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Childhood Mental Health and Labour Market Outcomes

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The Consequences of Childhood and Adolescent Mental Health on Labour Market Outcomes

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Abstract

The use of antidepressants to treat pediatric mental disorders is contentious as for instance the FDA black box warning in 2004 has shown. Using cross-sectional data containing retrospective mental health diagnostics, I study outcomes of childhood and adolescence mental health on labour supply and overall health in adulthood among those who were and were not affected by the market entry of fluoxetine, a new drug for mental disorders. The empirical strategy compares outcomes for subjects with and without access in their childhood. Difference-in-differences estimates show that access to treatment improved the labour force participation rate significantly and thus reduced the negative impact mental disorders have on labour market outcomes. Access to treatment led to a rise in labour force participation by roughly 12 percentage points and reduced the disability risk by more than one fourth.

Keywords: Mental Disorders, NCS, Fluoxetine, Labour Force Participation

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1. Introduction

Mental health conditions are globally among the top five most widespread diseases and increasing worldwide. The common mental disorder, *depression*, caused almost 40 million DALYs (Disability-Adjusted Life Years) across the globe in 2019. Being number four and eight on the list of leading causes for disability for people aged 10-24 years, depressive disorders and anxiety disorders are one of the major challenges to 21st century public health (GBD 2019 Diseases and Injuries Collaborators, 2020). One reason for the high proportion of DALYs attributed is the early onset and prevalence of depression, anxiety and other psychiatric disorders (Kessler et al., 2007; Merikangas et al., 2010). [Figure A1](#) plots the prevalence of depressive and anxiety disorders in U.S. teenagers over the past 30 years. The stark rise at the end of the 20th century is striking. Advances in diagnostic procedures and progresses in social acceptance may have contributed to the surge.

Importantly, mental health conditions have substantial impact on all areas of life. The economic burden is considerable. Increasing morbidity, mortality and health care expenditure as well as negatively affecting quality of life and productivity, mental disorders cost the global economy approximately \$2.5 trillion each year (The Lancet Global Health, 2020). In contrast, government mental health expenditure is very small relative to total health expenditure (USA: <0,05%; WHO,2017). With respect to human capital development, psychological fitness is similarly important as physical health and noncognitive skills are regarded equally important as cognitive skills (Currie et al., 2010).

In this paper, I investigate the labour market effects of childhood and adolescence mental health disorders¹. I do so by exploiting a major change in treatment to investigate the consequences of mental health disorders during childhood and adolescence on labour market outcomes. I use cross-sectional data from the U.S. National Comorbidity Survey (NCS) Series and the Collaborative Psychiatric Epidemiology Surveys (CPES) which cover a wide range of mental health diagnoses including the age of onset as well as household income, labour force participation, hours worked, and disability. About 8.5% of people in the sample suffered from Major Depressive Disorder (MDD), and 5.5% from Generalized Anxiety Disorder (GAD), the two central disorders in my analyses, between the ages 8 and 20.

¹Unless otherwise specified, the terms *childhood* and *adolescence* are used interchangeably to refer to the period of life between 8 and 20 years of age. *Parent* refers to biological parent or legal guardian.

The approval of *fluoxetine* as a new drug for MDD, Obsessive-Compulsive Disorder (OCD), Eating Disorder (ED), Panic Disorder (PD), and Bipolar Disorder (BD) in 1988 provides exogenous variation that I use to compare outcomes across cohorts affected by at least one of the disorders with and without access to treatment. To control for socioeconomic background and other characteristics related to the outcomes, I use a variety of control variables such as childhood circumstances. Parental background and socioeconomic status have been shown to be an important determinant for childhood mental health (e.g. Fitzimons et al., 2017).

I find that access to a new treatment increases the likelihood of participating in the labour force by roughly 12 percentage points. This effect is especially strong among those who experienced anxiety disorders in their adolescence. Controlling for family background and other relevant characteristics leaves the magnitude and significance by and large unchanged and confirm the result. Effects on the likelihood of having a disability, early retirement, marital status, substance use, and years of education shed light on possible mechanisms. Cohorts with access to treatment have a lower disability risk, are less likely to both retire early and abuse drugs.

By investigating the effects of access to fluoxetine (marketed as *Prozac*) on income, labour force participation, hours worked, and disability status, my study contributes to the literature about the consequences of health and health treatment on labour outcomes². As a special feature, this study draws the bow from retrospective childhood and adolescent mental health to adult labour market outcomes. Research about access to medication that improves mental health is scarce. To my knowledge, this is the first attempt that exploits the market entry of Prozac as identification strategy to examine the long-run impact of childhood mental health .

An earlier paper authored by Ettner et al. (1997) uses NCS-1 data to find that the presence of any mental disorder is associated with up to 11 percentage points lower employment rates for both men and women. Men with disorder work fewer hours and labour income is substantially lower for affected individuals across gender. Chatterji et al. (2011) and Banerjee et al. (2017) use NCS-R and NLAAS data and find negative effects of psychiatric disorders on labour force participation and employment. Whereas these studies presented short-term

²An overview about health and the labour market can be found in Currie and Madrian (1999). More recent evidence on childhood health and human capital is available in e.g. Currie (2009) and Currie (2020). In the past years the opioid use in the U.S. received amplified attention (e.g. Harris et al., 2020)

results for adults, I address long-run implications of mental health from childhood to adulthood by exploiting the retrospective diagnostics feature of NCS and CPES. Furthermore, these former studies either use questionable instruments (Ettner et al., 1997) or strategies that rely on the strong assumption that the relationship between treatment and observables can fully account for the relationship between treatment and unobservables (Chatterji et al., 2011). I, instead, make use of both the old NCS-1 and CPES to apply an exogenous change in access to treatment for mental disorders.

Two papers make use of the black box warning on antidepressants as exogenous variation. Finding increased suicide rates as well as worsened academic and behavioural performance of adolescents aged 12-17 after its introduction, Busch et al. (2014) express concerns about the unintended impacts of the warning. Using annual cross-section data from the National Survey on Drug Use and Health (NSDUH), the grade point average of students fell by 0.14 points after the warning was issued. The drop reflects the changes of students deemed probably being depressed (based on whether professional help for depressive problems was sought) relative to their improbable affected peers. Delinquency and substance use increased for girls. Also drawing on NSDUH data, Bütikofer et al. (2020) research the employment effects of the 2007 FDA black box warning extension to the age of 24. Their study shows that the exogenous intervention had negative spillover effects on the employment situation of (technically) unaffected women between 35 and 49 years of age. Labour participation declined by 0.23 percentage points equal to almost \$12 billion dollar of wages. Shapiro (2020) links exposure to antidepressant advertising to labour market supply and finds decreased absenteeism at work.

My paper is most closely connected to Biasi et al. (2020), who estimate effects of access to lithium for the treatment of bipolar disorders on earnings and disability. Using Danish registry data they find significant reductions in the earnings gap between those with bipolar disorder and those without thanks to treatment access at most relevant ages. The difference-in-differences estimates also show reductions in the probabilities of zero earnings and disability relative to siblings and the non affected population.

Although not addressing mental health, related work with respect to the identification approach exploits the removal of the Cox-2 inhibitor Vioxx used to treat chronic pain to estimate the effects of physical health on labour supply. Garthwaite (2012) suggests a decline in the overall labour force participation of 0.35 percentage points one year after the removal. Similarly, Bütikofer and Skira (2018) argue that the market entry of Vioxx decreased the days of sick leave among those with joint pain by 7 to 12 percent, the withdrawal resulted in a 12 to 16 percent increase. The probability of receiving disability benefits rose by 6 to 15 percent.

This study proceeds as follows. Section 2 lays out the [Background](#). The description of the [Empirical approach](#) follows in section 3. [Results](#) follow in section 4. The [Discussion](#) puts forward further considerations in section 5. Section 6 completes this paper with a [Conclusion](#).

2. Background

This section provides clarifications about the mental disorders included in this study and the new medication for the treatment of these.

2.1 Mental Health Disorders

In this subsection I summarize definition, symptoms and figures of the three mental disorders that are central in this study: major depressive disorder (MDD), obsessive-compulsive disorder (OCD), and generalized anxiety disorder (GAD).

Major depressive disorder (MDD). Depression disorders are diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) or International Classification of Diseases (ICD) criteria, usually by conducting a structured diagnostic interview (Hetrick et al., 2012). Typical symptoms are, amongst other, remarkable declined interest or pleasure in most activities, trouble sleeping, reduced ability to think or concentrate, and indecisiveness. To be diagnosed with MDD, a minimum of five symptoms must be present for at least two weeks and cause significant distress or impairment (Williams et al., 2009). In 1994, about 2% of children and 4% to 8% of adolescents in the USA suffered from MDD (Birmaher et al., 1996). NSDUH data from 2017 shows a prevalence of 9.4% in children between 12 and 17 years of age with a male-to-female ratio of roughly 1:3 (NIMH, 2019). Another depressive disorder consisting of very similar symptoms is *Dysthymia*. Given its resemblance, I group people with MDD and *Dysthymia* together.

Obsessive compulsive disorder (OCD). According to the DSM-IV, the guideline relevant in the data used here, OCD belongs to the disorder class of *Anxiety Disorders*. The more recent DSM-V introduced OCD as an independent disorder class, however. Obsessions are recurrent and persistent thoughts that cause noticeable anxiety or distress and which the individual tries to suppress or ignore by means of other thoughts or actions. Compulsions are such actions. They involve repetitive behaviours performed to alleviate the distress.

These behaviours are time consuming and affect social and occupational operations negatively (CDC, 2021). The prevalence of OCD in children and adolescents is estimated to be between 1% and 3% (Zohar, 1999).

Generalized Anxiety Disorder (GAD). Defined as having excessive anxiety and worry most of the days for at least 6 months. Symptoms are restlessness, sleep disturbance, difficulty concentrating, and muscle tension. About 7% of children aged between 3 and 17 have diagnosed anxiety (Ghandour et al., 2019). In the remainder of the paper, I will define GAD in a broader sense by including *Agoraphobia* and *Seperation Anxiety Disorder*, two types of anxiety disorders. Accounting for 32% of mental disorders, anxiety disorders are the most common in U.S. adolescents (Merikangas et al., 2010).

For comparison purposes, I will consider conduct disorders (CD) and panic disorders (PD). CD is a common pediatric mental disorder that almost exclusively appears before age 18 but that fluoxetine is not intended to treat. PD belongs to the disorders that fluoxetine has been approved for treatment but only for adults.

Most of mental disorders such as depression can affect people of all ages. However, psychiatric disorders disproportionately arise in childhood and adolescence (Kessler et al., 2007). Adolescence is characterized by considerable changes in neural systems and hormones that affect the processing and vulnerability of emotions. Disturbances around these changes are likely to account for parts of the augmented prevalence of mood and anxiety disorders in teenage years (Paus et al., 2008). In general, there is no single cause for mental illness, but different contributors like early adverse life experiences (violence, abuse, etc.), other medical conditions (e.g. cancer, diabetes), biological factors, or lack of social interaction (WHO, 2001). Statistically, half of any lifetime disorders occur by age 14, three-fourths by age 24. Fifty percent of all MDDs, OCDs, and GADs start by age 32, 19, and 31, respectively (Kessler et al., 2005).

2.2 A New Treatment: What is Fluoxetine?

Fluoxetine, marketed as Prozac, was approved in the United States by the Food and Drug Administration (FDA) in the last days of 1987, entering the U.S. market as of 1988. Notably, Prozac was the first of a new class of drugs called selective serotonin reuptake inhibitors (SSRI) that used a different mechanism than prior medications against mental disorders. Prozac belongs to the pharmaceutical group of antidepressants and quickly became the

most common prescribed antidepressant, ranking place 23 of the most frequently utilized medications in office practice already in 1990 (Nelson, 1993).

Observations for the period between 1990-2001 indicate a stark rise in the prescription of SSRIs among patients aged 5 to 18 years. Between 1990 and 1993 almost half of the children diagnosed with depression and antidepressant prescription (44%) received an SSRI. In 1998-2001 the share increased to two thirds (of a total of 60%), making SSRIs the dominant pediatric antidepressant. Comparing the same two time intervals, the number of diagnosed U.S. children surged from 2.5m to almost 7m. Fluoxetine was the most prescribed SSRI in each time interval. Close to 15% of all minor patients received fluoxetine in the period from 1998 to 2001 (Skaer et al., 2009).

Prozac was the first SSRI to enter the U.S. market (1988), and was subsequently followed by others like Zoloft (1991), Paxil (1992) and Luvox (1994) within six years. Another SSRI named Celexa got approved by the FDA in 1998. Prozac is used for patients suffering from MDD, OCD, PD, eating disorder (ED), and bipolar disorder (BD). It was approved for pediatric use but safety and effectiveness has not been established for children less than 8 years of age. According to the product label the pediatric use is restricted to the treatment of MDD and OCD ((Eli Lilly & Co., 2020). Of the later approved SSRIs, Zoloft, Luvox, and Celexa were also approved for the use in minors, but solely for the treatment of OCD (Dwyer & Bloch, 2019)³. Among the antidepressants, only Prozac is approved for use in pediatric patients with MDD. Prozac, Zoloft, Luvox, and Anafranil (not SSRI) are approved for pediatric OCD.

In fact, out of the antidepressants approved for pediatric use only Prozac has been shown in randomized clinic trials to be effective in treating depressive illnesses in children and adolescents (Emslie et al, 1997; 2002). A RCT with depressed adolescents showed significant improvement of depressive symptoms after a Prozac therapy compared to a placebo. The largest improvement occurred when the fluoxetine therapy was combined with cognitive-behavioral treatment (March et al., 2004).

Upon the market entry of Prozac, the pediatric use of antidepressants grew rapidly in the upcoming years but not without controversy about the adverse side effects, in particular

³Another SSRI, Lexapro, was introduced in 2002 and approved for adolescent (12+) MDD treatment. The NCS data used in this paper, however, was collected among adults between 1991-1992 and 2001-2003. Hence, Lexapro is ignored here.

suicidal thoughts. In 2004, the FDA issued a black box warning on pediatric antidepressants after concerns about severe side effects related to the taking of Paxil in young people. Warning of serious adverse side effects, a black box warning appears on the insert in the packaging of the drug and is the strongest warning by the FDA. The black box warning interrupted a steep rise in the adolescent antidepressant prescriptions. Within two years, antidepressant prescriptions for adolescents fell by 31%. Beginning in 2008, a reversal of the downward trend was visible again (Lu et al., 2014).

3. Empirical Approach

3.1 Data

The Collaborative Psychiatric Epidemiology Surveys (CPES) is a project dedicated to mental disorders among the general U.S. population with special emphasis on minority groups (Heeringa et al., 2004). Together, it consists of three nationally representative surveys: the National Comorbidity Survey Replication (NCS-R), the National Survey of American Life (NSAL), and the National Latino and Asian American Study (NLAAS). Each of the three cross-surveys are linked together in the CPES, allowing analysis as though it were one nationally representative survey. Missing data about the amount of weekly hours worked result in disregarding the NLAAS entirely, leaving me exclusively with respondents of the NCS-R and NSAL studies. All of the three surveys were administered to respondents aged 18 or older residing in the United States.

The *NSAL* was designed to understand ethnic differences in psychiatric disorders. The target population was African American, Afro-Caribbean, and White American. Within the project 6,082 adult interviews yielded information about prevalence and individual history of psychiatric disorders as well as the utilization of mental health care services and employment figures. Roughly 59% of the participants were of African American ancestry.

The *NCS-R* questionnaire was an expansion of the original 1992 NCS (referred to as NCS-1) with the purpose to picture developments in mental health one decade later. The NCS-R contains a sample of 9,282 individuals. While all of them received the same questionnaire, there was a second part surveyed to a subsample of only 5,692 respondents. As only the latter includes detailed information concerning mental disorders and labour supply, solely respondents that answered both parts are considered here.

The CPES data is cross-sectional, implying that cohorts of the control group (born prior to 1968) are necessarily older than the treatment cohorts when they are observed. Assuming comparability of labour supply outcomes without regarding the age at observation is not reasonable. Valid counterfactuals would be of same age when observed but would have had differential access to treatment. To circumvent this problem, I use the NCS baseline study (NCS-1), the 'mother' survey administered in the years 1991 and 1992. It was the first survey of the NCS Series, contains a sample of people aged 15-54 years in the United States (N=8,098), and had the same purpose as its successor studies, to observe psychiatric disorders in the US.

NCS-1 diagnoses were build on the DSM-III, a predecessor of the DSM-IV used in the CPES, criteria. However, a reinterview in the years 2001 and 2002 with NCS-1 respondents (N=5,001) applied the DSM-IV instructions. Hence, I rely on the reinterview (NCS-2) data to figure out disorder onset of affected people. Merging NCS-1 and NCS-2 data plus appending it to the CPES allows me to add year fixed effects to my estimation models thanks to distinct variation in the interview years.

Both NCS-R and NSAL were conducted between early 2001 and spring 2003. Unfortunately neither provides information on the year in which the participant was interviewed nor on the year of birth. Hence, I assume the year of observation to be 2002 and construct the year of birth using the age of the respondent at the time of the interview. Weighting is used to compensate for unequal probabilities of selection, nonresponse, and to make the sample conform to the true population distribution. Subjects aged 65 and older and those 21 and younger are excluded from the sample because they are least likely to participate in the labour market regardless of their mental health status in childhood.

For the assessment of mental disorders, a questionnaire based on the World Health Organization Composite International Diagnostic Interview (WMH-CIDI) was used (Kessler and Üstün, 2004). Diagnoses are made following the guidelines of the 4th Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) published in 1994 by the American Psychiatric Association. Studies suggest a significant correlation between diagnoses based on the CIDI and diagnoses made by clinicians (Haro et al., 2006). After excluding those with missing values for work status and psychiatric symptoms, the sample size is 13,209, including 5,511 men and 7,698 women.

I focus on four psychiatric disorders that belong to the most common in the sample as well as in the general population. However, when Prozac was introduced in 1988, the use in chil-

dren was not approved for illnesses other than MDD and OCD. The survey project group acknowledged a problem in the survey skip logic for OCD which caused the disorder to be underestimated in the diagnostics. Therefore, this disorder is not part of the public data anymore (Harvard Medical School, 2005). The DSM-IV used to pigeonhole OCD under the disorder class of 'Anxiety Disorders' so that I, henceforth, use the diagnostics belonging to the 'Generalized Anxiety Disorders' (GAD) as proxy for OCD, although that comes at the cost of accuracy (Center for Behavioral Health Statistics and Quality, 2016).

I define treatment and control group based on whether the individual experienced MDD or GAD in childhood and adolescence (i.e. between ages 8 and 20) or not. The fact that mental health assessments are based on diagnostic questioning and not on medical judgement is not necessarily a drawback considering potential changes in the composition due to individual changes in healthcare behaviour after medical diagnosis altered by the approval of Prozac (Bütikofer et al., 2020). Information about the onset of several types of mental illnesses is key to my study as it allows me to identify individuals with a history of psychiatric disorders and not only those with current suffering. In practice, the starting age of a disorder is determined by asking the interviewee a battery of questions upon affirmatively responding to questions about the experience of certain symptoms. The follow-up questions elicit criteria such as severity, duration, frequency, and concomitants of each of the qualifying symptoms but also health care utilization. Finally, answers to the age at first occurrence with respect to the criteria then help to find out the age of onset.

My main outcomes of interest are figures of labour supply at the time of the survey, namely labour force participation, hours worked for pay in an average week as well as household income and disability status. Hours worked only applies to those who are employed. Labour force participation and disability are binary coded and indicate whether the individual being in (1) or out of labour force (0) and being disabled (physically and/or mentally). Hours worked per week contains information about the absolute amount of hours worked for pay or profit in an average week of the past 12 months. Household income is the logged annual income of the respondent's household in the past 12 months. Control variables are age, sex, ethnicity, migration background, parents' mental health, as well as indicators for the socioeconomic status (SES) in childhood. Other information such as years of education, marital status or current receipt of social welfare do not qualify as covariates for the reason that these are most likely affected by childhood mental disorders.

3.2 Descriptive statistics

A summary of the sample characteristics is displayed in [Table 1](#) separately by gender and by whether or not experiencing childhood MDD or GAD (MDD/GAD). I find that almost all statistics (except *children in household*) are significantly different for those with and without childhood disorder experience at p-values less than 0.01. Compared to individuals without childhood disorder, those with disorder have less years of education on average, are more likely to have at least one parent with mental disorder, and are less likely to be married or cohabiting with a partner. In addition, labour force participation is much lower for men with childhood MDD/GAD background. Chronic conditions are more prevalent, and the risk of mental or physical disability substantially higher for affected men and women. Having MDD or GAD between the ages 8 and 20 is highly correlated with having a parent suffering from the Depression or Anxiety while growing up.

3.3 Empirical strategy

I examine the associations between psychiatric illnesses with onset in childhood and current labour market outcomes by estimating the following model:

$$y_{ict} = \beta_1 Disorder + \theta_c + \tau_t + \varepsilon_c \quad (1)$$

where the dependent variable y_{ict} is an outcome measure, such as household income, labour force participation, hours worked, and disability for individual i in cohort c and year t . The explanatory variable $Disorder$ constitutes the two mental disorders that Prozac is approved for pediatric use, major depression and general anxiety. In addition, I include with panic disorder and conduct disorder two more disorders that are also common in children to see whether associations are similar across type of disorder. The four mental health problems often have their onset in childhood and adolescence (Kessler et al., 2007). The indicator $Disorder$ equals one for subject i who has been (retrospectively) diagnosed with onset of the respective disorder between age 8 and 20. Cohort fixed effects θ_c account for unobservable factors that vary across birth cohorts but influence subjects within a given birth year equally. Year fixed effects τ_t consider changes in economic factors that influence the labour market.

Table 1 Sample Characteristics

	Men		Women		Total
	No Disorder	Disorder	No Disorder	Disorder	
Age	41.9	38.7	42.2	38.1	41.6
Education					
0-11	0.13	0.17	0.11	0.16	0.13
12	0.32	0.31	0.30	0.28	0.30
13-15	0.26	0.28	0.29	0.26	0.28
16+	0.30	0.24	0.30	0.30	0.30
Married/Cohabiting	0.67	0.51	0.63	0.51	0.63
ln(HH income)	10.8	10.5	10.5	10.3	10.6
Hours worked/week	44.5	42.8	37.8	38.1	41.2
Labour force	0.88	0.81	0.78	0.76	0.82
Employed	0.98	0.97	0.91	0.91	0.94
Low SES (childhood)	0.26	0.31	0.28	0.36	0.28
Nonwhite	0.30	0.27	0.31	0.24	0.30
Migration	0.18	0.18	0.18	0.15	0.18
Public assistance (Ever)	0.17	0.28	0.31	0.42	0.26
Health insurance	0.80	0.75	0.80	0.68	0.79
Condition	0.52	0.62	0.59	0.70	0.57
Disability	0.12	0.27	0.11	0.26	0.13
Antidepressants (12Mo)	0.05	0.18	0.12	0.30	0.11
Children in HH	0.26	0.21	0.29	0.28	0.28
Parent w/ disorder	0.15	0.33	0.19	0.38	0.19
Onset MDD/ADD	30.9	15.0	31.0	15.0	24.1
Diagnosed (12Mo)	0.07	0.52	0.12	0.56	0.15
2+ disorders (childhood)	0.02	0.61	0.02	0.53	0.08
N	4944	567	6516	1182	13209

Notes. *Disorder* refers to the mental health illnesses Depression and Anxiety. *Education* is categorical and defined in years of schooling. *Low SES* is a binary composite indicator taking into account factors like parents education, receipt of government assistance, and fathers working status while growing up. *Condition* refers to a set of other medical conditions, e.g. asthma, hypertension, diabetes, cancer etc., and assumes value 1 if i has one or more of these. *Hours worked/week* is measured among those who are employed, *Employed* among those participating in the labour force. *Children in HH* equals 1 if there are children living in the respondents household, 0 otherwise.

Effects of Access to Treatment

I exploit the effects of an exogenous variation, the market entry of Prozac in 1988, that induced a substantial increase in the use of antidepressants for treating pediatric MDD and GAD to investigate the effects of mental health problems on labour supply and disability risk. Assuming that people with MDD/GAD born in the year 1968 and later would have had similar labour market outcomes as those born before without access to treatment, the results identify causal effects of access to treatment for people that suffered from MDD/GAD in their childhood or adolescence. If the access lead to an improvement in labour market outcomes and this only thanks to better mental health, the estimates may be interpreted as the effect of enhanced mental health early in life on outcomes later in life.

Estimating the coefficients of interest, indicating the effect of access to Prozac, baseline OLS estimates compare differences in household income, disability, labour force participation, and amount of hours worked between the population and people with MDD/GAD who have had access to Prozac treatment between the ages 8-20 with the same differences for people with MDD/GAD who do not have had access to Prozac by age 20:

$$y_{ict} = \alpha_0 + \alpha_1 MDD_i / GAD_i + \alpha_2 Appro_{c(i)} \times MDD_i / GAD_i + \gamma X_{ic} + \tau_t + \delta_c + \varepsilon_c \quad (2)$$

where the dependent variable y_{it} reflects, as before, the outcome of interest for individual i . The binary variable $Appro_{c(i)}$ is equal to 1 if individual i belongs to cohorts born in 1968 and thereafter (i.e. access to Prozac before they turned 21). MDD_i is also binary and equals 1 if individual i suffered from MDD before age 21, zero otherwise. GAD is defined accordingly for the prevalence of GAD. The coefficient $alpha_2$ is the coefficient of interest and estimates the effect of treatment access. τ_t and δ_c represent year fixed effects and cohort fixed effects, respectively. The control variables age, sex, socioeconomic status, nonwhite, migration background, and parental disorder are included in X_{ic} . Standard errors are clustered at the cohort level. The interaction of childhood mental disorder and Prozac approval is the estimate of interest ($alpha_2$) and identifies the intention-to-treat (ITT) effect of exposure at age 8-20 relative to the reference group (people born before 1968).

Support for identification assumptions

The key identification assumptions of the difference-in-differences strategy are (i) the exogeneity of the approval of Prozac with respect to labour force participation, disability, household income and hours worked, and (ii) common trends for treated and untreated cohorts in the absence of Prozac. Regarding the first assumption, the approval onto the U.S. market was a decision by the Food and Drug Administration based on clinical trials and the weighing of risks and benefits. Thus, the exogeneity assumptions does not seem too strong. I cannot test the second assumption because technically everybody in the U.S. was exposed to the approval. However, I can test parallel trends in the outcome variables before the entry of Prozac on the U.S. market by means of the following estimation model:

$$y_{ict} = \alpha_0 + \alpha_1 MDD_i / GAD_i + \sum_{l=1938}^{1980} \pi_l I(c=l) \times MDD_i / GAD_i + \gamma X_{ic} + \theta_c + \tau_t + \varepsilon_c \quad (3)$$

where the omitted time period is the birth year 1967 so that the coefficients π_l describe how the difference in outcomes between individuals with and without MDD/GAD changed for every cohort with respect to 1967, i.e the last cohort which was not exposed to Prozac before age 21.

4. Results

4.1 Main findings

I now turn to the impact of mental disorders on all four outcomes and the effects of access to treatment. First, I present graphical evidence of the trends in labour force supply, household income, and disability. [Figure A2](#) shows the average of each outcome of interest for each cohort separated by childhood disorder. OLS estimates presented in [Table 2](#) suggest quite large and significant associations between having had a mental illnesses in childhood and labour market outcomes in adulthood. This relation notably applies to the two main disorders of interest, MDD and GAD. People with childhood MDD/GAD have a higher risk of being mentally or physically disabled, less likely to participate in the labour force, and work fewer hours on average. The latter results are driven by GAD experience and turn insignificant once the control variable female is included. Childhood and adolescence mental health as well as labour market outcomes are affected by parental and socioeconomic background (e.g. Currie, 2009). Previous estimates may be overstated in the case that children of disadvantaged background suffer disproportional from psychiatric conditions. I account for family background by creating a binary variable for low socioeconomic status during adolescence. The composite indicator contains parents education, fathers working status while growing up, receipt of government assistance, living in public housing, and frequency left unsupervised. Adding family background and sex to [Eq. \(1\)](#) reduces the magnitude of household income and labour force participation estimates, while disability remains as good as unaffected. The negative coefficient of hours worked is largely explained by female-male differences.

In other words, individuals with MDD/GAD are 14.5 percentage points more likely to be disabled. Compared with a 13% percent sample average this implies that depressive and anxiety disorders are associated with a 1.1-fold increase in the risk of being disabled. People with early onset of GAD are 9.2 percentage points less likely to participate in the labour force. Household income is significantly lower for those with disorder but reflects differences in marital status. Indeed, those affected are significantly less likely to be married or cohabiting with a partner. The two complementary disorders panic (PD) and conduct (CD) yield very similar estimates qualitatively but show somewhat lower magnitude and significance compared to both MDD and GAD.

Table 2 Relationships between Mental Health Illness and Dependent Variables

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MDD/GAD	-0.245*** (0.072)	-0.185** (0.074)	0.156*** (0.020)	0.156*** (0.020)	-0.062*** (0.015)	-0.048*** (0.015)	-1.371** (0.636)	-0.359 (0.644)
Low SES		-0.274*** (0.062)		0.009 (0.014)		-0.036** (0.017)		0.008 (0.435)
Female		-0.300*** (0.062)		-0.003 (0.013)		-0.085*** (0.014)		-6.487*** (0.505)
R^2	0.034	0.051	0.043	0.043	0.052	0.066	0.027	0.100
MDD	-0.197** (0.079)	-0.148* (0.081)	0.159*** (0.024)	0.159*** (0.024)	-0.032 (0.020)	-0.020 (0.020)	-0.801 (0.768)	-0.033 (0.762)
Low SES		-0.277*** (0.062)		0.011 (0.014)		-0.037** (0.017)		-0.004 (0.433)
Female		-0.305*** (0.061)		0.000 (0.012)		-0.087*** (0.014)		-6.507*** (0.499)
R^2	0.033	0.050	0.038	0.038	0.050	0.064	0.026	0.099
GAD	-0.334** (0.129)	-0.253** (0.128)	0.157*** (0.028)	0.156*** (0.028)	-0.094*** (0.024)	-0.077*** (0.026)	-1.954** (0.911)	-0.758 (0.892)
Low SES		-0.272*** (0.062)		0.010 (0.014)		-0.035** (0.017)		0.021 (0.436)
Female		-0.303*** (0.061)		0.001 (0.012)		-0.086*** (0.014)		-6.483*** (0.508)
R^2	0.034	0.051	0.032	0.032	0.052	0.066	0.027	0.100
PD	-0.105 (0.063)	-0.085 (0.063)	0.063*** (0.014)	0.062*** (0.014)	-0.009 (0.014)	-0.003 (0.014)	-0.346 (0.569)	0.143 (0.513)
Low SES		-0.280*** (0.062)		0.015 (0.015)		-0.038** (0.017)		-0.005 (0.430)
Female		-0.308*** (0.061)		0.004 (0.012)		-0.088*** (0.014)		-6.513*** (0.502)
R^2	0.032	0.050	0.025	0.026	0.049	0.064	0.026	0.099

Table 2 Continued

CD	-0.211*	-0.205*	0.099***	0.098***	-0.072	-0.079*	1.151	0.096
	(0.114)	(0.111)	(0.026)	(0.025)	(0.045)	(0.044)	(0.943)	(0.929)
Low SES		-0.272***		0.011		-0.035**		-0.009
		(0.063)		(0.014)		(0.017)		(0.437)
Female		-0.315***		0.008		-0.090***		-6.506***
		(0.061)		(0.012)		(0.015)		(0.506)
R^2	0.032	0.050	0.025	0.025	0.050	0.066	0.026	0.099
Cohort & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var.		-		0.13		0.82		41.26
N		13209		13209		13209		10227

Notes. OLS estimation coefficients of relationship between mental disorders and selected outcomes with standard errors in parentheses. The variables MDD, GAD, PD, and CD equal 1 for individuals who have been diagnosed with the according disorder at least once in their childhood (8-20y). Cohort fixed and year fixed effects are always included; even numbered columns also include SES and sex. Columns (7) and (8) refer to people with nonzero hours. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

There are various mechanisms that could explain these associations. Disability negatively affects labour market participation. The disability risk is higher for people with mental disorder experience (column (3)-(4)). In line with that notion, the same group is less likely to participate in the labour force. Mental disorders might also affect early retirement decisions, which in turn is related to disability. In fact, subjects with childhood MDD/GAD are 1.1 percentage points more likely to retire before age 65 (significant at 10% level). Relative to the sample average of 2%, it implies an increase of 55%. These subjects are also less likely to be married or cohabiting with a partner, explaining the lower household income. Further, childhood MDD/GAD is positively related to substance use and adult mental disorder but negatively related to health insurance coverage (all significant at 1% level). The education coefficient, however, is small and insignificant (not reported here).

The difference-in-differences estimates are presented in Table 4. Columns (5) and (6) display the coefficients for labour force participation. I find a quite large positive effect of access to Prozac on the rate of labour force participation. Significant at the 1% level, cohorts with MDD/GAD and access to treatment increase participation in the labour force by 11.6 percentage points, an increase of 14.1% relative to the sample average. Adding control variables in column (6) raises the effect slightly to 11.9 percentage points and does not affect its significance. Also, the risk of disability declined for cohorts with access to Prozac treatment, although statistically insignificant. The results in columns (1) and (2) suggest an insignificant positive effect on household income when including all covariates. Somewhat suprisingly, having had a parent with mental disorder is positively related to household income. However, household income is not the optimal measure. Preferably, I would have

used individual earnings if it would have been available and also assessed the risk of zero earnings. The coefficients for hours worked are positive as well, but insignificant. There is some selection involved in the latter because hours worked are applied to those employed only.

Table 4 Access to Treatment Estimates

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MDD/GAD	-0.242*** (0.088)	-0.253*** (0.088)	0.170*** (0.024)	0.147*** (0.024)	-0.105*** (0.019)	-0.087*** (0.019)	-1.812** (0.840)	-0.967 (0.770)
MDD/GAD×Appro	-0.008 (0.150)	0.051 (0.142)	-0.038 (0.042)	-0.030 (0.042)	0.116*** (0.030)	0.119*** (0.029)	1.131 (1.263)	1.495 (1.121)
Low SES		-0.212*** (0.059)		0.013 (0.013)		-0.028 (0.017)		0.502 (0.499)
Age		0.011 (0.010)		0.013*** (0.002)		-0.006** (0.003)		0.057 (0.081)
Female		-0.303*** (0.064)		-0.007 (0.013)		-0.084*** (0.015)		-6.492*** (0.504)
Migration		0.328*** (0.076)		0.011 (0.020)		-0.018 (0.019)		-1.108 (0.742)
Parent disorder		0.132*** (0.045)		0.086*** (0.015)		-0.040** (0.018)		-0.619 (0.795)
Nonwhite		-0.397*** (0.065)		-0.049*** (0.014)		-0.017 (0.013)		-1.427*** (0.547)
Cohort & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.034	0.067	0.043	0.057	0.054	0.071	0.027	0.105
Mean dep. var.		-		0.13		0.82		41.26
N		13209		13209		13209		10227

Notes. Entries represent the estimated difference-in-differences coefficients with standard errors in parentheses. Results come from OLS regressions of the effect of the entry of Prozac on household income, disability, labour force participation and hours worked on an average week. Cohort fixed and year fixed effects are always included; even numbered columns also include covariates. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Figure 1 plots the π_l coefficients from Eq. 3 alongside the 95% confidence interval for each cohort. 1967, the year of the last birth cohort without access to Prozac, is omitted. The pre-approval cohorts do not show a clear trend and the differences of the last cohorts before the approval are close to zero. In fact, the cohort specific effects are negative for most of the birth cohorts born prior to 1968 which could be indicative of different pre-trends. However, the coefficients a few years before the approval are all negative and insignificant. Thus, it is also unlikely that some had access to Prozac before it was approved which would lead to underestimations. I add to this an informal test by plotting the labour force participation rates across cohorts in panel (a) of Figure A2. There are no clear differences in pre-trends visible. Beginning with the 1968 birth cohort, an upward trend materializes. The cohort coefficients first become positive for individuals born in 1970 with an estimate of 0.113 (however, just

missing 10% level significance), implying a 11.3 percent rise in the labour force participation rate relative to the omitted 1967 cohort. The coefficient turns slightly negative again in 1972 but starts increasing thereafter until a peak in 1978 with a value of 0.219 (significant at 5% level). The delays in positive effects are not surprising as the diffusion of drugs generally takes time⁴. The estimates are robust to controlling for parental background and sex.

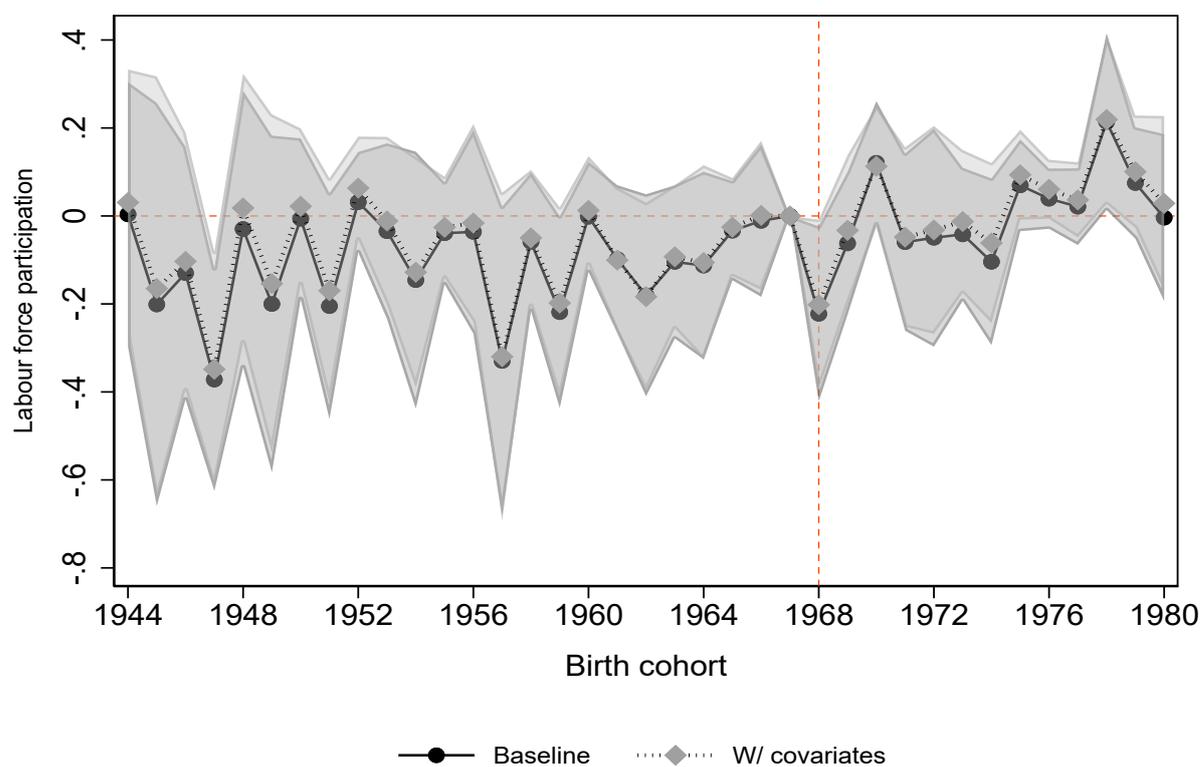


Figure 1 Effects of Access to Prozac on Labour force participation (by cohort). OLS point estimates of parameter π_l in Equation (3). Shaded area displays the 95 percent confidence intervals. Baseline estimate include cohort and year fixed effects. Dotted line coefficients additionally includes all covariates.

Figure A3 displays the share of females and males with childhood MDD/GDD by cohort. There is a clear upward trend beginning a few years after the approval, especially for females. If those in the post-approval cohorts are much more likely to have had MDD or GAD in the past 12 months than those in the pre-approval cohorts, that could explain differences in labour supply between control and treatment group. However, according to the graph in Figure A4, there are no major differences in the share with MDD/GAD within 12 months before the interview. In general, the share of subjects with MDD/GAD in the past year

⁴Agha & Molitor (2018) show that the information environment significantly affects the adoption of new cancer drugs, emphasizing regional differences

is significantly larger among those with childhood MDD/GAD experience relative to those without across all birth cohorts.

One way of evaluating the untestable common trend assumption is to address concerns about systematic differences in the predetermined variables between pre- and post-approval cohorts (Busch et al. 2014; Bütikofer et al. 2020). To be supportive of the assumption, these should be unrelated to treatment exposure. Specifically, I rewrite Eq. (3), such that each of the control variables included in X_{ic} (age, low SES, nonwhite, sex, migration, and parent disorder) become dependent variables whereas the interaction $MDD/GAD_i \times Appro_{c(i)}$ is taken as independent variable. The estimates are presented in Table A1. Post-approval cohorts with childhood MDD/GAD experience are less likely to have a parent with disorder compared to the control group (significant at 5% level). All other coefficients are statistical insignificant.

Robustness checks

I perform a number of robustness tests. First, effects on labour supply might reflect particularities in some industries at the time of observation. Economic conditions can impact individuals and cohorts differently. Also, unemployment rates can be a discouraging factor for labour force participation, whereas occupation can affect the disability risk. I add occupation dummies to Eq. (2) and control for age specific unemployment rates. Including labour market figures at time of observation reduces the labour force participation and disability estimation coefficients a little bit (statistical significance unaltered), possibly due to a smaller sample size resulting from missing occupation information (Table A2). Thus, my previous findings are not confounded by trends in occupational choice or unemployment rates.

One of the three survey samples comprising the CPES studies, the NLAAS, was omitted until now due to missing information on working hours. As I focus on labour force participation here, I can make use of the NLAAS sample as well, augmenting my sample size to 17,130 individuals. Presented in Table A3, the labour force participation coefficient remains unchanged. Plotting the coefficients by cohort again with the larger sample shows a more stable positive post-access trend (see Figure A6), making me more confident of a true positive effect on labour force participation.

Next, I take four mental disorders for which Prozac was not approved for pediatric treatment. If I find similar results I might have falsely claimed the access to Prozac as explanatory

variable, and some unobserved factors were causing the positive effect on labour market participation. Alternatively, Prozac could also have been prescribed for disorders that it was not approved for. In addition, conditional on being diagnosed with one disorder, it is not uncommon to have more than one mental disorder at the same time. The four placebo disorders are PD, CD, oppositional-defiant disorder (ODD), and intermittent explosive disorder (IED). [Table A4](#) presents the estimation results. The coefficients for labour force participation are positive but much smaller and not statistically significant. The risk of disability is declining in all instances and quite large for ODD and IED suggesting a downwards trend in disability risk for those affected post 1987. However, I regard the rather weak evidence on labour force participation for disorders that were not meant to be treated with Prozac as supportive regarding the validity of my identification.

Lastly, I claim to investigate the effects of childhood mental health, although every individual in my sample had access to Prozac after 1967. Thus, I change the critical age of onset to 20-32, instead of 8-20, to observe effects for young adults. Those without childhood but with young adult MDD/GAD and access to Prozac by age 32 clearly experience lower rates of disability than those without access and disorder in the same age range (-11.1 percentage points relative to 13% sample average; significant at 5% level). The effect on labour force participation, however, is almost zero and statistically insignificant. Household income and working hours remain statistically insignificant. The somewhat large effect on the risk of disability could be explained by the fact that the subjects of the control group are older at the time of the survey relative to those in the treatment group. The estimates are shown in [Table A5](#). These results underline the importance of childhood mental health, in particular with respect to labour force participation.

4.2 Mechanisms

The above results suggest that labour force participation rose for women and men with MDD/GAD experience between the ages 8–20 in response to access to the 1988 market entry of Prozac. One reason for this effect is that the entry of this new type of drug which is also approved for pediatric use, led to a rise in antidepressant use, improving mental health, and in turn leading to higher rates of labour force participation later in life. Indeed, Skaer et al. (2009) report a 44.4% rise in the rate of antidepressant prescriptions for US children aged 5 to 18 years between the years 1990 and 1993. The authors also show that particularly SSRIs are responsible for the largest part of the upward trend. Since Prozac was one out of two approved SSRIs during this period, it accounts for a significant share of the rise.

Unfortunately, my data does not provide information regarding actual antidepressant use. Data from the NSDUH show that the share of children and adolescents seeking treatment for psychological or mental reason is increasing just after the market entry of Prozac (see [Figure A5](#)).

Seemingly plausible mechanisms have been addressed in conjunction with disorder-outcome associations in [Table 2](#). Now, I am assessing how these possible explanatory variables differ between control and treatment group with respect to positive effects on labour force participation in view of the Prozac approval. The results are summarized in [Table A6](#).

Disability

As pointed out in the [Introduction](#), mental illnesses are a leading cause of lost disability-adjusted life years (DALYs). Notably, mental disorders not only affect emotional but also physical health (De Hert et al., 2011). Estimating [Eq. \(1\)](#) with disability (physical/emotional) as dependent variable indicates that individuals with childhood MDD/GAD are 15.1 percentage points more likely of being disabled. That is an increase of 16% compared to the sample average. People with MDD have the highest disability risk. Relative to the sample population without childhood MDD, those with have a 22% higher disability risk (15.4 percentage points compared to 12 percent, significant at 1 percent level). These results are virtually unchanged after controlling for parental background and socioeconomic status. The estimation coefficients for disability in column (3) and (4) of [Table 4](#) suggest a reduction in disability risk for cohorts with access to Prozac, although statistical insignificant. These results are largely driven by male subjects.

Early retirement

Disability affects retirement decisions and in the worst case precludes labour force participation. My sample includes people of the ages 22-65. Subjects reported to have been retired already are defined as early retired. Comparing means suggests a 1.2 percentage point higher early retirement probability for those with childhood MDD/GAD. Estimates in column (2) of [Table A6](#) suggest a reduction by 1.9 percentage points (significant at 5% level). In contrast to the 2% sample average, this coefficient implies a 95% reduction in the probability of early retirement after the approval.

Marital status

Mental disorders are negatively related to being married or cohabiting with a partner, affecting household income. Access to Prozac has a weakly positive effect on marital status (column (3)), possibly explaining higher household incomes in column (2) of [Table 4](#). Theoretically, being married could affect labour force participation negatively due to tax advan-

tages or childcare at home. Estimates propose a positive effect on having children at home for cohorts exposed to Prozac, however not statistically different from zero (not reported).

Substance use

People with mental disorders tend to be more likely to abuse alcohol and other drugs. Those with childhood MDD/GAD in the sample are more likely to report that drug use negatively interfered with their private and/or professional life than those without. The interaction coefficient suggests a reduction in substance use for cohorts with access to Prozac, possibly affecting labor force participation positively.

Education

Individuals with MDD/GAD experience are less educated on average, which itself is potentially an outcome of childhood mental disorders (e.g. Busch et al., 2014). Access to Prozac for affected children can improve their abilities important for educational achievement such as concentration and motivation. The result in column (6) implies a very small rise in the years of education for affected children with access and is hence unlikely to influence labour force participation.

Adult disorder

The descriptive statistics (Table 1) show that those with childhood mental disorders are substantially more likely to have an (adult) mental disorder within twelve months before observation, underlining the long-run impacts of childhood mental health. The differences in mental well-being between those with and without childhood later in life are very likely to explain part of the labour supply gap. If access to Prozac did improve long-term mental health, I would expect to see a negative coefficient in column (7). However, this is not the case and the coefficient is positive, yet statistically insignificant.

5. Discussion

It is important to note some limitations of my analysis. I am working with cross-sectional data so that my findings are rather a snapshot rather than a complete picture. The difference-in-differences estimates I calculate should be interpreted with caution because additional unexplored mechanisms through which the effects materialize are likely given the rather large unobserved time span between disorder onset and survey interview. Extensive registry data as used in papers by Biasi et al. (2020) as well as Bütikofer & Skira (2018) allows event studies around the time of disorder onset and on the way to adulthood, yielding much

more information with respect to mechanisms. Future research with extensive panel data is necessary to test the validity of my findings. An interesting path to investigate is family background and parental investments in children with mental problems, also with respect to antidepressant use.

Alternative Classification of Mental Diseases: ICD

Whereas the DSM-IV is the manual dedicated to mental disorders by the American Psychiatric Association, the International Statistical Classification of Diseases (ICD) is the global standard for all kind of health related problems published by the WHO. Using diagnostics according to the ICD instead of DSM does not change the results qualitatively but quantitatively such that the positive effect of access to Prozac on labour market participation becomes larger by 1.3 percentage points (13.2 percentage points instead of 11.9; significant at 1% level). All other coefficients are very similar but remain statistically insignificant (not reported here).

Effectiveness by age of onset

I divide those with childhood MDD/GAD into an earlier and later affected group, where the former consists of those between with onset between the ages 8 and 14 and the former of those between the ages 15 and 20. The effect of access to Prozac on labour market participation is similar for both groups but 1.7 percentage points larger for those affected between the ages 15-20. Both are statistically significant at the 5% level.

Zoloft (1991), Celexa (1992), and Luvox (1994)

As mentioned earlier in this paper, there were three more drugs of the same category introduced onto the market within six years after Prozac: Zoloft (1991), Celexa (1992), and Luvox (1994). I do not know how these three inventions affected the results but one can think of them as complements that contributed to the findings. Considering the time it usually takes for the diffusion of drugs, effects would be expected to be somewhat weaker.

Two and more mental disorders

It is not uncommon that those affected by one mental disorder are also diagnosed with another disorder. In my sample, 34% of all subjects with childhood disorders (MDD, GAD, PD, CD, ADD, ODD, BD) have two or more mental disorders during their childhood. Almost 18% among those with MDD/GAD are diagnosed with both between the ages 8-20. Comparing those with only MDD/GAD with those with MDD/GAD and at least another disorder, the effect access on labour force participation is significantly larger for those with two or more disorder, of which one is MDD/GAD (13.8 percentage points compared to 8.7 percentage points).

Differences between men and women

Analyses by Busch et al. (2014) and Bütikofer et al. (2020) have shown different reactions between males and females following the black box warnings on antidepressants in 2004 and 2007, respectively. The figures A1, A3, and A4 plot gender specific trends in the prevalence of depressive and anxiety disorders. Since the 1990s, depressive and anxiety disorders are disproportionately prevalent in the female population. Negative associations between MDD/GAD and household income and labour force participation are much stronger in magnitude as well as significance for men. Only the disability risk is higher for women with MDD/GAD compared to men. Access to treatment on the other hand improves labour market participation much more for women than for men. There are studies arguing that women are more responsive to antidepressants (Sramek et al., 2016). The disability coefficient, however, is largely driven by the males in the sample population.

6. Conclusion

The pediatric use of antidepressants for mental disorders is controversial as the black box warning in 2004 has shown. This study has applied the U.S. NCS Series to investigate the effects of mental disorders in childhood and adolescence on household income, disability, labour force participation, and amount of hours worked per week later in life. Descriptive statistics and simple regressions imply large costs related to mental illnesses. Depressive and anxiety disorders are highly associated with lower household income, higher disability risk, and lower labour market participation rates. People affected by depressive disorders between the ages 8 and 20 are 122% more likely to be disabled in adulthood, whereas anxiety disorders are connected to more than 9% lower labour market participation rates. Aiming at examining the long-run effects of mental health, I exploited the approval of fluoxetine (marketed as *Prozac*) as a new treatment for pediatric MDD and OCD at the end of the year 1987 to estimate the impact of a major change in the access to treatment. Difference-in-differences estimates suggest that access to fluoxetine closed the gap in labour force participation between individuals with childhood MDD/GAD and the population. Access to fluoxetine also reduces the excess risk of disability by roughly 27%. Besides the lower disability risk, early retirement and substance use are mechanisms that potentially explain the findings. These results imply that access to treatment could generate economic and social benefits through higher labour force participation and reduced disability risk. Moreover, I find that the effects on labour force participation are much larger in the bottom 25% of the household income

distribution than in the top 25%, addressing distributional aspects of access to treatment. My paper focuses on outcomes reported by adults with and without pediatric mental depressive and anxiety disorders, and thus they can be considered as long-run outcomes. The results suggest that mental disorders in childhood and adolescence affect economic outcomes later in life as access to Prozac yielded benefits in terms of labour market participation.

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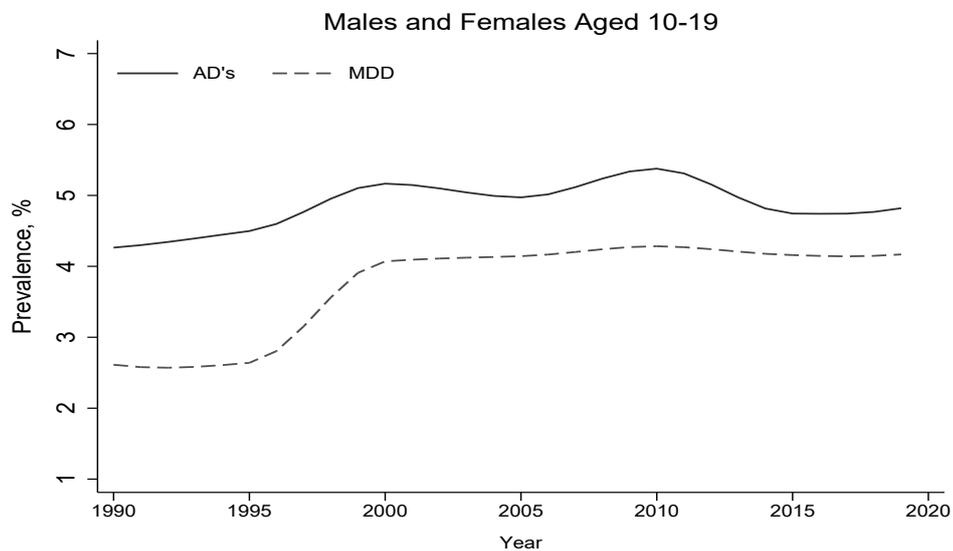
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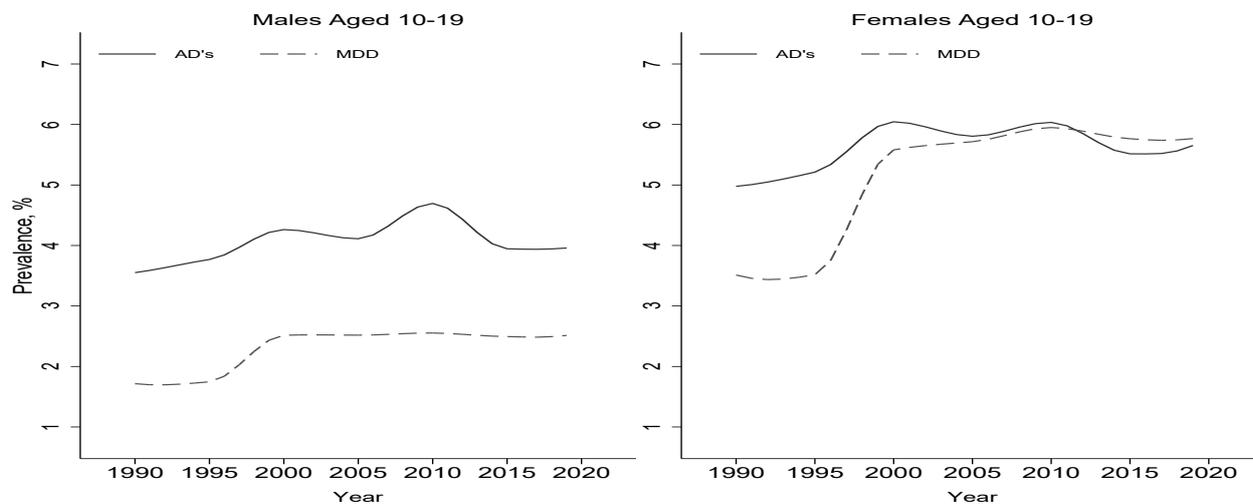
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A Appendix



(a) All sexes



(b) Males (left) and Females (right)

Figure A1 Prevalence (in %) of Anxiety Disorders (AD's) and Major Depressive Disorder (MDD) among U.S. Teenagers from 1990 to 2019 (Source: Global Burden of Disease Study 2019)

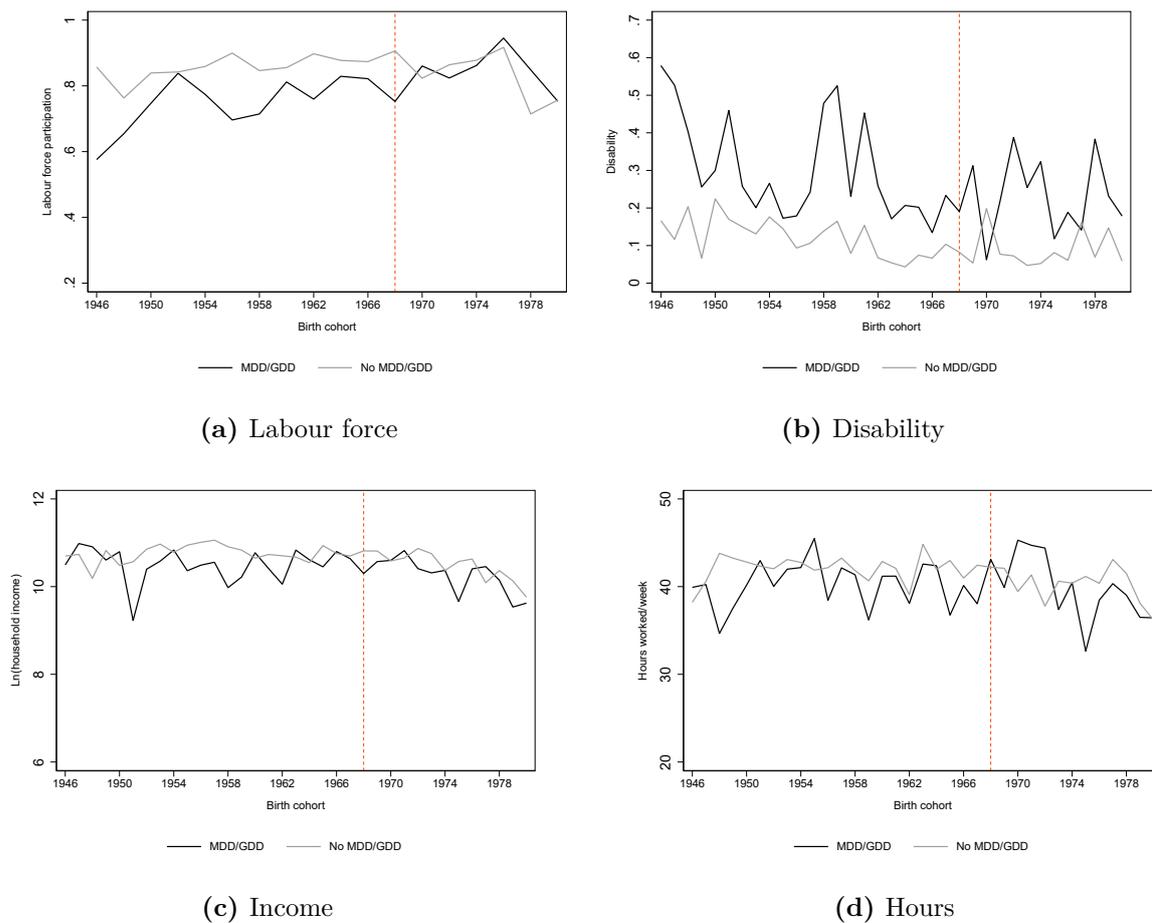


Figure A2 Raw data on outcomes by childhood disorder over time

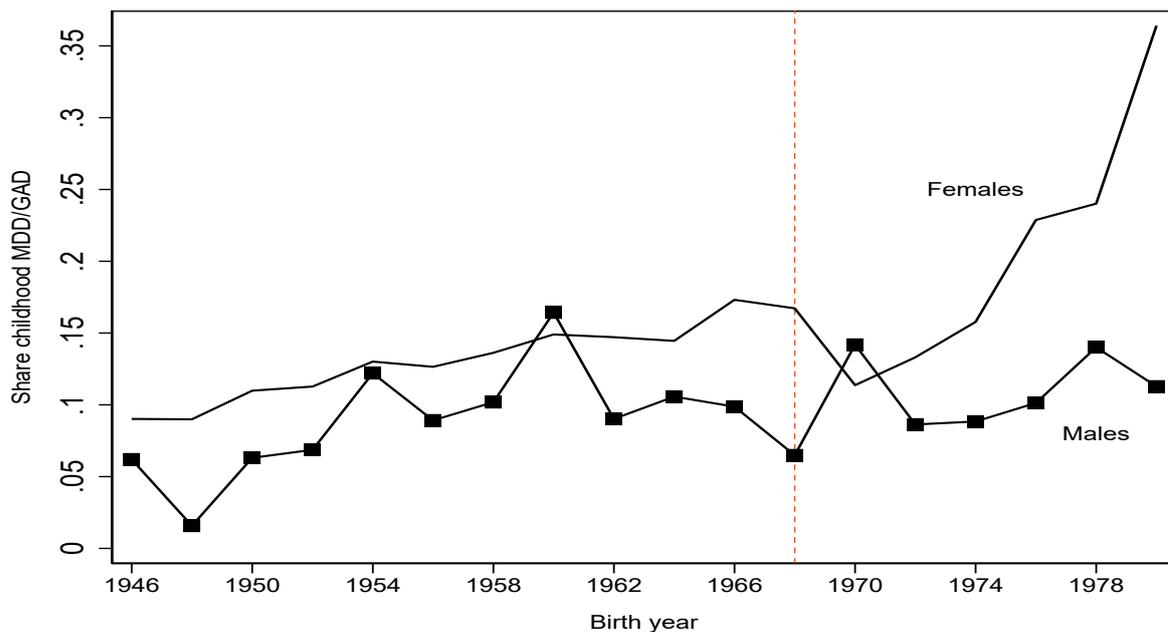


Figure A3 Share of Females and Males with childhood MDD/GAD over time

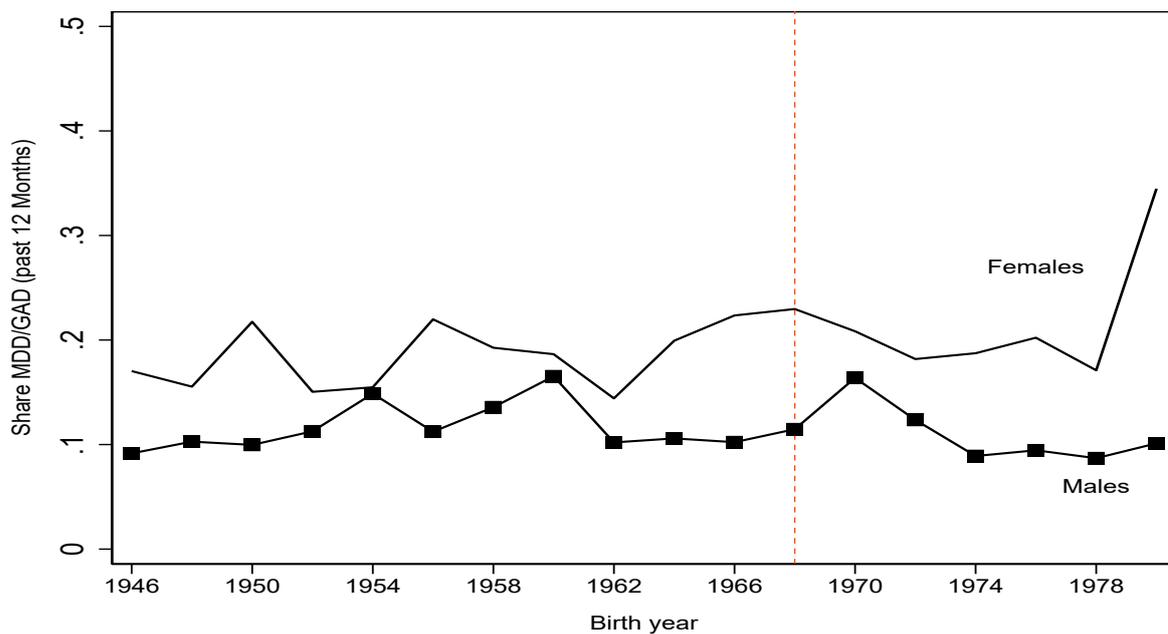


Figure A4 Share of Females and Males with MDD/GAD during last year before interview

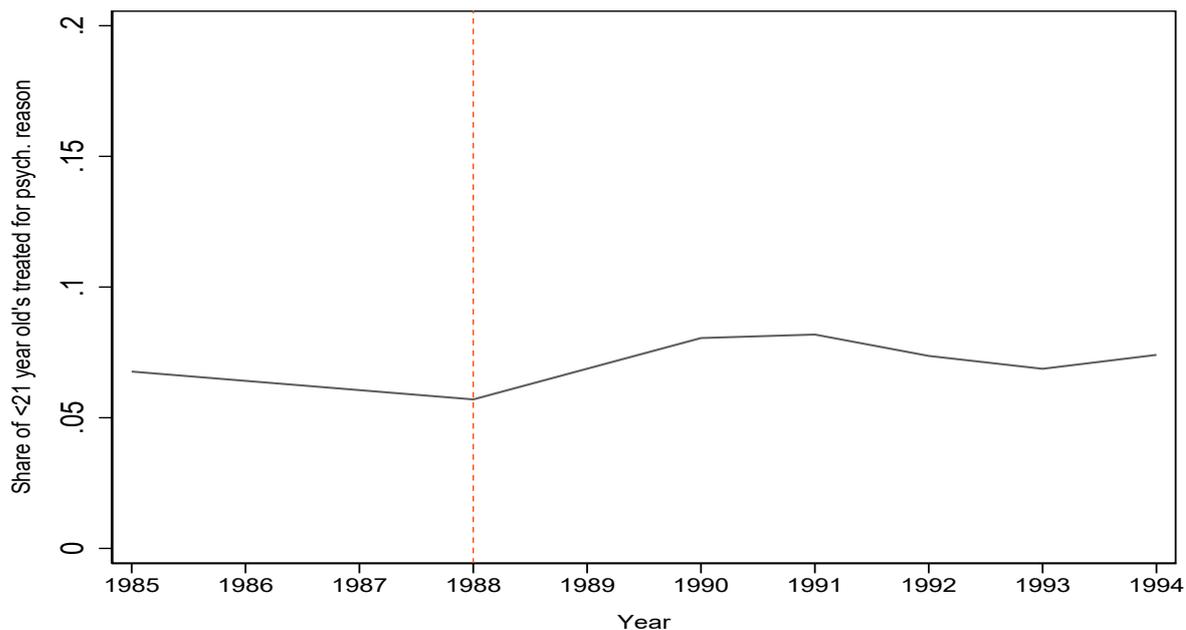


Figure A5 Share of US children and adolescents under 21 years receiving treatment for psychological/emotional reasons (Source: NSDUH)

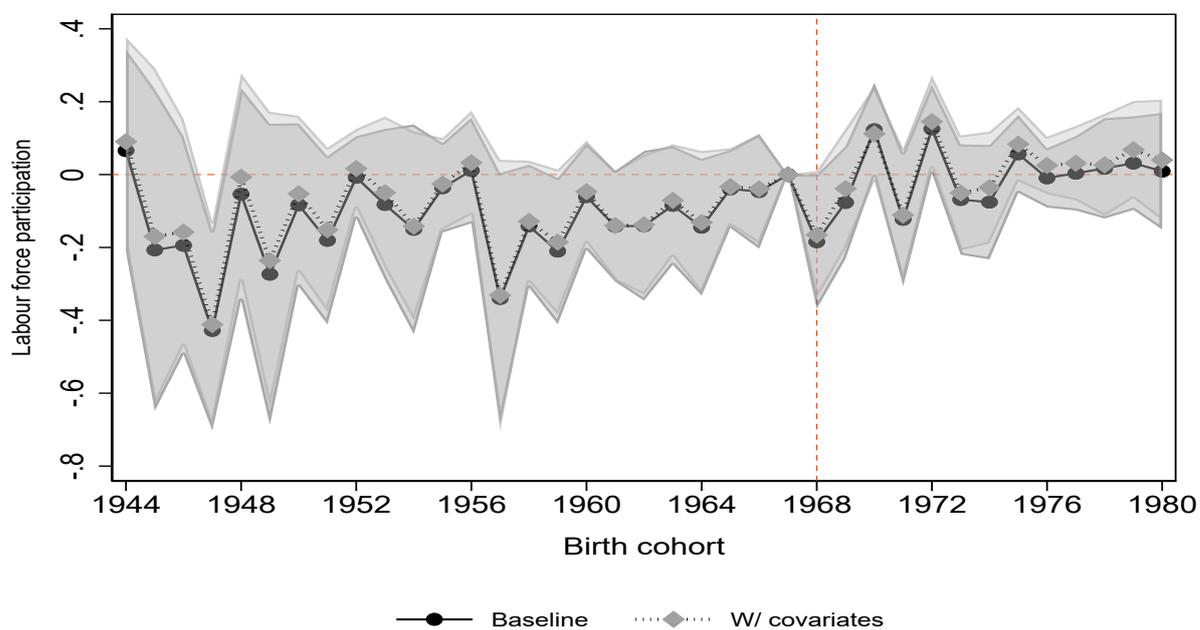


Figure A6 Birth Cohort Coefficients of Access to Prozac (including NLAAS sample)

Table A1 Testing for compositional changes

Age	Female	Low SES	Migration	Parent disorder	Nonwhite
	(1)	(2)	(3)	(4)	(5)
MDD/GAD	0.116*** (0.030)	0.045* (0.025)	-0.021 (0.025)	0.230*** (0.028)	-0.081*** (0.021)
MDD/GAD×Appro	0.052 (0.050)	0.075 (0.046)	-0.034 (0.041)	-0.082** (0.039)	0.016 (0.045)
Cohort FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.020	0.016	0.025	0.044	0.034
Mean dep. var.	0.52	0.28	0.18	0.19	0.30
N	13209	13209	13209	13209	13209

Notes. Entries represent the estimated difference-in-differences estimates with standard errors in parentheses. Dependent variables are sample characteristics. The variable MDD/GAD equals 1 for individuals who have been diagnosed with the according disorders at least once during childhood (21-32y). Cohort fixed effects and year fixed effects are always applied. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table A2 Controlling for unemployment and occupation

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MDD/GAD	-0.232*** (0.087)	-0.241*** (0.089)	0.171*** (0.023)	0.147*** (0.023)	-0.095*** (0.019)	-0.076*** (0.020)	-1.755** (0.799)	-1.020 (0.767)
MDD/GAD×Appro	-0.034 (0.135)	0.029 (0.127)	-0.036 (0.042)	-0.025 (0.042)	0.107*** (0.032)	0.109*** (0.032)	1.474 (1.169)	1.299 (1.086)
Age		0.021** (0.010)		0.014*** (0.002)		-0.013*** (0.003)		0.048 (0.091)
Female		-0.267*** (0.049)		0.007 (0.011)		-0.098*** (0.014)		-6.253*** (0.494)
Low SES		-0.164*** (0.054)		0.006 (0.012)		-0.022 (0.017)		0.629 (0.504)
Migration		0.336*** (0.050)		0.009 (0.019)		-0.018 (0.019)		-1.063 (0.785)
Parent disorder		0.111*** (0.040)		0.085*** (0.013)		-0.039** (0.019)		-0.635 (0.782)
Nonwhite		-0.297*** (0.053)		-0.062*** (0.012)		-0.001 (0.013)		-1.165** (0.560)
Unemp. rate		0.201* (0.110)		0.046** (0.023)		0.011 (0.029)		-1.951*** (0.727)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occ. dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.081	0.112	0.052	0.070	0.068	0.086	0.071	0.125
Mean dep. var.		-		0.13		0.83		41.26
N		12905		12905		12905		10129

Notes. Entries represent the estimated difference-in-differences coefficients with standard errors in parentheses. The variable MDD/GAD equals 1 for individuals who have been diagnosed with the according disorders at least once during childhood (8-20y). Cohort fixed effects, year fixed effects, and occupation dummies are always applied; even numbered columns include control variables including unemployment rates. Columns (7) and (8) refer to people with nonzero hours. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table A3 Access to Treatment Estimates (Augmented Sample)

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MDD/GAD	-0.251*** (0.089)	-0.260*** (0.090)	0.167*** (0.024)	0.145*** (0.023)	-0.116*** (0.018)	-0.096*** (0.018)	-1.639** (0.825)	-0.797 (0.773)
MDD/GAD×Appro	0.058 (0.147)	0.107 (0.141)	-0.003 (0.041)	0.006 (0.041)	0.114*** (0.027)	0.119*** (0.027)	1.227 (1.259)	1.808 (1.168)
Low SES		-0.227*** (0.046)		0.005 (0.011)		-0.030** (0.013)		-0.104 (0.462)
Age		-0.008 (0.013)		0.016*** (0.002)		-0.010*** (0.003)		0.069 (0.079)
Female		-0.284*** (0.068)		-0.007 (0.011)		-0.098*** (0.012)		-6.538*** (0.497)
Migration		0.239*** (0.063)		-0.002 (0.022)		-0.007 (0.022)		-0.631 (0.659)
Parent disorder		0.121*** (0.041)		0.085*** (0.017)		-0.035* (0.019)		-0.267 (0.671)
Nonwhite		-0.492*** (0.066)		-0.054*** (0.012)		-0.017 (0.013)		-0.865* (0.499)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.034	0.063	0.041	0.054	0.051	0.070	0.027	0.103
Mean dep. var.		-		0.13		0.81		41.50
N		17130		17130		17130		10227

Notes. Entries represent the estimated difference-in-differences coefficients with standard errors in parentheses. Results come from OLS regressions of the effect of the entry of Prozac on household income, disability, labour force participation and hours worked per week. Cohort fixed effects and year fixed effects are always included; even numbered columns include covariates. Significance levels: *p < 0.1 **p < 0.05 ***p < 0.01.

Table A4 Non-Prozac childhood mental disorders and effects of access to Prozac

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CD	-0.399** (0.196)	-0.448** (0.193)	0.135*** (0.047)	0.109** (0.043)	-0.102* (0.053)	-0.108** (0.051)	-1.220 (1.131)	-2.762** (1.076)
CD×Appro	0.319 (0.272)	0.427 (0.264)	-0.061 (0.048)	-0.042 (0.046)	0.050 (0.054)	0.058 (0.051)	4.063** (1.776)	4.744*** (1.594)
R^2	0.033	0.066	0.025	0.044	0.051	0.069	0.027	0.106
PD	-0.095 (0.081)	-0.102 (0.088)	0.068*** (0.019)	0.058*** (0.019)	-0.010 (0.017)	-0.007 (0.017)	-0.502 (0.689)	-0.446 (0.660)
PD×Appro	-0.026 (0.157)	-0.008 (0.175)	-0.015 (0.027)	-0.015 (0.027)	0.004 (0.033)	0.011 (0.035)	0.414 (1.358)	1.112 (1.373)
R^2	0.032	0.065	0.025	0.044	0.049	0.067	0.026	0.105
ODD	-0.072 (0.174)	-0.118 (0.182)	0.227*** (0.044)	0.200*** (0.041)	-0.053 (0.041)	-0.046 (0.043)	0.490 (1.374)	0.456 (1.168)
ODD×Appro	0.016 (0.227)	0.102 (0.225)	-0.152*** (0.044)	-0.142*** (0.042)	0.029 (0.043)	0.033 (0.043)	0.405 (2.616)	0.329 (2.461)
R^2	0.031	0.064	0.031	0.049	0.049	0.067	0.026	0.105
IED	0.039 (0.092)	-0.041 (0.093)	0.187*** (0.045)	0.168*** (0.045)	-0.035 (0.040)	-0.040 (0.040)	1.141 (1.222)	-0.212 (1.090)
IED×Appro	-0.009 (0.171)	-0.011 (0.156)	-0.105 (0.082)	-0.107 (0.084)	-0.009 (0.078)	-0.010 (0.074)	-2.057 (1.629)	-1.601 (1.673)
R^2	0.031	0.064	0.030	0.049	0.049	0.068	0.026	0.105
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Mean dep. var.	-		0.13		0.82		41.26	
N	13209		13209		13209		10227	

Notes. Entries represent the estimated difference-in-differences coefficients with standard errors in parentheses. The variables PD, CD, ODD, and IED equal 1 for individuals who have been diagnosed with the according disorders at least once in their childhood (8-20y). Cohort fixed effects and year fixed effects are always included; even numbered columns include covariates. Columns (7) and (8) refer to people with nonzero hours. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table A5 Young Adult Mental Disorder and Access to Treatment

	ln(income)		Disability		Labour force		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MDD/GAD	-0.356*	-0.328*	0.212***	0.189***	-0.042	-0.017	1.061	2.280
	(0.181)	(0.184)	(0.041)	(0.041)	(0.032)	(0.033)	(1.663)	(1.666)
MDD/GAD×Appro	0.353*	0.303	-0.116**	-0.111**	0.019	0.008	-2.802	-3.165
	(0.197)	(0.197)	(0.047)	(0.045)	(0.038)	(0.038)	(2.032)	(2.059)
Age		0.010		0.014***		-0.007**		0.060
		(0.010)		(0.002)		(0.003)		(0.080)
Female		-0.309***		-0.004		-0.085***		-6.505***
		(0.062)		(0.013)		(0.014)		(0.509)
Low SES		-0.217***		0.015		-0.028		0.484
		(0.059)		(0.014)		(0.017)		(0.495)
Migration		0.331***		0.009		-0.018		-1.121
		(0.077)		(0.021)		(0.020)		(0.743)
Parent disorder		0.113**		0.094***		-0.046***		-0.690
		(0.047)		(0.016)		(0.017)		(0.763)
Nonwhite		-0.392***		-0.050***		-0.016		-1.426**
		(0.064)		(0.014)		(0.013)		(0.552)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.033	0.065	0.034	0.051	0.049	0.067	0.027	0.106
Mean dep. var.		-		0.13		0.82		41.26
N		13209		13209		13209		10227

Notes. Entries represent the estimated difference-in-differences coefficients with standard errors in parentheses. The variable MDD/GAD equals 1 for individuals who have been diagnosed with the according disorders at least once during young adulthood (21-32y). Cohort fixed effects and year fixed effects are always applied; even numbered columns include control variables. Columns (7) and (8) refer to people with nonzero hours. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

Table A6 Possible Mechanisms

	Disability	Retirement	Marital	Insurance	Drugs	Education	Disorder
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MDD/GAD	0.147*** (0.024)	0.017* (0.009)	-0.120*** (0.023)	-0.069*** (0.022)	0.143*** (0.027)	-0.121* (0.066)	0.401*** (0.023)
MDD/GAD×Appro	-0.030 (0.042)	-0.019** (0.009)	0.025 (0.043)	-0.013 (0.038)	-0.022 (0.033)	0.027 (0.089)	0.044 (0.036)
Low SES	0.013 (0.013)	0.012** (0.005)	0.018 (0.019)	-0.092*** (0.014)	0.043*** (0.014)	-0.427*** (0.046)	0.018 (0.012)
Female	-0.007 (0.013)	0.001 (0.005)	-0.031* (0.018)	-0.009 (0.014)	-0.137*** (0.010)	0.077** (0.032)	0.044*** (0.010)
Age	0.013*** (0.002)	0.003*** (0.001)	0.007 (0.005)	-0.001 (0.003)	-0.007*** (0.002)	-0.004 (0.010)	0.001 (0.004)
Migration	0.011 (0.020)	0.009 (0.011)	0.098*** (0.022)	0.047 (0.029)	-0.048*** (0.013)	0.260*** (0.079)	-0.023 (0.014)
Parent disorder	0.086*** (0.015)	0.003 (0.005)	-0.022 (0.020)	0.029 (0.019)	0.106*** (0.020)	0.065 (0.055)	0.102*** (0.016)
Nonwhite	-0.049*** (0.014)	-0.016** (0.007)	-0.104*** (0.018)	-0.180*** (0.015)	0.007 (0.014)	-0.333*** (0.049)	-0.002 (0.012)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.057	0.107	0.086	0.100	0.082	0.092	0.187
Mean dep. var.	0.13	0.02	0.63	0.79	0.14	2.74	0.15
N	13209	13209	13209	13205	13209	13209	13209

Notes. Significance levels: * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$. Marital stands for marital status and equals 1 if respondent is married or cohabiting, zero otherwise. Insurance refers to health insurance, equals 1 if individual is (at least partly) covered by any health insurance. Drugs refer to consumption of alcohol, cocaine, heroin and similar drugs. Education is categorical, reaching from 1 for 11 and fewer years of schooling to 4 for 16 and more years of schooling. Disorder refers to mental disorders in past 12 months before interview.