CAREER EFFECTS OF MENTAL HEALTH*

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This paper investigates the career effects of mental health, focusing on depression, schizophrenia, and bipolar disorder (BD). Individual-level registry data from Denmark show that these disorders carry large earnings penalties, ranging from 34 percent for depression and 38 percent for BD to 74 percent for schizophrenia. To investigate the causal effects of mental health on a person's career we exploit the approval of lithium as a maintenance treatment for BD in 1976. Baseline estimates compare career outcomes for people with and without access in their 20s, the typical age of onset for BD. These estimates show that access to treatment eliminates one third of the earnings penalty associated with BD and greatly reduces the risks of low or no earnings. Importantly, access to treatment reduces the risk of disability for a person with BD by more than half.

KEYWORDS: MENTAL HEALTH, EARNINGS, DISABILITY, INEQUALITY, BIPOLAR DISORDER, DEPRESSION, AND SCHIZOPHRENIA.

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One in twelve Americans is affected by a mental health disorder, such as depression, schizophrenia, and bipolar disorder.[1] According to the World Health Organization (WHO, 2011) mental health disorders are the leading cause of lost disability-adjusted years of life. Yet, anecdotes about prominent executives have linked mental health disorders – and in particular bipolar disorder (BD) – with professional success, to the point that BD is called a "CEO's disease" (Cooper et al. 1988).

Estimating the causal effects of mental health and its treatments on a person's career involves two major empirical challenges. First, privacy regulations restrict access to individual-level data on diagnoses that researchers need to estimate causal effects of changes in mental health. Second, differences in mental health and access to treatment are rarely random. For example, people who grow up in low-income families are more likely to face traumatic events that trigger depression (Mortensen et al. 2003; Gardner and Oswalt 2007),[2] and they are less likely to receive treatment (Davis et al. 2008).[3]

This paper combines individual-level registry data on mental health and career outcomes with a significant change in treatment to investigate the career effects of mental health. Our data cover mental health diagnoses, earnings, employment and disability status for the population of Denmark, including 2.4 million people born between 1946 and 1977. Nearly 100,000 of these individuals were affected by depression, 23,000 by BD, and 42,000 by schizophrenia; these three major disorders are the focus of our analyses. Denmark's approval of lithium as a maintenance treatment for BD in 1976 allows us to compare career outcomes across people with BD with differential access to treatment. To control for socio-economic background and other characteristics that vary across families, we use identifiers for mothers and compare outcomes across siblings with and without a disorder.

Registry data show that mental health disorders are associated with large earnings penalties. Compared with the population, people with depression, BD and schizophrenia earn 36, 38 and 74 percent less, respectively. Controlling for family background reduces these penalties only slightly. Compared with their healthy siblings, people with depression, BD, and schizophrenia earn 31, 36, and 73 percent less, respectively. We also find that people

[1] National Institute of Mental Health, 2015, citing evidence from the National Comorbidity Survey Replication (NCS-R, Kessler and Meikangras 2004, Kessler et al 2005).
[2] Mortensen et al. (2003) show that abuse, neglect, the death of a parent, or other family-related stress can trigger mental health disorders. Gardner and Oswalt (2007) use a sample of British lottery winners to show that lottery wins improve mental well-being and that larger wins are followed by stronger improvements.
[3] Davis et al (2008) find that 22 percent of 220 participants recruited from urban hospital medical clinics met survey criteria for post-traumatic stress disorder (PTSD). Although desiring mental health services, only 13.3 percent of those with PTSD had prior trauma-focused treatment.

with mental health conditions are substantially more likely to decline into the bottom quantiles of earnings or to have no earnings at all. For example, people with depression and BD are 99 percent and 120 percent more likely to have earnings in the lowest decile compared with the population and 110 percent more likely to have no earnings at all.

To investigate the timing of changes in career outcomes we estimate event studies surrounding the year of diagnosis. These estimates show that earnings decline precipitously after a diagnosis: Ten years after a diagnosis, people with depression earn 9 percent less compared with their pre-diagnosis levels, those with schizophrenia earn 23 percent less, and those with BD earn 31 percent less. While earnings begin to recover after two years, they never recover to pre-diagnosis levels. Ten years after a diagnosis, people with depression earn 21 percent less, people with BD earn 34 percent less, and people with schizophrenia earn 57 percent less. Notably, earnings begin to decline before the diagnosis, consistent with interactions between career outcomes and mental health (e.g., Ross and Huber 1985).

If mental health conditions cause people to lose their jobs, part of these earnings penalties may reflect unemployment scars. A comparison of the earnings losses for people who experience unemployment and only receive one diagnosis with those of people with no unemployment who receive more than one diagnosis reveals losses that are significantly larger in the latter case. This suggests that the estimated penalties are more likely to be driven by mental health symptoms that make people unable to work, rather than by the scarring effect of unemployment.

The inability to work or to hold a full-time job might make people who suffer from mental health conditions more reliant on disability benefits. We find strong evidence of this in our data: People with depression are 1.2 times more likely than the population to receive disability pay, people with BD are 2.7 times more likely, and people with schizophrenia are 7 times more likely to receive disability pay.

A major change in the treatment of BD allows us to investigate the causal effects of changes in mental health, or more specifically, access to treatment. In 1976, Denmark's equivalent of the FDA approved lithium as a maintenance treatment for BD. Compared with other pharmaceuticals used to treat mental health disorders, lithium is highly effective for treating BD. For example, lithium use is associated with a significant reduction in the risk of hospitalization and suicide rates for people with BD (e.g., Tondo et al 1999; Angst et al 2005, Kessler et al 2005a).

Baseline estimates compare labor market outcomes of people with and without access to treatment at age 20, the typical age of onset for BD (Kessler et al 2003b), and a critical

period for a person's career (Kahn 2010; Oreopoulos 2012; Arellano-Bover 2019). Under the assumption that people with BD born before and after 1956 would have had similar labor market outcomes without access to treatment, this identification strategy allows us to estimate the causal effect of access to treatment on outcomes for people with BD. Moreover, if access to lithium eliminates the adverse labor market effects of BD, these estimates capture the career penalties associated with BD.

We find that access to treatment eliminates nearly one third of the earnings penalty associated with BD. Moreover, treatment reduces the risk of declining into the bottom earnings decile by 13 percent and lowers the risk of zero earnings by 33 percent. Cohort-specific estimates reveal a discontinuity in outcomes for cohorts born after 1956, confirming that access to treatment is most critical at age 20.

Controlling for family background further increases the estimated benefits of access to treatment. Compared with their siblings, treatment closes two thirds of the earnings penalty associated with BD, lowers the risk of earnings in the bottom decile by 28 percent, and reduces the risk of no earnings by 36 percent.

A large portion of the benefits from treatment is due to a reduced risk of disability. Access to treatment eliminates 59 percent of the risk of disability that people with BD face compared with the population and 57 percent of the risk they face compared with their siblings. Using the *number* of diagnoses as a measure of intensity of the disorder, we find that the benefits from treatment are largest for people with a more severe form of BD.

Existing studies document a connection between mental health and socioeconomic status (Aizer and Currie 2014; Adhvaryu et al. 2019).[4] In the United States, differences in insurance benefits are a major driver of differences in access to mental health treatment. In Denmark, universal health insurance eliminates this mechanism, allowing us to examine whether socioeconomic status shapes the career effects of mental health beyond the differences due to insurance. Our data show that the impact of parental wealth on the career effects of mental health is modest. People with BD and parental wealth in the top quartile of the distribution earn 5 percent more than people in the bottom quartiles. Importantly, however, the benefits from treatment are much stronger for people whose parents have little wealth. For people in the bottom half of the parental wealth distribution, access to treatment

[4] People with lower levels of income or wealth are more likely to experience stress (Cohen et al. 2006; Neugebauer et al. 1999; McClellan et al. 2006).

eliminates 31 percent of the earnings penalty from BD; this effect is almost three times larger than that for people in the top half of the parental wealth distribution.

Next, we estimate heterogeneous effects of access to treatment across people with more or less severe expressions of BD. In these analyses we compare outcomes for people who are diagnosed with BD just once with outcomes for people who receive two or more separate diagnoses. This analysis shows that people with more severe forms of a mental health disorder face larger earnings penalties and benefit more from treatment.

A final section presents a series of robustness checks. First, we investigate whether secular trends, such as changes in available treatments, access to health care, and stigmatization confound our estimates of the effects of lithium on people with BD. Using depression and schizophrenia as an additional control group in a triple-difference framework, we obtain estimates that confirm our main results: Access to treatment for people with BD closes almost two-thirds of a 50 percent baseline earnings penalty. Second, we re-estimate the main specifications for alternative definitions of BD, based on prescription data. These estimates confirm the main results.

Our findings contribute to a growing literature on the effects of mental health on socio-economic outcomes, and on careers and earnings more specifically. In one of the first economic studies of mental health, for a sample of 4,000 twins, Bartel and Taubman (1986) document a negative correlation between psychosis or neurosis and earnings.[5] Goodman et al. (2011) use data from the National Child Development Study and show that children with psychological problems at ages 7, 11, or 16 had 28 percent lower family incomes by age 50. Recent studies have attempted to quantify the causal effects of mental health by exploiting differences in the use of medications. Shapiro (2020), for example, shows that increased spending on advertisement of anti-depressants in the US leads to more prescriptions and fewer lost days of work. Butikofer et al. (2019) document that the introduction of black box warnings for SSRIs in 2004 decreased antidepressant prescriptions and reduced labor supply. Exploiting quasi-random separations of individuals from their physicians, Laird and Nielsen (2017), however, find that having a physician who is prone to prescribe mental health drugs has no discernable labor market effects.[6]

[5] Evidence from twin studies may, however, not be representative of correlations in the population. Bhalotra and Clarke (2019) for instance, have found that, in population data for 17 million birth in 72 countries, twins have healthier mothers and a better prenatal environment (Bhalotra and Clarke 2019).

[6] Fletcher (2010) finds that relative to their siblings, teens with a one standard deviation increase in depressive symptoms are 25-30% more likely to drop out of school. Currie et al. (2010) examine Canadian registry data and find that children with ADHD and conduct disorders in childhood were 30 to 100 percent more likely to receive welfare payments after age 18. Smith and Smith (2010) use retrospective survey data from the U.S.

We contribute to this research in two main ways. First, we compare the labor market penalties associated with different types of mental health conditions. Second, we use a major change in treatment to investigate the causal effects of changes in access to treatment. We perform these analyses for BD, which has been the subject of much research in psychology (e.g., Jamison 1996; Kyaga 2011 and 2013) but received little attention from economists, despite its prevalence and severity.

Our estimates on the effects of lithium on earnings and disability relate to the literature on the effects of health treatments, and specifically access to medication, on labor market outcomes (see Currie and Madrian, 1999 for a review). In this literature, our paper is most closely related to Garthwaite (2012), which estimates the labor supply effects of Cox-2 inhibitors, a class of pharmaceuticals used for the treatment of chronic pain. Garthwaite (2012) shows that the removal of a branded Cox-2 inhibitor (Vioxx) in 2005 was associated with a 0.35 percentage point decline in overall labor force participation and $19 billion in lost wages in the United States. Using Norwegian administrative data, Bütikofer and Skira (2018) show that the withdrawal of Vioxx increased sick days for individuals with joint pain by 12-16 percent and raised their probability of receiving disability benefits by 6 to 15 percent. Our research complements these studies by examining the effects of access to medications that improve mental health.

In addition, our findings provide new evidence on the differential impact of mental health conditions and their treatment across the socio-economic spectrum. Building on existing evidence on the effects of economic status on mental health (Haushofer and Shapiro 2016; Ridley, Rao, Schilbach, and Patel 2020), on the intergenerational persistence of mental health outcomes (Aizer and Currie 2014, Persson and Rossin-Slater 2017, Van der Bergh et al. 2015), and on the effects of parents' earnings on children's mental health (Adhvaryu et al. 2019), we demonstrate that access to treatment can be a powerful tool to reduce inequality in labor market outcomes due differences in mental health.

I. Background on Mental Health Disorders

This section summarizes relevant research from medicine and psychology on the three disorders that are the focus of this paper – depression, bipolar disorder (BD), and schizophrenia.

Panel Study of Income Dynamics and show that in addition to lower educational attainment, people who had experienced mental health disorders before age 16 had family incomes 20 percent less than their own siblings.

Major depressive disorder or, *depression* for short, is a common and serious mental disorder that negatively affects how people feel, think, or act. Symptoms include sadness, a loss of interest in activities, trouble sleeping, a loss of energy, difficulties concentrating or making decisions, and thoughts of death or suicide. For a diagnosis of depression, symptoms must last at least two weeks. In our data, 3.6 percent of people receive at least one diagnosis of depression between 1995 and 2015.[7]

Schizophrenia is a chronic brain disorder whose symptoms include hallucinations (such as hearing voices, paranoid delusions and exaggerated or distorted perception), a decrease in the ability to initiate plans, speak, or express emotions, as well as trouble with thinking, concentration, and memory. Although the precise causes of schizophrenia are unknown, researchers have identified genetic and environmental factors, as well as life events that contribute to the disorder. Approximately 1.5 percent of the Danish population is diagnosed with this disorder.

Bipolar I Disorder (thereafter *BD*) is a brain disorder that causes extreme shifts in mood, energy, and activity levels, limiting a person's ability to carry out day-to-day tasks. The American Psychiatric Association (2000) defines BD by at least one lifetime manic or mixed episode, which must last at least one week or require hospitalization. Symptoms of mania include irritability, euphoria, a decreased need for sleep, grandiose ideas, impulsivity, increased racing thoughts, flight of ideas, increased activity, and distractibility. Mixed episodes combine symptoms of mania with and simultaneous symptoms of depression for at least one week. A person can have BD without depression, though many people with BD also experience symptoms of depression. Compared with depression, BD is less prevalent but more persistent and impairing (Kessler, Merinkas, and Wang 2007). Suicide risks for people with BD are extremely high (Jamison 2000; Angst et al. 2005; Goldberg et al. 2005)[8] According to the WHO, BD affects about 60 million people worldwide and most of them remain untreated.[9] In our data, 0.8 percent of people receive at least one diagnosis of BD.

Although the precise causes of BD are unknown, existing evidence points towards differences in the brain systems that regulate emotions and a dysregulation in the use of dopamine, a neurotransmitter that helps regulate reward-motivating behavior (Miklowitz and

[7] In the NCS-R survey of 9,282 people in the continental United States, 16.2 percent had been affected by depression at least once and 6.6 percent within 12 months before the survey (Kessler et al. 2003b).
[8] Rates of attempted suicide for people with BD range from one in three (Goldberg et al. 2005) to one in two (Jamison 2000). Angst et al. (2005) documents that 11 percent of 406 people with BD admitted to a Psychiatric University Hospital in Zurich ultimately completed suicide.
[9] World Health Organization Fact Sheet, April 2017 (http://www.who.int/mediacentre/factsheets/fs396/en/).

Johnson 2006, p. 199).[10] Imaging studies of the brain have found that people with BD and their family members have less grey matter and lower levels of activity in the pre-frontal cortex, an area of the brain that is typically associated with moderating "good" and "bad" behaviors and with other types of executive functions (Drevets et al. 1997, Krueger 2006, and Appendix Figure 1).[11]

The median age of onset for BD lies around 18 years (Kessler, Merikangas and Wang 2007, p. 143). We exploit this fact to compare people with differential access to treatment when they entered their twenties. Alternative specifications estimate age-specific effects.

A. A New Treatment for BD: Lithium

In 1976 Denmark's equivalent to the Federal Drug Administration, the *Lægemiddelstyrelsen*, approved the mood-stabilizer lithium as a "maintenance" treatment for BD (Bech et al. 1976).[12] As a treatment for BD, lithium is typically given in stages. The first is the acute treatment of an episode that has already developed. The second is maintenance treatment to delay and moderate future episodes and to reduce symptoms between episodes.

Complementary treatments in the form of psychosocial interventions ("therapy") and other drug treatments also improved substantially after 1976.[13] Interest in the application of cognitive behavioral therapy (CBT) began in the early 1980s (Cochran 1984), after the introduction of lithium.[14] Among all treatments, however, lithium has the strongest scientific record of controlling mania and preventing recurrences. In clinical studies, lithium consumption is associated a significant reduction in the risk of hospitalization and with a 7-fold reduction in suicide rates for people with BD (Tondo et al 1999).

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[10] Drugs that increase dopamine-related activity in the brain, such as amphetamine, have been found to increase mood, energy and talkativeness in people without BD (Willner 1995). People with BD show pronounced behavioral responses to amphetamine (Anand et al. 2000).

[11] Drevets et al (1997) analyze brain activity in a sample of 20 family members of people with BD and unipolar depression and localize an area of abnormally decreased activity in the pre-frontal cortex. Krueger et al. (2006, N=18) find that siblings of people with BD are more likely to have physical markers of BD, even if they are not diagnosed with BD. Naranjo et al. (2001) link mood disorders (such as BD) to regions of the brain that are believed to be involved in rewarding motivation (including the *nucleus accumbens*, the ventral tegmentum, and the striatum).

[12] *Acta Psychiatrica Scandinavia* 1976, Price and Heninger 1994, McInnis et al. 2014. The US FDA had approved lithium two years earlier, in January 1974.

[13] Administered without a mood stabilizer, standard antidepressants can induce mania and accelerate mood cycling in 20-40 percent of patients (Altshuler et al 1995, Goldberg and Whiteside 2002).

[14] Recent approaches in CBT focus on psychoeducation and cognitive restructuring to challenge overly negative or positive cognitions. By 2005, the American FDA had approved four additional mood stabilizers for the treatment of BD: the anticonvulsant divalproex sodium (also known as valproate or valpro), the antipsychotic chloprozaine, the atypical antipschotic olanzapine, and the anticonvulsant lamotrigine.

Despite its effectiveness, many people with BD are reluctant to take it due to side effects that include tremors, weight gain, feelings of sedation, stomach irritations, thirst, and kidney problems (Miklowitz and Johnson 2006).[15] People also report stopping treatment because they miss "periods of exuberance or creativity" (Goodwin and Jamison 2007; Jamison and Akiskal 1983, Aasgard and Vestergaard 1990).

II. DATA

Our data cover mental health diagnoses, earnings, and disability payments for the population of Denmark, including 2,524,325 people in birth cohorts from 1946 to 1975.[16] Among these 2.5 million people, 80,361 have been diagnosed with depression (3.2 percent Table 1), 36,736 with schizophrenia (1.5 percent), and 18,729 people with BD (BD, 0.7 percent).[17]

A. Individual-Level Registry Data on Diagnoses

Individual-level data on diagnoses come from the Central Psychiatric Register (*Landspatientregistret for Psykiatri Diagnoser*), which includes all mental health diagnoses in Denmark between January 1, 1995 and December 31, 2015. The register uses the World Health Organization (WHO)'s International Statistical Classification of Diseases and Related Health Problems (ICD-10) to classify mental health disorders.[18] Appendix Table A3 includes a detailed description of this classification.

We construct indicators for people with at least one diagnosis of the three most frequent mental health disorders: depression, bipolar disorder, and schizophrenia.[19]

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[15] Between 25 and 50 percent of patients experience hand tremors. Abnormalities in the thyroid and parathyroid affect 10 to 20 percent (Price and Heninger 1994, McInnis et al. 2014).

[16] These data are administered by Statistics Denmark. Appendix Table A1 describes the individual registries.

[17] These shares are comparable to US estimates based on the National Comorbidity Survey (NCS, Kessler et al. 2005) for BD (1 percent) but substantially lower than US estimates for depression (16.6 percent).

[18] See http://apps.who.int/classifications/icd10/browse/2016/en#/F30-F39. The National Institute of Mental Health explains that bipolar I disorder is "defined by manic episodes that last at least 7 days, or by manic symptoms that are so severe that the person needs immediate hospital care. Usually depressive episodes occur as well, typically lasting at least 2 weeks. Episodes of depression with mixed features (having depression and manic symptoms at the same time) are also possible." US Department of Health and Human Services, National Institute of Mental Health. *First-Generation Versus Second-Generation Antipsychotics in Adults: Comparative Effectiveness*. (2017). The American Psychiatric Association (5th edition) defines a manic episode as a "distinct period of abnormally and persistently elevated, expansive, or irritable mood and abnormally and persistently increased activity or energy, lasting at least 1 week and present most of the day, nearly every day (or any duration if hospitalization is necessary)."

[19] These variables are not mutually exclusive: each individual can be diagnosed with different disorders over his or her lifetime. Approximately 0.4 percent of the population receives diagnoses for more than one type of disorder between 1995 and 2015. Appendix Table A5 tabulates comorbidities by disorder.

- *Depression* is an indicator for people who have received at least one diagnosis of major depressive disorder (diagnosis code ICD-10: F32): "Mild, moderate, severe or recurrent depressive episodes, the patient suffers from lowering of mood, reduction of energy, and decrease in activity."
- *BD* is an indicator for people who have been diagnosed at least once with BD (ICD-10: F30):"A disorder characterized by […] some occasions of an elevation of mood and increased energy and activity (hypomania or mania) and on others of a lowering of mood and decreased energy and activity (depression)" or mania (ICD-10: F30): "A disorder […] which varies from carefree joviality to almost uncontrollable excitement, […] accompanied by increased energy, resulting in overactivity, pressure of speech, and a decreased need for sleep."
- *Schizophrenia* identifies is an indicator for having at least one diagnosis with code (ICD-10: F20-F29): "schizophrenia, schizotypal, delusional disorders and a larger group of acute and transient psychotic disorders."

Reassuringly, the share of people with BD is stable across cohorts, with 0.9 percent for the 1946, 1954, and 1960 cohorts and 0.8 for the 1975 cohort, respectively (Appendix Figure A3). Rates of diagnosis for schizophrenia are stable around 1.4 percent, while rates of diagnosis for depression increase over time, from 2.8 percent for birth cohorts until 1956 to 3.3 for younger cohorts (Appendix Figure A5).

B. Lithium

As an additional way to identify people with BD, we modify our indicator for people with BD to include those with a diagnosis, as well as those who have been prescribed lithium at least once. To construct these measures, we combine data on medical diagnoses with information on drug prescriptions from the Prescription Register (*Lægemiddeldatabasen)*, which includes all prescriptions from 1995 to 2015. On average, 0.6 percent of all people have at least one lithium prescription during our time period, including 55 percent of people with at least one diagnosis of BD.

C. Earnings and Disability

To calculate a person's *earnings,* we add income from wages and self-employment (Appendix Table A4). We convert earnings from Danish Kroner (DKK) to in 2015 dollars

using the Danish CPI and the 2015 exchange rate. Individuals with positive earnings earn $44,705 on average, with a standard deviation of $42,421 (Appendix Table A4).

A separate variable measures *disability* receipt (*førtidspension*). People with disabilities apply for these benefits with their municipal government, which evaluates their ability to work (*ressource-forløb*), and assigns payments based on severity of the disability and on family status. People who receive disability can work part-time and earn up to $46,720; if they earn more they forfeit disability pay for that calendar year.[20] Eleven percent of people with depression, BD, or schizophrenia receive disability pay in an average year, including 5,051 people with BD (28 percent of all people with BD), 13,871 with depression (17 percent), and 17,243 with schizophrenia (47 percent, Table 1).[21]

D. Family Identifiers

To control for unobservable factors that vary across families, we link each person to their siblings using their mother's or father's social security number as a family identifier. Family identifiers are available for 1,788,166 people (71 percent of the population). Seventy-five percent of all people have one or more siblings. Among people with BD, the share of people with siblings is slightly larger (82 percent).

E. Parental Wealth

Information on parental wealth is available for people whose mother or father reported assets for at least for one year between 1980 and 2015. We set assets to zero for people whose parents are listed but do not have any financial assets.[22] To define a person's position in the distribution of parental wealth, we calculate the percentile of parental assets for each year (from 1980 to 2015) and assign each person to their parents' median percentile across all years.

III. Mental Health and Labor Market Outcomes

[20] After a reform on March 1, 2013 restricted disability pay to Danish citizens below 40, the number of new recipients declined from 14,450 in 2012 to 5,684 in 2014. Robustness checks exclude years 2013-2015.
[21] A total of 2,178,704 person-year observations (6 percent) have disability pay and positive earnings (with an average of $332 per year). This total includes 76,594 people with BD (89 percent of all people with BD on disability), who have earnings of $286 per year on average. Another 263,953 people on disability with depression have positive earnings (90 percent of all people with BD on disability, with average earnings of $399 per year), and 213,941 people with schizophrenia on disability have positive earnings (88 percent of people with schizophrenia on disability, average earnings $139 per year).
[22] Assets are reported by banks and other financial institutions and not by the individuals themselves. All results are robust to excluding individuals without information on parental assets from the analyses.

We start our analysis examining earnings and other career outcomes for people with three major mental health disorders: depression, bipolar disorder (BD) and schizophrenia.

A. Average Earnings Penalties

First, we investigate whether mental health disorders are associated with lower earnings. We estimate the following model:

$$(1)\ \ln(earnings_{it}) = \beta_1\, Depression_i + \beta_2\, BD_i + \beta_3\, Schizophrenia_i + \theta_{c(i)} + \tau_t + \varepsilon_{it}$$

where the dependent variable $\log(earnings_{it})$ is the natural logarithm of earnings of individual *i,* born in cohort *c,* in the calendar year *t*. The indicator variable *Depression* equals one for people who have been diagnosed with depression at least once. Indicators for *BD* and *Schizophrenia* are defined accordingly. Year fixed effects control for changes in aggregate rates of employment and other economic factors that may influence earnings and employment over time. Cohort fixed effects θ_c control for unobservable factors that vary across birth cohorts and affect the earnings of healthy and sick people in the same way (for example the state of the economy).

OLS estimates show vast earnings penalties for all three mental health disorders. People with depression earn 36 percent less (significant at 1 percent). People with BD earn 38 percent less (with an estimate of -0.478, Table 2, column 1, significant at 1 percent), and people with schizophrenia earn 74 percent less (significant at 1 percent).

B. Controlling for Family Background

Both earnings and the incidence of mental health conditions may vary across families. Medical research has shown that mental health disorders can be triggered by abuse, neglect, the death of a parent, or other family-related stress (Mortensen et al. 2003; Persson and Rossin-Slater 2017). In addition, a person's family background and socioeconomic status can influence the incidence of the condition and the odds of diagnosis and treatment (Adhvaryu et al. 2019).[23] If families with lower earnings have a higher rate of mental health disorders, a simple comparison of people with BD with the population may overstate the earnings penalties from mental health disorders. To address this issue, we re-estimate equation (1)

[23] Low income has been associated with an increased risk for the manic and hypomanic symptoms of BD (Bauer et al. 2011, Sareen et al. 2011, Hakulinen et al. 2019). Furthermore, access to specialized mental health care has been shown to depend, at least in part, on a person's socio-economic status (Hollingsworth 1992, Alegría, Bijil, and Lin 2000, Dohrenwend et al. 1992).

with controls for family fixed effects. This specification compares people with mental health conditions with their healthy siblings.

Including controls for a person's family background leaves the estimates substantially unchanged. Only the estimated earnings penalty associated with depression is significantly smaller, at 31 percent, when calculated relative to siblings (Table 2, column 2), compared with 35 percent when calculated relative to the population. These results are particularly striking considering that siblings may be affected by mental health disorders either indirectly (if parents focus time and attention on children with mental health disorders) or directly (if siblings are affected by undiagnosed and untreated forms of a disorder, e.g. Kruger 2006).[24] Our results suggest that these effects are small relative to the earnings penalties for people with the disorder.[25]

C. Event Studies Surrounding the Date of First Diagnosis

What is the timing of the changes in earnings associated with mental health conditions? If mental health affects earnings, earnings may begin to decline before a diagnosis, when people first experience symptoms but before they get diagnosed.[26] Furthermore, it may take some time for treatments to take effect. To investigate the timing of these changes, we estimate event stud of log earnings in the 10 years preceding and following a diagnosis:

$$(2)\ \ln(earnings_{it}) = \sum_{k=-10}^{10} \delta_k C_i \mathbf{1}(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_{c(i)} + \tau_t + \varepsilon_{it}$$

where C_i is an indicator for *Depression, BD*, *or Schizophrenia* and $Y(C)_i$ denotes the first year in which person i is diagnosed with condition C_i. Normalizing δ_{-2} to zero, δ_k captures changes in earnings k years relative to two years preceding the diagnosis.

OLS estimates of δ_k show that earnings decline dramatically and persistently after the diagnosis. Two years after the diagnosis, people with depression earn 29 percent less compared with 2 years before the diagnosis (Figure 1, significant at 1 percent). People with BD earn 34 percent less 2 years after the diagnosis, and people with schizophrenia earn 49

[24] Siblings may also be affected by "courtesy stigma," distancing and rejecting family members and other people who are associated with a devalued group (Hinshaw and Stier 2008, p. 372).
[25] We can identify siblings for 71 percent of the population. Restricting the sample for the baseline estimate to people with known siblings yields results (Appendix Table A6) that are similar to the baseline estimates.
[26] Calabrese et al (1996), for example, find that roughly one in five people who enter outpatient treatment for BD have experienced four or more periods within the prior year.

percent less. These declines are long-lasting: Ten years after the diagnosis, people with depression still earn 21 percent less, people with BD earn 34 percent less, and people with schizophrenia earn 57 percent less.

Notably, earnings begin to decline for people with all three disorders *before* they are diagnosed. Ten years prior to the diagnosis, people with depression earn 9 percent more than they do two years before it (significant at 1 percent), which implies that their earnings decline by 9 percent over this time period. Earnings of people with BD decline by 23 percent, and earnings of people with schizophrenia decline by 31 percent.

D. Differences in the Probability of Extremely High or Low Earnings

In addition to influencing average earnings, mental health disorders may determine a person's place in the *distribution* of earnings. Medical studies have found that people with BD have an elevated tolerance for risk, which might make them more likely to reach the top of the distribution. Mason et al. (2014), for instance, show that brain circuits involved in pursuing rewarding experiences (the *nucleus accumbens)* are more strongly activated in people with BD, guiding them towards riskier gambles.[27] Noting that people with BD share a high tolerance for risk and other personality traits common among entrepreneurs, Cooper et al. (1999) have called BD a CEO's disease.[28] Alternatively, people with mental health disorders may earn *less* if they are more likely to pursue creative professions. Jamison (1993) for example, documents that exceptionally creative people, such as Vincent Van Gogh, Ernest Hemingway, Virginia Woolf, and Robert Schumann exhibited traits associated with BD, suggesting a potential link between creativity and BD (Jamison 1993).

Our data indicate that people with mental health disorders are much more likely to fall into the bottom quantiles. People with BD are 12 percentage points (120 percent) more likely to be in the bottom 10 percent of earnings compared with the population (Table 3, column 7, significant at 1 percent) and 110 percent more likely compared with their siblings (column 8, significant at 1 percent). Estimates are similar for depression (with a 99 percent

[27] By comparison, the prefrontal cortex is more strongly activated in control subjects, guiding them towards safe gambles. Experimental evidence from a balloon analogue risk task (BART) analysis suggests that people with BD take the same levels of risks as other people, even though they score higher on self-reported tests of impulsiveness (Reddy et al 2011, 68 people with BD, 38 with schizophrenia, and 35 without either disorder).
[28] Successful entrepreneurs have been shown to overestimate their firm's probability of survival (Cooper, Woo, and Dunkelberg 1988), employment expansion, and sales growth (Landier and Thesmar 2008). Incorporated entrepreneurs are also more likely to have engaged in risky and illicit behavior in their youth (Levine and Rubinstein 2017)..Using a balloon analogue risk task (BART), Reddy et al. (2014) show that people with BD display excessive risk tolerance and impulsive behavior. Swann et al. (2004) find that impulsivity, the tendency to pursue rewards without considering negative consequences, is elevated in people with mania.

higher probability compared to the population and a 86 percent higher probability compared with their siblings, significant at 1 percent) and much larger for schizophrenia (a 319 percent higher probability compared to the population and a 309 percent higher probability compared with their siblings, significant at 1 percent).

Population data also show that people with mental health disorders are substantially less likely to reach the top quantiles of earnings. People with depression are 5.2 percent less likely compared with the population (Table 3, column 1, significant at 1 percent) and 4.1 percent less likely compared with their siblings (column 2, significant at 1 percent). Similarly, people with BD are 3 percentage points (3 percent) less likely to reach the top deciles of earnings compared with the population and 3.3 percentage points less likely than their siblings. People with schizophrenia are 5.8 and 4.4 times less likely (Table 3, columns 1 and 2). The same pattern holds for the top quartile (rather than the top decile) of earnings.

E. Differences in the Probability of No Earnings

While our analyses have focused on people with positive earnings, yet people with mental health disorders may also face an elevated risk of having no earnings at all. Examining these differences in the Danish population data, we find that people with mental health disorders are substantially more likely to earn nothing at all. In the population, 13.4 percent of people have zero earnings in a given year. For people with depression, this share is 15.3 percentage points higher (Table 2, column 3, significant at 1 percent). Compared with a 13.4 percent population share of people with zero earnings, this implies that depression is associated with a 1.1-fold increase in the risk of earning zero. People with BD are 15 percentage points more likely to have zero earnings, implying a 1.1-fold higher probability. People with schizophrenia are 45 percentage points more likely to have zero earnings, implying a 3.36 times higher probability (Table 2, column 3, significant at 1 percent). Controlling for family fixed effects leaves these estimates substantially unchanged (Table 2, column 4, significant at 1 percent).

Event study estimates show that a person's risk of zero earnings increases dramatically after a mental health diagnosis. Two years after the diagnosis, people with depression, BD, and schizophrenia have a 1.2-times higher chance of no earnings compared with 2 years before the diagnosis (Figure 2, significant at 1 percent). For people with depression, the risk of zero earnings declines slightly over time. For people with BD and schizophrenia, however, the risk of zero earnings remains high.

Importantly, event study estimates also show that, for people who will be diagnosed eventually, the risk of zero earnings begins to increase before the diagnosis. Ten years before the diagnosis, people with depression have an 18 percent lower risk of zero earnings compared with two years before the diagnosis (significant at 1 percent). For people with BD, the risk of no earnings increases by 61 percent between 10 and 2 years before the diagnosis, and for people with schizophrenia the risk of zero earnings increases by 87 percent.

F. Mechanisms: Unemployment

A higher chance of having no earnings suggests that people with mental health conditions might stay out of the labor force for extended periods of time, either by choice or because they become unemployed. In self-reported data from the World Health Organization Health and Work Performance Questionnaire (HPQ) BD and depression are associated with 65.5 and 27.2 excess lost workdays per worker, respectively (Kessler et al. 2003). Projecting these estimates to the US labor force suggests that 225.0 million workdays are lost to depression each year, and 96.2 million are lost to BD.

One possible reason for the lower earnings for people with mental health conditions is a "scarring effect" of unemployment (Jacobson, LaLonde, and Sullivan 1993; Davis and von Wachter 2012). To investigate the role of this scarring effect vis à vis the role of mental health symptoms, we estimate event studies of earnings and the probability of no earnings in which we compare the population with three groups of people with a mental health condition: (a) those experiencing an unemployment spell in the two years preceding or following a mental health diagnosis, and receiving only one diagnosis of a given mental health condition; (b) those not experiencing any unemployment and receiving only one diagnosis; and (c) those not experiencing any unemployment and receiving more than one diagnosis. Taking the number of diagnoses as a proxy for the intensity of the symptoms of a given condition, comparing (a) and (b) should isolate the scarring effect of unemployment on people with a relatively milder form of the condition, while comparing (b) and (c) should isolate the effects of the symptoms.

Estimates of the event studies of log earnings for these groups are shown in Figure 3. People who receive only one diagnosis and experience an unemployment spell close to that diagnosis see their earnings fall by 42 percent in the year of the diagnosis, relative to two years before it. They then start to recover, returning to their pre-diagnosis levels six years after the diagnosis. People who also receive one diagnosis but do not become unemployed have a similar earnings trajectory, with earnings falling by 32 percent two years after a

diagnosis and then returning to pre-diagnosis levels ten years after it. People who receive more than one diagnosis and do not become unemployed, however, see their earnings fall significantly more, by 56 percent two years after the first diagnosis. For these people, earnings also remain at this lower level in the ten years following the first diagnosis. The patterns are similar if we use the probability of zero earnings as the dependent variable (Appendix Figure A6). We interpret these findings as suggestive evidence that the lower earnings for people with mental health conditions are due to symptoms and the inability to work, rather than to a scarring effect of unemployment.

G. Mechanisms: Disability

The inability to work might increase the risk of disability for people with mental health conditions. Estimates by the World Health Organization (2011) suggest that mental illness is the leading cause of lost disability-adjusted life years (DALYs) worldwide, accounting for more than one third of years lost due to non-communicable diseases. Examining depression, Shapiro (2019) finds that people who take drugs for depression are less likely to miss days at work.[29] Imberman and Duggan (2009) show that mental illness accounts for over half of the rise in disability receipt after 1990 for men.

To systematically investigate the risk of disability, we estimate equation (1), changing the outcome variable to an indicator for people who receive disability pay. OLS estimates indicate that people with BD are 2.7 times more likely to receive disability pay compared with the population (12.8 percentage points compared with a population average of 5.9 percent, Table 2, column 5, significant at 1 percent). People with schizophrenia have the highest disability risk; they are 7 times more likely than the population to receive disability pay (41 percentage points, Table 2, column 5, significant at 1 percent). People with depression face the lowest risk of disability; they are 1.2 times more likely to receive disability pay compared with the population (7.4 percentage points compared with a population average of 5.9 percent). All results are robust to controlling for a person's family background through family fixed effects (Table 2, column 6).

[29] A related strand of literature has examined the role of physical health on labor market participation and disability. García-Gómez, Jones, and Rice (2010) shows that negative shocks to general health significantly affect entry into and exit from the labor market. García-Gómez (2011) shows that individuals who incur a health shock are more likely to leave employment and enter disability. García-Gómez, van Kippersluis, O'Donnell, and van Doorslaer (2013) estimate the effects of sudden illness on employment and income in the long run. Halla and Zweimuller (2013) shows that accidents increase the risks of unemployment and disability.

Event-study estimates show a large and persistent increase in the probability of disability after the diagnosis. Ten years after a diagnosis, a person with depression is 4.2 times more likely to receive disability pay compared with the year prior to the diagnosis (Figure 4). A person with BD is 5.8 times more likely, and a person with schizophrenia is 8.5 times more likely to receive disability pay. Similar to other types of career outcomes, the risk of disability increases before the diagnosis. Ten years before the diagnosis, people with depression face a 63 percent lower risk of disability pay compared with 2 years before the diagnosis (significant at 1 percent), which implies that the risk of disability increases by 63 percent over this time period. For people with BD the risk of disability increases by 101 percent, and for people with schizophrenia it increases by 140 percent.

IV. Effects of Access to Treatment

To investigate the career effects of changes in mental health and, more specifically, access to treatment, we exploit the approval of lithium as a maintenance treatment for BD. Baseline estimates compare changes in career outcomes for people with BD with and without access to treatment, relative to the population or their siblings. Event studies investigate the timing of changes in career outcomes relative to the year of diagnosis for people with and without access to treatment.

A. Access to Treatment Greatly Increases Average Earnings

Baseline OLS estimates compare differences in earnings between the population and people with BD who have access to treatment when they turn 20 with the same differences for people with BD who do not have access to treatment at age 20:

$$(3) \qquad ln(earnings_{it}) = \alpha\, BD_i + \beta\, BD_i \times post_{c(i)} + \theta_{c(i)} + \tau_t + \varepsilon_{it}$$

where the dependent variable $ln(earnings_{it})$ represents the natural logarithm of earnings for individual i in year t. The variable $post_c$ equals 1 for cohorts born after 1956, who had access to lithium treatment when they turned 20, the typical age of onset for BD (Kessler et al. 2005), and the population. Baseline specifications estimate differences in earnings for individuals with positive earnings; separate analysis below examine the risk of zero earnings.

Under the identifying assumption that differences in earnings for people with and without BD would have been comparable for people born before and after 1956, the coefficient β on the interaction $BD_i \times post_c$ estimates the effect of access to treatment. Cohort

fixed effects θ_c control for factors that may influence outcomes differentially for people in different cohorts.

OLS estimates indicate that access to treatment eliminates one third of the earnings penalty from BD. An estimate of -0.560 for *BD* implies that people with BD who did not have access to treatment earned 42.9 percent less than the population (Table 4, column 1, significant at 1 percent). An estimate of 0.112 for *BD x post* (significant at 1 percent) implies that people with BD who did have access to treatment earned 12 percent more than people with the same disorder but without access to treatment. Thus, treatment closes 28 percent of the earnings penalty associated with BD.

Controlling for family characteristics increases the estimated benefits from treatment. Compared with their siblings, people with BD earn 42 percent less, and access to treatment closes 64 percent of this gap (with an estimate of 0.240 for *BD x post* Table 4, column 2, significant at 1 percent).[30]

In interpreting these results, it is important to keep in mind that diagnoses are only observable starting in 1995, so that we may assign people who were diagnosed before 1995, but not after, to the control group. This would lead us to underestimate the true effects of mental health disorders and treatments. Moreover, we cannot observe people in older cohorts with BD who have died before 1995. Since BD raises the risk of death, this type of selection attenuates the estimated benefits of improvements in access to treatment over time.

B. Event Study Estimates

To investigate the timing of changes in earnings we estimate event-studies equivalent to equation (2), separately for cohorts born with and without access to lithium. In the years before and immediately after the diagnosis, the earnings of people with and without access to treatment are comparable and follow a similar trend. Ten years before a diagnosis, people with access to treatment earn 26 percent more compared with two years before the diagnosis, and people without access earn 24 percent more (Figure 5). In the year of the diagnosis, earnings decline by an additional 34 percent for both groups.

After the diagnosis, the earnings trajectories of people with and without access to treatment diverge. Without access to treatment, earnings of people with BD fall by an additional 16 percent in the year after the diagnosis relative to the year before the diagnosis. Ten years after the diagnosis, people with BD earn 43 percent less compared with the year

[30] See Appendix Table A7 for estimates without family fixed effects for the sample of people with siblings.

before the diagnosis. With access to treatment, earnings of people with BD begin to recover four years after a diagnosis. Ten years later people with BD earn just 29 percent less compared with diagnosis. Thus, access to treatment closes nearly one third of the decline in earnings associated with BD.

C. Access to Treatment Improves a Person's Position in the Distribution of Earnings

Next, we investigate the effects of access to treatment on a person's position in the distribution of earnings. Our estimates, shown in Table 5, indicate that access to treatment does not affect the probability that people with BD have earnings in the top decile of the distribution, relative to the population (with estimates of *BD* x *post* equal to -0.004, Table 5, column 1). Access to treatment does, however, increase the probability of earnings in the top decile by 21 percent relative to siblings (with estimates of *BD* x *post* equal to 0.021, Table 5, column 1, significant at 1 percent). Treatment reduces the risk of earnings in the bottom decile for a person with BD by 17 percent compared with the population (1.7 percentage points, Table 5, column 5, significant at 1 percent) and 42 percent compared with their siblings (Table 5, column 6, significant at 1 percent).

Taken together, these estimates indicate that access to treatment greatly reduces the risks of low earnings for people with BD and slightly increases their chance of high earnings.

D. Access to Treatment Greatly Reduces the Risk of No Earnings

Treatment may allow people with BD to stay in the labor force and reduce their risks of no earnings. To investigate this, we estimate equation (3) with an indicator for no earnings as the dependent variable.

OLS estimates imply that people with BD are 1.5 times more likely than the population person to have no earnings at all (19.6 percentage points compared with a population share of 0.134, Table 6, column 3, significant at 1 percent). Treatment reduces a person's risk of no earnings by 33 percent. With access to treatment, people with BD are only 98 percent more likely than the population to have no earnings (-6.5 percentage points, Table 6, column 1, significant at 1 percent). Estimates are robust to controlling for family fixed effects. Compared with their siblings, people with BD are 19.7 percentage points more likely to have no earnings; access to treatment eliminates 36 percent of this risk (-7.1 percentage points (column 2, significant at 1 percent).

Event studies around the time of a BD diagnosis show that the probability of no earnings is on similar trends for people with and without access to treatment in the years

before a diagnosis. People with access to treatment recover some of their earnings after three years after the diagnosis, while those without access continue to face a high risk of no earnings (Figure 6). Without access to treatment, people with BD face a 1.5- times higher risk of zero earnings 10 years after the diagnosis compared with the year before they were diagnosed. With treatment, people with BD face just a 1-time higher risk of zero earnings every year between 2 and 10 years after the diagnosis.

E. Access to Treatment Eliminates more than Half the Risk of Disability

BD is the sixth leading cause of disability worldwide (Murray and Lopez 1996). In a survey of 253 people with BD, Suppes et al. (2001) found that 57 percent of respondents were unable to work, and another 9 percent held part-time jobs. Access to treatment may allow more people to work. Examining nonsteroidal anti-inflammatory drugs (NSAIDs) Garthwaite (2012), shows that the removal of Vioxx (a branded Cox-2 inhibitor) from the market was associated with a 0.35 percentage point decline in overall labor force participation. If treatments for mental health disorders are similarly effective, they may reduce the risk of disability.

OLS estimates in Table 6 indicate that access to treatment reduces the risk of disability for people with BD by more than half. Estimates of equation (1) with an indicator for disability as an outcome variable show that people with BD are almost 4 times more likely receive disability pay compared with the population (21.8 percentage points, Table 11, column 3, significant at 1 percent, compared with a population average of 5.9 percent). Access to treatment eliminates 59 percent of this excess risk (with an estimate of *BD x post* equal to 0.128, Table 6, column 3, significant at 1 percent).

These estimates are robust to controlling for a person's family background. Compared with their siblings, people with BD are nearly 5 times more likely to receive disability pay (21.4 percentage points, Table 6, column 4, significant at 1 percent, compared with a population average of 4.6 percent for people with one or more siblings). Access to treatment closes 57 percent of this gap (with an estimate of 0.122 for *BD x post* compared with 0.214 for *BD*, Table 6, column 4, significant at 1 percent).

Event study estimates indicate a significant difference in rates of disability for people with treatment two years after the diagnosis (Figure 7). In the ten years leading to a diagnosis the risk of disability is on a similar, upward trend for cohorts with and without access to treatment, and it increases by 9.8 and 4.3 percentage points (166 and 73 percent) respectively (Figure 7). After the diagnosis the likelihood of being on disability continues to rise, but the

increase is more muted for people with access to treatment (with a 6.3-times increase ten years after a diagnosis relative to the year before) compared with people without access (5.6 times increase).

F. No Significant Effects of Treatment on Siblings

A diagnosis of BD might bear a relationship with the career prospects not only of the people who are diagnosed, but also their siblings. Medical research indicates that "healthy" siblings may be affected by a "subthreshold" form of BD, even if they are not diagnosed (Mortensen et al 2003, Kruger 2006).[31] Furthermore, siblings might be indirectly affected by growing up with a sibling who has BD, for example if parents under (or over-) invest in siblings of people with BD.

To examine this relationship, in Table 6 we compare healthy siblings of people with BD with the population. These comparisons reveal the presence of negative spillovers of BD individuals onto siblings but show no evidence of an effect of access to treatment. OLS estimates indicate that healthy siblings earn 6.6 percent less than the population (with an estimate of -0.067 for *BD sibling*, Table 6, column 1, significant at 1 percent). Access to treatment has a small negative effect on siblings (with an estimate of -0.032 for *BD sibling x post*, Table 7, column 1, significant at 10 percent).

V. Treatment Effects Across Birth Cohorts

Our baseline specifications estimate the average benefits of access to treatment for people with BD who had access to lithium by age 20. These estimates are precise if a) treatment is most important when a person enters their 20s and b) lithium was not available at all until 1976 and became available immediately to everyone afterwards. In reality, it takes years for a new drug to reach all patients (Agha and Molitor forthcoming, Dickstein, King, and Saxell 2017),[32] and it is possible that lithium was used by some before it was approved. Both of these errors will lead us to under-estimate the benefits of treatment.

To address this issue, we estimate cohort-specific treatment effects. Specifically, we estimate β separately for two-year cohorts between 1946 and 1976

$$(5)\ ln(earnings_{ict}) = \alpha\, BD_i + \Sigma_c\, \beta_c\, BD_i \times \theta_c + \gamma\, Z_{it} + \delta_f + \theta_c + \tau_t + \varepsilon_{ict}$$

[31] Analyses of US data indicate that people with a family history of BD are more likely to be affected by a milder form of (subthreshold) BD than the population (Judd and Akiskal 2003).
[32] Agha and Molitor (forthcoming) show that, within the first four years after the approval of a new cancer drug, patients who live near the lead investigator are more likely to be treated.

where the birth year 1953-54 is the omitted cohort.

These estimates firmly corroborate our baseline results. Cohort-specific estimates show no positive effects of treatment for cohorts before 1955-56, who would not have had access to lithium when they turned 20. For people born before 1956 all estimates are negative and insignificant, ranging from -0.054 for 1946 to 0.127 for 1948 (Figure 7).

Cohort-specific estimates first become positive for people born in 1960, with an estimate of 0.170, which implies a 19 percent increase in earnings (exp(0.17)-1, significant at 5 percent, Figure 8). This four-year delay after access to treatment is consistent with estimated delays in the diffusion of drugs (e.g. Agha and Molitor forthcoming). Estimates further increase to 0.200 for people born in 1963-64 (significant at 1 percent) and 0.262 for people born in 1975-76 (significant at 1 percent, Figure 7), implying a 22 and 30 percent increase, respectively. Estimates are robust to controlling for family fixed effects (Figure 7, lighter series). We therefore conclude that the baseline specification correctly captures the most salient change in access to treatment.

A. People with Access in their Early 20s have Much Lower Risks of Zero Earnings

Next, we obtain cohort-specific estimates for the risk of no earnings. These estimates confirm that there was no measurable effect of treatment for people who did not have access to treatment in their 20s. The risk of no earnings is on a flat trend across cohorts born between 1946 and 1954 (Figure 9).

Treatments first become statistically significant for cohorts born in 1957-58, with a 2.5 percentage points (-0.025) decline in the probability of no earnings (significant at 5 percent). Estimates decline continuously, reaching -0.089 for people born in 1975-76 (significant at 1 percent, Figure 9). Compared with a population share of 0.154, these estimates imply a 16 and 58 percent reduction in the risks of no earnings. Younger people, who had access to lithium for a larger share of their professional lives, are substantially more likely to have positive earnings.

B. People in Cohorts with Access to Treatment are Less Likely to Receive Disability Pay

Cohort-specific estimates indicate no significant differences in the probability of disability among people with BD born between 1946 and 1954 (Figure 8). Cohorts born after 1956, however, have a lower probability: Cohort-specific estimates are equal to -0.039 for 1958 (significant at 5 percent) and reach -0.218 for the 1976 cohort (significant at 1 percent,

Figure 10). Compared with an average probability of 0.059, this corresponds to a 66 and 369, and 322 percent lower probability, respectively. Estimates are robust when we control for family fixed effects (Figure 10, lighter series).

V. Parental Wealth

Population data on mental health diagnoses and earnings reveals enormous career costs of mental health disorders. In this section, we examine how differences in parental wealth influences these costs, investigating mental health as a potential mechanism for the persistence of inequality (see Chetty et al. 2014 for evidence from the United States, and Boserup et al. 2013 for evidence from Denmark).

Recent research has found that children who are born into poor family are more likely to suffer in mental health conditions as adults (McClellan et al. 2006, Neugebauer et al. 2006, Adhvaryu et al. (2019).[33] In the United States, low-income urban populations are less likely to receive targeted treatment for mental health disorders (Davis et al. 2018). Such inequality in access may exist because people in low-income families cannot afford the fees that are associated with mental health treatment, or it may be due to informal barriers and the stigmatization of treatment for mental health. In our empirical setting, when health care is essentially free, we can shut down costs as a channel.

Data on parental assets are available for 38 percent of our observations between 1985 and 2015. We first calculate the median percentile of a person's parents' assets between 1985-2015 (the full range of years for which these data are available). We then pinpoint each parents' percentile in the asset distribution for each year and determine parents' median position in assets across 1985-2015. Using this measure of parental assets, we estimate whether the penalties associated with depression, BD, and schizophrenia vary across people whose parents are in the bottom versus the top quartile of the distribution of assets.

OLS estimates indicate that parental assets play an important role in mitigating the career effects of mental health. For people in the top quartile of the wealth distribution, depression is associated with a relatively small reduction in earnings. An estimate of 0.039 for the variable *Depression x Parents >= 75th percentile* implies that people with depression

[33] McClellan et al. (2006) and Neugebauer et al. (2006) show that maternal exposure to famine increases rates of schizophrenia and anti-social behavior among children. Cohen et al. (2006) show that socioeconomic status is associated with stress, while Van der Bergh (2005) and Persson and Rossin-Slater (2017) show that in utero exposure to maternal stress and anxiety increase the incidence of mental health conditions during adulthood. Adhvaryu et al. (2019) use variation in the price of cocoa in Ghana to show that children who are exposed to negative wealth shocks in utero have lower mental health outcomes as adults.

whose parental assets are in the top quartile earn 4.0 percentage points more than other people with depression whose parental assets are in the second and third quartile (Table 3, column 1, significant at 1 percent). For people in the bottom quartile of parental assets estimates are negative but not statistically significant (Table 3, column 1, p-value equal to 0.21). Relative to a penalty of 32 percent for individuals with assets in the second and third quartile (given an estimate for *Depression* of -0.378, exp(-0.378)-1=-0.315), this implies that moving from the bottom to the top quartile of parental assets eliminates 8.7 percent of the earnings penalty from depression.

For people with BD, the benefits from wealthy parents are even larger: Moving from the bottom to the top quartile of parental wealth eliminates 10 percent of the earnings penalty associated with BD. Having parents in the top quartile of the earnings distribution is associated with a 5.3 percentage points higher earnings (estimate of *BD x Parents >= 75 percentile* equal to 0.052, Table 3, column 1, significant at 10 percent). Having parents in the bottom quartile is associated with a 4.1 percentage points lower earnings, although this estimate is not statistically significant, with a p-value of 0.18 (estimate of *BD x Parents < 25 percentile* equal to -0.042, Table 3, column 1). Given an earnings penalty of 35 percent for people with BD with parents in the second and third quartile, this implies that moving an individual from the bottom to the top quartile of parental wealth eliminates 10 percent of the earnings penalty associated with BD.

By contrast, the mitigating effects of parental assets for schizophrenia are relatively small. For people with schizophrenia, having parents' assets in the top quartile is associated with a 6.0 percentage points higher earnings, whereas having parents' in the bottom quartile is associated with a 9.6 percentage points lower earnings (estimates of *Schizophrenia x Parents >= 75 percentile* and *Schizophrenia x Parents < 25 percentile*, Table 3, column 1, significant at 10 and 1 percent). This implies that moving an individual from the bottom to the top quartile of earnings could eliminate 2.5 percent of the total earnings penalty associated with schizophrenia.

We also find that people with depression and BD are less likely to have zero earnings when parents' assets are in the top quartile (3.6 and 2.8 percentage points more likely respectively, or 39 and 30 percent, Table 3, column 2), whereas parental assets do not seem to matter for the labor force participation of individuals with schizophrenia.

Finally, people with mental health conditions and parents' assets in the top quartile are less likely to be at risk of disability (3.4 percentage points more likely for depression, 1.5

percentage points more likely for BD, and 1.6 percentage points more likely for schizophrenia, or 100 percent, 44 percent, and 47 percent more likely, Table 3, column 2).

Appendix Table A5 shows that the earnings and labor market penalties associated with mental health conditions are significantly smaller for individuals with parents' assets in the top quartile of the distribution. The magnitudes of these estimates suggest that higher family wealth is associated with smaller penalties from mental health conditions, and especially so for individuals with depression.

A. Benefits of Treatment are Largest for People with Little Parental Wealth

Cross-sectional correlations in Table 3 suggest that parental wealth can help to mitigate the career effects of depression and BD and, to a lesser extent, schizophrenia.[34] In this section, we examine whether benefits from access to treatment also vary across the distribution of parental assets.

Estimates from a triple difference specification indicate that, for people with parental assets in the bottom quartile, access to treatment eliminates 31 percent of earnings penalty from BD (estimate for *BD x Post x Parent < 25 percentile* equal to 0.191, Table 8, column 1, p-value equal to 0.47). By comparison, benefits from access to treatment are much smaller for people whose parents are in the top quartile of assets, with an imprecisely estimated reduction in the earnings penalty of 10 percent (estimate for *BD x Post x Parent >= 75 percentile* equal to -0.047, Table 8, column 1, p-value equal to 0.83). These point estimates imply that moving a person from the top to the bottom quartile of the distribution of parents' assets makes the effect of access to treatment three times as large.

Similarly, access to treatment reduces the risk of having zero earnings by an additional 7.0 percentage points for individuals with parents' assets in the bottom quartile (Table 9, column 2, p-value equal to 0.29) and by 2.4 percentage points less for individuals with parents' assets in the bottom quartile (Table 9, column 2, p-value equal to 0.69) relative to individuals with parents' assets in the second and third quartiles. Lastly, the effect of treatment on the risk of disability is 5.8 percentage points larger for individuals with parents' assets in the bottom quartile (Table 9, column 3, p-value equal to 0.33) and 9.0 percentage

[34] Figure A3 compares the distribution of earnings for people with BD and their healthy counterparts. For people with BD, the distribution of earnings residuals distribution is bimodal, with a first mode around 0 and a second mode around $50,000 (Figure A3). By comparison, the distribution of earnings for the healthy population has a much larger mass and a median around $50,000.

points smaller for individuals with parents' assets in the bottom quartile (Table 9, column 3, p-value equal to 0.12).

VI. Heterogeneity and Robustness

In this final section, we examine heterogeneous effects on people with more or less severe forms of BD, as measured by the number of diagnoses; we show that our estimates of the effects of treatment are not driven by secular changes in stigma and other factors affecting the labor market experiences of people with mental health conditions, using people with depression and schizophrenia as an additional control group in a triple-difference framework. As a final robustness check we test whether our findings are robust to using prescription data, rather than diagnoses, to identify people with BD.

A. Variation in Severity of BD

To assess whether the labor market penalties and the effects of BD are larger for people with a more severe form of this condition, we measure intensity by the number of diagnoses of BD each person receives. On average, BD individuals experience 2.4 diagnoses between 1995 and 2015, with a median of 2 episodes. We estimate the following equation:

$$(6)\ ln(earnings_{ict}) = \alpha_1 BD_i + \beta_1 BD_i \times post_c + \alpha_2 \#BD\ episodes_i + \beta_2 \#BD\ episodes_i \times post_c + \gamma Z_{it} + \theta_c + \tau_t + \varepsilon_{ict}$$

where $\#BD\ episodes_i$ is the number of BD episodes experienced by individual *i.*

OLS estimates imply that even people with just one single diagnosis of BD have 44 percent lower earnings compared with the population (calculated as the sum of the exponents of the estimates for *BD* and *# BD episodes* in Table 9, column 1, significant at 1 percent.)

Each additional episode is associated with an additional 22 percent lower earnings. The benefits of access to treatment, however, are also larger for individuals who experience more episodes. For individuals with only one diagnosis, the gap in earnings is reduced by 25 percent with access to treatment (exp(0.008) -1+ exp(0.098)-1/0.438, Table 9, column 1), and the benefit of treatment increases by 10 percentage points with each additional episode. Estimates which compare individuals with their siblings indicate similar wage gaps and smaller benefits from treatment associated with more episodes (Table 9, column 2).

People with more frequent episodes are also more likely to have zero earnings and benefit more from treatment. People with a single diagnosis of BD are 72 percent more likely

to earn nothing (with an estimate of 0.096 for *BD* and compared with a 13.4 percent population share of zero earning, Table 9, column 3, significant at 1 percent). Access to treatment eliminates 10 percent of this penalty (*BD x post* is -0.010, Table 9, column 3, p-value equal to 0.2). Each additional diagnosis of BD is associated with a 7.1 percentage point increase in the probability of zero earnings (with an estimate of 0.071 for # *BD episodes*, Table 9, column 3, significant at 1 percent). Access to treatment eliminates more than half of this penalty, with an estimate of 4.1 percentage for # *BD episodes x post* (Table 9, column 3, significant at 1 percent). For the median person with BD, who receives 2 diagnoses of BD, these estimates imply a 23.8 percentage point increase in the risk of zero earnings; access to treatment eliminates 5.1 percentage points of this increased risk.

B. Controlling for Time Changes in Other Factors Affecting People with Mental Health Conditions

Our identification strategy implicitly assumes that labor market outcomes for people with BD would have remained unchanged had lithium not been introduced as a maintenance treatment. Yet, many other things also changed after the introduction of lithium, including the development of alternative treatments such as mood stabilizers, SSRIs, and pscyhotherapy; the growth of community-based treatment centers; the de-institutionalization of mental health (Geddes and Miklowitz, 2013); along with changes in health insurance coverage.[35] In addition to these changes, the stigmatization of mental health disorders has been shown to vary over time (Hinshaw 2007).[36] All of these changes might have influenced the career outcomes of mental health patients, and thereby confound our estimates.

To address this issue and better isolate the effects of access to lithium, we use people with depression and schizophrenia as a placebo group in a triple-difference framework:

$$(7)\ ln(earnings_{ict}) = \alpha_1 Depr_i + \alpha_2 BD_i + \alpha_3 Schizo_i + \Sigma_c \beta_{1,c} Depr_i \times \theta_c + \Sigma_c \beta_{2,c} BD_i \times \theta_c + \Sigma_c \beta_{3,c} Schizo_i \times \theta_c + \gamma Z_{it} + \theta_c + \tau_t + \varepsilon_{ict}$$

In this equation, the coefficients $\beta_{1,c}$ and $\beta_{3,c}$ estimate cohort-specific differences in log earnings between people with depression and schizophrenia, respectively, and the population;

[35] Mental health care in Denmark has undergone considerable change during the last decades, including an increase in outpatient treatment, a reduction in the number of hospital beds, and the establishment of community mental health centers (Danish Ministry of Health, 2017). The Social Assistance Act of 1976 transferred psychiatric services from the state to local county responsibility. A Patients' Right law of 1992 prohibited treatment without consent and mandated that providers explain treatment options to patients (European Observatory on Health Care Systems, 2001).

[36] In principle, evidence on the genetic drivers of mental health may mitigate stigmatization. Yet surveys show that stigmatization towards BD and other disorders has intensified since the 1950s (Phelan et al. 2000).

the coefficients $\beta_{2,c}$ estimate instead the cohort-specific differences for people with BD. Controlling for $\Sigma_c \beta_{1,c} Depr_i \times \theta_c$ and $\Sigma_c \beta_{3,c} Schizo_i \times \theta_c$, estimates of $\beta_{2,c}$ for $c>1956$ can therefore safely be attributed to the effects of access to lithium.

Estimates of $\beta_{2,c}$, along with confidence intervals, are shown in panel A of Figure 11 and confirm the results in Figure 8. Estimates are indistinguishable from zero for cohorts before 1955-56, and they become positive for people born in 1960, with an estimate of 0.204 which implies a 23 percent increase in earnings (significant at 5 percent, Figure 11). Panels B and C of Figure 11 show estimates of equation (7) using the probability of no earnings and the probability of disability as the dependent variable, which confirm our findings in Figures 9 and 10.

C. Alternative Definitions for People with BD

In the main specifications, we use diagnosis data to identify people who are affected with BD. One limitation of these data is that they are only available after 1995. We now use data on prescriptions, which are available between 1995 and 2015, either (i) receives a diagnosis of BD or (ii) receives at least one prescription of lithium.

Estimates of access to treatment using this alternative definition for BD, shown in Table 10, are very similar to our baseline estimates in Table 4. These estimates confirm that treatment closes approximately one third of the earnings penalty associated with BD (with an estimate of *BD/lithium* equal to -0.560 and an estimate for *BD/lithium* x *post* equal to 0.112, Table 10, column 1, significant at 1 percent). Furthermore, treatment reduces the risk of having no earnings by 25 percent (column 3) and the risk of disability by 52 percent (column 5). Estimates are robust controlling for family fixed effects (columns 2, 4, and 6).

VII. Conclusions

This paper has used registry data on mental health diagnoses, earnings, and disability to investigate the career effects of mental health. Population data indicate that mental health disorders carry enormous social costs, with earnings penalties that range from 34 percent for a person with depression to 74 percent for a person with schizophrenia. Risks of zero earning range from 110 percent for depression and BD to 336 percent for schizophrenia. Risks of disability range from 120 percent for depression and 270 percent for BD to 700 percent for schizophrenia.

The approval of lithium as a maintenance treatment for BD in 1976 makes it possible to estimate the effects of major change in access to treatments. Baseline difference-in-

differences estimates indicate that access to lithium closed one-third percent of the earnings gap from BD compared with the population and compared with siblings. Access to treatment also greatly reduces the risks of zero earnings, and of declining in the bottom quantiles of earnings. Moreover, access to treatment eliminates 59 percent of the excess risk of disability compared with the population and 57 percent compared with siblings. These results imply that policies which improve access to treatments for mental health disorders could create large economic and social benefits by increasing earnings, encouraging labor force participation, and reducing the risk of disability.

Notably, gains from access are concentrated at the lower end of the earnings distribution, which suggests important distributional effects of treatments for mental health disorder. Denmark offers universal health care, granting better access to drugs to people in the lower quantiles of the earnings distribution. In countries without universal healthcare, such as the United States, variation in access to treatment across the earnings distribution may further exacerbate the distributional effects on mental health.

For the United States, estimates from the National Comorbidity Survey (NCS-R, Kessler et al 2003b) indicate that one in three people with BD remain untreated.[37] Expansions in Medicaid coverage have increased access to psychotropic prescriptions for mental illness by 22 percent (Maclean, Cook, Carson, and Pesko 2017). Our findings suggest that such changes have major welfare effects.

REFERENCES

Adhvaryu, A., Fenske, J., & Nyshadham, A. 2019. "Early life circumstance and adult mental health." *Journal of Political Economy*, *127*(4).

Agha, Leila and David Molitor. "The Influence of Pioneer Investigators on Technology Adoption: Evidence from New Cancer Drugs." *The Review of Economics and Statistics,* forthcoming.

Aizer, A., & Currie, J. 2014. The intergenerational transmission of inequality: maternal disadvantage and health at birth. *Science*, *344*(6186), 856-861.

Alegría, Margarita, Rob V. Bijl, Elizabeth Lin, Ellen E. Walters, and Ronald C. Kessler. 2000. "Income differences in persons seeking outpatient treatment for mental disorders: a comparison of the United States with Ontario and The Netherlands." *Archives of general psychiatry* 57, no. 4: 383-391.

[37] Even when people are treated, the quality of treatment is highly uneven. In the NCS-R, more than one third of all people with BD were treated by mental health professionals who are not psychiatrists (35.4 percent, Kessler et al 2003b), even though a striking 73 percent in general medical treatment received the wrong drugs (compared with an also large 43 percent in specialist treatment.

American Society of Health-System Pharmacists. *Lithium Salts.* Retrieved December 30th, 2014 at http://www.drugs.com/monograph/lithium-salts.html.

Arellano-Bover, Jaime. 2019. "Career Consequences of Firm Heterogeneity for Young Workers: First Job and Firm Size." Working paper.

Bartel, Ann and Paul Taubman. 1986. "Some economic and demographic consequences of mental illness." *Journal of Labor Economics* 4 (2):243–256.

Bauer, Michael, Tasha Glenn, Natalie Rasgon, Wendy Marsh, Kemal Sagduyu, Rodrigo Munoz, Rita Schmid, Sara Haack, and Peter C. Whybrow. 2011. "Association between median family income and self-reported mood symptoms in bipolar disorder." *Comprehensive psychiatry* 52, no. 1: 17-25. -treated patients with bipolar disorder," *Biological Psychiatry*, vol. 62(1), pages 7-16.

Bech, P., Vendsborg, P. B. and Rafaelsen, O. J. 1976. "Lithium Maintenance Treatment of Manic-Melancholic Patients: Its Role in the Daily Routine," *Acta Psychiatrica Scandinavica*, vol. 53, pp. 70–81.

Bhalotra, S. R., and Clarke, D. 2019. "The twin instrument: Fertility and Human Capital Investment." Working paper.

Boserup, S.H., Kopczuk, W. and Kreiner, C.T. 2013. Intergenerational wealth mobility: Evidence from danish wealth records of three generations. Mimeo, University of Copenhagen.

Carlson, Gabrielle A. 1998. "Mania and ADHD: Comorbidity or Confusion," *Journal of Affective Disorders*, vol.51(2), pp. 177-187.

Cooper, Arnold C., Carolyn Y. Woo, and William C. Dunkelberg. "Entrepreneurs' Perceived Chances for Success." *Journal of Business Venturing*, Volume 3, Issue 2, Spring 1988, pp. 97–108.

Chetty, R., Hendren, N., Kline, P., Saez, E. and Turner, N. 2014. Is the United States still a land of opportunity? Recent trends in intergenerational mobility. *American Economic Review*, *104*(5), pp.141-47.

Cohen, S., Doyle, W.J. and Baum, A. 2006. Socioeconomic status is associated with stress hormones. *Psychosomatic medicine*, 68(3), pp. 414-420.

Currie, Janet, and Rosemary Hyson. 1999. "Is the impact of health shocks cushioned by socioeconomic status? The case of low birthweight." *American Economic Review* 89(2): pp. 245-250.

Currie, Janet, and Brigitte C. Madrian. 1999. "Health, health insurance and the labor market." *Handbook of Labor Economics* 3: pages 3309-3416.

Currie, Janet, Mark Stabile, Phongsack Manivong, and Leslie L. Roos. 2010. "Child health and young adult outcomes." *Journal of Human Resources* 45(3): pp. 517-548.

Danish Economic Council (Det Økonomiske Råd). "Dansk Økonomi, Efterår 2015", 2015.

Danish Ministry of Health. 2017. *Healthcare in Denmark - an Overview. Version 1.2*. ISBN: 978-87-7601-365-3. Copenhagen: Ministry of Health.

Davis, Regina G. Kerry J. Ressler, Ann C. Schwartz, Kisha James Stephens, and Rebekah G. Bradley, "Treatment barriers for low-income, urban African Americans with undiagnosed posttraumatic stress disorder" *Journal of Traumatic Stress. Volume 21, issue 2, April 2008, pp. 218-22.*

Davis, Steven J., and Till von Wachter. 2012. "Recessions and the Costs of Job Loss." *Brookings Papers on Economic Activity Fall 2011.*

Dean BB, Gerner D, Gerner RH. 2004. A Systematic Review Evaluating Health-Related Quality of Life, Work Impairment, and Healthcare Costs and Utilization in Bipolar Disorder. Current Medical Research Opin. 20: 139-54.

Dickstein, Michael J, Marissa King, and Tanja Saxell. "The Role of Experience in Physician Treatment Decisions: Evidence from the Introduction of Medicare Part D." Working paper, 2017.

Dohrenwend, Bruce P., Itzhak Levav, Patrick E. Shrout, Sharon Schwartz, Guedalia Naveh, Bruce G. Link, Andrew E. Skodol, and Ann Stueve. 1992. "Socioeconomic status and psychiatric disorders: the causation-selection issue." *Science* 255, no. 5047: 946-952.

Drevets, Wayne C. Joseph L. Price, Joseph R. Simpson Jr, Richard D. Todd, Theodore Reich, Michael Vannier and Marcus E. Raichle. "Subgenual prefrontal cortext abnormalities in mood disorders." *Nature*, Volume 386, April 24, 1997.

Duggan, Mark and Imberman, S. A. 2009. "Why are the disability rolls skyrocketing? The contribution of population characteristics, economic conditions, and program generosity." in *Health at older ages: The causes and consequences of declining disability among the elderly* (pp. 337-379). University of Chicago Press.

E. J. H. 1970. "Current Drug Information: Lithium Carbonate," *Ann Intern Med.* 73:2, pages 291-293.

European Observatory on Health Care Systems. 2001. *Health Care Systems in Transition. Denmark*, 2001, 79.

Fletcher, Jason M. 2010. "Adolescent depression and educational attainment: results using sibling fixed effects." *Health economics* 19.7: pp. 855-871.

García-Gómez, P., Jones, A.M. and Rice, N., 2010. "Health effects on labour market exits and entries." *Labour Economics*, 17(1), pp.62-76.

García-Gómez, P. 2011. "Institutions, health shocks and labour market outcomes across Europe." *Journal of Health Economics*, 30(1), pp.200-213.

García-Gómez, P., Van Kippersluis, H., O'Donnell, O. and Van Doorslaer, E. 2013. "Long-term and spillover effects of health shocks on employment and income." *Journal of Human Resources*, 48(4), pp.873-909.

Gardner, Jonathan, and Andrew J. Oswald. 2007. "Money and mental wellbeing: A longitudinal study of medium-sized lottery wins." *Journal of Health Economics* 26.1: 49-60.

Garthwaite, Craig L. 2012. The economic benefits of pharmaceutical innovations: The case of cox-2 inhibitors. *American Economic Journal: Applied Economics*, *4*(3), pages 116-37.

Geddes John R., and David J. Miklowitz. 2013. "Treatment of bipolar disorder." *Lancet*, 381(9878), pp.1672-1682.

Goodwin Frederick K, Kay Redfield Jamison. *Manic-depressive illness: Bipolar disorders and recurrent depression. 2nd ed.* New York: Oxford University Press; 2007.

Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 1993. "Earnings losses of displaced workers." *The American Economic Review:* 685-709.

Jamison, Kay Redfield "Touched by Fire. Manic Depressive Illness and the Artistic Temperament." New York: Free Press. 1993

Judd, L.L. and H.S. Akiskal. 2003. "The Prevalence and Disability of Bipolar Spectrum Disorders in the US Population: Re-analysis of the ECA database taking into account subthreshold cases. *Journal of Affective Disorders.* Volume 73, pp. 123-31.

Hakulinen, Christian, Katherine L. Musliner, and Esben Agerbo. 2019. "Bipolar disorder and depression in early adulthood and long-term employment, income, and educational attainment: A nationwide cohort study of 2,390,127 individuals." *Depression and anxiety* 36, no. 11 (2019): 1080-1088.

Haushofer, Johannes and Jeremy Shapiro. 2016. "The Short-Term Impact of Unconditional Cash Transfers to the Poor: Experimental Evidence from Kenya." *The Quarterly Journal of Economics,* 131(4): pp. 1973-2042.

Halla, Martin, and Martina Zweimüller. 2013. "The effect of health on earnings: Quasi-experimental evidence from commuting accidents." *Labour Economics,* vol. 24, pp. 23-38.

Hinshaw, Stephen P., and Andrea Stier. 2008. "Stigma as related to mental disorders." *Annual Review of Clinical Psychology* 4, pp. 367-393.

Kahn, Lisa B. 2010. "The long-term labor market consequences of graduating from college in a bad economy." *Labour Economics* 17(2), pp. 303-316.

Kessler RC, Barber C, Beck A. Berglund P. Clearly PD. Et al. 2003a. "The World Health Organization Health and Work Performance Questionnaire (HPQ). *Journal of Occupational Environ. Medicine*. 45_ 156-74.

Kessler Ronald C, Berglund Patricia, Demler Olga, Jin R, Koretz D. et al 2003b. The Epidemiology of Major Depressive Disorder: Results from the National Comorbidity Survey Replication (NCS-R). *JAMA: 289_ 3095-105*

Kessler, Ronald C., Berglund, Patricia, Demler, Olga, Jin, Robert, Merikangas, Kathleen R., and Ellen E. Walters. 2005. "Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication," *Arch Gen Psychiatry*, 62 (6), pp. 593–602.

Kessler, Ronald C, Chiu WT, Demler O, Walters EE 2005b. "Prevalence, severity, and comorbidity of 12- month DSM-IV disorders in the National Comorbidity Survey Replication". Archives of General Psychiatry volume 62, pp. 617-27,

Krüger, Stephanie, Alda, Martin, Young, L. Trevor, Goldapple, Kim, Parikh, Saghar, and Mayberg, Helen S. 2006. "Risk and Resilience Markers in Bipolar Disorder: Brain Responses to Emotional Challenge in Bipolar Patients and Their Healthy Siblings," *American Journal of Psychiatry*, 163:2 , pages 257-264.

Kyaga, Simon, Lichtenstein, Paul, Boman, Marcus, Hultman, Christina, Langstrom, Niklas, and Mikael Landen. 2011. "Creativity and mental disorder: family study of 300 000 people with severe mental disorder," *The British Journal of Psychiatry*, 199 (5), pages 373-379.

Kyaga, Simon, Landen, Mikael, Boman, Marcus, Hultman, Christina M, Laangstrom, Niklas, and Paul Lichtenstein. 2013. "Mental illness, suicide and creativity: 40-year prospective total population study," *Journal of Psychiatric Research*, 47(1), pages 84-90.

Laird, Jessica, and Torben Nielsen. 2017. "The Effects of Physician Prescribing Behaviors on Prescription Drug Use and Labor Supply: Evidence from Movers in Denmark." *Harvard University Job Market Paper: https://scholar. harvard. edu/files/lairdja/files/Laird_JMP_1. pdf*

Landier, Augustin and David Thesmar. 2009. "Financial Contracting with Optimistic Entrepreneurs," *The Review of Financial Studies*, 22(1), pp. 117-150.

Levine, Ross and Yona Rubinstein. 2017. "Smart and Illicit: Who Becomes an Entrepreneur and Do They Earn more?," *Quarterly Journal of Economics*. 132(2), pages 963-1018.

McInnis, Melvin G., B. Thomas, and Nancy Upjohn Woodworth. 2014. "Lithium for bipolar disorder: a re-emerging treatment for mood instability," *Current Psychiatry*, 13(6), pages 39-44.

Miklowitz, David J. and Sheri L. Johnson. 2006. "The Pscychopathy and Treatment of Bipolar Disorder." *Annual Review of Clinical Psychology*, Volume 3:199–235.

Mortensen, Preben Bo, Pedersen, C. B., Melbye, M., Mors, O., and Edwald, H. 2003. "Individual and familial risk factors for bipolar affective disorders in Denmark," *Arch Gen Psychiatry*, vol. 60 (2), pages 1209-15.

National Institute of Health, John M. Eisenberg Center for Clinical Decisions and Communications Science. “Antipsychotic Medicines for Treating Schizophrenia and Bipolar Disorder. A Review of the Research for Adults and Caregivers” 2013.

Naranjo CA. Tremblay LK, Busto UE, 2001. “The Role of the Brain Reward System in Depression.” *Prog. Neurophsychopharmacol. Biol. Psychiatry. Vol.* 25, pp. 781-823.

Neugebauer, R., Hoek, H.W. and Susser, E. 1999. Prenatal exposure to wartime famine and development of antisocial personality disorder in early adulthood. *JAMA*, *282*(5), pp.455-462.

Oreopoulos, Philip, Till Von Wachter, and Andrew Heisz. 2012. “The short-and long-term career effects of graduating in a recession.” *American Economic Journal: Applied Economics* 4(1), pp. 1-29.

Phelan, Jo C., Bruce G. Link, Ann Stueve, and Bernice A. Pescosolido. 2000. “Public conceptions of mental illness in 1950 and 1996: What is mental illness and is it to be feared?” *Journal of Health and Social Behavior*, pp. 188-207.

Price, Lawrence H., and Heninger, George R. 1994. “Lithium in the treatment of mood disorders,” *N Eng J Med.,* vol. 331, pages 591–598.

Reddy, L Felice, Lee, Junghee, Davis, Michael C, Altshuler, Lori, Glahn, David C, Miklowitz, David J, and Michael F Green. 2014. “Impulsivity and Risk Taking in Bipolar Disorder and Schizophrenia,” *Neuropsychopharmacology,* 39**,** pp. 456–463.

Ross Catherine E., and Joan Huber. “Hardship and Depression.” *Journal of Health and Social Behavior*, vol. 26, no. 4, 1985, pp. 312–327.
Rothenberg, Albert. “Bipolar illness, creativity, and treatment.” *Psychiatry Quarterly* 2001 Summer;72(2):131-47.

Sareen, Jitender, Tracie O. Afifi, Katherine A. McMillan, and Gordon JG Asmundson. 2011. "Relationship between household income and mental disorders: findings from a population-based longitudinal study." *Archives of general psychiatry* 68, no. 4: 419-427.

Shapiro Brad. 2019. “Promoting Wellness or Waste? Evidence from Antidepressant Advertising. Evidence from Antidepressant Advertising.” Becker Friedman Institute for Research in Economics Working Paper. 2018 Dec 29(2018-14).

Schwartz, S. E. Frank, B. Anderson, JT Sherrill, I Siegel et al. 1998. Stressful life events and social rhythm disruption in the onset of manic and depressive bipolar episodes: a preliminary investigation. Archives of General Psychiatry. 55, 702-7.

Smith, James Patrick, and Gillian C. Smith. 2010. “Long-term economic costs of psychological problems during childhood.” *Social science & medicine* 71(1): pp. 110-115.

Swann, AC. DM Dougherty, PJ Pazzagiglia, M Pham, FG Moeller, 2004. “Impulsivity: A Link between Bipolar Disorder and Substance Abuse. Bipolar Disorder. Volume 6: 204-2012.

Schneck, CD, Miklowitz DJ, Calabrese JR. Allen MH, Thomas MR, et al. 2004. "Phenomenology of Rapid Cycling Bipolar Disorder: Data from the First 500 Particiements in the Systematic Treatment Enhancement Program for Bipolar Disorder." *American Journal of Psychiatry.* Volume 161, pp. 1902-8.

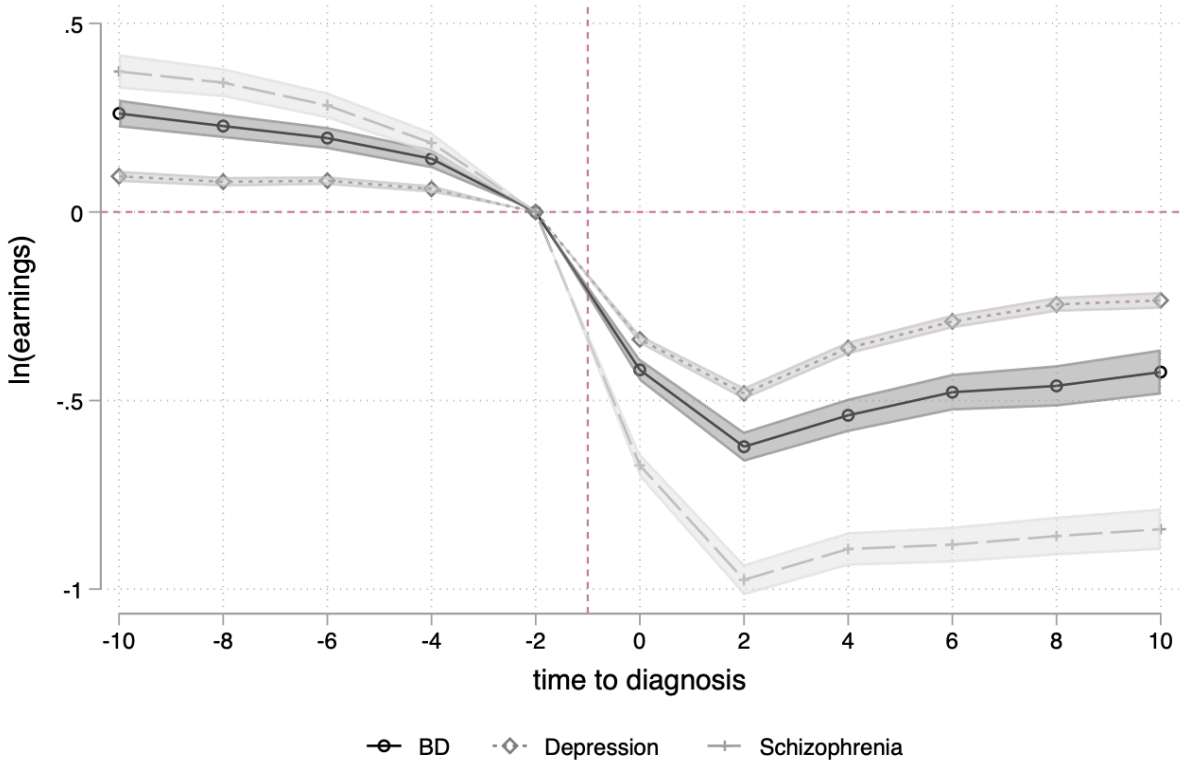
Suppes, T. GS Leverich, PE Keck, WA Nolen, KD Denicoff, et al. 2001. The Stanley Foundation Bipolar Treatment Outcome Network II Demographis and Illness Characteristics of the first 261 Patients. *Journal of Affective Disorders*, volume 68, pp. 45-59.

Tondo, Leonardo, Baldessarini, Ross J, Hennen, John, Minnai, Gian Paolo, Salis, Piergiorgio, Scamonatti, Luciana, Masia, Mercedes, Ghiani, Carmen, and Piero Mannu. 1999."Suicide attempts in major affective disorder patients with comorbid substance use disorders,"*Journal of Clinical Psychiatry*, vol.60 (2), pp. 63-69.

Van den Bergh, B.R., Mennes, M., Oosterlaan, J., Stevens, V., Stiers, P., Marcoen, A. and Lagae, L. 2005. High antenatal maternal anxiety is related to impulsivity during performance on cognitive tasks in 14-and 15-year-olds. *Neuroscience & Biobehavioral Reviews*, *29*(2), pp.259-269.

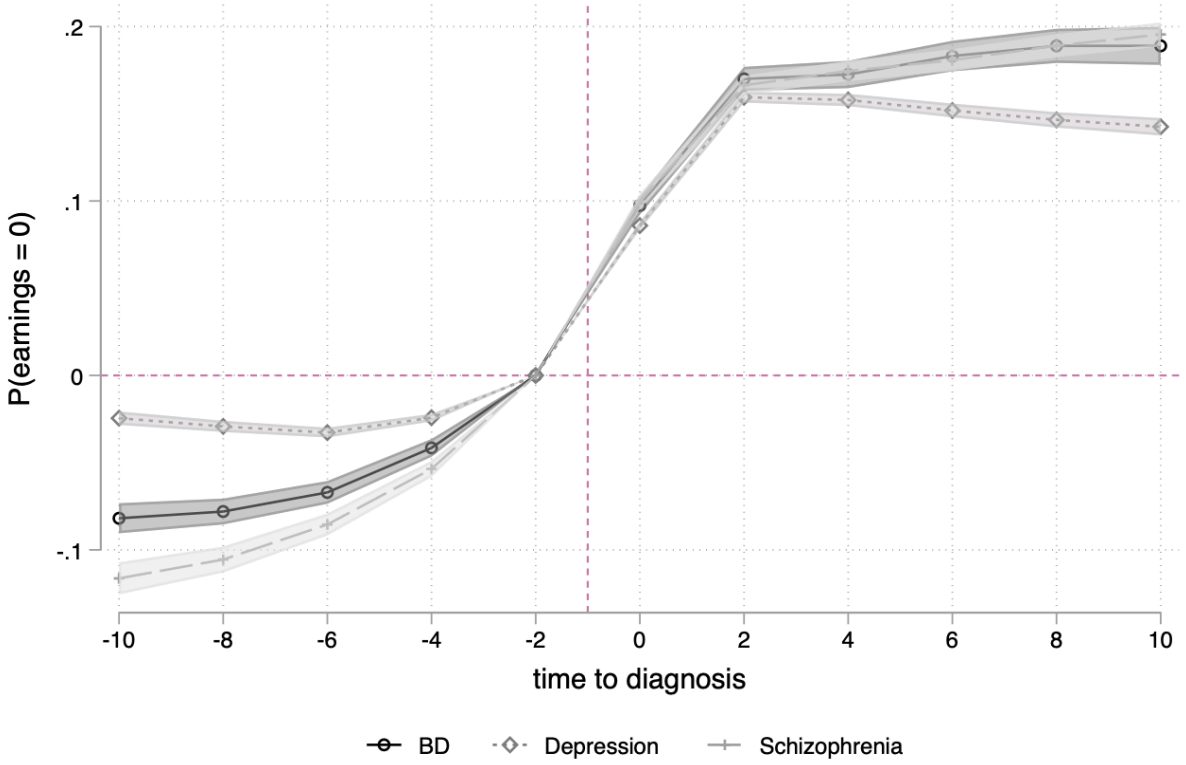
World Health Organization. 2011 *Global status report on non-communicable diseases 2010.* Geneva: WHO.

FIGURE 1– EVENT STUDY OF LN(EARNINGS) AROUND A DIAGNOSIS
BD, DEPRESSION, AND SCHIZOPHRENIA



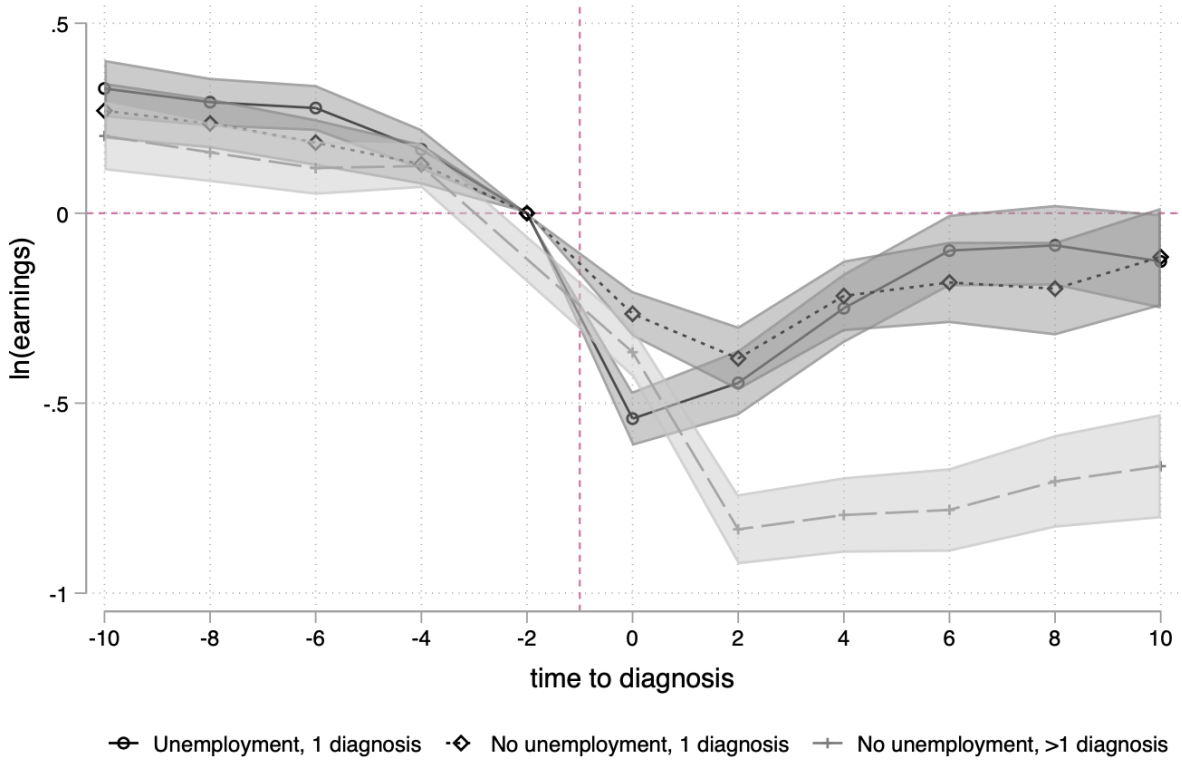
Note: Point estimates and 95 percent confidence of the parameter δ in equation $\log(earnings_{ict}) = \sum^{10}_{k=-10} \delta_k C_i I(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$ where the dependent variable is the natural logarithm of earnings, C_i is an indicator for either *BD*, *Depression*, *or Schizophrenia,* $Y(C)_i$ indicates the year when individual *i* is diagnosed with condition *C*, and *I()* is an indicator function. The vector θ_c contains cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976, and with positive earnings.

FIGURE 2– EVENT STUDY OF P(EARNINGS = 0) AROUND A DIAGNOSIS
BD, DEPRESSION, AND SCHIZOPHRENIA



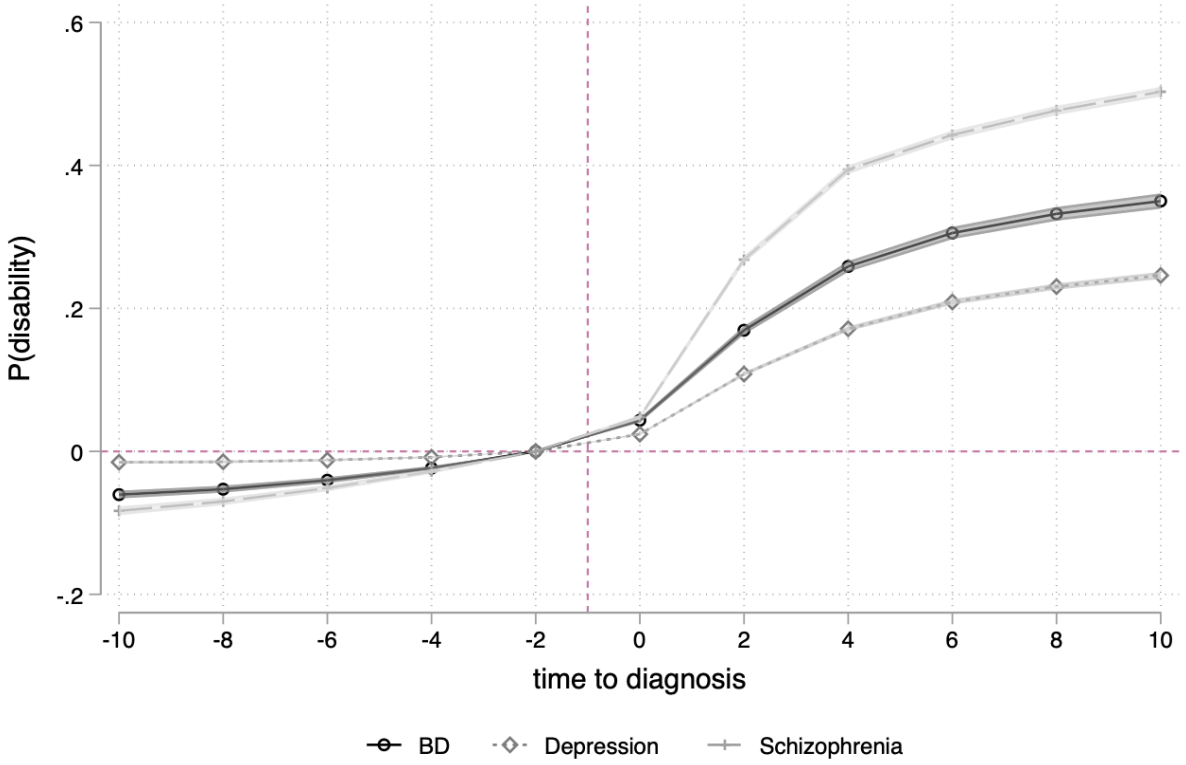
Note: Point estimates and 95 percent confidence of the parameter δ in equation $P(earnings_{ict}=0) = \sum^{10}_{k=-10} \delta_k C_i I(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is an indicator for having no earnings, C_i is an indicator for either *BD*, *Depression*, *or Schizophrenia,* $Y(C)_i$ indicates the year when individual *i* is diagnosed with condition *C*, and *I()* is an indicator function. The vector θ_c are cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.

FIGURE 3– EVENT STUDY OF LN(EARNINGS) AROUND A DIAGNOSIS
BY UNEMPLOYMENT AND #DIAGNOSES



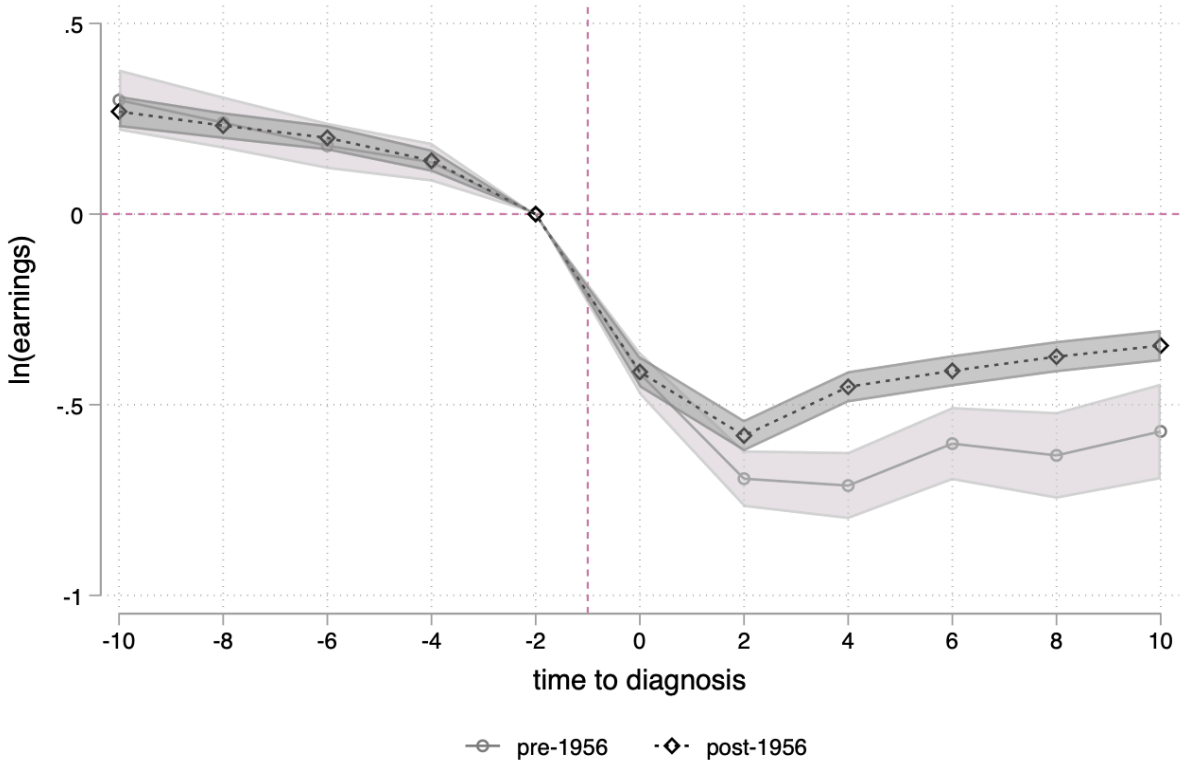
Note: Point estimates and 95 percent confidence of the parameter δ in equation $\log(earnings_{ict}) = \sum^{10}_{k=-10} \delta_k C_i I(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$ where the dependent variable is the natural logarithm of earnings, C_i is an indicator for any of *BD*, *Depression*, *or Schizophrenia,* $Y(C)_i$ indicates the year when individual *i* is diagnosed with any of these conditions, and *I()* is an indicator function. The vector θ_c contains cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. In the *Unemployment, 1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive only one diagnosis between 1995 and 2015 and experience at least one unemployment episode in the two years preceding and following the diagnosis. In the *No unemployment, 1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive only one diagnosis between 1995 and 2015 and do not experience any unemployment in the two years preceding and following the diagnosis. In the *No unemployment, >1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive more than one diagnosis between 1995 and 2015 and do not experience any unemployment in the two years preceding and following the diagnosis. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976, and with positive earnings.

FIGURE 4– EVENT STUDY OF P(DISABILITY) AROUND A DIAGNOSIS
BD, DEPRESSION, AND SCHIZOPHRENIA



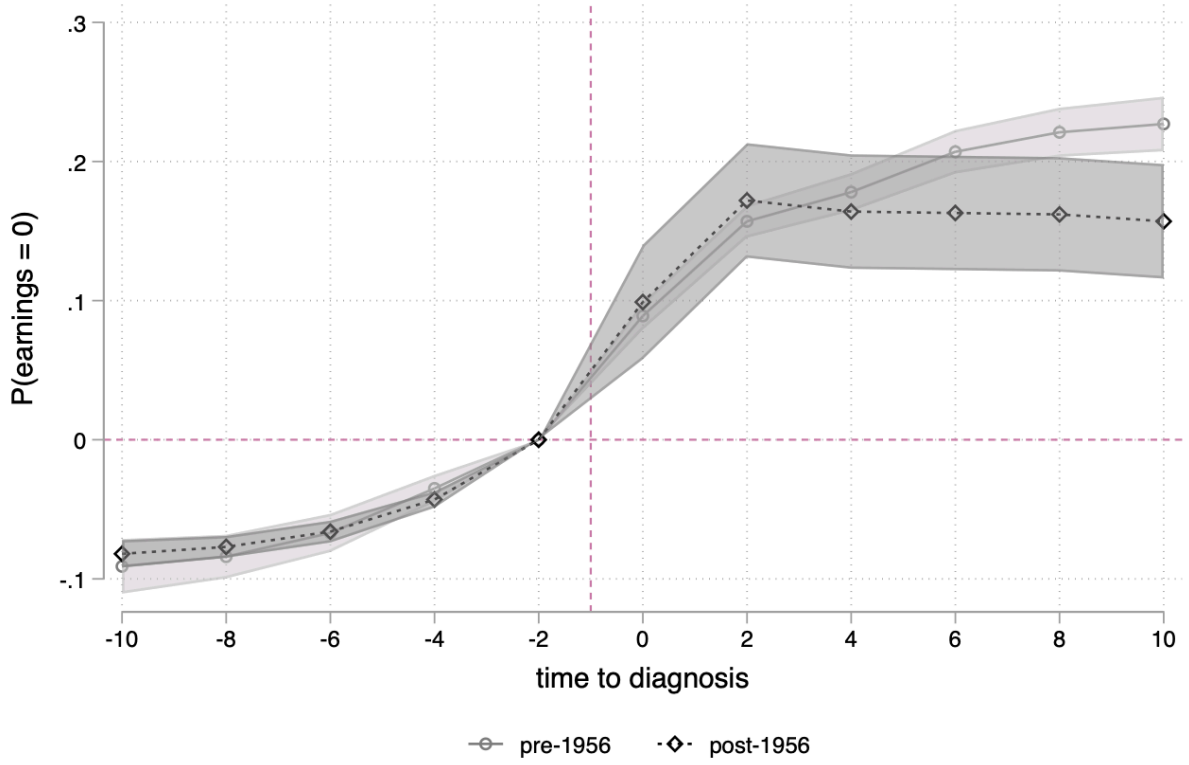
Note: Point estimates and 95 percent confidence of the parameter δ in equation $P(disability_{ict}) = \sum^{10}_{k=-10} \delta_k C_i I(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is an indicator for being on disability, C_i is an indicator for either *BD*, *Depression*, *or Schizophrenia, Y(C)*$_i$ indicates the year when individual *i* is diagnosed with condition *C*, and *I()* is an indicator function. The vector θ_c are cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.

FIGURE 5– EVENT STUDY OF LN(EARNINGS)
PEOPLE WITH BD WITH AND WITHOUT ACCESS TO LITHIUM



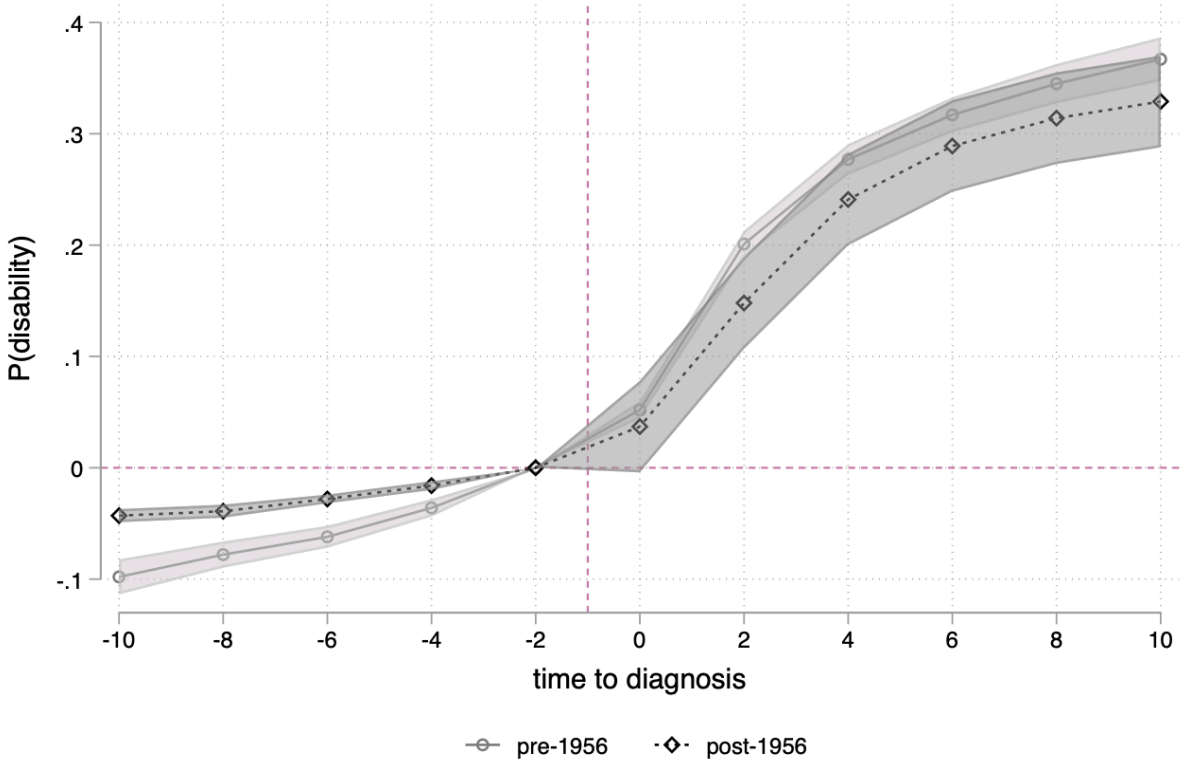
Note: Point estimates and 95 percent confidence of the parameter δ in equation $\ln(earnings_{ict}) = \sum^{10}_{k=-10} \delta_s \, BD_i \, I(t\text{-}Y(BD)_i = k) + \beta_2 \, Depression_i + \beta_3 \, Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is the natural logarithm of earnings, *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015, $Y(BD)_i$ is the year of the diagnosis, and *I()* is an indicator function. The vector contains θ_c cohort fixed effects, and τ_t are year fixed- ffects. Standard errors are clustered at the individual level. Estimates are shown separately for individuals born before and after 1956. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.

FIGURE 6– EVENT STUDY OF P(EARNINGS = 0)
PEOPLE WITH BD WITH AND WITHOUT ACCESS TO LITHIUM



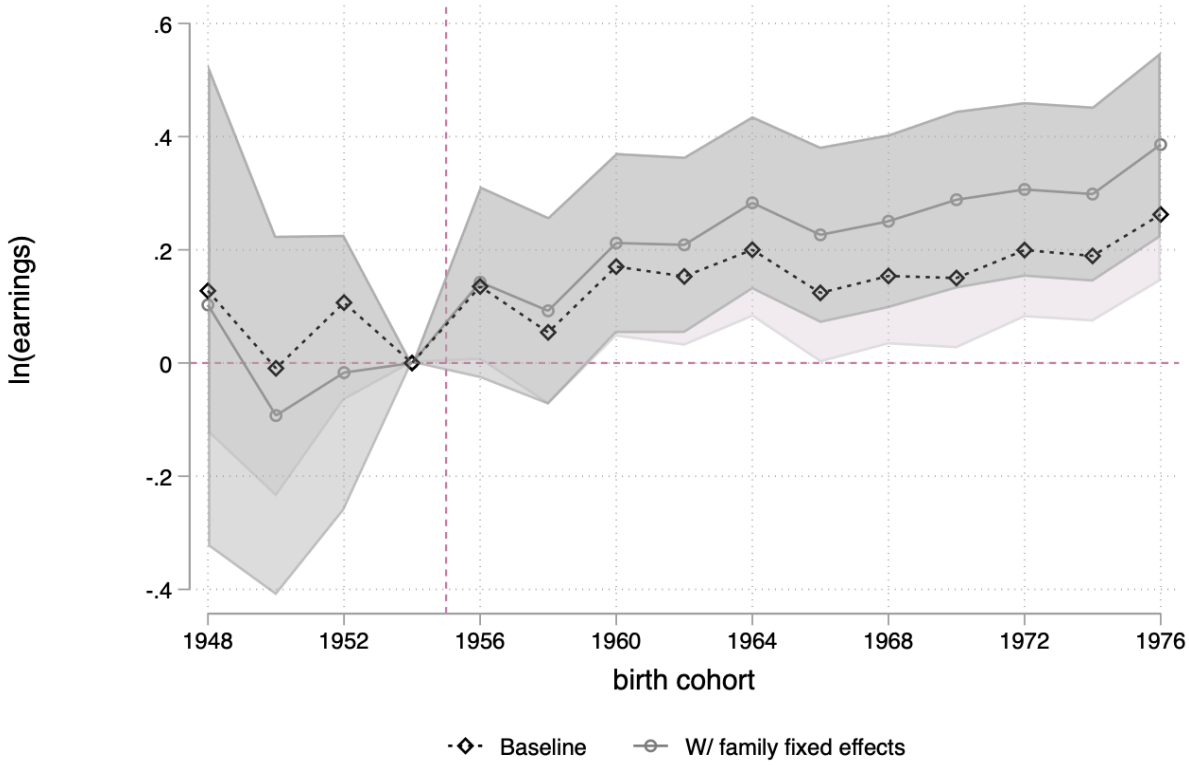
Note: Point estimates and 95 percent confidence of the parameter δ in equation $P(earnings_{ict}=0) = \sum^{10}_{k=-10} \delta_s \, BD_i \, I(t\text{-}Y(BD)_i = k) + \beta_2 \, Depression_i + \beta_3 \, Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is an indicator for having no earnings, *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015, $Y(BD)_i$ is the year of the diagnosis, and *I()* is an indicator function. The vector contains θ_c cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. Estimates are shown separately for individuals born before and after 1956. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.

FIGURE 7– EVENT STUDY OF P(DISABILITY = 0)
PEOPLE WITH BD WITH AND WITHOUT ACCESS TO LITHIUM



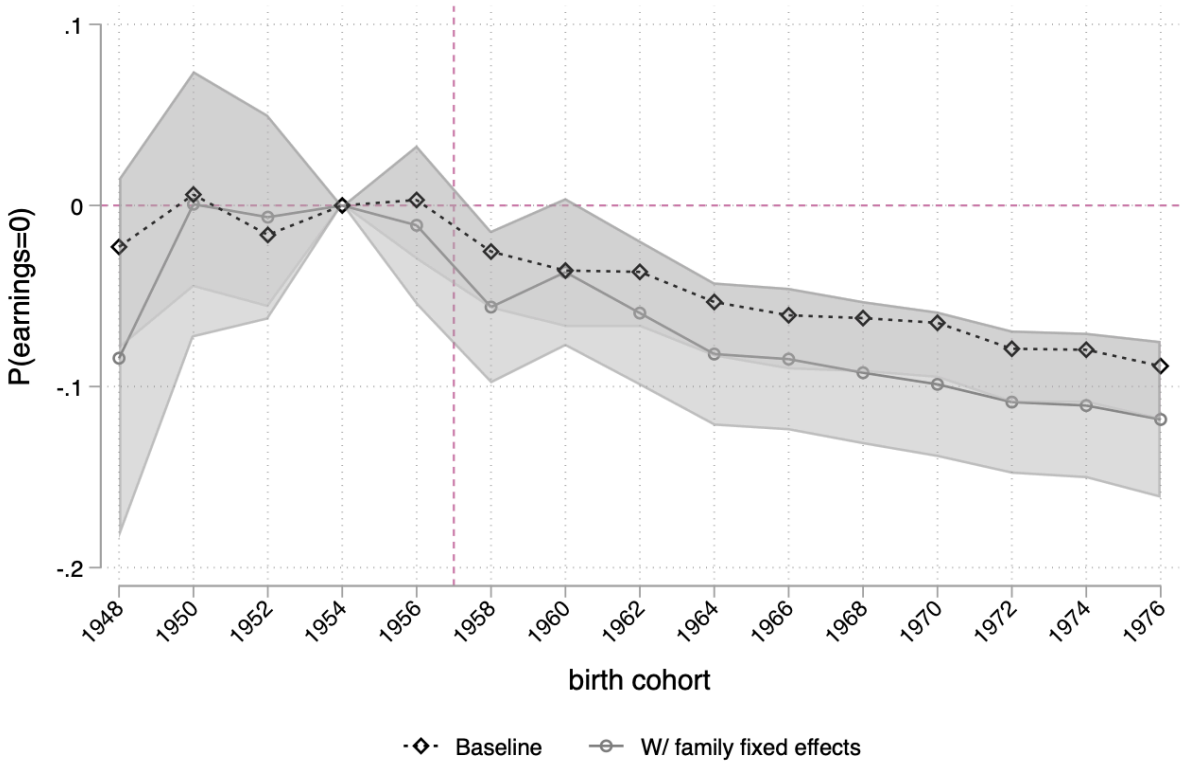
Note: Point estimates and 95 percent confidence of the parameter δ in equation $P(disability_{ict}=0) = \sum^{10}_{k=-10} \delta_s \, BD_i \, I(t\text{-}Y(BD)_i = k) + \beta_2 \, Depression_i + \beta_3 \, Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is an indicator for being on disability, *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015, $Y(BD)_i$ is the year of the diagnosis, and *I()* is an indicator function. The vector contains θ_c cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. Estimates are shown separately for individuals born before and after 1956. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.

FIGURE 8– COHORT-SPECIFIC EFFECTS OF ACCESS TO LITHIUM ON LN(EARNINGS)



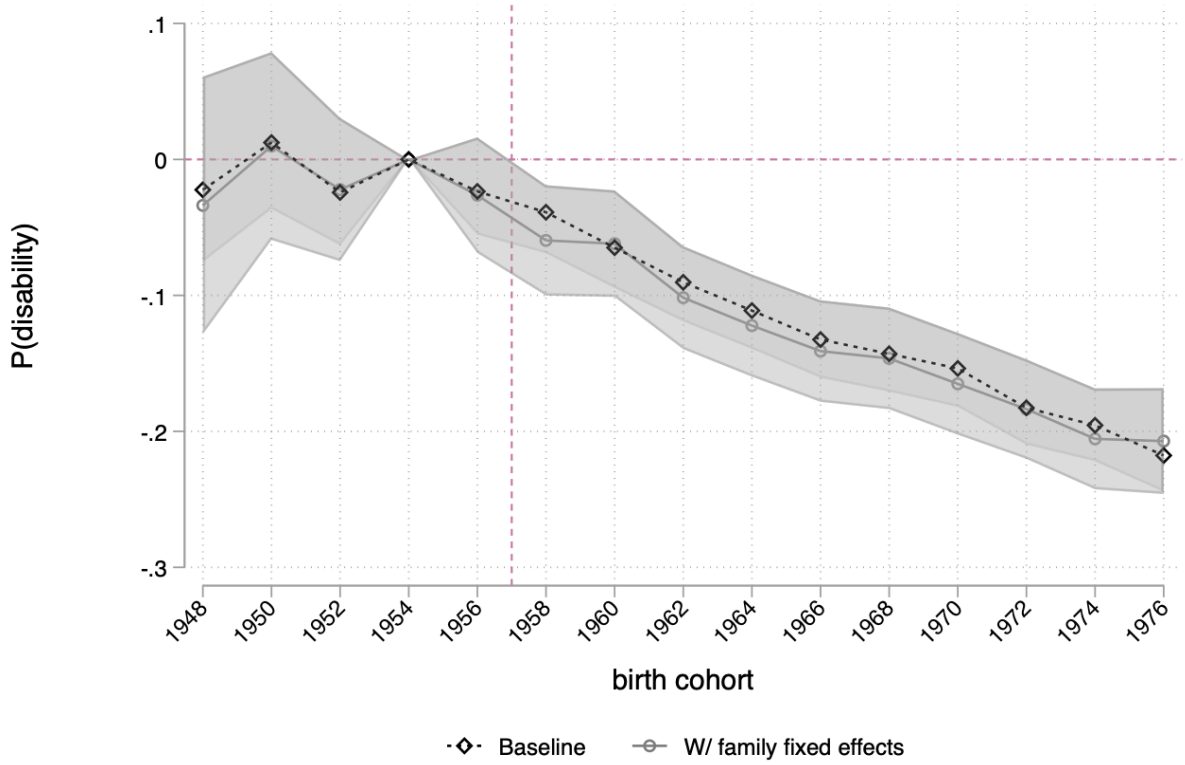
Note: OLS point estimates and 95 percent confidence intervals of the parameter β_c in the equation $ln(earnings_{ict}) = \Sigma_c \beta_c BD_i \times \theta_{c(i)} + \gamma_1 BD_i + \gamma_2 Depression_i + \gamma_3 Schizophrenia_i + \delta_{f(i)} + \theta_{c(i)} + \tau_t + \varepsilon_{it}$. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. The vectors θ_c, δ_f, and τ_t contain cohort, family, and year fixed effects respectively. Standard errors are clustered at the individual level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1977, with positive earnings.

FIGURE 9– COHORT-SPECIFIC EFFECTS OF ACCESS TO LITHIUM ON P(ZERO EARNINGS)



Note: OLS point estimates and 95 percent confidence intervals of the parameter β_c in the equation $P(earnings_{ict}=0) = \Sigma_c \beta_c BD_i \times \theta_{c(i)} + \gamma_1 BD_i + \gamma_2 Depression_i + \gamma_3 Schizophrenia_i + \delta_{f(i)} + \theta_{c(i)} + \tau_t + \varepsilon_{it}$, where $P(earnings_{it}=0)$ equals 1 for individuals with zero earnings in year t. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. The vectors θ_c, δ_f, and τ_t contain cohort, family, and year fixed effects respectively. Standard errors are clustered at the family level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1977.

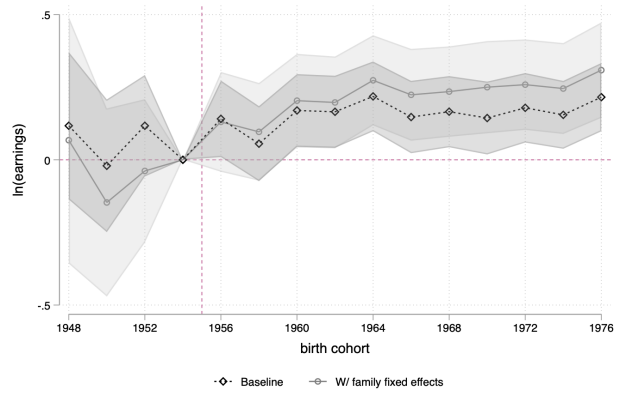
FIGURE 10– COHORT-SPECIFIC EFFECTS OF ACCESS TO LITHIUM ON P(DISABILITY)



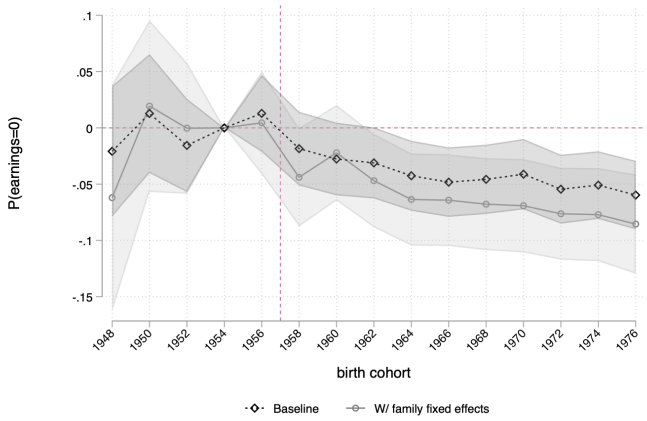
Note: OLS point estimates and 95 percent confidence intervals of the parameter β_c in the equation $P(disability_{ict}) = \Sigma_c \beta_c BD_i \times \theta_{c(i)} + \gamma_1 BD_i + \gamma_2 Depression_i + \gamma_3 Schizophrenia_i + \delta_{f(i)} + \theta_{c(i)} + \tau_t + \varepsilon_{it}$, where $P(disability_{ict})$ equals 1 for individuals on disability in year t. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. The vectors θ_c, δ_f, and τ_t contain cohort, family, and year fixed effects respectively. Standard errors are clustered at the family level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1977.

FIGURE 11– COHORT-SPECIFIC EFFECTS OF ACCESS TO LITHIUM – TRIPLE DIFFERENCE

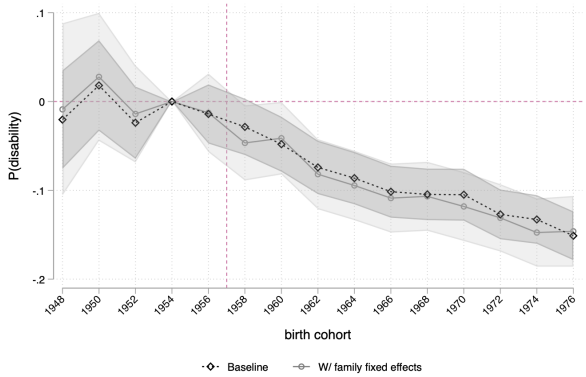
PANEL A) LOG EARNINGS



PANEL A) P(EARNINGS=0)



PANEL C) P(DISABILITY)



Note: OLS point estimates and 95 percent confidence intervals of the parameter β_c in the equation $Y_{ict} = \alpha_1 BD_i + \beta_1 BD_i \times post_c + \alpha_2 \# BD\ episodes_i + \beta_2 \# BD\ episodes_i \times post_c + \gamma Z_{it} + \theta_c + \tau_t + \varepsilon_{it}$, where the dependent variable is either the natural logarithm of earnings (panel A), an indicator for zero earnings (panel B), and an indicator for disability (panel C). The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. The vectors θ_c, δ_f, and τ_t contain cohort, family, and year fixed effects respectively. Standard errors are clustered at the family level. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1977.

TABLE 1 – COUNT OF PEOPLE WITH DEPRESSION, BIPOLAR DISORDER, AND SCHIZOPHRENIA

	All	Depression	BD	Schizophrenia
All	2,692,479	97,932	22,694	41,813
pre-1956	877,265	27,121	7,705	12,096
post-1956	1,815,214	70,811	14,989	29,717
Receiving disability pay (average per year)	150,261	16,981	6,026	19,327
pre-1956	70,311	6,244	2,537	5,952
post-1956	79,950	10,734	3,489	13,375
Average earnings ($)	52,307	37,643	35,359	24,661
	(83,476)	(33,599)	(35,319)	(27,826)
pre-1956	54,180	42,269	38,076	26,041
	(140,099)	(41,023)	(41,386)	(27,772)
post-1956	51,583	36,292	34,411	24,317
	(45,499)	(30,969)	(32,887)	(27,829)

Note: Counts of observations for individuals aged 20-60 born in cohorts 1946-1976 in Denmark between 1995 and 2015, and average earnings measured in 2015 US dollars ($). The variables *BD, Depression,* and *Schizophrenia* equal 1 for individuals who have ever been diagnosed with these pathologies at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015.

TABLE 2 - OLS — MENTAL HEALTH CONDITIONS, CAREER, AND EDUCATIONAL OUTCOMES

	ln(Earnings)		P(Earnings = 0)		P(Disability)	
	(1)	(2)	(3)	(4)	(5)	(6)
BD	-0.478***	-0.446***	0.150***	0.133***	0.128***	0.105***
	(0.009)	(0.010)	(0.002)	(0.003)	(0.002)	(0.002)
Depression	-0.438***	-0.370***	0.153***	0.106***	0.074***	0.048***
	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
Schizophrenia	-1.354***	-1.328***	0.447***	0.388***	0.411***	0.401***
	(0.011)	(0.012)	(0.002)	(0.002)	(0.002)	(0.002)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	No	Yes	No	Yes	No	Yes
Mean of Dep. Var.	--	--	.134	.105	.059	.047
R-squared	0.045	0.306	0.048	0.342	0.092	0.424
N	41,619,160	31,404,955	48,071,128	35,077,362	48,071,128	35,077,362

Standard errors in parentheses are clustered at the individual level.

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

Note: The dependent variable is the natural logarithm of earnings (columns 1-2), an indicator for individuals having zero earnings (columns 3-4), and for receiving disability benefits (columns 5-6). Earnings are measured in nominal DKK and are the sum of all wages and income from self-employment. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, and 6 include family fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; columns 1 and 2 refer to individuals with positive earnings.

TABLE 3 – OLS. MENTAL HEALTH DISORDERS AND THE PROBABILITY OF EXTREME EARNINGS

	Top 10%		Top 25%		Bottom 10%		Bottom 25%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BD	-0.030***	-0.033***	-0.070***	-0.077***	0.120***	0.111***	0.152***	0.146***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Depression	-0.052***	-0.041***	-0.112***	-0.091***	0.099***	0.086***	0.161***	0.141***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Schizophrenia	-0.058***	-0.044***	-0.137***	-0.111***	0.319***	0.309***	0.333***	0.303***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Family FE	No	Yes	No	Yes	No	Yes	No	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep. Var.	.10	.10	.25	.25	.10	.10	.25	.25
R-squared	0.009	0.373	0.014	0.381	0.024	0.210	0.030	0.277
N	41,619,160	31,404,950	41,619,160	31,404,950	41,619,160	31,404,950	41,619,160	31,404,950

Standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable equals 1 for individuals with earnings in the top 10 percent (columns 1-2), top 25 percent (columns 3-4), bottom 10 percent (columns 6-7), and bottom 25 percent (columns 7-8) of the earnings distribution. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, 6, and 8 include family fixed effects. Data include all people with positive earnings aged 20-60 and born in cohorts 1946-1975.

TABLE 4 - OLS, DEPENDENT VARIABLE IS LN(EARNINGS)

	ln(Earnings)		P(Earnings=0)		P(Disability)	
	(1)	(2)	(3)	(4)	(5)	(6)
BD	-0.560***	-0.662***	0.196***	0.198***	0.218***	0.214***
	(0.019)	(0.034)	(0.004)	(0.008)	(0.004)	(0.008)
BD x post	0.112***	0.240***	-0.065***	-0.073***	-0.128***	-0.122***
	(0.021)	(0.036)	(0.005)	(0.009)	(0.005)	(0.008)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	No	Yes	No	Yes	No	Yes
Mean of Dep. Var.	--	--	.134	.105	.059	.047
R-squared	0.045	0.306	0.049	0.344	0.092	0.424
N	41,619,160	21,541,180	48,071,128	35,077,362	48,071,128	35,077,362

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of earnings, defined as the sum of all wages and income from self-employment (columns 1-2); an indicator for individuals receiving zero earnings in a given year (columns 3-4); and for individuals on disability (columns 5-6). The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 4-6 include family fixed effects. The sample is restricted to people aged 20-60 born in cohorts 1946-1975; in columns 1-2, we further restrict the sample to people with positive earnings.

TABLE 5 - OLS, EFFECTS ON EXTREME EARNINGS.
DEPENDENT VARIABLE IS = 1 FOR INDIVIDUALS HAVING EARNINGS IN TOP AND BOTTOM PERCENTILES

	Top 10%		Top 25%		Bottom 10%		Bottom 25%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BD	-0.027***	-0.052***	-0.059***	-0.114***	0.133***	0.149***	0.148***	0.182***
	(0.003)	(0.008)	(0.005)	(0.010)	(0.004)	(0.008)	(0.005)	(0.010)
BD x post	-0.004	0.021***	-0.015***	0.040***	-0.017***	-0.042***	0.007	-0.039***
	(0.003)	(0.008)	(0.005)	(0.011)	(0.005)	(0.008)	(0.006)	(0.011)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	No	Yes	No	No	No	Yes	No	No
Mean of Dep. Var.	.10	.10	.25	.25	.10	.10	.25	.24
R-squared	0.009	0.373	0.014	0.381	0.024	0.210	0.030	0.277
N	41,619,160	31,404,955	41,619,160	31,404,955	41,619,160	31,404,955	41,619,160	31,404,955
Standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1								

Note: The dependent variable equals 1 for individuals with earnings in the top 10 percent (columns 1-2), top 25 percent (columns 3-4), bottom 10 percent (columns 6-7), and bottom 25 percent (columns 7-8) of the earnings distribution. The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, 6, and 8 include family fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975, with positive earnings.

TABLE 6 –OLS, DEPENDENT VARIABLE IS LN(EARNINGS), P(EARNINGS = 0), P(DISABILITY)

	ln(Earnings) (1)	P(Earnings = 0) (2)	P(Disability) (3)
BD	-0.563***	0.187***	0.208***
	(0.031)	(0.008)	(0.007)
BD x post	0.109***	-0.050***	-0.117***
	(0.032)	(0.008)	(0.007)
BD sibling	-0.067***	0.022***	0.022***
	(0.017)	(0.006)	(0.005)
BD sibling in post cohort	-0.032*	0.012*	-0.005
	(0.018)	(0.006)	(0.005)
Cohort	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Family FE	No	No	No
Mean of Dep. Var.	--	.105	.047
R-squared	0.063	0.055	0.101
N	31,404,955	35,077,362	35,077,362

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the logarithm of earnings (column 1), an indicator for zero earnings (column 2), and for disability (column 3). The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. *BD sibling* equals 1 for individuals with siblings with *BD*, and *BD sibling in post cohort* equals 1 for individuals with *BD* siblings born in cohorts after 1956. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*, the natural logarithm of the unemployment rate, an indicator for being enrolled in education, and an indicator for part-time work. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; in column 1, the sample is further restricted to include individuals with positive earnings.

TABLE 7 – OLS, DEPENDENT VARIABLE IS LN(EARNINGS), P(EARNINGS = 0), P(DISABILITY) – BY PARENTS' ASSETS

	Log(Earnings) (1)	P(Earnings=0) (2)	P(Disability) (3)
Parents assets < 25	-0.081***	0.036***	0.011***
	(0.009)	(0.003)	(0.002)
Parents assets >= 75	0.048***	-0.012***	-0.006**
	(0.012)	(0.004)	(0.003)
BD/Mania	-0.425***	0.137***	0.102***
	(0.017)	(0.004)	(0.004)
BD x Par. assets < 25	0.042	-0.014	-0.020***
	(0.031)	(0.009)	(0.007)
BD x Par. assets >= 75	0.052*	-0.028***	-0.034***
	(0.029)	(0.008)	(0.007)
Depression	-0.378***	0.108***	0.045***
	(0.007)	(0.002)	(0.002)
Depression x Par.assets < 25	-0.015	0.013***	-0.004
	(0.012)	(0.004)	(0.003)
Depression x Par.assets >= 75	0.039***	-0.036***	-0.015***
	(0.012)	(0.003)	(0.003)
Schizophrenia	-1.234***	0.374***	0.381***
	(0.020)	(0.004)	(0.004)
Schizophrenia x Par.assets < 25	-0.101***	-0.014**	-0.007
	(0.036)	(0.007)	(0.006)
Schizophrenia x Par.assets >= 75	0.058*	-0.002	-0.016**
	(0.034)	(0.007)	(0.007)
Cohort	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Family FE	No	No	No
Mean of Dep. Var.	--	.092	.034
R-squared	0.293	0.302	0.387
N	19,660,052	21,656,217	21,656,217

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the logarithm of earnings (column 1), an indicator for zero earnings (column 2), and for disability (column 3). The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015. The variable *Parent < 25th percentile* equals 1 for individuals whose parents have median assets below the *25th percentile*. Information of parents' assets is available for years 1985 to 2010 and for 38 percent of the sample. All regressions include cohort and year fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; in column 1, the sample is further restricted to include individuals with positive earnings.

TABLE 8 – OLS, DEPENDENT VARIABLE IS LN(EARNINGS), P(EARNINGS = 0), P(DISABILITY) – BY PARENTS' ASSETS

	ln(earnings) (1)	P(earnings=0) (2)	P(disability) (3)
BD/Mania	-0.561***	0.200***	0.246***
	(0.133)	(0.033)	(0.032)
BD/Mania x post	0.103	-0.057*	-0.152***
	(0.134)	(0.034)	(0.032)
Parents < 25 pctile	-0.107***	0.063***	0.043***
	(0.011)	(0.005)	(0.004)
BD x Parents < 25 pctile	-0.179	0.074	0.051
	(0.262)	(0.066)	(0.060)
Post x Parents < 25 pctile	-0.050***	0.009*	-0.019***
	(0.011)	(0.005)	(0.004)
BD x Parents < 25 pctile x post	0.191	-0.070	-0.058
	(0.264)	(0.066)	(0.060)
Parents >= 75 pctile	0.152***	-0.026***	-0.023***
	(0.010)	(0.003)	(0.003)
BD x Parents >= 75 pctile	0.119	-0.064	-0.127**
	(0.219)	(0.060)	(0.058)
Post x Parents >= 75 pctile	-0.033***	0.009***	0.013***
	(0.010)	(0.003)	(0.003)
BD x Parents >= 75 pctile x post	-0.047	0.024	0.090
	(0.220)	(0.060)	(0.058)
Cohort	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Family FE	No	No	No
Mean of Dep. Var.	--	.089	.032
R-squared	0.086	0.060	0.098
N	19,660,052	21,656,217	21,656,217

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the logarithm of earnings (column 1), an indicator for zero earnings (column 2), and for disability (column 3). The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*, the natural logarithm of the unemployment rate, an indicator for being enrolled in education, and an indicator for part-time work. Diagnoses data are available for calendar years 1995-2015. The variable *Parent < 25 (Parents >= 75)* equals 1 for individuals whose parents have median assets below the 25th percentile (above the 75th percentile). Information of parents' assets is available for years 1985 to 2010 and for 38 percent of the sample. All regressions include cohort and year fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; in column 1, the sample is further restricted to include individuals with positive earnings.

TABLE 9 – INTENSITY OF CONDITIONS. OLS, DEPENDENT VARIABLE IS LN(EARNINGS), P(EARNINGS = 0), P(DISABILITY)

	Log(earnings)		P(earnings = 0)		P(disability)	
	(1)	(2)	(3)	(4)	(5)	(6)
BD	-0.241***	-0.352***	0.096***	0.098***	0.099***	0.095***
	(0.030)	(0.058)	(0.007)	(0.014)	(0.007)	(0.013)
BD x post	0.008	0.201***	-0.010	-0.039***	-0.105***	-0.109***
	(0.035)	(0.061)	(0.009)	(0.015)	(0.008)	(0.014)
# BD episodes	-0.253***	-0.209***	0.071***	0.064***	0.085***	0.076***
	(0.022)	(0.036)	(0.004)	(0.008)	(0.004)	(0.007)
# BD episodes x post	0.098***	0.016	-0.041***	-0.019	-0.019***	-0.003
	(0.025)	(0.034)	(0.005)	(0.008)	(0.005)	(0.007)
Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	No	Yes	No	Yes	No	Yes
Mean of Dep. Var.	--	--	.134	.105	.059	.047
R-squared	0.045	0.306	0.049	0.342	0.093	0.425
N	41,619,160	31,404,955	48,071,128	35,077,362	48,071,128	35,077,362

Standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of earnings, defined as are the sum of all wages and income from self-employment (columns 1-2), an indicator for zero earnings (columns 3-4), and an indicator for disability (columns 5-6). The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. The variable *# BD episodes* counts the number of separate BD diagnosed received between 1995 and 2015 Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*, the natural logarithm of the unemployment rate, an indicator for being enrolled in education, and an indicator for part-time work. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, and 6 include family fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; columns 1-2 further restrict the sample to individuals with positive earnings.

TABLE 10 – ALTERNATIVE TREATMENT DEFINITION. OLS, DEPENDENT VARIABLE IS LN(EARNINGS), P(EARNINGS = 0), P(DISABILITY)

	ln(earnings)		P(earnings = 0)		P(disability)	
	(1)	(2)	(3)	(4)	(5)	(6)
BD/lithium	-0.482***	-0.557***	0.166***	0.175***	0.193***	0.198***
	(0.025)	(0.036)	(0.006)	(0.009)	(0.006)	(0.008)
BD/lithium x post	0.082***	0.174***	-0.041***	-0.058***	-0.101***	-0.104***
	(0.027)	(0.037)	(0.007)	(0.009)	(0.006)	(0.009)
Cohort	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	No	Yes	No	Yes	No	Yes
Mean of Dep. Var.	--	--	0.105	0.105	0.047	0.047
N	31,404,955	31,404,955	35,077,362	35,077,362	35,077,362	35,077,362

Standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of earnings, defined as are the sum of all wages and income from self-employment (columns 1-2), an indicator for zero earnings (columns 3-4), and an indicator for disability (columns 5-6). The variable *BD/lithium* equals 1 for individuals who have been diagnosed with this condition or have received a lithium prescription at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*, the natural logarithm of the unemployment rate, an indicator for being enrolled in education, and an indicator for part-time work. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, and 6 include family fixed effects. The sample is restricted to individuals aged 20-60 born in cohorts 1946-1975; columns 1-2 further restrict the sample to individuals with positive earnings.

DATA APPENDIX

Information on all demographic variables (age, gender, children, parents, employment and occupations) are drawn from a set of registries previously known as the Integrated Database for Labor Market Research (IDA). These registries combine high-accuracy information across more than 150 government registries.

Data on psychiatric patients are drawn from the LPSYDIAG registry. Data on prescriptions come from the LMDB registry.

Information on families, households and demographics are from the BEF, FAIN, FAM, FTDK, FTDM, UDDA and IDAP registries. Data on employment, occupations, unemployment, income and employers are drawn from the IDAN, IDAS, FIRM, IND and AKM registries. Information on start-ups is drawn from the IVPE and IVPS registries.

We link individual-level variables across these datasets using social security numbers (SSN). People born in Demark receive their SSNs at birth. Immigrants and foreign employees are assigned an SSN by the municipal office or the International Citizen Service when they receive a work permit or residence permit.

We define creative occupations using the ISCO variable in the AKS Danish registry data (variables DISCO88 and DISCO08). We link the ISCO-88 and ISCO-08 using the official correspondence table, available at http://www.ilo.org/public/english/bureau/stat/isco/.

TABLE A1: LIST OF VARIABLES

Variable	Variable name	Definition	Years available	Registry name	Registry
Prescriptions and Diagnoses					
BD		Indicator for individuals with diagnosis code ICD-10: F31	1995-2013	Landspatientregistret for Psykiatri Diagnoser	LPSYDIAG
Mania		Indicator for individuals with diagnosis code ICD-10: F30, and for which BD = 0	1995-2013	Landspatientregistret for Psykiatri Diagnoser	LPSYDIAG
Schizophrenia		Indicator for individuals with diagnosis codes ICD-10: F20-F29	1995-2013	Landspatientregistret for Psykiatri Diagnoser	LPSYDIAG
Depression		Indicator for individuals with diagnosis codes ICD-10: F32	1995-2013	Landspatientregistret for Psykiatri Diagnoser	LPSYDIAG
Lithium		Indicator for individuals with at least 1 prescription of lithium (ATC: N05AN)	1995-2013	Medicinal Product Statistics	LMDB
Labor Market Variables					
Earnings	ERHVERVSINDK + NETOVSKUD	Sum of total wages for all jobs and income from self-employment	1995-2013	Income and Employment	IND, IDAP and IDAN
Executive	STILL	Indicator for individuals with occupation, STILL = 31	1995-2013	Employment	IDAN/AKS

Self-employment	STILL, PSTILL	Indicator for individuals with occupation STILL or PSTILL = 11, 12, 13, 14, 19	1995-2013	Employment	IDAN/AKS
Creative professions	ISCO08, ISCO88	Indicator for individuals with occupation (See Table A2)	1995-2013	Employment	IDAN/AKS
Part-time work	TILKNYT	Indicator for individuals with a full-time contract	1995-2013	Employment	IDAN
Disability	PSTILL	Indicator for individuals with variable PSTILL = 93	1995-2013	Demographics	IDAP
Days of unemployment	ARLEDGR	Number of days of unemployment (based on information from the unemployment funds)	1995-2013	Demographics	IDAP
Enrollment in education	IG_VFRA	Indicator for individuals enrolled in any education program	1995-2013	Education	UDDA
Firm Characteristics					
Firm age	START_DATO	Date of establishment of each firm	1995-2013	Firm characteristics	FIRM
Firm size	GF_AARSV	Number of full-time employees	1995-2013	Firm characteristics	FIRM
Family					
Mother ID		Individual identifier of mother	1995-2013	Family information	BEF, FAIN and FAM

TABLE A2: CREATIVE PROFESSIONS IN KYAGA ET AL. (2011) AND LUDWIG ET AL. (1992)

Profession	Kyaga (2011)*	ISCO-88**/***	ISCO-08***	Kyaga	Ludwig	Kyaga + Ludwig
University teachers	051	2310 University and Higher Education Teachers	2310 University and Higher Education Teachers	X		X
Photographers	946	3131 Photographers	3431 Photographers	X		X
			3521 Broadcasting and Audiovisual Technicians	X		X
Visual artists and designers	081	2452 Visual artists (Sculptors, Painters and Related Artists)	2651 Visual artists (Sculptors, Painters and Related Artists)	X	X	X
	082		2166 Graphic and Multimedia Designers	X	X	X
Display artists and designers	083	3471 Decorators and Commercial Designers	3432 Interior Designers and Decorators	X	X	X
			3435 Other Artistic and Cultural Associate Professionals	X	X	X
			2163 Product and Garment Designers	X	X	X
			2166 Graphic and Multimedia Designers	X	X	X
			3433 Gallery, Museum and Library Technicians	X	X	X
Performing artists	086	2455 Film, Stage and Related Actors and Directors	2654 Film, Stage and Related Directors and Producers	X	X	X
			2655 Actors	X	X	X
		2454 Choreographers and Dancers	2653 Dancers and Choreographers	X	X	X

Composers and musicians	087	2453 Composers, Musicians and Singers	2652 Musicians, Singers and Composers	X	X	X
Authors	084	2451 Authors, Journalists and Other Writers	2431 Advertising and Marketing Professionals	X	X	X
			2432 Public Relations Professionals	X	X	X
			2641 Authors and Related Writers	X	X	X
			2642 Journalists	X	X	X
Other literary and artistic work	088	3474 Clowns, Magicians, Acrobats and Related Associate Professionals	3435 Other Artistic and Cultural Associate Professionals	X	X	X
Architects		2141 Architects, Town and Traffic Planners	2161 Building Architects		X	X
			2162 Landscape Architects		X	X

Note: Definition of creative professions. *) Kyaga et. al. (2011) "Creativity and mental disorder: family study of 300 000 people with severe mental disorder", The British Journal of Psychiatry, 199, 373–379. **) Kyaga (2014) "Creativity and Psychopathology", PhD Thesis, Stockholm, Sweden: Karolinska Instituttet. ***) International Standard Classification of Occupation (ISCO-08), Index correspondance with ISCO-88, International Labor Organization.

TABLE A3: DESCRIPTION OF DIAGNOSES

Variable	ICD code	ICD definitions
BD	ICD-10 30	A disorder characterized by two or more episodes in which the patient's mood and activity levels are significantly disturbed, this disturbance consisting on some occasions of an elevation of mood and increased energy and activity (hypomania or mania) and on others of a lowering of mood and decreased energy and activity (depression). Repeated episodes of hypomania or mania only are classified as bipolar.
Mania	ICD-10 31	A disorder which is elevated out of keeping with the patient's circumstances and may vary from carefree joviality to almost uncontrollable excitement. Elation is accompanied by increased energy, resulting in overactivity, pressure of speech, and a decreased need for sleep. Attention cannot be sustained, and there is often marked distractibility. Self-esteem is often inflated with grandiose ideas and overconfidence. Loss of normal social inhibitions may result in behavior that is reckless, foolhardy, or inappropriate to the circumstances, and out of character.
Depression	ICD-10: F32	A mental condition marked by ongoing feelings of sadness, despair, loss of energy, and difficulty dealing with normal daily life. Other symptoms of depression include feelings of worthlessness and hopelessness, loss of pleasure in activities, changes in eating or sleeping habits, and thoughts of death or suicide.
Schizophrenia	ICD-10: F20-F29	A group of severe mental disorders in which a person has trouble telling the difference between real and unreal experiences, thinking logically, having normal emotional responses to others, and behaving normally in social situations. Symptoms include seeing, hearing, feeling things that are not there, having false ideas about what is taking place or who one is, nonsense speech, unusual behavior, lack of emotion, and social withdrawal.

TABLE A4 –AVERAGE EARNINGS (IN US$)

	All	BD	Depression	Schizophrenia
All	52,307	35,359	37,642	24,661
	(83,476)	(35,319)	(335,991)	(27826)
pre-1956	54,180	38,076	26,047	26,041
	(140,099)	(41386)	(35,546)	(27,772)
post-1956	51583	34411	24,238	24,317
	(45,499)	(32887)	(28,385)	(27,829)
CEO in small/young firms	103,648	89,058	84,795	101,104
	(115763)	(136,733)	(201,603)	(218,782)
pre-1956	101,093	69,203	79,070	47,771
	(120,899)	(45,547)	(58,931)	(38537)
post-1956	104,483	94,098	86,696	121,5604
	(114,024)	(151071)	(230,200)	(253,757)
Self-employed	70,683	53,629	50,500	35,669
	(296,012)	(94,634)	(84,178)	(54469)
pre-1956	75190	57,456	59,151	39,931
	(476,117)	(106,007)	(100,946)	(56795)
post-1956	68,249	51,537	46,491	34,193
	(111,864)	(87,733)	(74,812)	(53,565)
Receiving disability pay	4,061	3,221	3,506	2,145
	(10,447)	(15,206)	(7,827)	(5,617)
pre-1956	4,763	3,452	4,158	2,112
	(13,605)	(23,766)	(10,261)	(8,943)
post-1956	3,608	3,091	3,206	2,154
	(7,727)	(6,541)	(6,384)	(4,142)

Note: Means and standard deviations (in parentheses) of annual earnings (measured in US dollars) for individuals aged 20-60 born in cohorts 1946-1976 between 1995 and 2015. Earnings are measured in 2015 US dollars and are the sum of all wages and income from self-employment. The variables *BD, Depression,* and *Schizophrenia* equal 1 for individuals who have ever been diagnosed with these conditions at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015.

TABLE A5– COMORBIDITY: BD AND OTHER MENTAL DISORDERS

	BD + Depression	BD + Schizophrenia	BD + Depression + Schizophrenia
All	6277	3093	1164
pre-1956	2236	1114	392
post-1956	4041	1979	772

TABLE A6 – MENTAL HEALTH CONDITIONS, CAREER, AND EDUCATIONAL OUTCOMES. SAMPLE OF PEOPLE WITH FAMILY IDENTIFIERS

	Ln(Earnings)	P(Earnings = 0)	P(Disability)
	(1)	(2)	(3)
BD	-0.470***	0.145***	0.109***
	(0.010)	(0.003)	(0.002)
Depression	-0.439***	0.137***	0.063***
	(0.004)	(0.001)	(0.001)
Schizophrenia	-1.376***	0.450***	0.428***
	(0.012)	(0.002)	(0.002)
Cohort FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Family FE	No	No	No
Mean of Dep. Var.	--	0.105	0.047
N	31,404,955	35,077,362	35,077,362

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the natural logarithm of earnings, defined as the sum of all wages and income from self-employment (column 1); an indicator for individuals receiving zero earnings in a given year (column 2); and for individuals on disability (column 3). Earnings are measured in nominal DKK and are the sum of all wages and income from self-employment. The variables *BD, Depression, Schizophrenia* equal 1 for individuals who have been diagnosed with these conditions at least once between 1995 and 2015. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 2, 4, 6, 8, and 10 include family fixed effects. The sample is restricted to people aged 20-60 born in cohorts 1946-1975 for whom family identifiers are available; in column 1, we further restrict the sample to people with positive earnings.

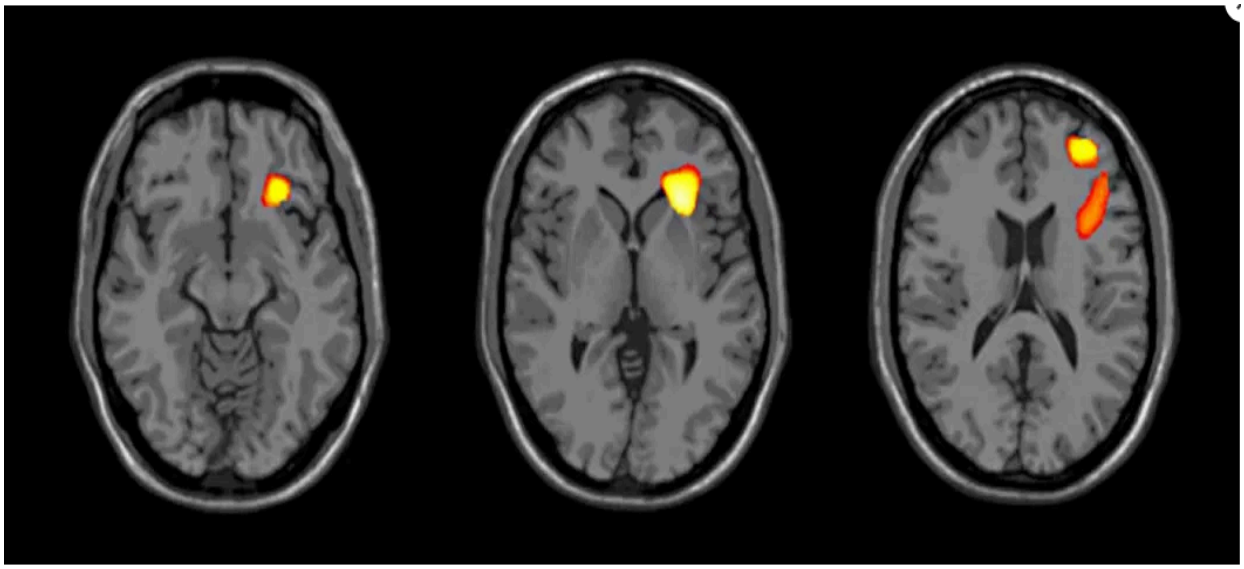
TABLE A7 - OLS, DEPENDENT VARIABLE IS LN(EARNINGS)

	Ln(Earnings)	P(Earnings = 0)	P(Disability)
	(1)	(2)	(3)
BD	-0.564***	0.188***	0.209***
	(0.031)	(0.007)	(0.007)
BD x post	0.108***	-0.050***	-0.117***
	(0.032)	(0.008)	(0.007)
Cohort FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Family FE	No	Yes	No
Mean of Dep. Var.	--	0.105	0.047
N	31,404,955	35,077,362	35,077,362

Standard errors in parentheses are clustered at the individual level.
*** p<0.01, ** p<0.05, * p<0.1

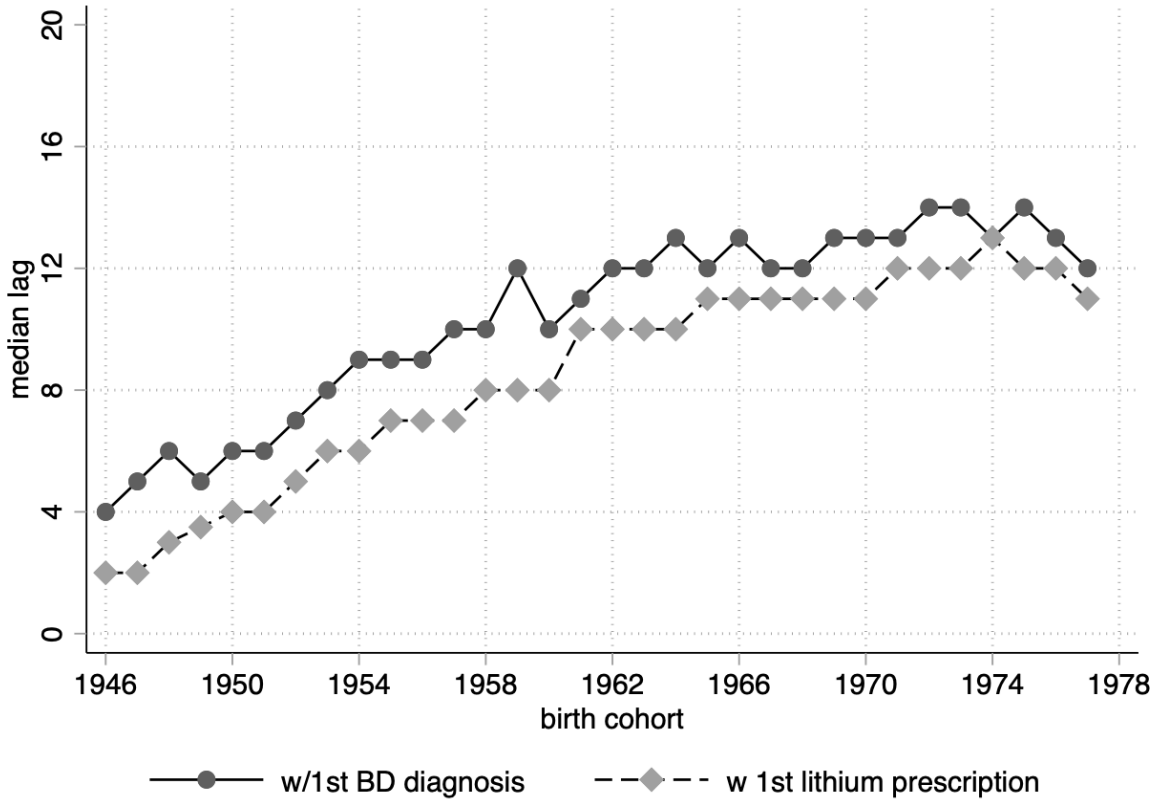
Note: The dependent variable is the natural logarithm of earnings, defined as the sum of all wages and income from self-employment (column 1); an indicator for individuals receiving zero earnings in a given year (column 2); and for individuals on disability (column 3). The variable *BD* equals 1 for individuals who have been diagnosed with this condition at least once between 1995 and 2015. *Post* equals 1 for individuals who were born after 1956, and turned 20 after lithium, the main treatment for bipolar disorder, became available in Denmark in 1976. Controls include indicators for having received at least one diagnosis of *Depression* and *Schizophrenia*. Diagnoses data are available for calendar years 1995-2015. All regressions include cohort and year fixed effects; columns 4-6 include family fixed effects. The sample is restricted to people aged 20-60 born in cohorts 1946-1975 for whom family identifiers are available; in column 1, we further restrict the sample to people with positive earnings.

FIGURE A1– BIPOLAR DISORDER AND THE BRAIN



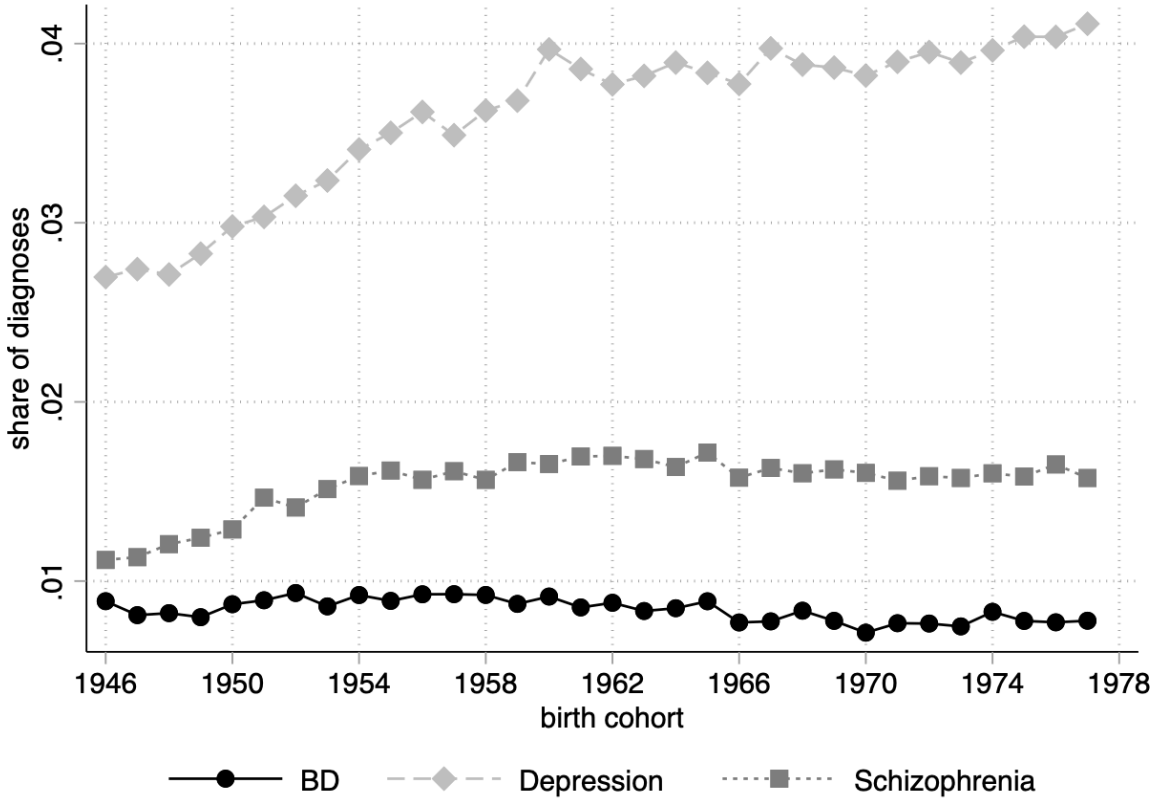
Note: The images show the brain regions (right insula and frontal cortex) where volume decreased more over approximately two years in adolescents with bipolar disorder, compared to adolescents without bipolar disorder. Image credit*: Blumberg lab* and *Biological Psychiatry*.

FIGURE A3– LAG BETWEEN FIRST YEAR IN THE SAMPLE AND FIRST BD DIAGNOSIS/LITHIUM PRESCRIPTION



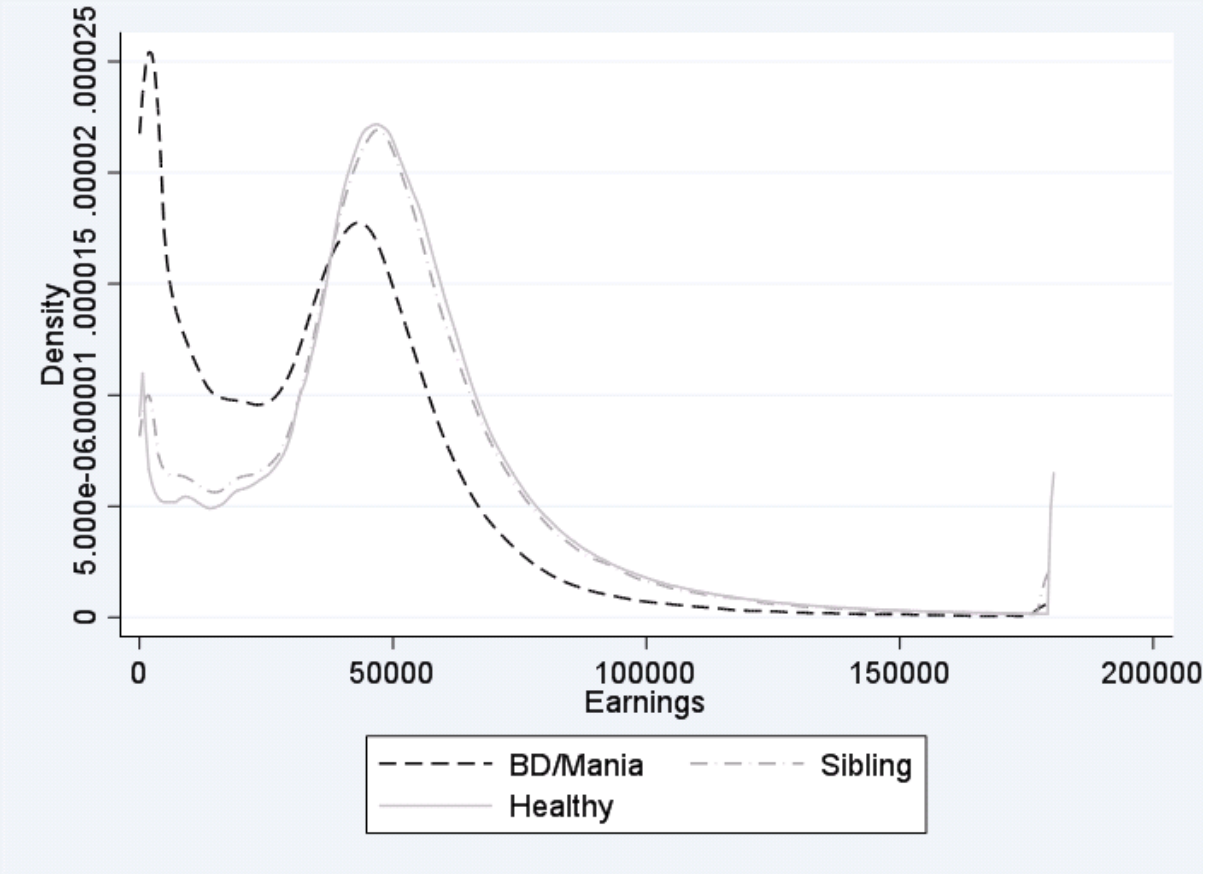
Note: Average lag between the year in which a person entered the sample between 1995 and 2015, and the year in which they received the first diagnosis of BD (solid line) or the first lithium prescription (dashed line).

FIGURE A3– COUNTS OF INDIVIDUALS DIAGNOSED, BY CONDITION AND ACROSS COHORTS



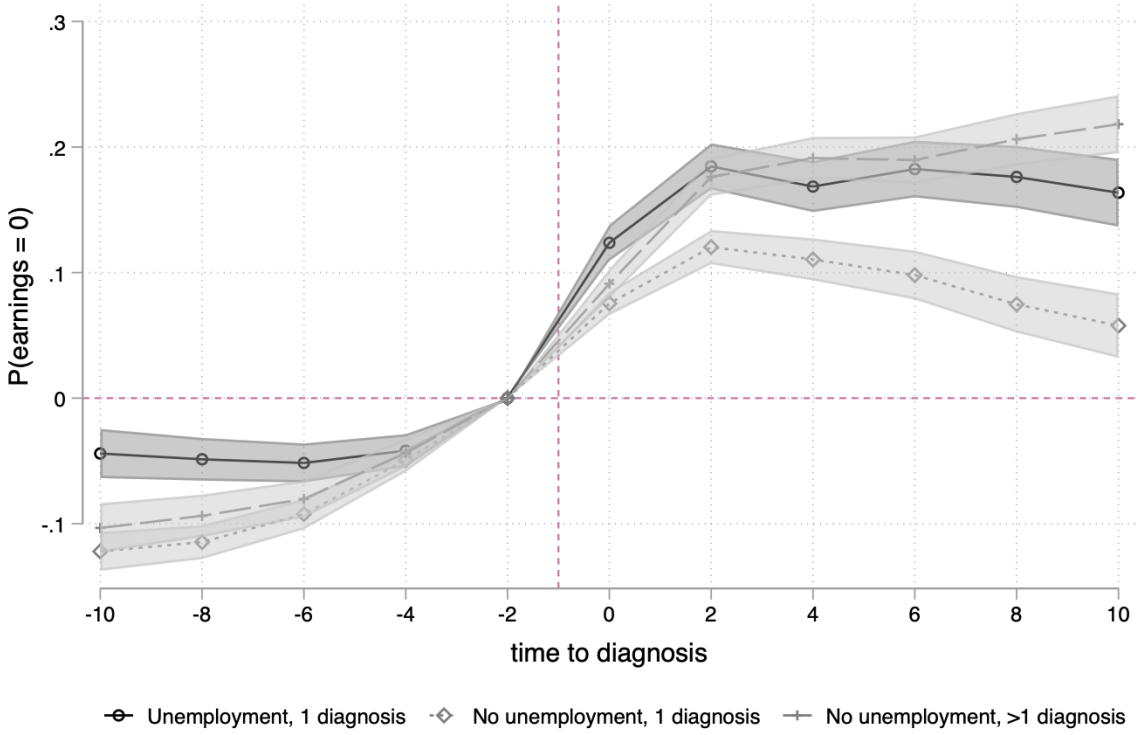
Note: Counts of individuals with at least one diagnosis of depression, BD, or schizophrenia between 1995 and 2015.

FIGURE A5 – EARNING DISTRIBUTION: INDIVIDUALS WITH BD/MANIA, THEIR SIBLINGS, AND HEALTHY INDIVIDUALS



Note: Kernel of the distribution of earnings, separately for individuals diagnosed with BD at least once, for their siblings, and for healthy individuals. The sample is restricted to individuals born between 1946 and 1976.

FIGURE A6– EVENT STUDY OF P(EARNINGS = 0) AROUND A DIAGNOSIS
BY UNEMPLOYMENT AND #DIAGNOSES



Note: Point estimates and 95 percent confidence of the parameter δ in equation $P(earnings_{ict}=0) = \sum^{10}_{k=-10} \delta_k C_i I(t\text{-}Y(C)_i = k) + \beta_1 BD_i + \beta_2 Depression_i + \beta_3 Schizophrenia_i + \theta_c + \tau_t + \varepsilon_{ict}$, where the dependent variable is is an indicator for having no earnings,, C_i is an indicator for any of *BD*, *Depression*, *or Schizophrenia,* $Y(C)_i$ indicates the year when individual *i* is diagnosed with any of these conditions, and *I()* is an indicator function. The vector θ_c contains cohort fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the individual level. In the *Unemployment, 1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive only one diagnosis between 1995 and 2015 and experience at least one unemployment episode in the two years preceding and following the diagnosis. In the *No unemployment, 1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive only one diagnosis between 1995 and 2015 and do not experience any unemployment in the two years preceding and following the diagnosis. In the *No unemployment, >1 diagnosis* series, we compare healthy individuals with people with mental health conditions who receive more than one diagnosis between 1995 and 2015 and do not experience any unemployment in the two years preceding and following the diagnosis. The sample is restricted to individuals between 20 and 60 years of age, born between 1946 and 1976.