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# **How childhood ADHD-like symptoms predict selection into entrepreneurship and implications for entrepreneurial performance**

## **Executive Summary**

Given the mental health crisis occurring across the world, scholars have become increasingly interested in mental health issues and entrepreneurship. The effects of mental health have been studied as either determinants of entrepreneurship, affecting the entrepreneurial process or being manifested as a result of the entrepreneurial process itself. Despite the extant research, there is still a significant gap in understanding how factors such as mental health influence entrepreneurial activity and outcomes like performance. Our paper examines mental health and entrepreneurship through a focus on the effect of ADHD-like symptoms on entrepreneurial performance. With more than a quarter of entrepreneurs exhibiting higher levels of attention deficit hyperactivity disorder (ADHD) (29%), such a discussion is long overdue.

The literature review within our paper highlights that mental health and entrepreneurship has become an increasingly popular focus for study, with much of the research focusing on entrepreneurial section. Much less is known regarding mental health and entrepreneurial performance. We begin the literature review by examining mental health and entrepreneurship, showing how existing studies lack consensus with regards to the impact of mental health on entrepreneurial activity. We then examine psychiatric conditions and entrepreneurship leading to a discussion of ADHD and entrepreneurial performance so there is a better understanding of how early life diagnoses impact on performance.

We advance literature by addressing a key research question: “*What is the impact of childhood ADHD-like symptoms on entrepreneurial performance as adults?*”. We do this by monitoring people who have been diagnosed with ADHD-like symptoms at age 10 and examining the employment implications of their symptoms at different age points in their adult life, i.e. 30 and 42. This approach is unique in the mental health and entrepreneurship literature and can offer us a better appreciation of the long term effects of the disorder on entrepreneurial intentions and outcomes.

Our paper focuses on mental health and entrepreneurial performance. In particular we examine how performance is impacted by ADHD-like symptoms. This enables us to make unique contributions to the literature:

- 1) We advance prior studies which have shown the potential benefits of ADHD traits on entrepreneurial intentions and entrepreneurial action, by further examining the underlying causes of this relationship. We do so by examining the impact of each ADHD component -as presented at the age of 10- on selection into entrepreneurship. We confirm that while indeed individuals (predominantly men) diagnosed with ADHD symptoms in childhood are drawn towards entrepreneurship, this is not due to their inherent impulsive nature, but rather it is a result of the inattention component.
- 2) We also show that whereas childhood ADHD-like symptoms may predict a positive effect on entrepreneurial selection, they also negatively impact on overall entrepreneurial performance and survival. In fact, we find that hyperactivity and impulsivity symptoms have discreet performance implications. Specifically, we observe that high levels of inattention are conducive to business failure and lower take-home income and high levels of impulsivity lead to overall negative earnings' growth. We extend understanding of the topic of mental health and entrepreneurial performance by showing that switching from unemployment to self-employment is not always a net positive and will be influenced by the specific underlying mental conditions and traits of the entrepreneurs.

Last but not least, our study offers good ground for some key policy recommendations. Policy makers tend to assume that entrepreneurship is an inherent good. However, our study highlights how mental health issues can act as a constraining factor on entrepreneurial performance. As mental health issues have risen up government agendas across many facets of policy, our study calls for greater understanding of how policy should address and support psychological improvements as a way of improving entrepreneurial performance. Furthermore, observing the strong role educational attainment may have on 'lifting' individuals who exhibit higher ADHD-like symptoms in childhood, we urge career advisors within schools to include measures of mental health issues in their assessment of individuals so they can better inform employment guidance. Doing so would better enable policy makers to understand the particular needs and requirements of these individuals and the challenges they may face in future entrepreneurial activities.

# **How childhood ADHD-like symptoms predict selection into entrepreneurship and implications on entrepreneurial performance**

## **Abstract**

This study advances research on mental health and entrepreneurship through the examination of Attention Deficit Hyperactivity Disorder (ADHD)-like symptoms, associated with hyperactivity/impulsivity and inattention. We examine the impact of these symptoms at age 10 on entrepreneurial performance as an adult. We find that while ADHD-like symptoms in childhood may have a positive impact on entrepreneurial selection, they negatively impact on survival and performance, with a variant effect by each symptom, predominantly among males. We find that high levels of inattention predict business failure and lower take-home income, while high levels of hyperactivity/impulsivity contribute to overall negative earnings' growth.

**Keywords:** Entrepreneurship, ADHD, impulsivity, inattention, firm performance, firm survival

**JEL:** J23, J24

## **1. Introduction**

A mental health crisis is considered to be occurring across the globe (Wiklund, Hatak, Patzelt, & Shepherd, 2018a). In response, scholars have become increasingly interested in links between mental health and entrepreneurship (Bönte, Procher and Urbig, 2015; Shane and Nicolaou, 2015; Wiklund, Patzelt and Dimov, 2016). Yet despite this emergent stream of research, there are still significant gaps in understanding how factors such as mental health influence entrepreneurial activity and outcomes like performance.

This paper examines mental health and entrepreneurship through a focus on the effect of ADHD-like symptoms on entrepreneurial performance. The role of Attention Deficit Hyperactivity Disorder (ADHD) in entrepreneurship, which, in line with Nicolaou and Shane (2009), we define as owning and running a business, has emerged as a valuable area of study (Antshel, 2018; Leung, Franken and Thurik, 2020). ADHD is a neurodevelopmental disorder with two primary symptoms: (1) poor attention span and (2) impulsive, hyperactive behavior (Faraone, Sergeant, Gillberg and Biederman, 2003). While the cause of ADHD is partially genetic and partially environmental (Lenz et al., 2008), it has recently been accredited to serve as an asset in the pursuit of entrepreneurial activity (Wiklund, Patzelt and Dimov, 2016; Wiklund, Yu, Tucket and Marino, 2017; Leung et al., 2020). ADHD and ADHD-like symptoms are found to increase selection into entrepreneurship (Wiklund et al., 2016, 2017), and entrepreneurial orientation (Wismans, Thurik, Verheul, Torrès and Kamei, 2020)<sup>1</sup>.

In fact, the person-environment (P-E) fit literature has suggested that people with mental disorders, such as ADHD, are more productive as entrepreneurs, rather than working for others, as they are able to manage their disorder in such fast-paced, changing and relatively unrestricted environments (Wiklund et al., 2018a).

Despite the increasing interest in the topic, an understanding of the implications of mental disorders on entrepreneurial performance remains under-researched. Indeed, to date, while several studies have focused on the implications of mental disorders -and ADHD in particular-on entrepreneurial orientation (Nikolova, 2019; Wiklund et al., 2016; 2017; Wismans et al., 2020), scarce attention has been placed on the impact of such disorders on entrepreneurial performance<sup>2</sup> (Lerner et al., 2018b; Freeman et al., 2019). Yet while

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<sup>1</sup> ADHD-like symptoms here refer to behaviors that are akin to the symptoms in the official diagnostic checklists, but do not constitute a formal diagnosis of ADHD.

<sup>2</sup> There is some empirical research on the implications of mental disorders on entrepreneurial performance (Stephan, 2018; Hessels et al., 2018) but the focus is based mainly on stress and depression rather than on mental disorders such as ADHD. To this end, as Freeman et al. (2019) most recently noted, significant gaps remain in our understanding of the role of key psychiatric conditions on entrepreneurial outcomes.

entrepreneurship may be an appropriate choice for people suffering from mental disorders like ADHD, who may find it difficult to function in paid employment, this tendency does not guarantee the survival and success of their entrepreneurial endeavours. Key entrepreneurial qualities such as persistence, perseverance, long-term planning and organization, may be in contrast to personality characteristics associated with ADHD, potentially hampering the overall success of the endeavour (Lerner, 2016).

In the current study, we bridge this gap in the literature by examining the impact of ADHD on entrepreneurial performance. We specifically ask: “*What is the impact of childhood ADHD-like symptoms on entrepreneurial performance as adults?*”. Recognizing that the two symptoms associated with ADHD, namely inattention and hyperactivity/impulsivity, are rather distinct, we examine each symptom separately to decipher their distinct implications on entrepreneurial behavior and performance.

Our paper contributes to the literature on mental disorders and entrepreneurship in two distinct ways. First, we advance prior research which has shown the potential benefits of ADHD traits on entrepreneurial intentions (Wiklund et al., 2016, 2017) and entrepreneurial action (Wiklund, Yu and Patzelt, 2018b)<sup>3</sup>, by further examining the underlying causes of this relationship. We do so by examining the impact of each ADHD component on selection into entrepreneurship. We confirm that while ADHD individuals may indeed be drawn towards entrepreneurship, this may not be due to their inherent impulsive nature as suggested in the existing literature (Wiklund et al., 2018b). Rather it is the result of the inattention component, a finding particularly strong among males. Second, whereas ADHD-like symptoms may have a positive effect on entrepreneurial selection, we show that they negatively impact on overall entrepreneurial performance and survival, particularly for businesses run by males. In fact, we find that hyperactivity and impulsivity symptoms have discreet performance implications.

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<sup>3</sup> Due to increased levels of impulsivity.

Specifically, high levels of inattention are conducive to business failure and decreased take-home income and high levels of impulsivity lead to overall negative earnings' growth. We hence extend our understanding of the topic of mental health and entrepreneurial performance by showing that switching from unemployment to self-employment is not always a net positive as suggested by prior empirical studies as well (i.e. Nikolova, 2019), and will be influenced by the specific underlying mental conditions and traits of the entrepreneurs.

The paper is structured as follows. First, we begin by setting out the theoretical gaps underlying our hypothesis development. We then set out the research design and analysis, followed by results. The paper concludes with consideration of the theoretical and practical implications of the findings.

## **2. Theoretical background and Hypothesis development**

### **2.1. Mental Health and Entrepreneurship**

Recent research has explored dimensions of mental health (Nikolova, 2019), mental wellbeing (Stephan, 2018) and mental disorders which influence entrepreneurship (Antshel, 2018; Hessels et al., 2018). The effects of mental health have also been studied as either a determinant of entrepreneurship (Wiklund et al., 2018a) and the entrepreneurial process (Lerner, 2016) or as a result of the entrepreneurial process itself (Louie, 2016; Nikolova, 2019). Despite the plethora of this discourse, views have been varying and contrasting, severely impairing our understanding of the true relationship between mental health and entrepreneurship.

Mental health issues, including personality disorders, are known to impair an individual's "daily functioning" and be of detriment to their overall well-being (Stephan, 2018: 292). This is particularly pervasive among entrepreneurs, who face unique working conditions that differ substantially from employed individuals. When compared with salaried employees, entrepreneurs are required to deal with many diverse and complex issues simultaneously from

creating new marketable items to fending off retaliation from rivals and dealing with various stakeholders' concerns, including their own employees (Markman and Baron, 2003). Meanwhile, entrepreneurs operate under uncertainty, capital constraints and time pressure, with limited practical and social support (colleagues and/or external advisors) (Stephan, 2018). A number of scholars have already raised concerns over the increased presence of mental and physical health issues among entrepreneurs (Parslow et al., 2004; Saarni et al., 2008; Freeman et al., 2019).

Other studies have indicated that mental health problems are less pervasive among entrepreneurs, as they are more independent in their decision-making, and enjoy higher control over their work (Patzelt and Shepherd, 2011; Stephan, 2018). Entrepreneurs can enjoy a type of freedom that can counteract both physical and mental pressures of stress (Hausser et al., 2010; Stephan, 2018). Indeed, entrepreneurs have therefore been reported to better withstand daily stressful situations and uncertainty, and/or utilising more efficient coping mechanisms (Patzelt and Shepherd, 2011). The increased levels of persistence and tenacity that characterises entrepreneurship, has been argued to reduce the effects of stress (Patzelt and Shepherd, 2011), allowing them to experience everyday problems with less negativity, and transforming as such stress into a positive driver towards success (Cardon and Patel, 2015).

## **2.2. Psychiatric Conditions and Entrepreneurship**

The mental health literature has placed great emphasis on the implications of mental health issues on self-employment (Leung et al., 2020). However, there has been limited focus on the “nature...and characteristics of psychiatric conditions” (Freeman et al., 2019: 323). With more than a quarter of entrepreneurs exhibiting higher levels of attention deficit hyperactivity disorder (ADHD) (29%), such a discussion is long overdue (Freeman et al., 2019). In this study,

we advance the current discourse by exploring the implications of ADHD symptoms on entrepreneurship.

ADHD is often considered to be age-inappropriate behavior<sup>4</sup>, including poor inhibition as the primary deficit (Barkley, 1997). Individuals with ADHD exhibit lower states of arousal and the symptoms of ADHD are attempts to regulate the low state of arousal. Individuals with high-ADHD symptoms are prone to high reward and high stimulation as a means of attaining the optimal state of arousal (Geissler, Romanos, Hegerl and Hensch, 2014; Sikström and Soderlund, 2007; Zentall and Meyer, 1987). As a result, individuals with high ADHD-symptoms are prone to risk-seeking, ambiguity tolerance and novelty-seeking behaviors (Faraone, Kunwar, Adamson and Biederman, 2009; Shoham et al., 2016; Sikström and Söderlund, 2007; Williams and Taylor, 2005). Novelty seeking individuals are impulsive, easily bored, curious and extravagant (Faraone et al., 2009). Novelty seeking is related to both the inattention and hyperactive/impulsive types of ADHD (Faraone et al., 2009). These personality characteristics will have an impact on selection into entrepreneurship as well as the performance of entrepreneurial activity (Wiklund et al, 2018b).

In examining ADHD and entrepreneurship we draw from the theory of person-environment fit (Wiklund, Patzelt and Dimov, 2016; Wiklund et al., 2018a). The theory posits that people are attracted to vocations whose perceived characteristics and requirements are congruent with their personalities (Holland, 1997). Congruence between the individual's personality traits and workplace requirements results in higher personality satisfaction and longevity in the vocation (Dawis and Lofquist, 1984; Wiklund et a., 2017). In an

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<sup>4</sup> Both scientists and clinicians now acknowledge that once diagnosed with certain ADHD symptoms in childhood, the likelihood for these symptoms to persevere and influence the cognitive and functional skills of individuals in their adult lives is very high. In fact, different meta-analytic reviews have reported that between 50-70 percent of those diagnosed with ADHD symptoms continue to show impairing symptoms into adulthood too (Biederman et al., 2010; Faraone, Biederman, & Mick, 2006; Antshel, 2018). These results verify the notion that ADHD symptoms are chronic (APA, 2013) and persist into adulthood thus, measurements of ADHD in childhood constitute a valuable predictor of adult behavior as well.

entrepreneurial setting, the benefits are bestowed in the freedom of the individual to make their own choices and decisions; indeed “control over the person’s behavior derives neither from superiors, nor professional norms, nor peer group members” (Miner et al., 1989: 554). ADHD individuals may be suited to entrepreneurship through the core impulsivity associated with ADHD: “the very traits that make it difficult to fit into most regular vocations could provide a good fit with the high uncertainty environment and lack of established routines associated with entrepreneurship” (Wiklund et al., 2017: 628). Verheul et al. (2015) hypothesise that the symptoms of ADHD are related to entrepreneurship through risk-taking. Investigating entrepreneurial intentions in relation to ADHD symptoms in over 10,000 students, they observe that higher levels of ADHD symptoms led to greater entrepreneurial intentions among examined students (Verheul et al., 2015).

Subsequent studies on entrepreneurs have offered some stronger corroboration to the above. Lerner (2016) reports that nascent entrepreneurs with higher disinhibition, a core symptom of ADHD related to impulsivity and risk-taking (Nigg, 2001), exhibited higher creativity, greater ‘vision’ and better recognition of opportunities, despite their observed reduced ability to conduct repetitive administrative tasks. It has also been found that entrepreneurs exhibiting these symptoms have a higher tendency for entrepreneurial behavior and innovation (Wismans et al., 2020). Further studies have reported a clear connection between ADHD-symptoms and entrepreneurs with impulsivity being the underlying factor (Wiklund et al., 2016, 2017). These studies observed that ADHD-symptoms, particularly hyperactivity and impulsivity, were greater among respondents who have either started a business or exhibited stronger entrepreneurial preferences.

In order to examine the implications of ADHD-like symptoms on entrepreneurial intentions, we first investigate the impact of each ADHD component on selection into entrepreneurship. We go beyond existing research by examining underlying relationship at

different points in the lifetime of an individual. That is, we measure ADHD-like symptoms in childhood (age 10) against later entrepreneurial activity across and within a 12-year period (from age 30 to 42). Tracking ADHD-like symptoms in childhood is akin to the approach adopted by clinicians when diagnosing ADHD, which requires the symptoms to be present in childhood (Faraone et al., 2009; Nigg, 2001). In this way, we are able to identify occupational choice with respect to employment while highlighting the relationship between occupational choice and ADHD-like symptoms in childhood.

We therefore test two distinct assumptions, specifically hypothesising that individuals who exhibit higher inattention and hyperactivity/impulsivity symptoms in childhood will exhibit higher propensity for being self-employed.

**Hypothesis 1a:** Entrepreneurs exhibit higher inattention symptoms in childhood than those individuals in full-time employment

**Hypothesis 1b:** Entrepreneurs exhibit higher hyperactivity /impulsivity symptoms in childhood than those individuals in full-time employment

### **2.3. ADHD and Entrepreneurial Performance**

While attention has been placed on the implications of entrepreneurship on mental health issues, and the influence on entrepreneurial selection, the implications of mental health on entrepreneurial performance has so far not been studied (Freeman et al., 2019; Patel et al., 2019). With extant studies already denoting a causal, negative link between entrepreneurial stress and long-term survival (Rauch, Unger and Rosenbusch, 2007), and a positive association to entrepreneurial exit (Hessels et al., 2018), understanding the implications of specific mental health disorders such as ADHD on entrepreneurial firm survival and growth is important.

When examining the impact of ADHD on entrepreneurial performance, the two distinct symptoms associated with ADHD (hyperactivity/impulsivity and inattention) ought to be examined separately. Impulsivity is linked to individuals' inherent need to raise their arousal levels (Geissler, Romanos, Hegerl and Hensch, 2014; Sikström and Soderlund, 2007). This need for arousal can lead to higher levels of novelty seeking, uncertainty-tolerance and risk-taking behavior through a desire for immediate rewards (Faraone et al., 2009). After all, heightened sensation seeking has been associated with a heightened receptiveness to new experiences irrespective of the risks involved, lack of premeditation and deliberation of consequences before acting, as well as urgency (Wiklund et al., 2017).

Since the outcomes of the entrepreneurial process are largely uncertain, higher levels of impulsivity may in fact prove rather beneficial to entrepreneurial performance and success. While uncertainty can normally invoke negative emotions, driving individuals into doubt and procrastination (McMullen & Stepherd, 2006), such emotions tend to be ameliorated among impulsive individuals, who often mask - or even underplay - the negative implications associated with risk and uncertainty for the benefits of novelty and higher rewards (Baron, 2008). It is hence not surprising that impulsivity has been associated with important implications on the identification entrepreneurial opportunities (Davidsson, 2015) but also on their rapid assessment and action (LeDoux, 2003). Wiklund et al. (2018b) report that impulsive entrepreneurs are not just drawn to act on under uncertainty, but "impulsivity as a trait-like individual-level characteristic might well explain differences in decision making and behavior across managers under uncertainty" (2018b: 380) including opportunity recognition, opportunity evaluation, opportunity exploitation and overall performance. It can therefore be expected that entrepreneurs exhibiting higher levels of impulsivity to thrive under conditions of uncertainty and risk that others would not act upon.

However, whilst entrepreneurship may be a fitting environment for highly impulsive individuals, individuals with high inattention symptoms may find it difficult to sustain their interest in it for long periods of time (Wiklund et al., 2017). Such individuals may lack perseverance and will thus find it difficult to remain focused on the task of entrepreneurship for long, particularly when the task starts becoming repetitive and trivial (Wiklund et al., 2016). Given that it can take time to start and grow a business, and requires huge resources of resilience, resourcefulness and patience (Ayala and Manzano, 2014), since in most cases it takes years before the first signs of success, which can be especially daunting for individuals who seek thrill and suspense constantly. In addition, lack of perseverance does not allow individuals exhibiting high inattention symptoms to ascertain all the important information required to make the most informative decisions (Bechara and Van Der Linden, 2005), rendering them prone to mistakes and anxiety (Paulus, 2007). Challenges in starting and growing a business may lead to difficulties in business performance in entrepreneurs with high ADHD symptoms. Yet, this aspect of the relationship between ADHD and entrepreneurship has received no particular attention.

There are limited studies that have examined performance implications, and these offer no associations to firm growth or survival. For example, Lerner (2016) observed a negative association between ADHD symptoms and administrative ability, denoting that entrepreneurs with ADHD symptoms are less able to adapt to the changes associated with the growth of the firm (i.e., increase of ‘red-tape’) and are hence more susceptible to failure. Indeed, it has been proposed that ADHD can have an inverted ‘U’ effect on a country’s gross domestic product (GDP) and that in industrialised societies individuals exhibiting high levels of ADHD-like symptoms would be poorly suited to the general environment (Galor and Michalopoulos, 2012; Gören, 2017). Patel et al. (2019) show a negative relationship between the probability of having ADHD (derived through polygenic risk scores) and yearly earnings; yet, this study does not

differentiate between the ADHD symptoms domain and entrepreneurial performance. Given that scholars have found hyperactivity/impulsivity to be related to selection into entrepreneurship (Lerner et al., 2018a,b; Lerner et al., 2019; Wiklund et al., 2016; Wismans et al., 2020), it is also important to understand the independent effects of each symptom domain on business performance. Furthermore, Patel et al. (2019) study individuals between age 50 and 65, and as such overlook significant information from the individual's early life.

Based on the above, we hypothesise that ADHD symptoms will have a distinct effect on business survival and performance, differing across the two different dimensions of the symptoms. While impulsivity - the so called 'functional impulsivity' (Lawrence et al., 2008) - may be beneficial to entrepreneurial performance and success, inattention may actually counteract the positive effects of the former and lead to business failure instead.

**Hypothesis 2a:** Impulsivity symptoms positively influence business survival and growth amongst entrepreneurs.

**Hypothesis 2b:** Inattention symptoms negatively influence business performance amongst entrepreneurs.

### **3. Research Design**

#### **3.1. Data Sample**

For our analysis, we used the data from the British Cohort Survey (1970) (BCS), a repeat cross-sectional data set managed by the UK Data Service. The study tracks the lives of 17,196 individuals born within a single week in April 1970. The data provides information on the physical, educational and social development of the individuals included from the age of five and onwards, as well as economic, social and relationship data from the age of 26 (1996) onwards.

The BCS is an appropriate dataset to address our requirements as it contains survey instruments addressing ADHD-like symptoms in research participants. Data in the BCS is gathered through comprehensive surveys, including interviews, questionnaires and medical examinations. Interviews and questionnaires have been completed by participant's parents, teachers and the participants themselves. There have been nine survey rounds in total, with the earliest at birth and the latest in 2012-2013 (age 42). Overall, the BCS includes completed surveys for 11,237 individuals pertaining to ADHD-like symptoms, which constitutes the sample for the current research.

### **3.2. Model Variables**

*ADHD-Like symptoms.* To identify the ADHD-like symptoms of the research participants in our sample, we run a confirmatory factor analysis to approximate the ADHD-like symptoms, as rated by teachers at age 10. These variables originate in the Childhood Behavior Scale (CBS) from the 1980 sweep (age 10) and includes elements from the Conners' Hyperactivity Scale and Rutter Behavior Scale. These two scales were prominently used to measure hyperactive behavior in school children in the 1980s. Here, our approach has been to select variables from the CBS that closely align with the current APA definition of ADHD. A discussion of our confirmatory factor analysis can be found below<sup>5</sup>. Our approach is consistent with previous longitudinal studies analysing labour market outcomes of ADHD, which have approximated ADHD symptoms in a similar manner (Galérea et al., 2011; Salla et al., 2016).

Furthermore, and while prior studies on entrepreneurship have used self-reported responses to measure ADHD-like symptoms in adults (i.e. Verheul et al., 2015; Wismans et

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<sup>5</sup> There is an extensive discussion of the hyperactivity/ADHD debate in the technical manual of sweep '3723' (Age 10). At this age, researchers conducting the BCS survey aimed to understand the extent to which hyperkinesis/hyperactivity could be identified as a separate disorder. At this time, the American Psychological Association also moved to begin the classification of hyperactivity as attention deficit disorder. The BCS 3723 created a new Childhood Behavior Scale (CBS) using exploratory factor analysis, incorporating elements of the above scales.

al., 2020), we recognize that this approach suffers limitations that can hamper appreciation of the extent of the examined symptoms. As strongly supported by Rosenman et al. (2011), self-reported data in behavioral and healthcare research are particularly vulnerable to misrepresentation and response bias of the respondents. A misunderstanding of what a proper measurement or even the desirability of the respondent to ‘look good’ in a survey - even when this is anonymous - (2011: 320) can produce unreliable estimates which will only skew our perception of the phenomenon investigated, and any interventions or treatment effects (Sprangers and Hoogstraten, 1989). To this end, in the current study, we adopt the NHS recommendations which requires the diagnostic criteria for ADHD symptoms in childhood to be reported by individuals who knew the adult well as a child (i.e., teachers and or parents) (NHS UK, 2019). The approach of using teacher-rated behavior has been increasingly adopted in recent longitudinal birth cohort studies (Galérea et al., 2011; Salla et al., 2016), potentially as a counter measure against the response bias limitation (Rosenman et al., 2011).

Using data on ADHD-like symptoms presented in childhood can temporally disentangle the entrepreneurial process from the symptoms. Using this robust approach, we can ensure that the entrepreneurship process is not causing the presentation of ADHD symptoms in adults. Our longitudinal analysis offers a wealth of socioeconomic data (such as employment type; accurate employment history; business performance; detailed educational attainment) that is linked with the individuals’ ADHD symptoms in childhood. Such an approach would not otherwise be possible in a cross-sectional study.

In the confirmatory factor analysis, we examine two components, inattention symptoms (5 variables) and hyperactivity/impulsivity symptoms (4 variables)<sup>6</sup>. The model indicates strong fit, meeting the guidelines set by Hooper, Coughlan and Mullen (2008) and Kline (2011)<sup>7</sup>.

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<sup>6</sup> The items used for each construct can be found in the appendix.

<sup>7</sup> ( $\chi^2$  (26df) = 905.289,  $p < 0.01$ ; Standardized Root Mean Square Residual (SRMR) < 0.05; Root Mean Square Error of Approximation (RMSEA) < 0.06; Comparative Fit Index (CFI): 992; Tucker Lewis Index (TLI): 990.

**Entrepreneurship:** Entrepreneurship is defined in a similar manner to Nicolaou and Shane (2009); i.e., “has the research participant ever owned a business?”. From age 26 (1996), the BCS contains employment information. Further, detailed information regarding the type of self-employment (own business, contractor) is available from age 30 (2000) and onwards.

**Employment:** The BCS contains a wide range of data concerning the research participants’ employment and economic activity. These are available from age 26 (1999) up to age 42 (2012). Starting at the age of 30, there are 439 business owners, compared with 6999 full time employed individuals. This number rises to 853 business owners at the age of 42, where the number of full-time employed individuals drops to 5,245.

**Control Variables:** There are factors that can influence selection into entrepreneurship and may interact with other independent variables. Such factors include education (Dickson et al., 2008; Lerner, Verheul and Thurik, 2019)<sup>8</sup>, gender (Zhang and Arvey, 2009; Lerner et al., 2019), father’s entrepreneurship status (Lindquist et al., 2015), and social class (Audretsch, Bönte and Tamvada, 2013). In the model estimation, we control for education and father’s self-employment status in the regression models, whereas gender and social class are controlled for by sub-setting and analysing the data. Social class here is defined according to the available data in the BCS into six categories; (1) Professional; (2) Managerial-Technical; (3) Skilled Non-Manual; (4) Skilled Manual; (5) Partly Skilled; (6) Unskilled<sup>9</sup>.

Below we provide the descriptive statistics and correlation matrix for the first age point, Age 30.

---- Insert Tables 1a and 1b about here ----

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Whilst the model fails the chi-square test, this is not atypical for such a large sample size (Kline, 2011). Given the inspection of other reliability, discriminant validity and model fit indices, we conclude that the large sample size is at issue here.

<sup>8</sup> Education can represent a number of factors, such as intelligence and abstract thinking (Koellinger, 2008).

<sup>9</sup> Age is also implicitly controlled for, as all cohort members are born within one week in 1970.

### 3.3. Main Model Estimation

Our first set of hypotheses, H1a and H1b, states that entrepreneurs are likely to have greater ADHD-like symptoms, namely hyperactivity and inattention, than those in full-time employment at cross sectional data points. To test these hypotheses, we estimate equation 1 as follows:

$$\gamma = \alpha + \beta_1\lambda + \beta_2\omega + \Delta\beta_3 + \varepsilon^{\text{AgePoint}} \quad (\text{Equation 1})$$

where the dependent variable is a binary dummy variable (logit model) of whether or not research participants are business owners at the age point or in full-time employed ( $\gamma$ ), and the independent variables include the inattention or hyperactivity/impulsivity rating ( $\lambda$ ), the participants' fathers' self-employment status at age 16 ( $\Delta$ ), and the age the research participant left education as a dummy variable ( $<18=0$ ;  $\geq 18=1$ ) ( $\omega$ ). In the BCS database, employment data is available at five age points. To test these hypotheses, we estimate equation 1 across all five age points (models 1 to 4 in Table 1 of results).

As a test of robustness, we estimate equation 1 again, but using aggregated employment information across these five age points (models 1 to 4 in Table 2 of results). Sample selection in this model is contingent upon non-missing data across five variables; viz., ADHD-like symptoms from age 10, father's self-employment status at age 16, education information from age 30, social class information and employment data, reducing our study sample to a maximum of 1,632 respondents. The last variable requires that those in full time employment have completed information across the 12-year period. This is done to ensure that non-responses from those in full-time employment are definitely not small business owners; i.e., a non-response for this individual could mean that they became a small business owner but simply did not respond in any sweeps. This robust approach, in addition to sub-setting the data by gender, limits the total sample size to 773 in models 3 and 4 (Table 2 of results) that selects between social class one or two from age 34.

$$\gamma = \alpha + \beta_1\lambda + \beta_2\omega + \Delta\beta_3 + \varepsilon^{\text{Aggregated}} \quad (\text{Equation 2})$$

For hypothesis H2a, we investigate business ownership continuity and growth among the examined entrepreneurs. For the business continuity, we take those research participants, who owned a small business at the age of 30 and analyse their activity at the age of 34<sup>10</sup>. If the research participant is still a small business owner, a value of 1 is assigned, otherwise a value of 0. This forms the dependent variable ( $\pi$ ) in our logistic regression. Research participants who are in part-time self-employment are removed at this point from our analysis to capture those businesses that may have ceased to exist. The independent variables in the model (model 2 in Table 3 of results) include the binary inattention rating for inattention symptoms from age 10 (cut-off 90;  $< 90 = 0$ ;  $\geq 90 = 1$ ) ( $\lambda$ )<sup>11</sup>. Finally, we control for full-time education so those participants who left education earlier and hence close their business to return to education once again could be removed. A binary dummy for the age the research participant left education ( $< 18 = 0$ ;  $\geq 18 = 1$ ) ( $\omega$ ) is also included.

To analyse business growth, we run a logistic regression model where the dependent variable is those business owners who have increased or maintained business earnings (assigning them a value of 1) or have seen a loss in earnings (assigning them a value of 0) ( $\pi$ ). The independent variable includes the binary hyperactivity/impulsivity ratings for ADHD-like symptoms from age 10 (cut-off 125;  $< 125 = 0$ ;  $\geq 125 = 1$ ) ( $\lambda$ ) and the education variable ( $< 18 = 0$ ;  $\geq 18 = 1$ )( $\omega$ )<sup>12</sup>. We also control for gender effects by sub-setting, in which only male business owners are considered (the effect is not found in female business owners<sup>13</sup>).

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<sup>10</sup> This age comparison was chosen as it contained the richest set of data with regard to business ownership.

<sup>11</sup> This is approximately 10% below the observed median value for inattention rating for males at age 10.

<sup>12</sup> This binary cut-off point is approximately 2.5 times greater than the median hyperactivity / impulsivity rating at age 10 for males.

<sup>13</sup> The lack of significant findings among female business owners is very surprising. Scientists have long raised concerns over not only the persistence of these symptoms among female participants (Babinski et al., 2011; Hinshaw et al., 2006; Ramtekkar et al., 2010). One explanation is that females diagnosed with ADHD symptoms tend to be severely impaired by their symptoms experience sever anxiety disorders, antisocial disorders, developmental disorders, substance dependence, and eating disorders, as well as suicide attempts

For hypothesis H2b, we examine take home income at age 42 (model 4 of Table 3)<sup>14</sup>. In this performance test, we run a multi-linear regression model where the dependent variable is the reported take home income at age 42 of business owners ( $\pi$ ). The independent variable here includes the teacher rated inattention from age 10 on a continuous scale (range = 5 - 235) ( $\lambda$ ). As mentioned previously, we take education in the form of a dummy control variable ( $< 18 = 0; \geq 18 = 1$ )( $\omega$ ). Research participants with take home income above £80,000 are removed to avoid skewness presented by outliers (judged as three standard deviations above the median)<sup>15</sup>. Further, we control for gender effects by sub-setting, in which only male business owners are considered (the effect is not found in female business owners). Thus, hypothesis 2A and hypothesis 2B can be given succinctly in the following equation.

$$\pi = \alpha + \beta_1\lambda + \beta_2\omega + \varepsilon \quad \text{(Equation 3)}$$

### 3.4. Robustness Model Estimations

As a measure of robustness with regard to hypothesis 1a and 1b, we use two methods; first we use propensity score matching at age 30 and multinomial logistic regression at age 30. We create two comparison groups based on discrete choice in the labour market, thus business ownership vs. full-time employment. We develop the propensity score based on the following covariates: family income, father's education and CM's education. The first propensity score model has the age the CM left education included in the propensity score calculation, the second has the age of leaving education in the logistic regression itself. We use nearest

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and self-injury, impairments that could refrain them from running a business in the first place. Therefore, if this were the case, they would have been excluded in the initial stages of our screening process.

<sup>14</sup> Values above eighty-thousand pounds are removed, as they are three standard deviations above the mean.

<sup>15</sup> The above excluded cases (N=31) present mean/median *Teacher Hyperactivity Rating* of 39.1/25.0 (SD: 29.6), mean/median *Teacher Inattention Rating* of 65.3/57.0 (SD:52.7) with 11 of them (35.5%) having *Left Education Before Age 18* and another 12 (38.7%) having *Left Education at or After Age 18*. Compared to our standard sample in Table 1a, the above cases present clearly lower scores in both *Inattention* and *Hyperactivity*, while they *Left Education Before Age 18* at a much lower percentage. In addition, pairwise correlations in this outlier group resemble those of the standard sample, with a few interesting observations:  $\rho_{(\text{Hyperactivity, Inattention})}$  is 0.54 (versus 0.64 for the entire sample), while the group consists of only males, business owners. For brevity, we do not tabulate full statistics and correlations matrix in the outlier sample. Results including the outliers and for log earnings of the full sample can be found in Table A4 in the Appendix for Robustness.

neighbour matching to a ratio of 1:14 business owners to full-time employees, which is approximately the same as in the BCS dataset at age 30. The matched sample is reduced to 1,125. Thus, using logistic regression, the employment status ( $\gamma$ ) is predicted by gender ( $\pi$ ), inattention symptoms ( $\lambda$ ); the model further includes the age of leaving education (<18 = 0; >=18 = 1) ( $\omega$ )

$$\gamma = \alpha + \beta_1\pi + \beta_2\lambda + \beta_3\omega + \varepsilon \quad (\text{Equation 4a})$$

As a second test of robustness and to allow the cohort member to choose between different labour market outcomes beyond full time employment, we conduct multinomial logistic regression with three levels; full-time employment; business ownership; and unemployment ( $\gamma$ ). The full-time employment is taken as the reference group, given its higher frequency. Independent variables in model include the inattention rating ( $\lambda$ ) and age the CM left education ( $\omega$ )<sup>16</sup>.

$$\gamma = \alpha + \beta_1\lambda + \beta_2\omega + \varepsilon \quad (\text{Equation 4b})$$

## 4. Results

The results for the first two hypothesis can be seen in Table 2 (Table 2a and b) and Table 3 (Table 3a and b) respectively. The evidence offers mild support to hypothesis H1a. While we have hypothesised that entrepreneurs will exhibit higher inattention symptoms than those in full-time employment, we find this to stand true only at one of the cross-sectional levels, the age 30; in which a 50 percent increase in inattention symptoms increases the probability of business ownership by approximately 3 percent. Interestingly, across the aggregated results (Table 2b), inattention is significant across all models, at a confidence interval of 95% in model 1 and 90% in models 2, 3, and 4<sup>17</sup>. The results are controlled for gender and social class. As a

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<sup>16</sup> All robustness tests are included in the Appendix, Tables A1, A2 and A3

<sup>17</sup> Models 6 and 8 are further robustness tests for the ‘hyperactivity/impulsivity’ symptoms. However, only model 8 mildly supports H1b at the 90 percent confidence interval.

test of robustness, model 1 of Table 2b does not constrain itself to any social class and the results remain significant. Furthermore, the two robustness tests conducted are in support of this relationship. Propensity score matching and the multinomial logistic regression both suggest that unemployment and business ownership are predicted by inattention symptoms in childhood, in addition to the age of leaving education (Tables A2 and A3 in Appendix)<sup>18</sup>

---- Insert Tables 2a and 2b about here ----

We find no support for our second hypothesis, H1b. Our results in Tables 3a and 3b show that at none of the cross-sectional age points nor the aggregated employment history is hyperactivity/impulsivity significant in predicting entrepreneurship status.

---- Insert Table 3a and 3b about here ----

A further finding from the analysis at this point is that the number of research participants who own their own business increases with age. This is not particularly surprising, given the purported relationship between age and entrepreneurship (Azoulay, Wahlen and Sivan, 2018; Lerner et al., 2019). Furthermore, we observe that leaving education at or after the age of 18 has an overwhelmingly negative effect on the possibility of business ownership across a 12-year period. This is an interesting finding in itself, given the inconsistencies in the literature concerning the relationship between education and selection into entrepreneurship (Dickson et al., 2008).

The results for the next set of hypotheses (H2a, H2b) are found in Table 4. Hypothesis H2a is partially supported by the results, whereas Hypothesis 2b is fully supported. More specifically, and while we have hypothesised a contrasting impact of each symptom on performance, with impulsivity affecting it positively and inattention negatively, our results suggest that both symptoms have a strong negative effect on survival and performance. As

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<sup>18</sup> Our results are robust for males; while gender was controlled for, it proved to be insignificant.

shown in Table 3, our results show that high levels of inattention can lead to poorer business survival (model 1), and high levels of hyperactivity/impulsivity can affect negatively earnings' growth (model 2). Furthermore, we also observe that inattention symptoms in childhood have a marked negative effect on take-home income of business owners at age 42. For instance, in the model, at the median level of inattention rating and with a degree, the take home income is predicted as £29,203. Increasing inattention by 50 percent leads to a predicted £2,100 reduction in income. All in all, it is clear that ADHD symptoms are responsible for poor performance and earning capacity. Finally, we need to further note that the above results are particularly robust and strong for the males in our sample whereas such associations among female seem to be rather very weak or even non-significant.

---- Insert Table 4 about here -----

## **5. Discussion**

Prior research has raised concerns regarding the implications of mental health and psychiatric conditions, such as ADHD, on entrepreneurial selection (Wiklund et al., 2016; 2017) and performance (Lerner, 2016). Yet, to date, our understanding of this relationship remains rather scarce. With more than a quarter of entrepreneurs exhibiting higher levels of attention deficit hyperactivity disorder (ADHD) (29%), such a discussion has been long overdue (Freeman et al., 2019). Our study offers fresh insights and empirical validations in addressing this important question while examining how the specific traits associated with ADHD, thus inattention and hyperactivity/impulsivity, are influencing the decision to entrepreneurial selection and performance respectively.

Recognizing that people are attracted to vocations congruent with their personalities as suggested by the P-E theory (Holland, 1997; Dawis and Lofquist, 1984), an inclination of ADHD individuals towards entrepreneurship has already been acknowledged (Wiklund et a.,

2017; Lerner et al., 2019). Yet we still know very little on what drives these individuals to entrepreneurship. We therefore examine the impact of each ADHD component on selection into entrepreneurship. We confirm that indeed individuals diagnosed with ADHD symptoms in childhood are drawn towards entrepreneurship. Yet while prior literature has assumed that this inclination would be due to their inherent impulsive nature (Wiklund et al., 2018b)<sup>19</sup>, we in fact reveal that it is rather the trait of inattention that drives ADHD individuals towards entrepreneurship, particularly when examining male business owners.

The above finding is particularly interesting, as it seems that it may not necessarily be the thrill and excitement that drives ADHD individuals into entrepreneurship, but rather their inability to sustain interest on a particular task for long periods of time (Wiklund et al., 2017). The latter along with a natural absence of perseverance and patience for anything repetitive or mundane (Wiklund et al., 2016) may in fact be the driving force behind their decision to get out of employment and into entrepreneurship, in an attempt to instigate higher control and flexibility over their employed life, and a better fit to their personal needs and conditions, as per the P-E theory.

Furthermore, it can be argued that inattention is linked to novelty-seeking behaviors associated with entrepreneurship (Gören, 2017; Nicolaou et al., 2011). The possibility of high reward may necessitate the need to take risk for those with greater inattention symptoms, as per the arousal theory of ADHD (Sikström and Soderlund, 2007). Thus, it may not be the case that hyperactivity/impulsivity is not important, but that inattention is simply more pervasive. However, with past research relying predominately on Adult ADHD Self-Report Scale Screener (i.e. Verheul et al., 2015; Wismans et al., 2020) it is possible that previous studies may have overestimated or inaccurately captured the hyperactivity/impulsivity component. We

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<sup>19</sup> Our results showed no relationship between hyperactivity/impulsivity and entrepreneurship at any cross-sectional age points employed.

thus add to the burgeoning discussion and challenge past research on the better capturing each symptom and its implications.

Overall, our findings advance both our understanding of how certain mental disorders, like ADHD, influence the decision into entrepreneurial selection, but most importantly raises awareness to the diverse and discreet characteristics associated with ADHD and how these impact on the decision outcome. This is particularly important for the P-E literature. While self-employment has been recognised as fitting to non-typical individuals, such as those with ADHD symptoms, different symptoms can make it difficult to fit in any environment (Wiklund et al., 2017). Therefore, understanding the distinct drivers behind such a decision is instrumental to instigate entrepreneurial success.

Having established the link between childhood ADHD symptoms and entrepreneurial selection as adults, we proceed in the current study in disseminating the implications of each symptom on entrepreneurial performance, a topic that has rather been ignored in the past literature. With only limited studies offering insights on the expectations (Lerner, 2016), we concentrate on the implications of each symptom on decision making and performance. Our results reveal that both symptoms have a strong negative effect on survival and performance, with particularly high levels of inattention being predictive to business failure whereas high levels of impulsivity affect negative earnings' growth. It is apparent, that while entrepreneurs with higher childhood ADHD-like symptoms may select into entrepreneurship, as it provides the best environment to address their inattentive nature, over time these same symptoms can hamper their firm's performance. Lack of resilience, resourcefulness and patience required to grow a business (Ayala and Manzano, 2014; Wiklund et al., 2016), as well as an inherent inability to adapt to the changes associated with the growth of the firm (Lerner, 2016), may be the culprits for long term under-performance. We further need to comment here that the lack of strong findings among our female sample strengthens past convictions denoting that females

diagnosed with ADHD symptoms tend to be more severely impaired by their symptoms (Babinski et al., 2011; Hinshaw et al., 2006; Ramtekkar et al., 2010), impairing as a result their overall ability to function successfully as business owners too.

The above findings offer the P-E literature new ground for research and theory building on how certain psychiatric disorders can influence entrepreneurial selection for both men and women. Whereas the P-E fit has been conceptualized and examined across different attitudes and behaviors (Kristof-Brown et al., 2005), little attention has been given on how psychiatric conditions may in fact “modulate the influence of personality traits on entrepreneurial results” as Freeman et al. succinctly noted (2019: 324). Our empirical study offers first empirical insights for these assertions.

An unexpected finding from our study is the fact that leaving education at or after the age of 18 has an overwhelmingly negative effect on the possibility of business ownership with 1-24 employees across the 12-year period of 30-42. This is a significant finding given that entrepreneurs are commonly understood to have higher levels of education, and that individuals with ADHD have lower educational attainment levels. It has long been argued that more educated individuals are likely to be exposed to business opportunities, and that educational attainment aids entrepreneurial performance (Parker, 2004). Yet our finding corroborates other studies which have shown ambiguity with regards to education and selection into entrepreneurship (Dickson et al., 2008; van Der Sluis et al., 2008). This finding has implications for investigating ADHD-like symptoms, acknowledging that educational attainment of children with ADHD is poor, with higher rates of suspension and expulsion (Fletcher, 2013; Kent et al., 2010). Furthermore, individuals with ADHD are less likely to pursue further education and instead choose full-time employment (Kuriyan et al., 2012). Given that our analysis finds that leaving education at or after 18 is negatively associated with

entrepreneurial activity, it may be that those individuals leaving education earlier due to ADHD-like symptoms have a greater propensity towards entrepreneurship.

## **6. Limitations and future directions**

We acknowledge that there are limitations to the current study. One limitation concerns the measurement of the ADHD variable being an approximation for the ADHD symptoms, identified from the Conners' Hyperactivity Scale and the Rutter Behavior Scale in the BCS dataset, and not from a diagnostic checklist, such as the DSM-IV (APA, 2000). Nevertheless, since the scale has been validated by the factor analysis preceding our estimations, we are confident of the validity of their interpretation. Furthermore, an approach that approximates ADHD-like symptoms may be useful over studying diagnosed ADHD cases, as it avoids diagnosis bias and thus allows one to see the effects of high ADHD-like symptoms in those who do not receive diagnosis (Russell, Ford, Rosenberg and Kelly, 2014).

A further limitation is the fact that ADHD-like symptoms were not tracked over time, but rather were captured at age 10 and the implications of this examined for later life outcomes. However, this approach has its own benefits, in that it temporally separates the outcome variable (employment status) and the independent variable of interest (ADHD symptoms), allowing us to be more confident the outcome variable is not influencing the independent variable of interest. Also, the relatively small sample size is another restriction of this study attributed to missing data for all the years examined. While this reduction was purposeful because it allowed us to examine the longitudinal implications of ADHD-like symptoms and provide a more crystallised view of the phenomenon, we recognize that a larger sample could offer further support and validation to our findings.

An interesting finding from our study is the lack of any significant results among female business owners despite the empirical literature arguing clearly over ADHD persistence among

females too (Babinski et al., 2011; Hinshaw et al., 2006; Ramtekkar et al., 2010). As we explained earlier, this finding may be caused by the fact that girls diagnosed with ADHD symptoms tend to be severely impaired in their adult lives limiting them from running a business in the first place and hence being excluded during our screening process. Nevertheless, recognizing the importance of this limitation in the empirical literature, we suggest that more research is required on ADHD among young women, particularly on policies and the support society can offer to better incorporate ADHD diagnosed women into employment.

Another unexpected finding from our study was the overwhelming negative implications of lower levels of education. Future research could explore lower levels of education for those individuals with ADHD-like symptoms and the long-term implications of this behavior for entrepreneurship and/or certain maladaptive activities. After all, a link between ADHD and certain rule-breaking behaviors (i.e. criminal records and criminal activities, substance use) has been reported in the past (Zhang and Arvey, 2009). Examining therefore more closely constructs of rule-breaking behaviors, could shed further light on the role of such behavior on entrepreneurial performance and survival among ADHD entrepreneurs. Furthermore, and while in the current study research participants with take-home income of above £80,000 were removed to avoid skewness presented by outliers, future studies could place a particular focus on these outliers with intention to examine whether these individuals show lower inattention symptoms in early childhood to begin with or whether there were other factors (i.e. education) that allowed them to overcome their inclinations and excel above them, as indicated among the excluded ‘Outliers’ in our study<sup>20</sup>.

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<sup>20</sup> As mentioned earlier, our robustness analysis included outliers and also log transformed earnings (see table A4 in the Appendix). These did not change our results.

Lastly, future research could also seek to develop further biological explanations for selection into entrepreneurship and the impacts of biology on the long-term trajectories of entrepreneurial activity by looking at young children diagnosed with ADHD and track their economic outcomes at different intervals in their lives as recently alluded in Peltonen et al. (2020). Whilst this group may represent the most severe of ADHD cases, it would be of scholarly and societal importance to decipher the differentiating factors (demographics, societal parameters etc.) that drive these individuals into entrepreneurship so we can offer in the future better support to their entrepreneurial endeavours.

## **7. Conclusions and policy implications**

Our study adds to the growing body of evidence on the implications of ADHD traits on selection into entrepreneurship. More importantly, however, our results confirm a negative relationship between ADHD symptoms in childhood and entrepreneurial survival and growth. Recognising that the two symptoms associated with ADHD (hyperactivity/impulsivity and inattention) are distinct, we examine each trait separately so we can offer a deeper appreciation of their discreet effects on the underlying relationships. We unveil indeed a stronger effect of inattention symptoms when it comes to entrepreneurial selection, which has rather been overlooked in prior research. Furthermore, we further provide empirical validation that while ADHD may be conducive to entrepreneurial selection, it is detrimental to the success of the endeavour. In fact, we find that both symptoms have a strong negative effect on survival and performance, with high levels of inattention driving business failure, and high levels of impulsivity leading to overall negative earnings' growth. A final interesting and unexpected finding from our study is that education is pivotal in the relationship between entrepreneurship and ADHD, potentially ameliorating even the direction of the relationship. Overall, we contest that while there has been an increase in the number of papers examining mental health and

particularly psychiatric disorder issues and entrepreneurship, there is significant scope for expanding knowledge of this important field.

Our study offers ground for some policy recommendations, particularly with regard to the role educational attainment may have on ‘lifting’ individuals who exhibit higher ADHD-like symptoms in childhood. Career advisors within schools may include measures of mental health issues in their assessment of individuals to better inform employment guidance (Leung et al., 2020). Doing so would better enable policy makers to understand the particular needs and requirements of these individuals and the challenges they may face in future entrepreneurial activities. Policy makers tend to assume that entrepreneurship is an inherent good (Wiklund et al., 2019). However, our study highlights how mental health issues can act as a constraining factor on entrepreneurial performance. As mental health issues have risen up government agendas across many facets of policy, there is clearly a need for better understanding of the constraints on entrepreneurship. Previous studies have found that necessity entrepreneurship improves mental health, and that unemployment can have numerous mental health consequences (Nikolova, 2019). Our study calls for greater understanding of how policy should consider mental health issues as an element of entrepreneurship, addressing and supporting psychological improvements as a way of improving entrepreneurial performance. Furthermore, our study suggests that more training on business growth and survival could be provided to entrepreneurs with ADHD and/or ADHD-like symptoms, helping them to manage risks and uncertainty associated with their entrepreneurial activities once they have been established.

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## Tables & Figures

**Table 1a: Descriptive Statistics at Age 30**

|  | Full Time<br>Employee<br>(n=6999) | Business Owner<br>(n=439) | Overall<br>(n=11237) |
|--|-----------------------------------|---------------------------|----------------------|
| <b>Gender</b>                          |                                   |                           |                      |
| Male                                   | 4221 (60.3%)                      | 320 (72.9%)               | 5456 (48.6%)         |
| Female                                 | 2778 (39.7%)                      | 119 (27.1%)               | 5781 (51.4%)         |
| <b>Education</b>                       |                                   |                           |                      |
| Left Before Age 18                     | 4225 (60.4%)                      | 302 (68.8%)               | 7293 (64.9%)         |
| Left at or After Age 18                | 2591 (37.0%)                      | 124 (28.2%)               | 3613 (32.2%)         |
| Missing                                | 183 (2.6%)                        | 13 (3.0%)                 | 331 (2.9%)           |
| <b>Teacher Hyperactivity Rating</b>    |                                   |                           |                      |
| Mean (SD)                              | 50.4 (40.8)                       | 51.5 (41.0)               | 50.8 (41.1)          |
| Median [Min, Max]                      | 38.0 [4.00, 185]                  | 39.0 [4.00, 184]          | 39.0 [4.00, 188]     |
| Missing                                | 1980 (28.3%)                      | 128 (29.2%)               | 3285 (29.2%)         |
| <b>Teacher Inattention Rating</b>      |                                   |                           |                      |
| Mean (SD)                              | 83.0 (53.1)                       | 94.5 (51.9)               | 85.5 (53.61)         |
| Median [Min, Max]                      | 74.0 [5.00, 231]                  | 89.0 [6.00, 229]          | 77.0 [5.00, 233]     |
| Missing                                | 1980 (28.3%)                      | 128 (29.2%)               | 3285 (29.2%)         |
| <b>Father's Self Employment Status</b> |                                   |                           |                      |
| Not Self Employed                      | 2490 (35.6%)                      | 105 (23.9%)               | 3674 (32.7%)         |
| Self Employed                          | 642 (9.2%)                        | 64 (14.6%)                | 1018 (9.1%)          |
| Missing                                | 3867 (55.3%)                      | 270 (61.5%)               | 6545 (58.2%)         |

**Table 1b: Correlation Matrix at Age 30**

|  | 1.        | 2.        | 3.        | 4.       | 5.     | 6.    |
|--|-----------|-----------|-----------|----------|--------|-------|
| 1. Employment Status<br>( <i>Business Owner = 1</i> )          | 1.000     | .         | .         | .        | .      | .     |
| 2. Gender<br>( <i>Female = 1</i> )                             | -0.056*** | 1.000     | .         | .        | .      | .     |
| 3. Education<br>( <i>Left at or After Age 18 = 1</i> )         | -0.044**  | 0.099***  | 1.000     | .        | .      | .     |
| 4. Teacher Hyperactivity Rating                                | 0.038*    | -0.199*** | -0.186*** | 1.000    | .      | .     |
| 5. Teacher Inattention Rating                                  | 0.079***  | -0.238*** | -0.284*** | 0.641*** | 1.000  | .     |
| 6. Father's Employment Status<br>( <i>Business Owner = 1</i> ) | 0.097***  | 0.006     | 0.036*    | -0.004   | 0.036* | 1.000 |

Note:

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table 2a – Hypothesis 1a**

|                                  | <i>Dependent variable: Business owner (1) or Full Time Employee (0)</i> |                       |                       |                       |
|----------------------------------|---|-----------------------|-----------------------|-----------------------|
|                                  | Age 30<br>(1)   | Age 34<br>(2)         | Age 38<br>(3)         | Age 42<br>(4)         |
| Constant                         | - 3.613***<br>(0.475)   | - 3.102***<br>(0.455) | - 2.658***<br>(0.350) | - 2.642***<br>(0.634) |
| Inattention Rating               | 0.007**<br>(0.004)  | 0.006<br>(0.004)      | 0.002<br>(0.003)      | 0.002<br>(0.004)      |
| Father Self Employed             | 0.860**<br>(0.362)  | 2.517***<br>(0.577)   | 1.181***<br>(0.301)   | 1.382***<br>(0.480)   |
| Education                        | - 0.185<br>(0.373)  | - 0.532*<br>(0.317)   | - 0.258<br>(0.299)    | 0.399<br>(0.515)      |
| Inattention*Father Self Employed |   | - 0.012**<br>(0.006)  |                       |                       |
| Observations                     | 644   | 607                   | 625                   | 160                   |
| Pseudo R <sup>2</sup>            | 0.05  | 0.11                  | 0.06                  | 0.10                  |

Note:

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table 2b – Hypothesis 1a**

|                                  | <i>Dependent variable: Business owner (1) or Full Time Employee (0)</i> |                           |                                |                                |
|----------------------------------|---|---------------------------|--------------------------------|--------------------------------|
|                                  | No Social<br>Class<br>(1)   | No Social<br>Class<br>(2) | SC1 or 2<br>From Age 34<br>(3) | SC1 or 2<br>From Age 34<br>(4) |
| Constant                         | - 1.958***<br>(0.166)   | - 2.581***<br>(0.287)     | - 3.086***<br>(0.466)          | - 3.500***<br>(0.561)          |
| Inattention Rating               | 0.003**<br>(0.001)  | 0.004*<br>(0.002)         | 0.006*<br>(0.004)              | 0.011**<br>(0.005)             |
| Father Self Employed             |   | 0.850***<br>(0.266)       | 1.196***<br>(0.397)            | 2.269***<br>(0.765)            |
| Education                        | - 0.394**<br>(0.162)  | - 0.362<br>(0.261)        | - 0.384<br>(0.386)             | -0.351<br>(0.389)              |
| Inattention*Father Self Employed |   |                           |                                | -0.012<br>(0.008)              |
| Observations                     | 1,632   | 779                       | 422                            | 422                            |
| Pseudo R <sup>2</sup>            | 0.017   | 0.044                     | 0.077                          | 0.091                          |

Note:

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table 3a – Hypothesis 1b**

|                       | <i>Dependent variable: Business owner (1) or Full Time Employee (0)</i> |                       |                       |                       |
|-----------------------|---|-----------------------|-----------------------|-----------------------|
|                       | Age 30<br>(1)   | Age 34<br>(2)         | Age 38<br>(3)         | Age 42<br>(4)         |
| Constant              | - 3.078***<br>(0.390)   | - 2.613***<br>(0.322) | - 2.783***<br>(0.321) | - 2.520***<br>(0.538) |
| Hyperactivity Rating  | 0.003<br>(0.004)  | 0.0005<br>(0.004)     | 0.004<br>(0.003)      | 0.001<br>(0.006)      |
| Education             | - 0.382<br>(0.357)  | - 0.554*<br>(0.308)   | - 0.238<br>(0.295)    | 0.288<br>(0.492)      |
| Father Self Employed  | - 0.920**<br>(0.361)  | 1.548***<br>(0.307)   | 1.214***<br>(0.300)   | 1.392***<br>(0.479)   |
| Observations          | 644   | 607                   | 625                   | 160                   |
| Pseudo R <sup>2</sup> | 0.035   | 0.098                 | 0.061                 | 0.098                 |

*Note:* \* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table 3b – Hypothesis 1b**

|                                    | <i>Dependent variable: Business owner (1) or Full Time Employee (0)</i> |                           |                                |                                |
|------------------------------------|---|---------------------------|--------------------------------|--------------------------------|
|                                    | No Social<br>Class<br>(1)   | No Social<br>Class<br>(2) | SC1 or 2<br>From Age 34<br>(3) | SC1 or 2<br>From Age 34<br>(4) |
| Constant                           | - 1.628***<br>(0.128)   | - 2.436***<br>(0.241)     | - 2.895***<br>(0.403)          | - 2.926***<br>(0.437)          |
| Hyperactivity Rating               | -0.000<br>(0.002)   | 0.004<br>(0.003)          | 0.006<br>(0.004)               | 0.007<br>(0.005)               |
| Education                          | - 0.490***<br>(0.158)   | - 0.427*<br>(0.254)       | - 0.454<br>(0.379)             | -0.455<br>(0.379)              |
| Father Self Employed               |   | 0.891***<br>(0.265)       | 1.262***<br>(0.396)            | 1.357**<br>(0.640)             |
| Hyperactivity*Father Self Employed |   |                           |                                | -0.002<br>(0.009)              |
| Observations                       | 1,632   | 779                       | 422                            | 422                            |
| Pseudo R <sup>2</sup>              | 0.011   | 0.041                     | 0.073                          | 0.073                          |

*Note:* \* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table 4 – Hypothesis 2a & 2b**

|  | Business Continuity<br><i>Logistic</i><br>(1) | Earnings Growth<br><i>Logistic</i><br>(2) | Take Home Income at 42<br><i>OLS</i><br>(4) |
|--|---|---|---|
| Constant                               | 1.120***<br>(0.291)                           | 0.972***<br>(0.314)                       | 27,078.040***<br>(2132.38)                  |
| Binary Inattention Rating              | -0.719**<br>(0.332)<br>OR: 0.487              |   |   |
| Education                              | 0.540<br>(0.352)<br>OR: 0.583                 | -0.4970<br>(0.6007)<br>OR: 0.608          | 6,585.523***<br>(2447.15)                   |
| Binary Hyperactivity Rating            |   | -1.329**<br>(0.584)<br>OR: 0.122          |   |
| Inattention Rating                     |   |   | -48.744***<br>(17.48)                       |
| Observations                           | 174   | 68  | 325   |
| Pseudo R <sup>2</sup> / R <sup>2</sup> | 0.049   | 0.137                                     | 0.058                                       |
| F Statistic                            |   |   | 9.915*** (df = 2; 322)                      |

*Note:*

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

## Appendix:

**Table A1: Description of ADHD Symptoms**

| <b>Inattentive Type</b>                                   | <b>Hyperactive/Impulsive Type</b>                   |
|---|---|
| Cannot concentrate on particular task<br>Range 1-47       | Excitable/Impulsive<br>Range 1-47                   |
| Easily Distracted<br>Range 1-47                           | Shows restless or overactive behavior<br>Range 1-47 |
| Pays attention in class [negatively scored]<br>Range 1-47 | Squirmy and Fidgety<br>Range 1-47                   |
| Fails to finish tasks<br>Range 1-47                       | Interferes with others<br>Range 1-47                |
| Shows perseverance [negatively scored]<br>Range 1-47      |   |

**Table A2: Robustness Test for H2a - Propensity Score Matching**

|                       | <i>Dependent variable:</i>         |                       |
|-----------------------|------------------------------------|-----------------------|
|                       | Own Business or Full Time Employed |                       |
|                       | (1)                                | (2)                   |
| Constant              | -3.229 ***<br>(0.299)              | -3.201 ***<br>(0.264) |
| Education Binary      | -0.291<br>(0.263)                  |                       |
| Gender                | 0.221<br>(0.260)                   | 0.143<br>(0.258)      |
| Inattention Rating    | 0.007 ***<br>(0.002)               | 0.006 **<br>(0.002)   |
| Observations          | 1,125                              | 1,125                 |
| Pseudo R <sup>2</sup> | 0.034                              | 0.016                 |

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

**Table A3: Robustness Test for H2a - Multinomial Logistic Regression**

| <i>Dependent variable:</i>                         |                        |
|--|------------------------|
| Multinomial with Full-Time Employment as Reference |                        |
| 1:(Constant - Own Business)                        | - 2.503 ***<br>(0.644) |
| 2:(Constant - Unemployed)                          | -1.659 *<br>(0.923)    |
| 1: Teacher Inattention Rating                      | 0.003 **<br>(0.001)    |
| 2: Teacher Inattention Rating                      | 0.007 ***<br>(0.002)   |
| 1: Age of Leaving Education                        | -0.022<br>(0.034)      |
| 2: Age of Leaving Education                        | -0.117 **<br>(0.051)   |
| Observations                                       | 3,342                  |
| Pseudo R <sup>2</sup>                              | 0.014                  |

\* p&lt;0.1; \*\* p&lt;0.05; \*\*\* p&lt;0.01

**Table A4: Robustness Test for H2b - Take Home Income at 42**

| <i>Dependent variable: Take Home Income of Business Owners at 42</i> |                               |                         |                                     |
|--|-------------------------------|-------------------------|-------------------------------------|
|  | No Outliers<br>Removed        | Log Transformed<br>(2)  | Log Transformed with<br>Interaction |
| Constant   | 41,296.820 ***<br>(5,487.356) | 10.284 ***<br>(0.147)   | 10.155 ***<br>(0.161)               |
| Inattention Rating   | -129.013 ***<br>(46.442)      | -0.005 ***<br>(0.001)   | -0.003**<br>(0.001)                 |
| Education  | 12,593.160 **<br>(5,358.276)  | 0.247 *<br>(0.144)      | 0.698 **<br>(0.275)                 |
| Education * Inattention  |                               |                         | -0.006 *<br>(0.003)                 |
| Observations   | 347                           | 333                     | 333                                 |
| R <sup>2</sup>   | 0.048                         | 0.060                   | 0.071                               |
| F Statistic  | 8.722 *** (df = 2; 344)       | 10.578 *** (df = 2;330) | 8.343 *** (df = 3;329)              |

\* p&lt;0.1; \*\* p&lt;0.05; \*\*\* p&lt;0.01