

The Impact of Adolescent Anxiety on Future Economic Outcomes

Oliver Sprange

BSc Economics

School of Economics

University of Kent, July 2023

Abstract

Investigating the impact of adolescent anxiety on future income, this paper uses longitudinal data from the 1970 British Cohort Study (BCS70) to test whether the presence of anxiety at 10 years old has any significant impact on future income, measured at 42 years old. Various models were created to understand how income is affected by the presence of anxiety in adolescence, whilst also investigating how it interacts with other variables such as ability and education. OLS and Logit methods were used for the statistical estimation of the relationship between variables. Contradictory to the existing literature, this paper finds that those with higher anxiety scores at 10 years old earn £70.72 per week more than those with lower anxiety scores. A possible explanation for the positive relationship may be that, due to the young age that the anxiety variable was taken from, certain individuals may have learned coping mechanisms that reduced the symptoms they experienced before the effects became more substantial and irreversible. Additionally, it is also possible that some individuals within the received effective treatment in order to reduce the impacts on their education and subsequent income. However, the relationship between mental health and future economic outcomes is complex and more work will be needed in the future to understand the relationship between the variables more clearly.

Acknowledgements

Many thanks to my supervisor Amanda Gosling, as well as the module convenor Alastair Bailey for the support with this research paper. I would also like to say a huge thanks to Moatazbellah Farid for the consistent support with various aspects of the process. Finally, I would like to give the biggest thanks to Mum, Dad, Alex and Ali, as well as the rest of my family and friends, for the support throughout university.

1. Introduction

1.1. Background

The awareness of the potential impacts mental health conditions and the implications of suffering from disorders such as anxiety, depression and ADHD is increasing. Mental health problems that affect an individual's ability to concentrate or work effectively may impact their job security and employment prospects, as well as their opportunities for career progression and, consequently, greater income. Losses in income, reduced educational attainment and difficulties with employment can be hugely damaging on an individual level and are also likely to be detrimental on an economy-wide level. If this is the case, the increase in the prevalence of mental health disorders could even be one aspect that could help to explain the current productivity gap in the UK. As a result, understanding the relationship between mental health conditions and future economic outcomes is important in order to effectively limit any negative future impacts on individuals or the wider economy.

Much of the previous research regarding health and economic outcomes has focused on physical health, but with global rates of mental health disorders rising, more attention has been placed on investigating the effects of mental health problems. According to the National Institute of Mental Health (NIMH), the percentage of adolescents aged 13 to 18 who suffer from any mental health disorder increased from 16.2% to 22.2% between 2001 and 2019 in the US. Specific conditions have seen even more substantial increases, with anxiety rates of those aged 13 to 18 increasing from 31.9% in 2019 to 38.0% in 2021 (NIMH). With the rising trend likely to continue in the modern day, there is a growing concern regarding the long-term implications of mental health conditions. The statistics are similar in the UK, with one in eight (12.8%) of 5 to 19-year-olds in England being diagnosed with at least one mental disorder (Mental Health Foundation, 2019) in 2017.

Many of the existing research papers have found negative effects of specific conditions such as ADHD on educational outcomes, labour market outcomes and other social outcomes. De Araujo Roland (2018) found that those with ADHD were 2.5% less likely to be employed. Due to the wide range of life outcomes that may be affected by mental health conditions, it is expected that the relationship between anxiety and future income is complex and multifaceted. The presence of a mental health disorder is likely to affect income directly, as well as indirectly by affecting an individual's educational attainment, employment opportunities and general health. This means that the substantial reported increases in mental illness rates are likely to impact many aspects of society. However, it is worth noting that the increased awareness around mental health and changes to the diagnostic criteria of mental health issues may have slightly contributed to the reported increase in prevalence rates. Nevertheless, the overall trend clearly shows that mental health disorders are becoming increasingly common and are a growing concern for public health.

This paper aims to contribute towards the study of adolescent mental health impacts on future economic outcomes. It will do this by investigating the relationship between anxiety in childhood and future income. The focus will be on anxiety, as much of the existing literature surrounding mental health and outcomes doesn't focus on anxiety disorders but instead focuses on more easily diagnosable conditions such as ADHD and autism. Additionally, many of the existing studies group mental health conditions together as a conglomerate which means that the impact of individual conditions cannot be assessed. As a result, it will be interesting to decompose the relationships and focus solely on the impacts of anxiety in adolescence. An additional aim of the paper includes investigating the impacts of anxiety on certain variables in adolescence (e.g., educational attainment), attempting to understand whether its presence has significant impacts on other variables such as ability and education. However, as this is not the main aim of the study, it is unlikely that these relationships will be clearly illustrated and therefore need to be looked at in more depth in future research.

The paper will begin by analysing the existing literature to get a general idea of how anxiety is likely to impact future income. This will involve looking at research on a wide range of topics such as the link between anxiety and education, as well as the various factors that could influence whether a child suffers from anxiety. Next, a suitable dataset will need to be selected as the source of the data that will be used. This is going to be a cohort study that follows individuals through a large span of their lives, in order to investigate the long-term impacts of the condition. The next step is to organise the data into a dataset that can be used in statistical analysis, involving the gathering of a suitable set of variables with corresponding observations. After this, a statistical method will need to be used that can reliably and accurately estimate the relationship between anxiety and income. Finally, the results will be collected and discussed, coming to a clear conclusion as to what was found and what this may mean for future studies surrounding mental health and future economic outcomes.

1.2. Theory

Anxiety is a medical condition that is characterised by the existence of excessive and persistent worry. It is classed as a medical condition when it interferes with daily life activities. This happens through symptoms such as tiredness, sleep disturbance and difficulties with concentration. There are several types of anxiety disorders, including generalized anxiety disorder (GAD), panic disorder and social anxiety disorder. For the purpose of simplification, the different types of anxiety will not be distinguished between in this study. For an anxiety disorder to be diagnosed, symptoms must be present for a significant period and cause significant distress or impairment in daily functioning.

According to the World Health Organization (WHO), anxiety disorders are among the most prevalent mental health disorders globally. It is estimated that around 264 million people worldwide suffer from anxiety disorders (WHO, 2017). In the United States, anxiety disorders affect approximately 18.1% of the adult population, making it the most common mental health

condition in the country (National Institute of Mental Health, 2021). Furthermore, a study conducted by Greenberg et al. (2015) found that anxiety disorders cost the global economy approximately \$1 trillion each year in lost productivity.

This highlights the importance of understanding and addressing the implications of anxiety on various life outcomes such as education, employment, and overall well-being.

1.3. The Social Environment

As this study will have a focus around adolescent anxiety, it is important to provide some context to the attitudes around mental health conditions at the time the data is taken from. This study will investigate the research question using an anxiety variable measured in 1980, when the individuals within the sample that will be used were 10 years of age.

Socially, there was a lesser understanding around mental health problems and conditions such as anxiety were often stigmatised and not fully understood. This may have implications to this study because, if individuals are not able to accurately describe and understand their own mental health, the accuracy of the results may be affected.

1.4. Literature Review

Previous literature investigating the relationship between health and economic outcomes has been more largely focused on the effects of physical health problems, as opposed to mental health problems. However, with a greater emphasis on the importance of mental health in the modern day, researchers have begun to look at the impacts of mental health in more depth.

It is important to note that there may be important relationships between mental and physical health that help to explain the economic outcomes of individuals, but they will not be covered in this paper.

1.4.1. Adolescent mental health and future income

The majority of the existing literature directly investigating the impact of adolescent mental health on future income concludes that, if an individual suffers from a mental health disorder, they earn less when older.

De Araujo Roland (2018) did a similar empirical study to this paper, but instead looked at the link between ADHD and future economic outcomes rather than anxiety. This study used Ordinary Least Squares (OLS) regressions of ADHD on education, controlling for socioeconomic and parental background information. He found that ADHD impacted individuals' future income through the subsequent impacts on their education. The study also found that those with ADHD were less likely to be supervisors or managers, and were also less likely to be employed full time. These are all additional aspects that are likely to reduce the

individual's future income. This meant that breaking down the individual impacts of anxiety on education was also important in understanding the link between anxiety and future income.

A study by Smith and Smith (2010) estimated that the lifetime cost in lost family income as a result of psychological problems during childhood was approximately \$300,000, with the total lifetime cost for all those affected totalling \$2.1 trillion. As a result, there is a large impact on the individual's adult socioeconomic status. The paper uses siblings which, although won't be possible in this study, allowed for the control of unobserved environmental effects such as family environments. However, a weakness of the study was that it used retrospective self-reports of mental health in childhood, taken when the individuals in the study were adults. As a result, this was likely to impact the reliability and accuracy of their findings.

Research by Goodman, Joyce and Smith (2011) suggests that adolescent mental health problems have substantial impacts on future income. The study was conducted using the OLS method to investigate the long-term impacts on adult socioeconomic status after experiencing psychological and physical health problems in childhood. Prospective panel data that was measured at key points in individuals' lifetimes was used in order to make estimations more accurate, rather than relying on the retrospective self-reports of certain variables used in the work of Smith and Smith (2010). The main dependent variable of interest was family income, rather than solely the income of the individual. They estimated that family incomes were reduced by 28% at age 50 if an individual had experienced mental health problems as a child. This is preceded by an initial 19% lower family income at age 23, signifying that the effects of poor mental health in adolescence become more severe with time. In terms of employment, they found a sustained impact on the labour supply when an individual suffers from psychological problems as a child. The results showed an 11% lower probability of working for those affected. This is a significant impact that creates problems across the wider economy. If individuals are not working, it is likely that there will be significant social impacts and impacts on government expenditure, such as increased transfer payments. Affected individuals also displayed reduced cognitive ability, negatively impacting their ability to work productively and effectively.

1.4.2. Adolescent mental health and future economic outcomes

If mental health problems are not treated in adolescence, then the symptoms and impacts are likely to continue into adulthood. Kessler et al. (2005) discovered that many mental health disorders are likely to continue into later life if left untreated. This is likely to have impacts on a wide range of different aspects of adult life. They also found that 50% of lifetime cases of mental health disorders start by the age of 14. As a result, this study will use an anxiety variable recorded when the individuals were 10 years old, in order to capture those that may suffer from the condition at an early age.

Lerner and Henke (2008) found that the incidence of depression in individuals leads to a reduction in productivity, higher rates of absenteeism and presenteeism, and increased

healthcare costs as opposed to those without the condition. This shows that if these conditions aren't treated effectively, there is likely to be damaging long-term impacts to the individual. Because treatment rates were lower in the 1970s and 1980s, this study implies that the relationship between anxiety and future income will be negative.

1.4.3. Adolescent mental health and educational outcomes

The impacts of mental health are also likely to affect future outcomes through various channels, such as education, rather than only directly affecting the individual's productivity and earning potential. As a result, it is important to break down the individual components that may be affected by the presence of a mental health condition.

One of the biggest ways that adolescent mental health problems may impact the future economic outcomes of an individual is through the impact on their education.

Fletcher (2008) investigated the relationship between depression and educational attainment, using sibling fixed-effects models to control for environmental and genetic factors. He found that depression in adolescence negatively affected educational attainment which could potentially impact future income prospects. As there is usually a correlation between depression and anxiety disorders, it could be expected that the impacts are similar when looking at the impacts of anxiety on educational attainment.

Schoon, Bynner, Joshi, Parsons, Wiggins, Sacker (2002) investigated the impact of risk exposure on the education of children, also utilising the BCS70 dataset. They found that if a child is exposed to persistent socioeconomic disadvantage, they are less likely to do well academically in childhood. This is likely to negatively impact their ability to adapt and be successful in adulthood. Although this doesn't directly indicate mental health problems, according to research by Sweeting et al. (2015), risk exposure and persistent socioeconomic disadvantage are likely to lead to mental health difficulties for children. Consequently, the mental health issues that are caused as a result of socioeconomic disadvantage may be a significant factor in explaining the relationship between socioeconomic background and educational attainment.

De Araujo Roland (2018) also found that, in 1980, those with ADHD were 4.77% less likely to obtain a higher degree. If the impacts are similar for anxiety, it may mean that individuals who suffer from the condition may earn less if it impacts their ability to obtain a degree.

In addition to this, a study by Feinstein (2002) concluded that individuals with further education "tend to present better health outcomes", such as a lower incidence of depression in adulthood. This means that the negative impacts of mental health problems may be multiplicative, which could explain how symptoms, and subsequent impacts, worsen over time.

This paper will contribute to the existing literature by specifically investigating the impact of higher anxiety at a young age, rather than grouping conditions together and looking at the dynamic relationship between anxiety and income in adulthood.

2. The Data

2.1. The 1970 British Cohort Study

The dataset this study will be using is the 1970 British Cohort Study (BCS70). This is a cohort study that began in 1970, at the birth of the individuals in the study, collecting data on the births and social circumstances of over 17,000 babies born in the UK. It contains a great depth of information including employment history, medical records, educational attainment and even information on the parents of the individuals. Currently there are eleven ‘sweeps’ of the BCS70 dataset, with the most recent sweep taken in 2021 when the respondents were 51 years of age. The number of respondents in each year has usually decreased (see Table 0), however during the year 2000 additional funding meant a higher number of cohort members could be targeted. In 2012, 57.2% of the original sample were found and included within the data collection.

TABLE 0: Sample Participation in Each Sweep (Sweep 0-8)

Sweep	Year	Age	Number of Participants	% of Original Sample
0	1970	0	17198	100
1	1975	5	13135	76.4
2	1980	10	14875	86.5
3	1986	16	11622	67.6
4	1996	26	9003	52.3
5	2000	30	11261	65.5
6	2004	34	9665	56.2
7	2008	38	8874	51.6
8	2012	42	9841	57.2

Source: British Cohort Study 1970

The strengths of the data is that it is a large, nationally representative sample with regular follow-ups that cover a large amount of the respondent’s lives. As a result, it is possible to test the impacts of a particular variable on an outcome variable of interest.

Additionally, the huge range of variables included within each sweep of the study means that there is a great deal of opportunity for comparisons with other cohorts. Although this isn’t something that is covered in this study, it means that findings from similar studies done using other cohorts can be compared to the findings from this study in future.

However, the dataset does have some weaknesses. As with all cohort studies, the problem of selective attrition is likely to be a cause of some bias within the data. This is where the number of observations drops over time due to a lower number of responses from the individuals within the study. There is usually an element of bias introduced, due to the fact that there are often shared characteristics between those that are not involved in later sweeps of the study. However, as this is a disadvantage of all cohort studies, it is not something that will be rectified in this study. The large number of variables also means that few variables have a complete set of responses for every individual. This means there can be a substantial reduction in sample size when missing values are removed. The most important weakness of the BCS70 dataset to this study in particular is the fact that it doesn't include variables for the clinical diagnoses of anxiety disorders. As a result, this study uses a self-reported variable as a proxy for anxiety.

2.2. Data Visualisation

Below (Figure 1) is a histogram showing the distribution of anxiety scores for the individuals in the final dataset that is used in this study. Around 57% of the individuals within the study recorded an anxiety score of less than 20, whereas just over 14% recorded a score of 80 or over. 26.64% of the individuals in the sample recorded an anxiety score of 50 or over.

The mean value of the anxiety score was 33.2 (see Table 1), with an even lower median (18.8). Only 26.64% of the individuals recorded an anxiety score of 50 or over.

FIGURE 1: Histogram Displaying the Distribution of Anxiety Scores

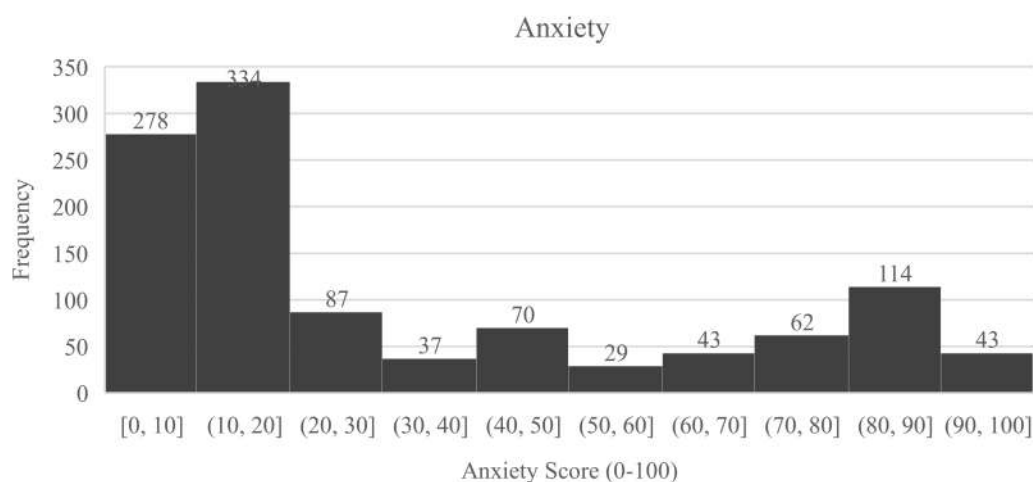
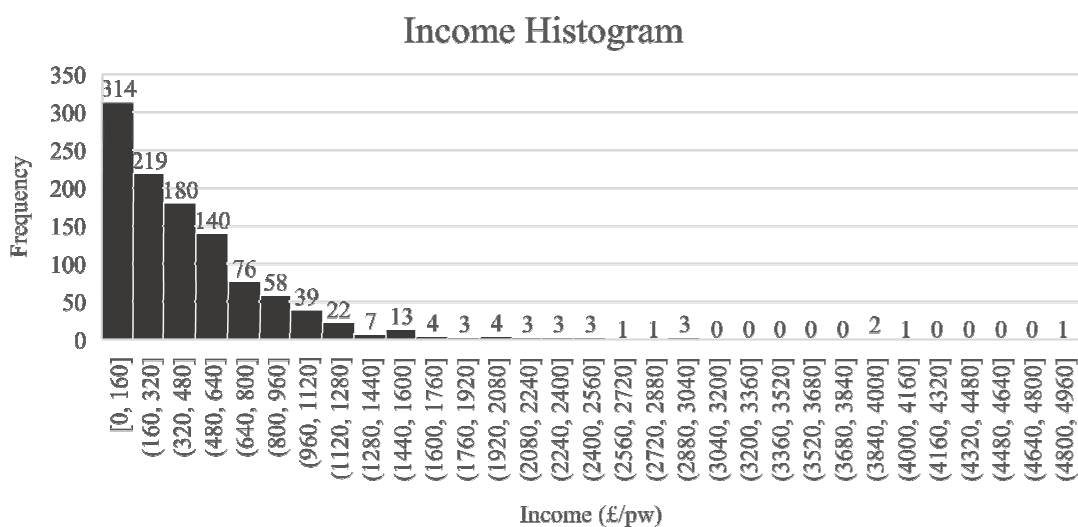


TABLE 1: Summary Statistics for Anxiety Variable

Mean	1 st Quartile	Median	3 rd Quartile	Std Deviation
33.2	10.0	18.5	54.3	30.2

Next, another histogram (Figure 2) was created to visualise the distribution of income within the sample. The majority of the individuals are on the lower end of the income spectrum, with very few earning more than around £2000 per week. 87.1% of individuals recorded an income of £880 per week or below. There is a significant outlier at the high end of the income scale, recording an income value of £12500 per week. This outlier will not be removed because it is a genuine observation, rather than a data error. The mean income in the sample was £469.70 per week. All observations above £5000 were removed only for the histogram, but not for any of the regressions that were run.

FIGURE 2: Histogram Displaying Income Distribution

*observations over £5000 were removed **only** for the data visualisation of this histogram.

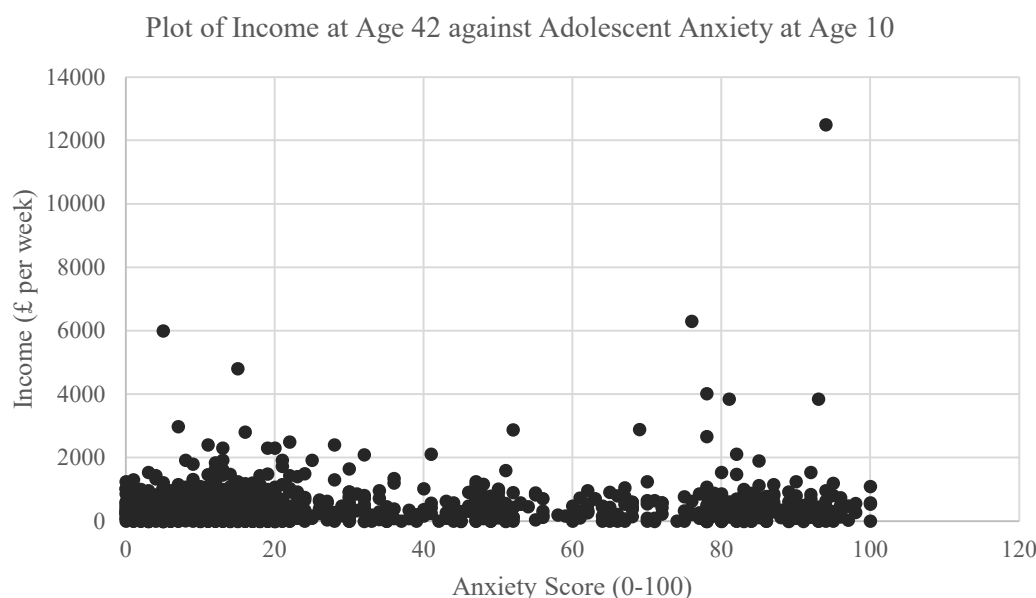
TABLE 2: Summary Statistics for Income Variable

Mean	1 st Quartile	Median	3 rd Quartile	Std Deviation
469.7	138.2	326.9	600.0	651.2

Finally, a scatter graph (Figure 3) was created plotting anxiety against income. It is worth looking at the relationship between the main dependent variable of interest (income) against the main independent variable of interest (anxiety). This can help to identify any visual relationships between the two variables and help to identify the best way of estimating the statistical relationship between the two.

There appears to be no explicit visual relationship between the two variables, which means that it is not clear at first glance whether income is affected positively or negatively by anxiety. The only visible patterns are a cluster of observations below the £2000 per week threshold. This again shows that the majority of individuals earned below this amount, but there is no indication as to how this interacts with how anxious each individual was when they were younger.

FIGURE 3: Scatter Graph of Adolescent Anxiety Against Income



3. Method and Empirical Model

3.1. Method Overview/Plan

Three separate stages were necessary in order to conduct the statistical analysis effectively. Firstly, a dataset needed to be created that included the variables of interest to the study (anxiety and income), as well as a set of suitable control variables that would help to increase the accuracy and reliability of the coefficient estimates. Next, a model was needed to estimate the impacts of the independent variables on income. The model needed to include as many important variables as possible that could help to control for the relationship between anxiety and income. However, only a certain number of control variables could be included so that the

final model was not over specified and biased. Finally, a suitable statistical method was required that could be used to generate reliable and unbiased estimates of the impacts of each independent variable.

3.2. Methodology

3.2.1 Variable Selection

The first step was to identify variables of interest to the study that could help to explain the relationship between adolescent anxiety and future income. All variables were isolated from their individual data files using the statistical software ‘Stata’, along with the identifier variable (BCSID) to maintain the order of data.

The main dependent variable for this study is income. Income was selected as the main dependent variable of choice due to the fact it can give a fairly complete picture of an individual’s economic and socioeconomic outcomes. This variable was taken from a later point in the study, when the individuals were 42 years old (Sweep 9). As a result, it meant that the effects of adolescent anxiety in the long-term would be more visible once the individuals had matured into their various careers or roles. Sweep 9 was also the most desirable sweep to use due to the range of dependent variables that could be used to provide further clarity to the study. Additional dependent variables of interest were also identified, such as economic status and whether the individuals had any managerial/supervisory responsibilities within their current role.

The main independent variable of interest is adolescent anxiety. Much of the existing literature has looked at mental health disorders that can be more easily diagnosed, such as ADHD. Due to the increased anxiety rates in recent times, it is important to see the effects of the condition on a person’s future outcomes. An issue with using anxiety as the main independent variable of interest was that, as previously stated, there are no variables in the BCS70 dataset for medically diagnosed anxiety disorders. As a result, the variable *worried* was used as a proxy variable for anxiety. This is possible because anxiety is highly likely to be correlated with the level of worry an individual experiences. The variable ranges from 0 to 100, created by a self-completed questionnaire where the individuals ranked how worried they feel in a range of day-to-day scenarios. The results were compiled into the final *worried* variable, where a score of 0 signified that the individual never felt anxious and a score of 100 signified that they felt anxious all of the time. This variable was taken from Sweep 3 of the dataset, when the individuals were 10 years old. As a result, there would be minimal impact from academic and social pressures, and the level of anxiety the individuals were experiencing would be a true-to-self reflection of the extent to which they naturally experienced symptoms of the disorder. This variable was also used in the hope that a greater proportion of those who may suffer from anxiety are captured in the model, rather than only those who were explicitly diagnosed. Additionally, because the questionnaire was completed by the individuals when they were 10 years of age,

they are less likely to be affected by the stigmas regarding mental health at the time. As a result, the answers they give are more likely to be honest and unbiased which may help to improve the reliability of the results that are obtained.

The next step was to select the control variables that would be used to create a more reliable and accurate estimate of the impacts of adolescent anxiety on income. The control variables used in the study were selected under three separate categories: general controls, educational controls and parental/background controls. The two general controls that were selected were gender and ethnicity, as it is highly likely that both of these will affect how much an individual will earn in the future. The control variables for education controlled for both academic achievement and also ability. This was done because an individual's education is also highly likely to influence how much they earn in adulthood. Finally, the parental/background controls hoped to account for the impacts of environmental and genetic factors, in order to provide a more reliable estimate of the impact of adolescent anxiety. These controls were all taken from Sweep 3 and consisted of whether the individual's parents were married, whether the individual's parents had a degree and if there was overcrowding in the house. The purpose of selecting such a wide range of variables was to limit the impacts of omitted variable bias. By including as many of the potentially significant variables as possible, it is easier to isolate the individual impacts of anxiety on how much the individuals earn in the future whilst also ensuring that the estimates are reliable and unbiased. Only certain key variables that had been proven to have significant impacts on the dependent and independent variables of interest were included, to avoid creating an over specified model.

3.2.2 Data Merging

Once the variables had been selected and paired with their respective identifier variables, they could be merged into a single data set. This was done in the coding software 'R'. Variables were merged by the ID variable to create the full dataset that would be used in the later regressions.

3.2.3 Variable Creation

After the variables had been merged into a single dataset, the next step was to create any individual variables that were not explicitly included within the BCS70 dataset. This included any variables that were a combination of two existing variables, such as income, or any binary variables that were originally in non-binary form, such as ethnicity.

The first variable that had to be created was the income variable. This was done by dividing the amount an individual earned by the period over which they earned it. The result was a value that indicated the individual's average weekly income. A large amount of the variables in the final regressions were binary variables.

The purpose of this was to simplify the interpretation of the impacts associated with each independent variable. For example, at age 10, if an individual's parents were married (where x_1 , the binary variable, takes a value of 1) the subsequent value from the regression is the direct impact on how much the individual earns in the future, in percentage terms.

e. g.: $\beta_1 x_1 = 0.225x_1$ means that, when the binary variable x_1 takes the value of 1, the subsequent impact on the dependent variable is a 22.5% increase.

Using the examples above, we would conclude that there was a 22.5% increase in future income if an individual's parents were married ($x_1 = 1$) at Age 10. All binary variables take the value of 1 if a certain condition is met, and 0 otherwise. As most of the variables in the original data files were not binary, the majority of these variables had to be created in R.

3.2.4 Data Clean-Up

Finally, the dataset needed to be finalised and organised. This involved removing negative values and missing observations, and to correct any duplication problems that had been experienced in the merging stage. An example of this was that, when the *manager* variable was included, duplications of certain observations appeared within the dataset. This was corrected for by creating the final binary variable for *manager*, taking a value of 1 if the individual had managerial/supervisory responsibilities during one or more of the periods included within the data. The impact from the removal of individuals due to missing observations was limited by selecting variables that would limit the sample drop-off, and removing variables that would have led to a small and potentially unrepresentative sample.

3.2.5 Final Dataset

The final dataset included 1100 observations, with 17 different variables. In total, 447 of the individuals in the study were men. Additionally, 1044 of the 1100 individuals were in active employment.

3.3. Variable List

Below is the full list of variables within the final dataset, including the main independent and dependent variables of interest (anxiety and income respectively) as well as the range of control variables and additional dependent variables that may be of interest.

3.3.1. Dependent Variables

Income

Income measures how much each individual earns, on average, per week. This is a continuous variable and is the main dependent variable of interest to this study.

Life Satisfaction

This is a self-completed variable at the age of 42, where the individuals rank their personal satisfaction with their life outcomes on a scale from one to ten. This variable is important to look at due to the fact that income isn't the most important factor to all individuals. The final variable is called *life.satisfaction*.

Economic Status

Although this variable will not be used in the regressions, it can be used to separate the observations within the dataset between those who are employed and those who are unemployed. As a result, it will be possible to see if the effects are consistent when only looking at the outcomes of those who were actively working at age 42. The final variable is a binary variable '*economic.status*', taking a value of 1 if the individual was employed at Sweep 9 and 0 otherwise.

Manager

Being a manager or having greater responsibility can mean that individuals earn more. The final variable, *manager*, is a dummy variable that takes a value of 1 if the individual has a job with supervisor/managerial responsibilities and 0 otherwise.

3.3.2. Independent Variables

Anxiety

The main independent variable of interest is the anxiety variable. This enters the dataset as two variables, both constructed from the same BCS70 variable. The first variable *worried* measures how anxious the individual was at 10 years old on a scale of 0-100, with 100 measuring the highest possible level of anxiety. The second variable, *worried.binary*, is an adapted version of *worried* that instead takes the form of a binary variable. This variable takes a value of 1 if the individual had a worried 'score' of ≥ 50 , and 0 otherwise.

General Controls

Gender

As one of the most extensively studied factors in the determinants of wage, it is very important to control for gender when looking at the relationship between a variable and income. Due to many factors such as discrimination, occupational requirements and

preferences, there is a discrepancy between the wages of men and women. The final variable *gender* takes a value of 1 if the individual is male and 0 otherwise.

Ethnicity

Due to factors such as discrimination or certain cultural differences, there is likely to be differences in how much different ethnicities earn. This is incorporated using a binary variable, called *non.white*, taking the value of 1 if the individual is non-white and 0 otherwise.

Educational Controls

Ability

Ability was measured using variables from Sweep 3 that recorded whether the individual displayed a strong ability in a certain subject. The three subjects used were maths, reading and spelling, three areas that are likely to signify stronger academic performance. These variables are all binary variables, taking a value of 1 if the individual displayed a good ability in that particular subject and 0 otherwise. All ability variables are in the form '*subject.ability*'.

O-Levels

Academic achievement made use of two variables from Sweep 4 (Age 16) of the dataset. These variables recorded their maths O-Level results and their English O-Level results. The purpose of this was to control for both intelligence and academic achievement, which were both predicted to have significant impacts on how much the individual earns in adulthood. O-Levels are a good indicator of these as they were fairly hard to obtain. The variables are included within the dataset as binary variables taking a value of 1 if the individual obtained an O-Level in that particular subject and 0 otherwise. All O-level variables are in the form '*subject.olevel*'.

Degree

A variable was also selected for whether the individual had obtained a degree by age 42 as this is also likely to have a significant impact on how much they earn. This is important to control for when looking at income because many higher-earning jobs require a degree. The final variable *degree* is a binary variable, which takes a value of 1 if the individual obtained a degree by age 42 and 0 otherwise.

Parental/Background Controls

Parental Education

It is important to take the individual's parents' educational background into account, as this is likely to have a direct impact on the education of the child. Furthermore, there is likely to be a greater academic pressure for children with well-educated parents. This takes the

form of the binary variable *parent.degree*, taking a value of 1 if one or both parents had a degree and 0 otherwise.

Parents' Marital Status

Studies have found that children from single-parent households or those whose parents experience marital disruption tend to have lower educational attainment than children from two-parent households. For example, a study done by McLanahan and Sandefur (1994), found that children from single-parent households had lower levels of educational attainment, even after controlling for other factors such as socioeconomic status. *parent.marital* is a binary variable taking a value of 1 if the individual's parents were married at age 10 and 0 otherwise.

Overcrowding

Overcrowding in the home is usually an indicator of lower socioeconomic class. This is likely to have impacts on the educational outcomes of children. For example, if a child shares a room with one or more siblings, it may be harder for them to focus on studying. The variable *overcrowding* was created by dividing the number of people living in the individual's house by the number of bedrooms in that house. It takes a value of 1 if there is overcrowding (> 1.5 people per room) and 0 otherwise.

TABLE 3: Variable List

Type	Variable	Name	Binary	Sweep	
ID	Identifier Variable	<i>bcsid</i>	×	-	
Dependent	Income	<i>income</i>	×	9	
	Life Satisfaction*	<i>life.satisfaction</i>	×	9	
	Economic Status*	<i>economic.status</i>	✓	9	
	Manager*	<i>manager</i>	✓	9	
Independent	Anxiety	<i>worried</i>	×	3	
		<i>worried.binary</i>	✓	3	
Control	Gender	<i>gender</i>	✓	-	
	Ethnicity	<i>non.white</i>	✓	-	
	Maths Ability	<i>maths.ability</i>	✓	3	
	Reading Ability	<i>reading.ability</i>	✓	3	
	Spelling Ability	<i>spelling.ability</i>	✓	3	
	O-Levels		<i>maths.olevel</i>	✓	4
			<i>english.olevel</i>	✓	4
	Degree	<i>degree</i>	✓	9	
	Parents' Marital Status	<i>parent.marital</i>	✓	3	
	Parents' Degree	<i>parent.degree</i>	✓	3	
	Overcrowding	<i>overcrowding</i>	✓	3	

*Additional variables of interest

3.4. Statistical Method

A statistical method was then required to estimate the relationships between the variables in the study. This method needed to estimate coefficients that would represent the numerical impact of the independent and control variables on the dependent variables.

For regressions with a non-binary dependent variable, the Ordinary Least Squares (OLS) method was used. This is because it provides unbiased estimates for the coefficients estimated in linear regressions, assuming the OLS assumptions are met. Additionally, many similar studies also used the OLS method for the estimation of the impact of mental health conditions on future outcomes. The OLS method appeared to be a suitable method to use for this study due to the distribution of income against anxiety. Most of the observations fell in a certain income range and so a linear model was suitable. For any regressions that had a binary dependent variable, such as the regression of anxiety on ability, the OLS method cannot be used. The OLS method is not suitable for these types of regressions because the linearity

assumption gets violated. This is because standard OLS regressions assume that the dependent variable is continuous. However, because the dependent variable is binary (non-continuous), the relationship is considered non-linear and therefore the OLS estimates are likely to be biased. As a result, the Logit method was used for these regressions. This method accounts for non-linearity and estimates the predicted probabilities for binary outcomes. It measures the change in probability of the dependent variable associated with the variable being either true (taking a value of 1) or false (taking a value of 0). Logit is robust to heteroscedasticity and doesn't assume normality of the residuals, meaning the estimates will be unbiased as long as certain conditions are met. These conditions include the observations in the sample being independent of one another and the model being correctly specified. The Logit model was used as opposed to the Linear Probability Model (LPM) method to simplify the interpretation of the generated coefficients and to limit the impact of the extreme outliers found in the data.

3.5. Empirical Models

The main models of interest, adolescent anxiety on income, were created using the control variables from Sweep 3, as well as controlling for adolescent educational attainment (degree not included). Two models with identical controls were created, one with the anxiety variable in its scale form and one with anxiety as a binary variable, taking the value of 1 if the individual was classed as 'anxious'. The additional models were created in order to break down the relationships between anxiety and some of the control variables, such as ability and education. The intention of this was to understand whether some of the impact of adolescent anxiety is observed in an individual's ability or educational attainment, which would explain part of the subsequent impact on income.

3.5.1. Effect of Adolescent Anxiety on Future Income

The main model that needed to be constructed for this study was one that could estimate the impact of anxiety on how much the individuals in the BCS70 earned in the future. The aim is to include as many independent variables as possible without creating an over specified model. It is important to note that the variables 'manager' and 'degree' were not included in the main regressions. This is because they led to overspecification of the models and reduced the reliability of the coefficient estimates for the main variables of interest.

The first model is a standard regression including all controls from when the individuals were 10 years old. This includes gender, ethnicity, parental controls, overcrowding, ability controls and educational controls.

$$\begin{aligned} \text{income} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} + \beta_4 \text{parent.degree} \\ & + \beta_5 \text{gender} + \beta_6 \text{non.white} + \beta_7 \text{maths.ability} + \beta_8 \text{spelling.ability} \\ & + \beta_9 \text{reading.ability} + \beta_{10} \text{maths.olevel} + \beta_{11} \text{english.olevel} + u \end{aligned}$$

The second model is also a standard regression including all controls from when the individuals were 10 years old. However, the main independent variable of interest (worried variable) now takes the form of a binary variable. This was done to observe the impact of anxiety on the future income of those that are more likely to be diagnosed with an anxiety disorder.

$$\begin{aligned} \text{income} = & \beta_0 + \beta_1 \text{worried.binary} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} \\ & + \beta_4 \text{parent.degree} + \beta_5 \text{gender} + \beta_6 \text{non.white} \\ & + \beta_7 \text{maths.ability} + \beta_8 \text{spelling.ability} + \beta_9 \text{reading.ability} \\ & + \beta_{10} \text{maths.olevel} + \beta_{11} \text{english.olevel} + u \end{aligned}$$

3.5.2. Additional Models of Interest

In order to decompose the impacts of anxiety, additional relationships were created to test for statistically significant impacts on ability and education.

Effect of Anxiety on Ability

The first of these additional models looks at the relationship between anxiety and ability, including control variables from when the ability variables were recorded (age 10).

$$\begin{aligned} \text{maths.ability} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} \\ & + \beta_4 \text{parent.degree} + \beta_5 \text{gender} + \beta_6 \text{non.white} + u \end{aligned}$$

$$\begin{aligned} \text{spelling.ability} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} \\ & + \beta_4 \text{parent.degree} + \beta_5 \text{gender} + \beta_6 \text{non.white} + u \end{aligned}$$

$$\begin{aligned} \text{reading.ability} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} \\ & + \beta_4 \text{parent.degree} + \beta_5 \text{gender} + \beta_6 \text{non.white} + u \end{aligned}$$

Effect of Anxiety on Educational Outcomes

Next, models were created to look at the impact of anxiety, ability and the additional control variables on the O-Level results of the individuals in the dataset.

$$\begin{aligned} \text{maths.olevel} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} + \beta_4 \text{parent.degree} \\ & + \beta_5 \text{gender} + \beta_6 \text{non.white} + \beta_7 \text{maths.ability} + \beta_8 \text{spelling.ability} \\ & + \beta_9 \text{reading.ability} + u \end{aligned}$$

$$\begin{aligned} \text{english.olevel} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} + \beta_4 \text{parent.degree} \\ & + \beta_5 \text{gender} + \beta_6 \text{non.white} + \beta_7 \text{maths.ability} + \beta_8 \text{spelling.ability} \\ & + \beta_9 \text{reading.ability} + u \end{aligned}$$

A model was also created to examine the relationship between anxiety, ability, O-Level results (and the rest of the age 10 controls) on whether the individuals obtained a degree or not. This was an important relationship to decompose due to the impact of a degree on income. Additionally, much of the existing literature indicating that poor mental health in adolescence leads to a lower probability of an individual obtaining a degree.

$$\begin{aligned} \text{degree} = & \beta_0 + \beta_1 \text{worried} + \beta_2 \text{overcrowding} + \beta_3 \text{parent.marital} + \beta_4 \text{parent.degree} + \beta_5 \text{gender} \\ & + \beta_6 \text{non.white} + \beta_7 \text{maths.ability} + \beta_8 \text{spelling.ability} + \beta_9 \text{reading.ability} \\ & + \beta_{10} \text{maths.olevel} + \beta_{11} \text{english.olevel} + u \end{aligned}$$

4. Results and Discussion

After the models had been constructed, the regressions could be run. The following section will state the results obtained from each model and discuss what the results may mean to the overall study. All coefficient estimates and standard errors are rounded to two decimal places.

4.3.1. Adolescent Anxiety and Future Income

For the main regression, the estimated coefficient of the impact of anxiety on future income was positive. This means that, in this model, individuals who were more anxious at 10 years old earn slightly more when older. The value of this coefficient was 1.056, meaning that a one unit increase in the anxiety score of an individual is estimated to lead to a £1.056 increase in future weekly income when they are 42 years old. Although this seems like a small increase, when comparing an individual who recorded an anxiety score of 0 with one who recorded a score of 100, the difference in weekly income will be £105.60. This is a fairly substantial difference that could lead to a £5491.20 difference between the two individuals over the course of a year, which may be observable when comparing their standards of living.

The magnitude of the coefficient is also significant due to the fact that 87.1% of individuals within the sample earned an income of £880 per week or below. As a result, the presence of more extreme anxiety is likely to have a large impact on the majority of the people included in the dataset. The result is statistically significant at the 10% significance level, meaning that there is a high likelihood that this is a reliable and accurate estimation of the relationship between the variables.

The result is similar when including only those who are employed. The coefficient is still positive, but now increases to 1.27. This indicates that an employed individual earns £1.27 per week more in the future if their anxiety score increases by one unit. In this model, the weekly difference between an individual who recorded an anxiety score of 0 with one who recorded a score of 100 is now £127 weekly, amounting to a substantial £6604 difference in yearly income. This result is also statistically significant at the 10% significance level.

Although the main focus of this study is to investigate the impact of anxiety on future income, some additional relationships were also found. Gender had the largest impact on income, with men earning £302.71 per week more than women, on average. This was found to be significant at any significance level. There were also large, positive and statistically significant results on future income when looking at the impacts of parents having a degree, obtaining a maths O-Level and showing a strong ability in maths or reading. These are all results we would expect to have positive impacts on future income, which increases the likelihood of the model estimates being reliable and unbiased.

TABLE 4a: Adolescent Anxiety and Income Regression Output

<i>Variable</i>	β	
	All observations	Employed only
<i>Anxiety</i>	1.056 . (0.62)	1.27 . (0.65)
<i>Overcrowding</i>	-19.67 (39.65)	-22.44 (41.18)
<i>Parents' Marital Status</i>	-28.89 (38.70)	-34.49 (40.18)
<i>Parent Degree</i>	113.19 . (59.07)	125.51* (61.42)
<i>Gender</i>	302.71*** (39.14)	310.17*** (40.67)
<i>Ethnicity</i>	59.96 (131.87)	54.24 (136.39)
<i>Maths Ability</i>	104.36** (39.44)	106.91** (41.04)
<i>Spelling Ability</i>	1.38 (39.49)	-0.50 (41.04)
<i>Reading Ability</i>	98.31* (47.66)	109.18* (49.37)
<i>Maths O-Level</i>	140.48* (55.27)	124.55* (56.67)
<i>English O-Level</i>	25.35 (51.83)	13.70 (53.43)

*Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%*

The next model involved turning the primary independent variable, anxiety, into a binary variable signifying whether the individuals had an anxiety score of 50 or over.

The coefficient for anxiety was again found to be positive, meaning that those who were anxious, on average, earn more than those who were not anxious. The coefficient of (£)70.72 now measures the difference in weekly income between an individual who was anxious at age 10 and an individual who was not anxious. As a result, on average, an individual who was anxious in adolescence earns £3677.44 per year more than an individual who was not. This was also statistically significant at the 10% significance level and is likely to be a more realistic

estimate of the impact of anxiety, due to the fact that this model differentiates between high anxiety scores and low anxiety scores. When only looking at those who are employed the impact is even greater, with the presence of greater worry leading to a £79.93 increase in income.

The additional relationships that were observed in the first model were also consistent with the results from this model, with the gender, reading ability, maths O-level, maths ability and parent degree variables all having significant positive impacts on income.

TABLE 4b: Adolescent Anxiety as a Binary Variable and Income Regression Output

<i>Variable</i>	β	
	All observations	Employed only
<i>Anxiety (binary)</i>	70.72 . (42.11)	79.93 . (43.94)
<i>Overcrowding</i>	-20.24 (39.65)	-23.36 (41.18)
<i>Parents' Marital Status</i>	-29.04 (38.70)	-34.70 (40.19)
<i>Parent Degree</i>	113.32 . (59.08)	125.69* (61.44)
<i>Gender</i>	302.52*** (39.15)	309.64*** (40.69)
<i>Ethnicity</i>	57.59 (131.85)	51.58 (136.42)
<i>Maths Ability</i>	103.44** (39.42)	105.87* (41.04)
<i>Spelling Ability</i>	1.13 (39.50)	-0.55 (41.06)
<i>Reading Ability</i>	98.44* (47.66)	109.08* (49.38)
<i>Maths O-Level</i>	140.75* (55.27)	125.19* (56.71)
<i>English O-Level</i>	26.02 (51.81)	14.26 (53.44)

Significance Levels: "***" 0.1%, "**" 1%, "*" 5%, "." 10%

4.3.2. Adolescent Anxiety and Ability

After running the regression of adolescent anxiety against the ability of the individuals, no significant results were found. The coefficients that were estimated were small with fairly large standard errors in relation. As a result, it can be assumed that there is no significant relationship between anxiety and ability. Consequently, ability can therefore be classed as an exogenous variable within the model and should reduce the problem of multicollinearity. This finding is beneficial to the study because it means that the ability controls are suitable to decompose the

effects of anxiety on income. Additionally, very few control variables had significant impacts on ability, reducing the problem of multicollinearity within the main regression further.

The only variable to have a statistically significant impact on ability was gender. It was found that males were 43% more likely to have a good ability in maths, but 26% less likely to have a good ability in spelling.

TABLE 5: Adolescent Anxiety and Ability Regression Output

<i>Variable</i>	β	
	Maths Ability	English Ability
<i>Anxiety</i>	-0.0032 (0.0020)	0.00047 (0.0024)
<i>Overcrowding</i>	-0.032 (0.13)	-0.20 (0.15)
<i>Parents' Marital Status</i>	-0.049 (0.13)	-0.15 (0.15)
<i>Parent Degree</i>	0.24 (0.19)	0.36 (0.25)
<i>Gender</i>	0.43*** (0.13)	-0.23 (0.15)
<i>Ethnicity</i>	-0.085 (0.43)	-0.44 (0.46)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

4.3.3. Adolescent Anxiety and Educational Outcomes

O-Levels

It was also found that anxiety at 10 years old had no significant impact on whether the individuals in the sample obtained an O-Level in either maths or English.

Overcrowding appears to have a large and significant negative impact on whether individuals obtained an O-Level. Individuals who lived in a house with 'overcrowding' were 50% less likely to obtain a maths O-Level and 63% less likely to obtain an English O-Level. Males were also 43% less likely to obtain an English O-Level than females.

TABLE 6a: Adolescent Anxiety and Educational Attainment (O-Levels) Regression Output

<i>Variable</i>	β	
	Maths	English
<i>Anxiety</i>	-0.0014 (0.0023)	0.0010 (0.0021)
<i>Overcrowding</i>	-0.50*** (0.15)	-0.63*** (0.14)
<i>Parents' Marital Status</i>	0.12 (0.14)	0.13 (0.13)
<i>Parent Degree</i>	1.23*** (0.20)	0.89*** (61.42)
<i>Gender</i>	0.15 (0.14)	-0.43** (0.13)
<i>Ethnicity</i>	0.68 (0.46)	0.15 (0.45)
<i>Maths Ability</i>	1.08*** (0.15)	0.58*** (0.13)
<i>Spelling Ability</i>	0.41** (0.15)	0.56*** (0.13)
<i>Reading Ability</i>	0.34 . (0.18)	0.66*** (0.17)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

Degree

Adolescent anxiety also appeared to have no significant impact on whether the individuals in the sample obtained a degree or not.

This is an interesting observation because it appears that the level of anxiety measured at 10 years old doesn't appear to affect educational outcomes. Consequently, the resulting impact of anxiety on income seems to measure the direct impact of anxiety, rather than measuring the impact through the various channels such as educational attainment.

The impacts of the control variables were similar to the impact on the probability of obtaining O-Levels, with O-Levels themselves also having a positive impact on the probability of getting a degree.

TABLE 6b: Adolescent Anxiety and Educational Attainment (Degree) Regression Output

<i>Variable</i>	β
<i>Anxiety</i>	0.0021 (0.0028)
<i>Overcrowding</i>	-0.57** (0.19)
<i>Parents' Marital Status</i>	-0.49** (0.18)
<i>Parent Degree</i>	1.21*** (0.22)
<i>Gender</i>	0.14 (0.17)
<i>Ethnicity</i>	2.42*** (0.50)
<i>Maths Ability</i>	0.13 (0.18)
<i>Spelling Ability</i>	0.11 (0.18)
<i>Reading Ability</i>	0.49* (0.24)
<i>Maths O-Level</i>	1.59*** (0.23)
<i>English O-Level</i>	0.53* (0.23)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

4.4. Discussion and Speculation

The results of the regressions of adolescent anxiety against future income contradict what was found in the existing literature. It was expected that the relationship was going to be negative, meaning that the presence of the mental health condition (anxiety) led to reduced income when the individual was older. However, the relationship discovered in these models appears to show that increased anxiety in adolescence leads to a slight, but statistically significant, increase in how much the individual earns in adulthood. This is the case for when anxiety is both a binary and non-binary variable, with both having significant positive impacts on future income at the 10% significance level. The weekly difference of £79.93 found in Table 4b was significant in comparison to the average income in the sample. This increase in income is 17.02% of the mean income and 24.45% of the median income, meaning that the difference would likely have a large impact on the standard of living of many of the individuals within the sample.

It was found that the level of anxiety at 10-years-old has no significant impact on the individual's educational attainment, and appears to have no correlation with their ability. This means that the observed impact may measure the direct impact of inherent worry the children experienced, rather than measuring the overall impacts of anxiety disorders.

It does not appear, however, that these results are a cause for concern regarding the reliability of the models. This is because, for the majority of the other variables within each model, the results for the control variables coincided with the findings of the existing literature such as gender and the possession of a degree having significant impacts on income. Additional regressions were also ran that were not included within the empirical models of the methodology, in order to do further tests of reliability and accuracy. It was found that adolescent anxiety had no impact on life satisfaction, whilst having a small negative impact (-0.73%) on the probability of an individual when controlling for gender and ethnicity. Furthermore, when looking at the regression of the independent variables on the manager variable, there was a significant positive coefficient estimate for the impacts of gender (all significance levels) and whether the individuals have a degree (1% significance level). This gives further reassurance as to the reliability of the models used, as this is what we would expect to find when looking at whether the individual has managerial duties or not.

The use of the variable *worried* may have led to the results that were obtained. It may be that 10-year-old children don't have a clear and well-rounded understanding of their thoughts and feelings, and it may be possible that different results would be obtained if looking at anxiety scores when the individuals were slightly older. Additionally, 10-year-olds are more likely to feel greater levels of anxiety in certain situations due to their age. As a result, some of the 'anxiety' that was displayed by some of the individuals may just be general worry, rather than signifying an explicit anxiety disorder. This could be rectified in the future by using a variable for medically diagnosed anxiety disorders, at a slightly later age.

Another potential explanation for the positive relationship could be that individuals who are more anxious when younger may learn certain coping mechanisms that could minimise the negative impacts of future events. Individuals in the study who experienced high levels of worry when younger may also have received the specific help required to limit any impacts on their education and, consequently, future income prospects.

An alternative theory is that the relationship between adolescent anxiety and future income is not linear, and consequently the wrong statistical models were used. This could mean that some of the relationship between the two variables was unobserved in the results. More work could be done in the future to better understand the nature of the relationship between adolescent anxiety and income, in order to calculate the magnitude of the relationship more accurately.

4.5. Limitations

One limitation of this study is that a proxy variable was used for the anxiety variable, due to the lack of an explicit variable for the diagnosis of an anxiety disorder. Although the proxy variable appeared suitable, due to the high likelihood of correlation between worry and anxiety, the fact that this relationship was not explicitly tested is a limit to this study.

Additionally, there was a large reduction in observations once missing values and N/A values were removed. As a result, although there was an attempt to limit the impacts of this, there may have been an element of selection bias involved as it is likely that there were shared characteristics between the individuals with missing values.

A further limit of this study is that it doesn't track the developments in health and economic outcomes over time. This means that the individual components of the models don't vary over time and it is therefore not possible to see how variables interact over time, such as whether anxiety at 16 years old is consistent with what was found at 10 years old.

Finally, there is no control in this study for individuals that receive treatment for the condition. As a result, it is not possible to distinguish between the outcomes of those who were treated for the condition and those who were not.

5. Concluding Remarks

5.1. Future Research

It is important that future research continues focus on this topic as anxiety rates continue to rise in the modern day. Consistent, regular studies using modern data will allow the nature of the relationship between anxiety disorders and future income to be understood more clearly. Future studies that investigate the relationship between adolescent anxiety and future income could use a variable for the explicit diagnosis of anxiety disorders. This would allow for a more accurate estimation of the impact of anxiety on future income. A further improvement to this study would also be to use anxiety scores measured across different time periods in adolescence, which would allow for the analysis of the impacts when anxiety increases or worsens. Finally, the results of this study indicate that it may be important to control for the treatment of any anxiety disorders in order to directly measure the impact of untreated disorders.

5.2. Conclusion

This paper investigates the relationship between adolescent mental health and future economic outcomes by measuring the impact of anxiety in adolescence on the future earnings of an individual. The findings are just one small part of a highly complex relationship that is affected by many variables throughout an individual's life span. It was found that there is a small,

positive impact of higher anxiety levels on future earnings. The impact slightly increases when only looking at those who are in active employment. These results were found to be statistically significant, however there were other variables such as gender that had a much more considerable impact on how much an individual earns in the future. Nonetheless, the findings indicate that higher levels of worry lead to a fairly substantial difference in income when looking over the course of a year. This is likely to have had significant impacts on the standards of living of certain individuals within the sample. A possible explanation for the positive relationship between anxiety and future income is that because the anxiety variable was self-completed, 10-year-old children may not have an accurate and well-rounded view of their own mental health. Future studies should use a variable for the explicit diagnosis of an anxiety disorder.

Additional relationships between anxiety and educational outcomes were also investigated with the results indicating that, when anxiety is measured at the age of 10, the level of anxiety individuals experience has no significant implications on the individual's ability or educational attainment.

In conclusion, future studies investigating the relationship between adolescent anxiety and future income should focus on how the condition develops throughout an individual's life, attempting to locate the age at which the condition is likely to have the greatest impact on their life outcomes.

6. Reference List

de Araujo Roland, D. (2018). The interaction between health, education and life outcomes from childhood to adulthood (Doctoral dissertation). University of Kent.

Feinstein, L. (2002). Quantitative estimates of the social benefits of learning. *London Review of Education*, 1(2), 135-148.

Fletcher, J.M., 2010. Adolescent depression and educational attainment: results using sibling fixed effects. *Health economics*, 19(7), pp.855-871.

Goodman, A., Joyce, R., & Smith, J. (2010). The long shadow cast by childhood physical and mental problems on adult life. *Proceedings of the National Academy of Sciences*, 107(9), 3557-3562.

Greenberg, P. E., Fournier, A. A., Sisitsky, T., Pike, C. T., & Kessler, R. C. (2015). The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *Journal of Clinical Psychiatry*, 76(2), 155-162.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62(6), 593-602.

Lerner, D., & Henke, R. M. (2008). The economic consequences of mental health. *Annual Review of Public Health*, 29, 315-328.

McLanahan, S., & Sandefur, G. (1994). *Growing up with a single parent: What hurts, what helps*. Harvard University Press.

Schoon, I., Bynner, J., Joshi, H., Parsons, S., Wiggins, R.D. and Sacker, A., 2002. The influence of context, timing, and duration of risk experiences for the passage from childhood to midadulthood. *Child development*, 73(5), pp.1486-1504.

Smith JP, Smith GC (2010) Long-term economic costs of psychological problems during childhood. *Soc Sci Med* 71:110-115. *Soc Sci Med* 71:110-115.

Sweeting, H., Hunt, K., & Bhaskar, A. (2015). Socioeconomic disadvantage in childhood and mental health in adolescence: a systematic review and meta-analysis. *Child and Adolescent Mental Health*, 20(1), 3-13.

7. Appendix

Additional regressions were run, breaking down the impacts at each stage throughout education on final outcomes of interest. Controls were for gender and ethnicity.

7.1. Impact of ability on whether the individuals obtained an O-Level

TABLE 7: Impact of ability on whether the individuals obtained an O-Level regression output

<i>Variable</i>	β	
	Maths O-Level	English O-Level
<i>Maths Ability</i>	0.65*** (0.083)	-
<i>Spelling Ability</i>	-	0.37 (0.080)
<i>Reading Ability</i>	-	0.39 (0.10)
<i>Gender</i>	0.075 (0.082)	-0.20 (0.079)
<i>Ethnicity</i>	0.23 (0.27)	-0.051 (0.27)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

- Having a good ability in maths meant individuals were 64.9% more likely to obtain a maths O-Level.
- Having a good ability in spelling meant individuals were 37.2% more likely to obtain an English O-Level.
- Having a good ability in reading meant individuals were 38.7% more likely to obtain an English O-Level.

7.2. Impact of obtaining an O-Level on whether the individuals obtained a degree

TABLE 8: Impact of obtaining an O-Level on whether the individuals obtained a degree regression output

<i>Variable</i>	β Degree
<i>Maths O-Level</i>	0.99*** (0.12)
<i>English O-Level</i>	0.38** (0.12)
<i>Gender</i>	0.091 (0.094)
<i>Ethnicity</i>	1.21*** (0.29)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

- Having a maths O-Level meant individuals were 99% more likely to obtain a degree.
- Having an English O-Level meant individuals were 38% more likely to obtain a degree.

7.3. Impact of having a degree on economic outcomes

TABLE 9: Impact of having a degree on economic outcomes regression output

<i>Variable</i>	β Degree
<i>Degree</i>	301.39*** (44.81)
<i>Gender</i>	308.16*** (38.13)
<i>Ethnicity</i>	-75.67 (132.00)

Significance Levels: "****" 0.1%, "***" 1%, "**" 5%, "." 10%

- Having a degree increased average income by £301.39 per week.
- Having a degree had no statistically significant impact on whether an individual was employed or not.
- Having a degree meant individuals were 35.8% more likely to end up in a managerial or supervisory role.
- There were also large disparities in economic outcomes between men and women.
 - Men with a degree earned £610 per week more than women without a degree.

- Men were 42.7% more likely to be managers or have supervisory roles than women.
- Men without a degree earned £6.77 per week more than women with a degree.