is large enough to expect robust results. Performance shows a mean of 11.87 which corresponds with a business value of roughly \$142,000. Furthermore, it is notable that there is a large gap between the minimum and the maximum value of over 10.3 million dollars. Following, the variable Anxiety shows a mean of -0.11 and a standard deviation of 0.97. This indicates a distribution close to a normal distribution. However, this is expected as a PGS of value 0 represents the mean of the total population. Also note that extreme values are relatively small for the selected sample, with the minimum value being -2.97 and the maximum 2.64. The variable age shows a mean of 64. This shows that the average age of the sample is 64 years, which is expected as the sample is based on the Health and Retirement study. This relatively high mean is no problem however, as the sample still contains 385 entrepreneurs. The youngest entrepreneur in this sample is

44 and the oldest is 88 years old. Notable, 92% of the sample is based on entrepreneurs of European ancestry relative to 8% of African ancestry. Also, the percentage of males in the sample is 64%, and the percentage of females is 36%. The mean of 3.88 shows that the average entrepreneur has graduated from High School. For Education in Table 1, category one represents the lowest level of education and category 5 the highest level of education.

## Results

Hypothesis one states that entrepreneurs have higher levels of anxiety than non-entrepreneurs. Entrepreneurs face effects that increase anxiety. Here, we explore whether being exposed to conditions that increase anxiety actually influences the performance of entrepreneurs. The method to test hypothesis one is a two sample t-test. First, the European sample will be analysed, and later the African sample. Sample sizes here are larger than the sample size in the descriptive statistics and methodology concerning hypothesis two. This is because non-entrepreneurs are included in this test, and second, the Performance variable has considerably more missing values than the variable Anxiety. Table 3 and Table 4 both perform two tests, whether the means differ, and whether the mean of entrepreneurs is higher than the mean of non-entrepreneurs. The results of this t-test are shown in Table 3.

*Table 3 Two sample t-test for anxiety levels of entrepreneurs and non-entrepreneurs with European ancestry data*

Variables	N	Mean	Std. Error
Entrepreneurs	833	-0.052	0.034
Non-Entrepreneurs	2904	0.021	0.018
Diff = Mean(Entrepreneurs) - Mean(Non-Entrepreneurs)			
Pr.(Diff!=0) = 0.058*		Pr.(Diff>0) = 0.971	

Note that \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

The results presented in Table 3 provide insufficient evidence to support hypothesis one. The p-value is  $0.970 > 0.05$ . Furthermore, the results indicate that the two means of entrepreneurs and non-entrepreneurs of the European ancestry are different at the 90% confidence interval. The p-value is 0.058 which is significant at 0.10. Moreover, the mean anxiety score of non-entrepreneurs is higher than the mean anxiety score of entrepreneurs. This suggests that non-entrepreneurs have more anxiety than entrepreneurs.

Table 4 displays a two sample t-test for dealing with hypothesis one with the African ancestry data. The African ancestry is used to see if the results are like those of the European ancestry. Also, for the African ancestry hypothesis one will not be supported.

*Table 4 Two sample t-test for anxiety levels of entrepreneurs and non-entrepreneurs with African ancestry data*

Variables	N	Mean	Std. Error
Entrepreneurs	144	-0.172	0.089
Non-Entrepreneurs	957	0.044	0.032
Diff = Mean(Entrepreneurs) - Mean(Non-Entrepreneurs)			
Pr.(Diff!=0) = 0.015**		Pr.(Diff>0) = 0.993	

Note that \*p<0.10, \*\*p<0.05, \*\*\*p<0.01.

For the African ancestry the mean of anxiety differs between entrepreneurs and non-entrepreneurs. The p-value of a difference in means is 0.015 which is significant at the 0.05 threshold. Additionally, Table 4 shows that entrepreneurs have a lower mean anxiety score than non-entrepreneurs. This indicates that non-entrepreneurs are more anxious than entrepreneurs, which is the same conclusion as with the European ancestry in Table 3.

Hypothesis two states that entrepreneurs with a higher level of anxiety, have lower performance. This hypothesis is tested with a multivariate regression with entrepreneurial performance as dependent variable, anxiety as independent variable and the control variables Age, Gender Education and the dummy EU Ancestry. Table 5 displays the regression results. The first model is with both ancestries. The second and third model splits the results per ancestry to check for robustness.

*Table 5 Regression results for hypothesis two with dependent variable Performance and independent variable Anxiety.*

Variable	Both Ancestries	EU Ancestry	African Ancestry
Anxiety	-0.009 (0.091)	0.056 (0.095)	-0.702** (0.277)
Male	0.407** (0.202)	0.521** (0.214)	-0.372** (0.566)
Age	0.026** (0.011)	0.031*** (0.012)	-0.014 (0.036)
EU Ancestry	1.101*** (0.324)		
Education			
2. GED	-1.505* (0.895)	-1.260 (1.194)	-0.857 (1.395)
3. High School Graduate	-0.158 (0.399)	-0.300 (0.398)	1.157 (1.047)
4. Some College	-0.222 (0.417)	-0.309 (0.418)	0.998 (1.001)
5. College and Above	0.144 (0.402)	0.062 (0.402)	0.837 (1.197)
Constant	9.033*** (0.862)	9.807*** (0.883)	10.735*** (3.088)
N	385	353	32
R <sup>2</sup>	0.103	0.069	0.404

Standard error in brackets; \*p<0.10, \*\*p<0.05, \*\*\*p<0.01.

The first thing to note from Table 5 is the insignificant coefficient of Anxiety for the model Both Ancestries and EU Ancestry. This insignificance shows that there is not enough evidence to conclude that anxiety lowers entrepreneurial performance. However, in Both Ancestries, age, gender, and type of ancestry do seem to influence Performance. Significance for the coefficient Male indicates that males, on average, have 50% more Performance than females. Furthermore, people who are one year older increase their Performance with roughly 2.6% on average. Also, people with a European ancestry have on average 201% more Performance than people with an African ancestry. Education is not significant in this sample. Only GED in the model Both Ancestries does seem to have an effect. Notable, this is a negative effect of having a GED relative to the category Less Than High School on Performance.

## Discussion

To start the discussion of the results it must be noted that reverse causality can be a problem, and therefore should be discussed before going into the detailed results. Reverse

causality can be a problem when working with entrepreneurship. For example, personality traits do not only influence entrepreneurship, but entrepreneurship can also influence personality traits of the entrepreneurs (Rauch & Frese, 2007). However, reverse causality is less of a problem in this paper, as the genetic score for anxiety is used. This score is less likely to change over time and therefore will not be significantly impacted by a change in entrepreneurial performance. It may however be possible to be more anxious as your performance is too low. Low performance may cause money problems and therefore anxiety for some people. However, this increased anxiety is most of the time temporary and will disappear if performance rises again and money is less of an issue. To conclude, entrepreneurial performance is unlikely to change the long-term anxiety of an entrepreneur. Therefore, reverse causality is not an issue in this paper.

The results of hypothesis one show a barely significant value when tested whether means of entrepreneurs and non-entrepreneurs differ. However, the mean anxiety of entrepreneurs is lower than the mean anxiety of non-entrepreneurs. This is opposite to what hypothesis one states. One reason for entrepreneurs to have lower anxiety levels than non-entrepreneurs can be because anxious individuals are less likely to choose a profession in which much uncertainty is present. When presented the choice between becoming an employee with guaranteed pay and other benefits or becoming an entrepreneur and being fully responsible yourself for what you get, more anxious individuals choose the safe route and become an employee. More research on the different anxiety levels between entrepreneurs and non-entrepreneurs may provide valuable insights into either becoming an employee or an entrepreneur.

For hypothesis two this paper uses a linear multivariate regression model. The aim of this linear regression is to estimate the effect of the independent variable on the dependent variable. Omitted variable bias is partly dealt with by encompassing control variables in the regression. The main assumption of this model is the Conditional Independence Assumption (CIA). The CIA states that differences in characteristics of treatment and control are only due to observable characteristics. In other words, no important control variables are left out. There is no definitive way to test the CIA assumption. However, the CIA is likely to hold in this paper because of the genetic aspect of this study. Many variables may influence the performance of entrepreneurs, but few also influence the anxiety of individuals. This is because many effects that influence anxiety are incorporated in the PGS. The PGS



incorporates the majority of relevant aspects of anxiety that stem from the genetics of the respondent (Otowa, et al., 2016).

Next, the European Ancestry dummy provided significant results. The regression results in Table 1 show a positive and significant coefficient of the European Ancestry, which indicates that entrepreneurs of European Ancestry have 201% more Performance than entrepreneurs of the African Ancestry. This difference seems disproportionate. A logical explanation for the disproportionate effect could be that the sample size of the African ancestry is too low to be representative for all African ancestry entrepreneurs in the US. However, it may still be possible for a difference to exist in Performance of the two ancestries. Also note that many Americans nowadays have mixed ancestries, making it difficult to apply results of this study to a specific group. Future research may provide insights regarding policy for entrepreneurs if a difference in Performance between the two ancestries exists for a larger sample size.

Another comment, in the HRS dataset more people of European ancestry are questioned than people of African ancestry. This is not a problem for representativeness, as more people in the US have a European ancestry relative to an African ancestry. This is however an issue for the regression results of the African Ancestry model and the EU Ancestry variable in the Both Ancestries model in Table 5. Because of the relatively small number of observations, the precision and reliability of the coefficients that rely solely on the African ancestry suffers. For this reason, the focus of this paper is on the European ancestry or the European and African ancestry combined. The results of the African ancestry are still added to be transparent and provide some sort of robustness to the method.

Also notable, the sample size differs between the samples used in the regression and in the two sample t-tests. This is mainly because the dataset has got some missing values for the variable Performance. Therefore, the sample size shrinks considerably when running the regression relative to the t-tests. However, the sample size remains large enough for the EU ancestry and the EU and African ancestry combined for the regression to be reliable.

Another point, the fraction of masculine entrepreneurs in this sample indicate that the sample overrepresents men. Actually, in the US in 2012 there were more female entrepreneurs than male entrepreneurs (GEM, 2012). Therefore, future studies should increase the number of female respondents or at least equalise the fraction of males and females to get a higher external validity.

## Conclusion

The goal of this paper is to explore the influence of anxiety on entrepreneurial performance in the US in 2012. The first hypothesis states that entrepreneurs have higher levels of anxiety than non-entrepreneurs. This paper did not find enough evidence to suggest that entrepreneurs have higher levels of anxiety than non-entrepreneurs. However, there is enough evidence to say that anxiety levels differ between entrepreneurs and non-entrepreneurs. Furthermore, the second hypothesis states that entrepreneurs with higher anxiety levels, have lower performance. The results suggest that there is no significant claim that anxiety lowers performance of entrepreneurs. However, the regression did show evidence for the significance of age, gender, and ancestry on entrepreneurial performance. So, entrepreneurs are different from non-entrepreneurs regarding anxiety, but entrepreneurs with higher anxiety levels do not necessarily have lower entrepreneurial performance than entrepreneurs with lower anxiety levels.

To better understand the implications of these results, future studies could address the importance of female entrepreneurs in their samples. In addition, further research may look deeper into the differences between European and African ancestries. Shedding light on the roots of the differences may provide valuable insights on areas such as equality in the work environment. Practitioners such as governments or international institutions may benefit from more research regarding genetic effects such as anxiety on the performance of entrepreneurs. This could provide more knowledge for making the entrepreneurial support programmes more efficient.

This paper contributes to the research of successful entrepreneurship and to the genetic and health research regarding anxiety. The performance effects cause by anxiety from health and genetic studies are applied to economic topics such as entrepreneurship. Anxiety differs between entrepreneurs and non-entrepreneurs. This finding may be incorporated in occupational choice models to increase precision. Anxiety may be a valuable measure in determining who is more likely to become an entrepreneur and who is more likely to become successful as an entrepreneur. What is more, adding genetics to the research of entrepreneurship provides new perspectives and opportunities for research. Also, genetic data may be more precise than self reported data on health, which may increase the reliability and precision of estimates.

## References

- Alvarez, S. A., & Barney, J. B. (2005). How Do Entrepreneurs Organize Firms Under Conditions of Uncertainty? *Journal of Management*, *31*(5), 776-793.
- Arvey, R. D., Bouchard, T. J., Segal, N. L., & Abraham, L. M. (1989). Job satisfaction: Environmental and genetic components. *Journal of Applied Psychology*, *74*(2), 187-192.
- Bryc, K., Durand, E. Y., Macpherson, J. M., Reich, D., & Mountain, J. L. (2015). The Genetic Ancestry of African Americans, Latinos, and European Americans across the United States. *American Journal of Human Genetics*, *96*(1), 37-53.
- Butler, J. E., & Hansen, G. S. (1991). Network evolution, entrepreneurial success, and regional development. *Entrepreneurship & Regional Development*, *3*(1), 1-16.
- Carleton, R. N., Mulvogue, M. K., Thibodeau, M. A., McCabe, R. E., Antony, M. M., & Asmundson, G. J. (2012). Increasingly certain about uncertainty: Intolerance of uncertainty across anxiety and depression. *Journal of Anxiety Disorders*, *26*(3), 468-479.
- Derakshan, N., & Eysenck, M. W. (2009). Anxiety, Processing Efficiency, and Cognitive Performance. *European Psychologist*, *14*(2), 168-176.
- Dickson, P. H., Solomon, G. T., & Weaver, K. M. (2008). Entrepreneurial selection and success: does education matter? *Journal of Small Business and Enterprise Development*, *15*(2), 239-258.
- Dudbridge, F. (2013). Power and Predictive Accuracy of Polygenic Risk Scores. *PLOS Genetics*, *9*(3).
- Egloff, B., Schwerdtfeger, A., & Schmukle, S. C. (2005). Temporal Stability of the Implicit Association Test-Anxiety. *Journal of Personality Assessment*, *84*(1), 82-88.
- European Commission (2003, May 3). *SMALL AND MEDIUM-SIZED ENTERPRISES (SMES)*. Retrieved from eurostat: <https://ec.europa.eu/eurostat/web/structural-business-statistics/structural-business-statistics/sme>
- Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and Performance: The Processing Efficiency Theory. *Cognition and Emotion*, *6*(6), 409-434.

- Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*(2), 336-353.
- GEM (2012). Adult Population Survey [Data file]. Retrieved from <https://www.gemconsortium.org/data/sets?id=aps>
- HRS (2012). HRS Polygenic Scores (Release 3 2006-2012 Genetic Data) [Data file]. Retrieved from <https://hrs.isr.umich.edu/data-products>
- Keller, L. M., Bouchard, T. J., Arvey, R. D., Segal, N. L., & Dawis, R. V. (1992). Work values: Genetic and environmental influences. *Journal of Applied Psychology, 77*(1), 79-88.
- Kowalski, R. M. (2000). *Encyclopedia of Psychology: Anxiety*. (A. E. Kazdin, Ed.) American Psychological Association; Oxford University Press.
- Lovibond, P. F. (1998). Long-term stability of depression, anxiety, and stress syndromes. *Journal of Abnormal Psychology, 107*(3), 520-526.
- McClelland, M. C. (1965). Achievement and entrepreneurship: A longitudinal study. *Journal of Personality and Social Psychology, 1*(4), 389-392.
- Newman, T. (2018). Anxiety in the West: Is it on the rise? *Medical News Today*. Retrieved from <https://www.medicalnewstoday.com/articles/322877>
- Nicolaou, N., Shane, S., Adi, G., Mangino, M., & Harris, J. (2011). A polymorphism associated with entrepreneurship: evidence from dopamine receptor candidate genes. *Small Business Economics, 36*(1), 151-155.
- Nicolaou, N., Shane, S., Cherkas, L., Hunkin, J., & Spector, T. D. (2008). Is the Tendency to Engage in Entrepreneurship Genetic? *Management Science, 54*(1), 167-179.
- Otowa, T., Hek, K., Lee, M., Byrne, E. M., Mirza, S. S., Nivard, M. G., . . . Hettema, J. M. (2016). Meta-analysis of genome-wide association studies of anxiety disorders. *Molecular Psychiatry, 21*(10), 1391-1399.
- RAND (2016). RAND HRS Longitudinal File 2016 (Version 2) [Data file]. Retrieved from <https://hrs.isr.umich.edu/data-products>
- Rauch, A., & Frese, M. (2007). Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success. *European Journal of Work and Organizational Psychology, 16*(4), 353-385.
- Ronstadt, R. (1987). The Educated Entrepreneurs: A New Era of Entrepreneurial Education is Beginning. *American Journal of Small Business, 11*(4), 37-53.

- Rothwell, R. (1989). Small Firms, Innovation and Industrial Change. *Small Business Economics*, 1(1), 51-64.
- Singh, S., Corner, P., & Pavlovich, K. (2007). Coping with entrepreneurial failure. *Journal of Management & Organisation*, 13(4), 331-344.
- Stel, A. v., Carree, M., & Thurik, R. (2005). The Effect of Entrepreneurial Activity on National Economic Growth. *Small Business Economics*, 24(1), 311-321.
- Thurik, A., Stam, E., & Audretsch, D. (2013). The rise of the entrepreneurial economy and the future of dynamic capitalism. *Technovation*, 33(8), 302-310.
- Twenge, J. M., Gentile, B., DeWall, N., Ma, D., Lacefield, K., & Schurtz, D. R. (2010). Birth cohort increases in psychopathology among young Americans, 1938–2007: A cross-temporal meta-analysis of the MMPI. *Clinical Psychology Review*, 30(2), 145-154.
- Vaillant, Y., & Lafuente, E. (2007). Do different institutional frameworks condition the influence of local fear of failure and entrepreneurial examples over entrepreneurial activity? *Entrepreneurship & Regional Development*, 19(4), 313-337.
- Wennekers, S., & Thurik, A. R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics*, 13(1), 27-56.
- Wennekers, S., Stel, A. v., Thurik, R., & Reynolds, P. (2005). Nascent Entrepreneurship and the Level of Economic Development. *Small Business Economics*, 24(1), 293-309.