

Effects of Psychiatric Disorders on Labor Market Outcomes: A Latent Variable Approach Using Multiple Clinical Indicators

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ABSTRACT

In this paper, we estimate the effect of psychiatric disorders on labor market outcomes using a structural equation model with a latent index for mental illness, an approach that acknowledges the continuous nature of psychiatric disability. We also address the potential endogeneity of mental illness using covariance instruments as suggested by Lewbel (2012), thus not requiring questionable exclusion restrictions for identification. Data come from the US National Comorbidity Survey – Replication (NCS-R) and the National Latino and Asian American Study (NLAAS). We find that mental illness adversely affects employment and labor force participation for both males and females, but the effects on weeks worked and days missed at work are statistically significant for males only. Using our structural model, we assess the policy implications of some of the recommendations in the 2010 *Affordable Care Act*, relating to expansion of benefits for mental health and substance use disorder benefits. We estimate potential gains in employment for 3.2 million individuals, and reduction in workplace costs of absenteeism of \$18.9 billion due to improved mental health of individuals who are in most need of treatment.

INTRODUCTION & BACKGROUND

The wide-ranging labor market consequences associated with mental illness have been well-documented.⁴ Mental disorders are associated with unemployment, lower earnings, work absences, reduced labor supply, and lower on-the-job productivity (Ettner et al., 1997; Chatterji et al., (2007, 2011); Marcotte et al., 2000; Marcotte and Wilcox-Gok, 2003; Ojeda et al., 2010; Hamilton et al., 1997). The annual earnings loss associated with serious mental illness in the US was estimated to be over \$193 billion in 2001-2003 alone (Kessler et al., 2008). The main emphasis in the economics literature on mental illness and labor market outcomes has been on testing whether the observed association between mental illness and labor market outcomes reflects a causal relationship. Mental illness may be endogenous to labor market outcomes in a structural sense, if these outcomes are determined simultaneously, and/or in a statistical sense, if there are difficult-to-measure characteristics, such as personality traits and family background, which are correlated with mental illness and directly related to labor market outcomes. In prior work, researchers have addressed the potential endogeneity of mental disorders with respect to labor market outcomes using a variety of approaches.⁵ In most prior studies, there are conceptual as well as empirical concerns about the validity of the identification strategy, and dealing with identification issues is the focus of this literature.

Although there has been much interest in this area in testing for causality between mental disorders and labor market outcomes, one relatively neglected issue has been the measurement of mental health itself. Many of the more recent economic studies in this area are based on state-of-the-art surveys which include fully structured, diagnostic psychiatric interviews. These studies typically use an indicator variable (1, if an individual meets diagnostic criteria for a particular mental disorder and 0, otherwise) as the regressor of primary interest. Dichotomous indicators are easy to interpret, and, in epidemiological

⁴ A recent OECD report highlights the labor market burden of mental illness. See OECD (2012), *Sick on the Job? Myths and Realities about Mental Health and Work*, Mental Health and Work, OECD Publishing. <http://dx.doi.org/10.1787/9789264124523-en>

⁵ See, for example, Frijters et al., 2010; Ettner et al., 1997; Ojeda et al., 2010; Chatterji et al., (2007, 2011); Lu et al., 2009; DeSimone, 2002; Renna, 2008; Bartel and Taubman, (1979,1986); Mitchell and Anderson,1989; Chang et al., 2011.

work, they are useful for measuring and tracking changes in disease prevalence. However, the shortcoming of using such a measure in examining the effect of mental illness on labor market outcomes is that it dichotomizes a health condition that is inherently continuous, and it assumes away any heterogeneity in the population in the way psychiatric symptoms affect work capacity. In other words, using dichotomous indicators for mental illness ignores individuals who do not pass the threshold for clinical diagnosis of any particular mental disorder, but, nonetheless, could have a range of sub-threshold symptoms that cause significant work-related impairments. In Figure 1, for example, we show a schematic diagram of the diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) used for a single disorder, Major Depressive Episode (MDE). As the diagram indicates, many individuals who experience symptoms will not meet the threshold for MDE; however, their symptoms may still affect their labor market performance, and they would be coded as “healthy” in a study using binary indicators based on diagnostic criteria. This issue has been recognized by policymakers in the US. Notably, in the 1980’s, screening criteria for federal disability benefits programs were modified such that more consideration was given to work functioning rather than strict psychiatric diagnosis, and non-severe, multiple impairments potentially were viewed as work disabling (Lahiri et al., 1995, 2008; Autor & Duggan, 2003).

In this paper, we estimate the effect of mental illness on labor market outcomes using a structural equation modeling framework with a Multiple Indicator and Multiple Cause (MIMIC) (Joreskog and Goldberger, 1975) model embedded in the structure. A latent index for mental health is generated from the model using multiple indicators (symptoms) and multiple causes (determinants) of psychiatric disorders and the different indicators are linked to the labor market outcome measures. Thus, the latent measure reflects the fact that not all psychiatric symptoms are equally important in explaining the labor market behavior of individuals. In fact, using this approach, we can identify which symptoms and clusters of symptoms are most important to particular labor market outcomes, and potentially also simulate the labor market benefits of particular treatments. Notably, our approach incorporates the high

levels of co-morbidity between different psychiatric conditions because the latent index is constructed based on all psychiatric symptoms, not just those that correspond to a particular disorder. In order to motivate the use of our approach using a continuous measure of mental illness, rather than a binary indicator, we perform a concordance analysis, where we examine whether use of strict diagnostic measures potentially misclassifies a group of individuals as “healthy” when they actually have a range of symptoms not meeting diagnostic threshold.

Data come from two unique and recently publicly available datasets, the National Comorbidity Survey Replication (NCS-R) and the National Latino and Asian American Study (NLAAS) which include a fully structured diagnostic assessment of mental disorders and also rich data on the correlates of mental disorders. We study the impact of mental illness on a wide range of labor market outcomes (employed, in labor force, number of weeks worked for pay in the past 12 months among employed individuals, and number of full days of work missed during the last 30 days conditional on being employed) to account for the manifold effects of mental illnesses. The mental illness measure incorporates symptoms of four psychiatric disorders – Major Depressive Episode (MDE), Panic Attack, Social Phobia and Generalized Anxiety Disorder (GAD).

Our main contribution to the existing literature is the use of a continuous latent index for mental disorder to assess the impact on a range of labor market outcomes. In addition, we also address the potential endogenous nature of the mental illness variable by using covariance instruments, proposed in Lewbel (2012), which, to our knowledge, have not been used previously in this literature. Lewbel argues that the covariance restrictions imposed are reasonable in many classes of models where there are measurement error problems or the error correlations are due to an unobserved common factor. Further, this identification strategy is most useful in situations where the conventional instruments are either weak or unavailable (Lewbel, 2012). This makes a strong case for using this approach in our context. We show the usefulness of our structural modeling approach in a practical application by assessing the potential labor market benefits from expanding access for mental health and substance use disorder services and

treatment alternatives, as laid out in the 2010 *Affordable Care Act*. To this end we conduct a counterfactual simulation exercise, whereby, we simulate the employment effects of amelioration of mental health of individuals who are in most need of treatment, by using the “Rank and Replace” method (McGuire et al., 2006; Cook et al., (2009, 2010)).

EMPIRICAL MODEL & DATA

In order to examine the impact of mental illness on labor market outcomes, we use the following structural equation model:

$$\kappa = \alpha' \mathbf{x} + \beta \eta + \delta , \quad (1)$$

$$K = \begin{cases} 1 & \text{if } \kappa > 0 \\ 0 & \text{if } \kappa \leq 0 \end{cases} , \quad \text{for binary labor market outcomes} \quad (1')$$

$$\eta = \gamma' \mathbf{x} + \zeta , \quad (2)$$

$$\mathbf{y} = \lambda \eta + \epsilon . \quad (3)$$

$\kappa(K)$ is the labor market variable of interest; η is a latent index for mental illness; \mathbf{x} is a vector ($q \times 1$) of control variables (eg. age, race/ethnicity, education); \mathbf{y} is a vector ($n \times 1$) of indicators (eg. depressed mood, diminished pleasure, restlessness) for all mental disorders considered in the analysis; δ , ζ (scalars) and ϵ ($(n \times 1)$ vector) are error terms.

Substituting (2) into (1) and (3) yields the following reduced form equations:

$$\kappa = (\alpha' + \beta \gamma') \mathbf{x} + (\delta + \beta \zeta) , \quad (4)$$

$$\mathbf{y} = \lambda \gamma' \mathbf{x} + (\epsilon + \lambda \zeta) . \quad (5)$$

These equations can be written in compact notation as,

$$\mathbf{R} = \Pi' \mathbf{x} + \mathbf{v} \quad (6)$$

where,

$$\mathbf{R} = \begin{bmatrix} \kappa \\ \boldsymbol{\gamma} \end{bmatrix}; \quad \boldsymbol{\Pi} = [\boldsymbol{\Pi}_{11} \quad \boldsymbol{\Pi}_{12}] = [\boldsymbol{\alpha} + \boldsymbol{\gamma}\boldsymbol{\beta}' \quad \boldsymbol{\gamma}\boldsymbol{\lambda}']; \quad \mathbf{c} = \begin{bmatrix} \delta \\ \boldsymbol{\epsilon} \end{bmatrix}; \quad \mathbf{d} = \begin{bmatrix} \beta \\ \boldsymbol{\lambda} \end{bmatrix}$$

and,

$$\mathbf{v} = \mathbf{c} + \mathbf{d}\zeta.$$

The covariance matrix of the composite error term can be written as,

$$\boldsymbol{\Omega} = \text{var}(\mathbf{v}) = \boldsymbol{\Theta} + \mathbf{d}\mathbf{d}'\sigma_{\zeta}^2 + 2\sigma_{c,\zeta}\mathbf{d}'$$

where,

$$\boldsymbol{\Theta} = \text{var}(\mathbf{c}); \quad \sigma_{\zeta}^2 = \text{var}(\zeta); \quad \text{and} \quad \sigma_{c,\zeta} = \text{cov}(\mathbf{c}, \zeta).$$

Since the latent variable η is unobserved and does not have a natural scale of measurement, in order to identify $\boldsymbol{\lambda}$, one requires normalization of one element of $\boldsymbol{\lambda}$. The choice of the normalized factor loading is arbitrary and the other elements in $\boldsymbol{\lambda}$ are interpreted relative to the normalized factor. In our context, the symptom “depressed mood” is normalized to one. An additional normalization constraint is imposed – the intercept in the mental illness equation (2) is constrained to zero.

Initially, we assume $\text{cov}(\delta, \zeta) = 0$ and consider η as exogenous. Subsequently, we address the endogeneity of mental illness by allowing $\text{cov}(\delta, \zeta) \neq 0$ and use instrumental variables for the endogenous η in order to achieve identification. We use different specifications of the model, each using a different set of instruments: (1) external instrument (w), (2) covariance instruments and, (3) both external and covariance instruments. First, we use the number of psychiatric disorders with onset prior to age 18 as an external instrument for the possibly endogenous mental illness latent variable.⁶ Although the

⁶ The disorders considered for the instrument are Dysthymia, Major Depressive Disorder, Major Depressive Episode, Agoraphobia, Generalized Anxiety Disorder, Panic Attack, Panic Disorder, Post-Traumatic Stress

aforementioned instrument has been used in prior research (Ettner et al., 1997; Chatterji et al., (2007, 2011)) there are conceptual as well as empirical issues about its validity (Chatterji et al., 2011). For example, individuals who have particular personality traits (unobserved) may be both more likely to have a psychiatric disorder in childhood and more likely to fare poorly in the labor market after controlling for possible mediating factors like education and marital status. In this case, the instrument would not be valid.

As an alternative to this standard IV method, we use an approach suggested in Lewbel (2012) which is based on the heteroskedasticity of the error term in equation (2). Lewbel (2012) shows that β can be estimated consistently using $(\mathbf{z} - \bar{\mathbf{z}})\hat{\zeta}$ as instruments⁷ in equation (2) under the assumption that $cov(\mathbf{z}, \zeta^2) \neq 0$ and $cov(\mathbf{z}, \delta\zeta) = 0$. The vector \mathbf{z} is a set of covariates, which could be the entire vector of exogenous variables (\mathbf{x}, \mathbf{w}) and $\bar{\mathbf{z}}$ is the mean of \mathbf{z} . The residual $\hat{\zeta}$ of equation (2) was computed based on the estimated residuals from the reduced form (5) of the MIMIC model. The reduced form residual can be written as,

$$u_{ij} = \lambda\zeta_i + \epsilon_{ij}, \quad i = 1, 2, \dots, N; j = 1, 2, \dots, n$$

where, N denotes the sample size and n the number of indicators (symptoms). The above one-way error component structure is standard in panel data models and $\hat{\zeta}_i$ can be estimated by averaging the residuals over symptoms. Since the applicability of the Lewbel (2012) approach hinges on the assumption of heteroskedasticity of the error term ζ , we conducted a Breusch-Pagan (1979) test, which resoundingly rejected the null hypothesis.

Studies which use symptom scales as a measure of mental illness are more informative than those which merely use binary indicators for disorders. However, the disadvantage of using symptom scales is that it is unclear which symptoms are driving the effects on labor market outcomes. Moreover, all the

Disorder, Social Phobia, Alcohol Abuse, Alcohol Dependence, Drug Abuse, Drug Dependence, Anorexia, Binge Eating Disorder, Bulimia and Intermittent Explosive Disorder.

⁷ We refer to these instruments as covariance instruments in the paper.

symptoms used in the construction of the mental illness scale are assigned equal weights, thus ignoring the differential impact of the psychiatric symptoms on the labor market. Also, the symptoms included in the scales are not necessarily part of the diagnostic criteria used to determine psychiatric diagnosis, which makes it hard to interpret findings.

The main contribution of our paper is that we use a structural equation modeling approach with latent indices for mental disorders, whereby, we simultaneously estimate the determinants of labor market outcomes and mental disorders, and also the loadings of different symptoms on mental health. One of the main advantages of estimating all the equations together under one roof is that the model picks out those indicators of a mental disorder which are important in explaining the labor market outcome variable. Within disorder classes (for example, major depression), we can identify the symptoms that are most important in affecting work capacity using this approach. More broadly, we also can identify psychiatric symptoms across disorder classes that have important effects on work capacity. This is important since some disorders have similar symptoms, and there are high levels of co-morbidity across disorders. In sum, because our modeling approach links the different measurements of a mental disorder to the labor market outcome variable, we are able to create a latent index of a mental disorder which is more nuanced and better at capturing the true continuous and highly co-morbid nature of psychiatric disability.

We employ data from two sources, the National Comorbidity Survey Replication (NCS-R) (NCS-R; Kessler et al. 2004) and the National Latino and Asian American Study (NLAAS) (NLAAS; Alegria et al. 2004).⁸ These data sources, when combined with the National Survey of American Life (NSAL), comprise the Collaborative Psychiatric Epidemiology Studies (CPES), which is collected by the University of Michigan Survey Research Center (SRC). Data collected for the NCS-R and the NLAAS is based on a multi-stage area probability sample including the following four steps: first stage sampling of US Metropolitan Statistical Areas (MSAs) and counties; second stage sampling of area segments;

⁸ The reason for using the pooled NCS-R/NLAAS rather than only the NCS-R was that we could take advantage of an expanded sampling frame.

selection of the housing units from the area segments in the third stage; and finally, randomly selecting the eligible respondents from the selected housing units (Heeringa et al. 2004). The richness of the data lies in detailed information on the distributions, risk factors and correlates of mental disorders and also health services use, in addition to socioeconomic, demographic, physical health conditions, and employment outcomes of the individuals.

The NCS-R is a nationally representative household survey of the non-institutionalized, English speaking population who are 18 years and older and living in the coterminous states of the US. The survey comprised two parts - Part I including a core diagnostic assessment, with a sample size of 9282; and Part II being administered to all the respondents from Part I of the survey who met lifetime criteria for any disorder as well as a probability sample of new respondents (sample size = 5692). The response rate for the survey was 70.9% (Heeringa et al. 2004) and the data was collected between February 2001 and April 2003.

The NLAAS included non-institutionalized Latino and Asian Americans residing in the coterminous states in the US. Latinos were categorized under the following heads: Mexican, Cuban, Puerto Rican and all other Latinos; whereas, Asian Americans were classified based on their ancestry or national origin as: Chinese, Filipino, Vietnamese and all other Asians. The data collection process was completed by late fall 2003. The Latino sample comprised 2554 individuals, with a response rate of 75.5% and the Asian American sample included 2095 individuals with a response rate of 65.6% (Heeringa et al. 2004).

The initial sample with which we begin with consists of 10,341 individuals from Part II of the NCS-R and the NLAAS. We excluded individuals who were either less than 25 years old or older than 64 years old (n=2577), individuals with missing values for the work status variable (n=13) and individuals with missing values for symptoms of disorders (n=11). Since we focus on Asians (Vietnamese, Filipino, Chinese, all other Asians), Latinos (Cuban, Puerto Rican, Mexican , all other Hispanic), African

Americans and Non-Latino Whites (baseline category) in our study, we excluded those individuals who reported their race to be different from the above categories (n=223). The final sample with which we work with consists of 7566 individuals⁹; 4235 women and 3331 men.

The dependent variables are measures of labor market outcomes at the time of the survey: (i) employment status, (ii) labor force participation, (iii) number of weeks worked in the past 12 months conditional on employment, and (iv) number of work absences in the last 30 days among employed individuals. The employment outcome is a binary indicator for whether the individual is currently employed for pay (either part-time or full-time); the labor force participation outcome is also a binary indicator, indicating whether the respondent is currently a part of the labor force (employed/unemployed vs. not in the labor force). Both of these variables are created from a survey question about the individual's current work status (employed/unemployed/not in labor force). The continuous measures of labor market outcomes (iii) and (iv) are generated from the stem questions regarding the number of weeks worked for pay/profit, either part-time or full-time in the past 12 months and the number of full days of work missed in the last 30 days. We restricted the sample for these measures to those who were employed at the time of the survey.

In the NCS-R and the NLAAS the diagnostic battery for each disorder is administered in the following manner. First, there is a set of screener questions which is asked to every respondent in the survey. For example, in the case of MDE, the screener questions include: (1) "Have you ever in your life had a period of time lasting several days or longer when most of the day you felt sad, empty or depressed", (2) "Have you ever had a period of time lasting several days or longer when most of the day you were very discouraged about how things were going in your life" and, (3) "Have you ever had a period of time lasting several days or longer when you lost interest in most things you usually enjoy like work, hobbies, and personal relationships". Second, if the respondent answered in the

⁹ There are some observations with missing values in more than one category. Therefore, the total number of missing observations is greater than the number of observations excluded from the sample.

affirmative to any one of the screener questions, the entire battery of questions corresponding to the disorder is then asked. Clinical diagnosis of a psychiatric disorder is then made based on the responses to the questions. In Figure 1 we depict how a determination is made for MDE in the DSM-IV.

The latent index for mental illness is generated from the model using an array of questions which relates to the symptoms of four psychiatric disorders MDE, Social Phobia, Panic Attack and GAD and underlying causes of mental illness, including demographic, socioeconomic and health conditions variables. We focus on these four disorders since they are the most prevalent hierarchy-free psychiatric disorders in our sample, with no missing values for the symptoms. A list of the symptoms used in our study for each disorder is provided in Table 1 and are indicative of symptoms in the past 12 months. We did not include a few work related symptoms in the study to avoid reverse causality i.e. poor work outcomes can cause psychiatric symptoms and thereby preclude any causal inference.

The covariates (\mathbf{x}) we use as predictors of work outcomes and mental illness comprise age, marital status (married, widowed/divorced/separated with single as the reference), race/ethnicity (Asian, Latino, African American, with Non-Latino Whites as the reference category), education (12 years, 13-15 years, 16 or more years, with less than 12 years as the reference category), any health conditions (either Arthritis/Rheumatism, Stroke, Heart Attack, Diabetes, Ulcer or Cancer at any point during their lifetime) and region (Midwest, South, West with Northeast as the baseline). We estimate our model for each gender separately, since the prevalence of mental disorders and labor market outcomes differ significantly for women and men.

The first identifying instrument (external) is the number of psychiatric disorders (Dysthymia, Major Depressive Disorder, Major Depressive Episode, Agoraphobia, Generalized Anxiety Disorder, Panic Attack, Panic Disorder, Post-Traumatic Stress Disorder, Social Phobia, Alcohol Abuse, Alcohol Dependence, Drug Abuse, Drug Dependence, Anorexia, Binge Eating Disorder, Bulimia, Intermittent Explosive Disorder) with onset before age 18. We also use covariance instruments, without and with the

external instrumental variable. Refer to the *SEM results* section for a reference of the models which the different instruments correspond to. In order to implement the Lewbel (2012) approach, we use a subset of (\mathbf{x}, \mathbf{w}) covariates as the vector \mathbf{z} ; namely, a binary indicator for whether an individual is married or not and the number of early onset of psychiatric disorders. These two variables were chosen since the correlation between the endogenous mental illness variable and the covariance instruments was strongest using these variables from the vector (\mathbf{x}, \mathbf{w}) .

RESULTS

Summary statistics

In Table 1 we report the weighted means of the variables used in our study. Compared to 84% of males, 69% of females are employed; 86% and 75% of males and females resp. are part of the labor force; employed males work about 51 weeks a year relative to 49 weeks for employed females; and both males and females miss about 1 day of work in the past month conditional on being employed. The prevalence rate for any psychiatric disorder in the past 12 months is 29% for women compared to 20% for men; length of depressive episode is higher for women than for men - little more than 3.5 months compared to under 2.5 months for men; among women 14% and 12% had symptoms of depressed mood and diminished pleasure resp. in the past 12 months compared to 9% and 8% for men. Among women 10% had symptoms of choking, 12% feared a social situation, 9% was afraid of meeting new people, 11% had symptoms of excess anxiety and 10% had symptoms of restlessness in the past 12 months. For men the figures were 5%, 9% and 7% for symptoms of choking, fearing a social situation and afraid of meeting new people resp. and 6% for symptoms of excess anxiety and restlessness in the last year.

SEM results

In Table 2 we report the coefficients from the estimated model of the impact of mental illness on the likelihood that an individual is employed. In columns (1) and (5) we do not address the endogeneity of mental illness; in columns (2) and (6) we present estimates using the “number of psychiatric disorders

with onset prior to age 18” as an external instrument for the potentially endogenous mental illness latent variable; in columns (3) and (7) we use instruments suggested in Lewbel (2012), namely, (a) covariance instrument early onset of disorders and (b) covariance instrument married¹⁰, finally, in columns (4) and (8) we use the covariance instruments mentioned above along with the external instrument number of psychiatric disorders with early onset. As anticipated, we find significant dampening effect of mental illness on employment regardless of the model specification. An increase in the mental illness score by one unit reduces the likelihood of employment by 0.253 for males and .135 for females. The coefficient on the latent mental illness variable in the labor market equation is higher after we account for endogeneity (columns (2) - (4) vs. column (1) for males and columns (6) - (8) vs. column (5) for females). The estimated effects are higher using the covariance instruments ($\mu = -0.330$ for males and $\mu = -0.232$ for females) or the covariance instruments in conjunction with the external instrument ($\mu = -0.329$ and $\mu = -0.226$ for males and females resp.), compared to using only the external instrument ($\mu = -0.327$ and $\mu = -0.187$ for males and females resp.). Examining the indicators (symptoms) which weigh most heavily on the mental health of individuals, we find that the length of a depressive episode, severe emotional distress, indecisiveness and insomnia/hypersomnia are the most crucial in the context of employment for both men and women. In addition, we find that the symptom of fatigue is detrimental for women, but not so much for men. The results of the effect of mental ill health on labor force participation of men and women are presented in Table 3. The estimated effects are very similar to those obtained in the previous table and are not discussed in the paper.

The estimated structural parameters for the model with continuous work outcome variables are reported in Tables 4 and 5. We observe significant reduction in the number of weeks worked for both males and females ($\mu = -2.558$ and $\mu = -1.449$ resp.) when we do not allow for correlated errors in the labor market equation and the mental illness equation (Table 4). Accounting for the potential endogeneity of mental illness we find much larger effects for men; however, the coefficient loses significance for the

¹⁰ These instruments are defined in the *Empirical Model* section.

female sample in our preferred specification including the 3 instruments. In Table 5 the outcome of interest is number of days of work missed in the past month. We find poor mental health to significantly increase work absenteeism in the past month for males, but there is no significant impact for females.

Validity of the instruments

In order to test for the validity of the instruments we conducted a set of Hausman tests. First, we tested for the validity of the additional instrument “number of psychiatric disorders with onset prior to age 18”, using “parent/parental figure’s experience of a period of sadness for at least 2 weeks or a period of constant anxiety/nervousness for at least 1 month during most of the respondent’s childhood” as the baseline valid instrument¹¹. We failed to reject the validity of the additional instrument for both the male (*Hausman statistic* $H = 0.007 < 26.30 = \chi^2_{16}$) and female ($H = 0.22 < 26.30 = \chi^2_{16}$) samples in the model with the outcome employment. In the second step, using “number of psychiatric disorders with onset prior to age 18” as a valid instrument for mental illness we tested for the validity of the two additional covariance instruments “covariance instrument early onset of disorders ” and “covariance instrument married”. Again, we failed to reject the validity of the two additional covariance instruments (Male: $H = 0.0007 < 27.59 = \chi^2_{17}$; Female: $H = 0.77 < 27.59 = \chi^2_{17}$) in the same model. The instruments also passed the Hausman test for instrument validity in our structural equation model for each labor market outcome for males and females (see Table 6).

Concordance Analysis

Next, we perform a concordance analysis to determine whether there is a significant advantage to our latent variable approach over the standard approach of using a binary indicator of mental illness in estimating effects of psychiatric disorder on labor market outcomes. To this effect, we dichotomize the estimated latent scale over the relevant range for different alternative values for the cut-off points (τ).

¹¹ We conduct this test using the NCS-R sample since our baseline instrument is not available in the NLAAS sample.

Thus, individuals with a predicted score for the latent mental disorder variable to the left of τ are characterized as not having a disorder and those with a score greater than or equal to τ are classified as having the disorder. The predicted value for each disorder is obtained from equation (3), using only the indicators related to the particular mental disorder.

Given a cut-off point (τ), we define the hit rate (H) as the proportion of correct diagnosis (based on our measure) when an individual meets diagnostic criteria for a disorder and the false alarm rate (F) as the proportion of incorrect diagnosis when an individual does not meet diagnostic criteria (see Lahiri and Wang, 2013). In Table 7.1 we show the contingency table for diagnosis based on clinical measures and that based on the model, given τ . In terms of Table 7.1, $H = a/(a + c)$ and $F = b/(b + d)$.

We use two measures to evaluate the performance of our latent indices vis-à-vis the standard binary variables used: (a) the Peirce skill score (PS) (Lahiri and Wang, 2013) and (b) the odds ratio (OR), which are better discriminatory measures when the outcome of interest is relatively uncommon. PS is the difference between the hit rate and the false alarm rate ($PS = H - F$) and the odds ratio is defined as the ratio of the odds of making a correct prediction and the odds of an incorrect prediction ($OR = [H/(1 - H)]/[F/(1 - F)]$). A value of 0 for the PS or alternatively, a value of 1 for the odds ratio indicates a perfect mismatch between our prediction based on the MIMIC model and a clinical diagnosis of the disorder. In Table 7.2, we report these statistics for given values of τ for each psychiatric disorder used in our study. Our preferred choice of cut-off value τ is one which maximizes PS and/or OR . Thus, we choose $\tau = 0.1$ for MDE, $\tau = 0.1$ for Panic Attack, $\tau = 0.7$ for Social Phobia and $\tau = 0.4$ for GAD. Following Van Doorslaer and Jones (2003), we normalize the predicted values of the latent mental disorder variables such that they lie in the $[0, 1]$ interval.

In Table 8, we present contingency tables for clinical diagnosis and diagnosis of a mental disorder based on the optimal cut-off values chosen above for each psychiatric disorder. In the case of MDE, Social Phobia and GAD, we identify a large number of individuals who do not meet diagnostic criteria

but would be classified as having the disorder based on our chosen cut-off value (176, 262, and 367 individuals, respectively). Further, the distribution of the latent indices for mental disorders for this set of individuals closely resembles those who meet diagnostic criteria for the disorder, thus indicating similarly poor mental health. In an analysis of the labor market effects of mental illness using a binary indicator for meeting diagnostic criteria for a disorder, one would misclassify these groups of individuals as being perfectly healthy, and thus potentially generating a misleading estimate of the impact of mental illness on work outcomes. Note that the number of false negatives, denoted by c in Table 7.1, is very small for each disorder (see Table 8).

Counterfactual policy simulations

With the enactment of the 2010 *Affordable Care Act*, there will be a widespread expansion of coverage for mental health and substance use disorder services and provision of these services at parity with general medical and surgical care beginning in 2014 (Beronio et al., 2013). In the light of this policy change, it is important to analyze whether (i) the increase in access to mental health services would translate into greater utilization and subsequently effective treatment of mental disorders and, (ii) adequate treatment of disorders ultimately lead to improved labor market outcomes and broader inclusion of the mentally ill into the workplace. In this analysis we seek to address the second question.

We simulate the labor market outcomes for those who are in need of treatment (individuals diagnosed with a mental disorder in the past 12 months¹² ($D=1$)) if they had the same symptom profile as those who do not require treatment (individuals not meeting diagnostic criteria for any mental disorder in the past 12 months ($D=0$)).¹³ In other words, we create a counterfactual group of $D=1$ individuals with identical profile of symptoms as $D=0$ individuals and their original demographic, socio-economic and other health characteristics. In order to implement this we apply the “Rank and Replace” method used

¹² The disorders include MDE, Panic Attack, Social Phobia and GAD.

¹³ We assume that policymakers would initially target treatment expansions at persons meeting diagnostic criteria for disorder. To the extent that we do not include the group of individuals who do not meet clinical diagnostic criteria but are classified as mentally ill according to our measure in the $D=1$ group, we underestimate the benefits from mental health treatment on the labor market outcomes.

previously in research on health care disparities (McGuire et al., 2006; Cook et al., (2009, 2010)). The procedure is outlined as follows: (i) Rank the $D=1$ and $D=0$ group individuals separately by their mental illness score¹⁴ and obtain the percentile scores of the ranked individuals in each group, (ii) Rank the combined sample of $D=1$ and $D=0$ individuals in increasing order of their percentile scores previously computed, (iii) Replace the symptoms of $D=1$ individual with symptoms of higher ranked (healthier) $D=0$ individual and, (iv) Using coefficients from previously estimated model (with 2 covariance instruments and 1 external instrument) obtain predicted value of labor market outcome with simulated mental health profile of $D=1$ individuals and original mental health profile of $D=0$ individuals. The above procedure is carried out separately for males and females.

In Table 9 we present results of the labor market benefits from improved mental health of the diagnosed individuals. We find a 15 percentage point increase in the likelihood of employment and 13 percentage point increase in the probability of labor force participation for males; and slightly lower 11 and 10 percentage point increases, respectively for women. Further, males are predicted to work an additional two and a half weeks longer and females about one week more in a given year as a result of better mental health. We also conducted counterfactual simulations of the labor market effects of worsening mental health of undiagnosed individuals ($D=0$), to match the symptom profile of diagnosed individuals ($D=1$). We find substantial adverse impact of poor mental health on all the labor market outcomes and the magnitude of the effects are very similar to those obtained in Table 9 (see Table 10). The “Rank and Replace” method is useful for this analysis as it acknowledges two important facts. First, within the $D=1$ and $D=0$ groups, there is a great variation in mental health levels. Second, given that the need-for-treatment group utilizes and adheres to effective treatment, the improvement in mental health would not be uniform across the distribution of mental health scores.

In order to put the individual level labor market effects into perspective, we calculate the societal impact of amelioration of mental health of the diagnosed group of individuals. We compute the gain in

¹⁴ The mental illness score is computed from equation (3).

employment by using the number of individuals 24-64 years old who are in the labor force¹⁵ (BLS, 2002a), the prevalence rate of any mental disorder¹⁶ and the estimated increase in the likelihood of employment. We find that a total of 3.2 million individuals (1.59 million men and 1.57 million women) would gain employment from improved mental health. Further, we also calculate the workplace cost of absenteeism – this was carried out in two steps. First, we compute the monetary value of the lost work days in a year per person. We used the estimated value of the reduction in missed days due to improved mental health, obtained earlier, and the median weekly wages (following Greenberg et al., 1993) obtained from the Bureau of Labor Statistics (2002b). Second, we calculate the societal cost of absenteeism for the working age employed individuals. To this effect we use the employment figures for the 24-64 year old individuals (BLS, 2002a) and the prevalence rate of any mental disorder¹⁷. We find that the workplace cost of absenteeism is \$18.9 billion (\$14.4 billion for men and a much lower \$4.5 billion for women) in 2002 dollars¹⁸.

DISCUSSION

In this paper we have proposed an alternative methodological approach to examine the effect of mental disorders on labor market outcomes of individuals using latent indices for disorders. We believe this method is more nuanced and better able to capture heterogeneity in the manner in which psychiatric disorders limit work functioning and lead to poor work related outcomes. Another contribution to the literature is obtaining identification without the use of exclusion restrictions, using an approach suggested in Lewbel (2012). We find evidence that poor mental health adversely affects the likelihood of being employed and labor force participation of both men and women. The effects are much larger across all

¹⁵ Here we assume that individuals who are out of the labor force do not reenter the labor force as a result of improved mental health. This provides a conservative estimate of the increase in employment.

¹⁶ The disorders considered are MDE, Panic Attack, Social Phobia and GAD. The prevalence rate for any mental disorder is 16.75% for men and 26.11% for women, computed from our dataset.

¹⁷ The disorders considered are MDE, Panic Attack, Social Phobia and GAD. The prevalence rate for any mental disorder is 16.75% for men and 26.11% for women, computed from our dataset.

¹⁸ We use employment, labor force participation and median weekly wages data from BLS (2002a, b) to arrive at the employment gain and societal cost estimates, since the NCS-R and the NLAAS was conducted between 2001 and 2003.

model specifications after addressing the endogeneity of mental illness and the impact is greater for men compared to women. In case of the continuous work outcomes we find mental illness to reduce number of weeks worked and increase work absence for males only. Our findings also suggest that the indicators of depression are most debilitating for work outcomes.

One of the significant advantages of modeling mental health as a latent continuous measure and using symptoms of mental disorders to generate the latent mental health index is that we can examine the potential labor market benefits from enhanced and effective treatment of mental disorders by using counterfactual simulations. We find an increase in the likelihood of employment of 15 and 11 percentage points for men and women respectively, which is similar to the 11 percentage point increase for both men and women found in Ettner et al. (1997). We also calculate the workplace cost of absenteeism to be \$18.9 billion, which is much lower than \$36.2 billion found by Greenberg et al. (2003) for depression alone using the NCS-R. Greenberg et al.'s estimate, however, is not directly comparable with our finding since they do not examine the causal effect of depression on absenteeism, merely association between the two. In our counterfactual simulation exercise we have attempted to highlight some of the potential benefits from expanding access for mental health care benefits which have been proposed in the *Affordable Care Act*. A more thorough treatment, including direct costs of inpatient, outpatient and pharmaceutical costs and also other benefits in terms of improved productivity of treated individuals should be undertaken in future research to assess the cost effectiveness of the proposed changes for mental health and substance abuse disorder benefits.

Although we have included four highly prevalent psychiatric disorders in the present study, which belong to the class of affective disorders, we have not included other disorders in the same class of disorders. In future work, we propose to include psychiatric symptoms from Bipolar Disorder, Dysthymia, Agoraphobia, Posttraumatic Stress Disorder and Specific Phobia in the analysis to get a more complete picture of how affective disorders limit employment opportunities and performance of individuals.

REFERENCES

1. Alegria M, Takeuchi D, Canino G, Duan N, Shrout P, Meng XL, Vega W, Zane N, Vila D, Woo M, Vera M, Guarnaccia P, Aquilar-Gaxiola S, Sue S, Escobar J, Lin KM, Gong F. Considering context, place and culture: The National Latino and Asian American Study. *International Journal of Methods in Psychiatric Research* 2004; **13**(4): 208-220.
2. Bartel A, Taubman P. Health and Labor Market Success: The Role of Various Diseases. *The Review of Economics and Statistics* 1979; **61**(1): 1-8.
3. Bartel A, Taubman P. Some Economic and Demographic Consequences of Mental Illness. *Journal of Labor Economics* 1986; **4**(2): 243-256.
4. Beronio K, Po R, Skopec L, Glied S. Affordable Care Act Expands Mental Health and Substance Use Disorder Benefits and Federal Parity Protections for 62 Million Americans. ASPE Issue Brief, Department of Health and Human Services 2013.
5. Breusch, T, and Pagan A. A Simple Test for Heteroscedasticity and Random Coefficient Variation. *Econometrica* 1979; **47**(5):1287-1294.
6. Bureau of Labor Statistics. Employment and earnings: Table 3: employment status of the civilian noninstitutional population by age, sex, and race. Washington, DC: US Dept of Labor; 2002a. Available at: <ftp://ftp.bls.gov/pub/special.requests/lf/aa2002/pdf/CPSAAT3.PDF>.
7. Bureau of Labor Statistics. Highlights of women's earnings in 2002. Washington, DC: US Dept of Labor; 2002b. Available at: <http://stats.bls.gov/cps/cpswom2002.pdf>.
8. Chang H, Yen ST. Mental Health and Employment of the Elderly in Taiwan: A simultaneous Equation Approach. *Pacific Economic Review* 2011; **16**(4): 504-519.
9. Chatterji P, Alegria M, Lu M, et al. Psychiatric disorders and labor market outcomes: evidence from the National Latino and Asian American Study. *Health Econ* 2007; **16**: 1069-1090.

10. Chatterji P, Alegria M, Takeuchi D. Psychiatric disorders and labor market outcomes: Evidence from the National Comorbidity Survey-Replication. *J Health Econ* 2011; 30: 858-868.
11. Cook BL, McGuire TG, Meara E, Zaslavsky AM. Adjusting for health status in non-linear models of health care disparities. *Health Serv Outcomes Res Method* 2009; 9:1-21.
12. Cook BL, McGuire TG, Lock K, Zaslavsky AM. Comparing Methods of Racial and Ethnic Disparities Measurement across Different Settings of Mental Health Care. *Health Services Research* 2010; 45(3): 825-847.
13. Ettner SL, Frank RG, Kessler RC. The Impact of Psychiatric Disorders on Labor Market Outcomes. *Industrial and Labor Relations Review* 1997; 51: 64-81.
14. Frijters P, Johnston DW, Shields MA. Mental Health and Labor Market Participation: Evidence from Panel Data Models. *Discussion Papers* 2010; IZA DP No. 4883:1-26.
15. Greenberg PE, Kessler RC, Birnbaum HG, Leong SA, Lowe SW, Berglund PA, Corey-Lisle PK. The Economic Burden of Depression in the United States: How Did It Change Between 1990 and 2000? *J Clin Psychiatry* 2003; 64(12): 1465-1475.
16. Greenberg PE, Stiglin LE, Finkelstein SN, Berndt ER. The Economic Burden of Depression in 1990. *J Clin Psychiatry* 1993; 54(11): 405-418.
17. Hamilton VH, Merrigan P, Dufresne E. Down and Out: Estimating the Relationship between Mental Health and Unemployment. *Health Economics* 1997; 6: 397-406.
18. Heeringa S, Wagner J, Torres M, Duan NH, Adams T, Berglund P. Sample designs and sampling methods for the Collaborative Psychiatric Epidemiology Studies (CPES). *International Journal of Methods in Psychiatric Research* 2004; 13(4): 221-240.
19. Joreskog KG, Goldberger AS. Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable. *Journal of the American Statistical Association* 1975; 70: 631-639.

20. Kessler R, Ustun T. The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research* 2004; **13**: 93-121.
21. Kessler RC, Heeringa S, Lakoma MD, Petukhova M, Rupp AE, Schoenbaum M, Wang PS, Zaslavsky AM. Individual and societal effects of mental disorders on earnings in the United States: Results from the NCS-R. *American Journal of Psychiatry* 2008; **165**(6): 703-711.
22. Lahiri K., Vaughan D.R., Wixon B. Modeling SSA's sequential disability determination process using matched SIPP data. *Social Security Bulletin* 1995; **58**(4): 3-42.
23. Lahiri K., Song J., Wixon B. A Model of Social Security Disability Insurance Using Matched SIPP/Administrative Data. *Journal of Econometrics* 2008; **145**: 4-20.
24. Lahiri K, Wang JG. Evaluating probability forecasts for GDP declines using alternative methodologies. *International Journal of Forecasting* 2013; **29**(1): 175-190.
25. Lewbel A. Using Heteroscedasticity to Identify and Estimate Mismeasured and Endogenous Regressor Models. *Journal of Business and Economic Statistics* 2012; **30**(1): 67-80.
26. Lu C, Frank R, Liu Y, Shen J. The Impact of Mental Health on Labour Market Outcomes in China. *The Journal of Mental Health Policy and Economics* 2009; **12**: 157-166.
27. Marcotte DE, Wilcox-Gok V. Estimating earnings losses due to mental illness: a quantile regression approach. *The Journal of Mental Health Policy and Economics* 2003; **6**:123–134.
28. Marcotte DE, Wilcox-Gok V, Redmond DP. The labor market effects of mental illness: the case of affective disorders. In: Salkever D, Sorkin A, eds. *The Economics of Disability*. Greenwich, CT: JAI Press; 2000:181–210.
29. McGuire TG, Alegria M, Cook BL, Wells KB, Zaslavsky AM. Implementing the Institute of Medicine Definition of Disparities: An Application to Mental Health Care. *Health Services Research* 2006; **41**(5): 1979-2005.
30. Mitchell JM., Anderson KH. Mental Health and the Labor Force Participation of Older Workers. *Inquiry* 1989; **26**: 262-271.

31. OECD. *Sick on the Job? Myths and Realities about Mental Health and Work. Mental Health and Work*, OECD Publishing 2012; <http://dx.doi.org/10.1787/9789264124523-en>.
32. Ojeda VD, Frank RG, McGuire TG, Gilmer TP. Mental Illness, Nativity, Gender and Labor Supply. *Health Economics* 2010; **19**: 396-421.
33. Renna F. Alcohol Abuse, Alcoholism, and Labor Market Outcomes: Looking for the Missing Link. *Industrial and Labor Relations Review* 2008; **62**(1): 92-103.
34. Van Doorslaer E, Jones AM. Inequalities in self-reported health: validation of a new approach to measurement. *J Health Econ* 2003; **22**: 61-87.

Figure 1. Diagnostic criteria for Major Depressive Episode (MDE) in the DSM-IV

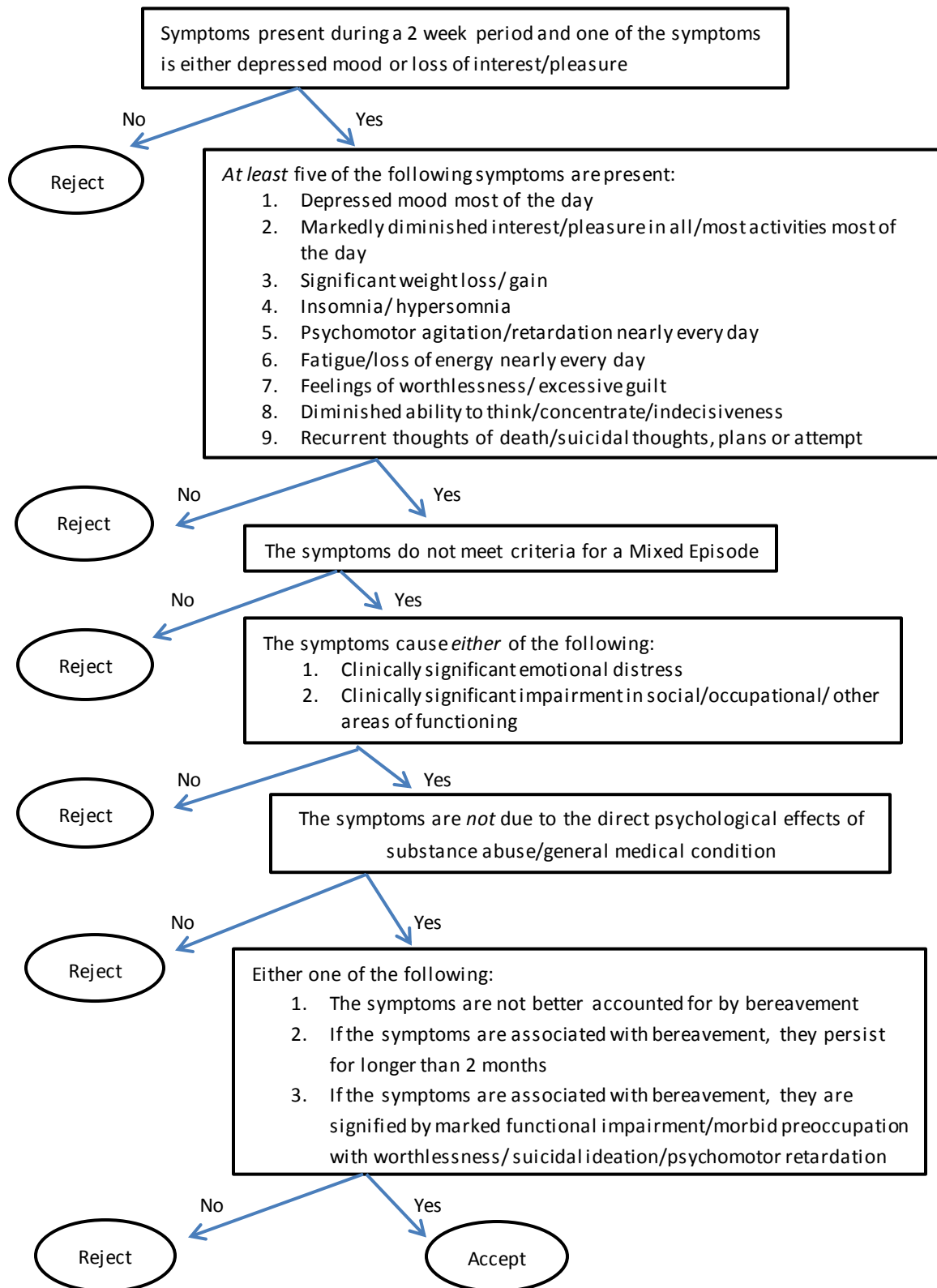


Table 1: Summary statistics (weighted means)					
Variables	Definition	Male		Female	
		(N= 3331)		(N= 4235)	
Labor Market outcomes					
Employed	Binary variable = 1 if respondent is employed (full-time or part-time) ; 0 otherwise	0.84		0.69	
In labor force	Binary variable = 1 if respondent is in the labor force (employed or unemployed) ; 0 if not in the labor force	0.86		0.75	
Weeks worked in past year conditional on employment	Number of weeks worked for pay or profit in past 12 months conditional on being employed	50.46	(0.20)	49.41	(0.19)
Days missed in past month conditional on employment	Number of full days of work missed in past 30 days conditional on being employed	1.08	(0.13)	1.22	(0.10)
Indicator variables					
Depressed mood	Binary variable =1 if felt depressed/ nothing could cheer you up/discouraged about things in life/ felt hopeless about future most days during episode in past 12 months; 0 otherwise	0.09		0.14	
Diminished pleasure	Binary variable =1 if nothing was fun even though good things were happening during episode in past 12 months; 0 otherwise	0.06		0.10	
Significant weight change	Binary variable =1 if smaller appetite/ larger appetite than usual most days during episode in past 12 months; 0 otherwise	0.06		0.12	
Insomnia or Hypersomnia	Binary variable =1 if trouble sleeping/ sleeping more than usual most nights during episode in past 12 months; 0 otherwise	0.08		0.13	
Restlessness or retardation	Binary variable =1 if others notice talking/ moving more slowly/ restlessness during episode in past 12 months; 0 otherwise	0.05		0.07	
Fatigue	Binary variable =1 if low energy and tired without hard work most days during episode in past 12 months; 0 otherwise	0.07		0.13	

Worthlessness	Binary variable =1 if feeling of worthlessness most days during episode in past 12 months; 0 otherwise	0.04		0.07	
Indecisiveness	Binary variable =1 if slow or mixed up thoughts most days/ more trouble concentrating most days/ unusual indecisiveness during episode in past 12 months; 0 otherwise	0.08		0.13	
Suicidal thoughts	Binary variable =1 if often thought of death/ thought would be better if dead/ thought about suicide/ made suicide plan/ attempted suicide during episode in past 12 months; 0 otherwise	0.06		0.10	
Frequently severe emotional distress	Binary variable =1 if severe emotional distress often/ sometimes during episode in past 12 months; 0 otherwise	0.07		0.12	
Severe emotional distress	Binary variable =1 if moderate/ severe/ very severe emotional distress during episode in past 12 months; 0 otherwise	0.08		0.13	
Length of Depressive episode	Length of Depressive episode in days	71.02	(11.05)	107.77	(14.81)
Sweating	Binary variable =1 if sweating during attack in past 12 months; 0 otherwise	0.04		0.06	
Trembling	Binary variable =1 if trembling/ shaking during attack in past 12 months; 0 otherwise	0.03		0.05	
Choking	Binary variable =1 if short of breath/ felt you were choking during attack in past 12 months; 0 otherwise	0.05		0.10	
Chest pain or nausea	Binary variable =1 if chest pain/ discomfort or nausea/stomach discomfort during attack in past 12 months; 0 otherwise	0.05		0.09	
Dizziness or unreality	Binary variable =1 if felt dizzy/ felt you were not really there/ felt things around you unreal/ might lose control or go crazy/ afraid might die / numbness or tingling/ hot flushes or chills during attack in past 12 months; 0 otherwise	0.05		0.09	
Afraid meeting new people	Binary variable =1 if shy/afraid/uncomfortable meeting new people in past 12 months; 0 otherwise	0.07		0.09	
Afraid talking to authority	Binary variable =1 if shy/afraid/uncomfortable talking to authority in past 12 months; 0 otherwise	0.06		0.09	

Shy at social gathering	Binary variable =1 if shy/afraid/uncomfortable at parties and social gatherings in past 12 months; 0 otherwise	0.06		0.08	
Shy performing	Binary variable =1 if shy/afraid/uncomfortable performing in front of audience in past 12 months; 0 otherwise	0.08		0.11	
Shy of unknown people	Binary variable =1 if shy/afraid/uncomfortable talking to people don't know well in past 12 months; 0 otherwise	0.06		0.08	
Shy at disagreement	Binary variable =1 if shy/afraid/uncomfortable disagreeing with people don't know well in past 12 months; 0 otherwise	0.05		0.08	
Shy with others watching	Binary variable =1 if shy/afraid/uncomfortable while writing/eating/drinking with someone watching in past 12 months; 0 otherwise	0.03		0.06	
Shy using public restroom	Binary variable =1 if shy/afraid/uncomfortable using public bathroom in past 12 months; 0 otherwise	0.03		0.04	
Shy in dating situation	Binary variable =1 if shy/afraid/uncomfortable in dating situation in past 12 months; 0 otherwise	0.05		0.06	
Uncomfortable getting attention	Binary variable =1 if shy/afraid/uncomfortable being center of attention/ being in an embarrassing situation in past 12 months; 0 otherwise	0.07		0.09	
Fear of embarrassment	Binary variable =1 if fear of embarrassment/humiliation/ fear of embarrassing others/ fear someone looking/talking/ thinking negatively about you/ fear of being focus of attention in past 12 months; 0 otherwise	0.09		0.12	
Fear of social situation	Binary variable =1 if very upset/nervous in a social situation or in front of a group in past 12 months; 0 otherwise	0.09		0.12	
Avoid social situations	Binary variable =1 if avoid social situation or activity in front of group due to fear in past 12 months; 0 otherwise	0.09		0.11	
Social situations cause intense anxiety	Binary variable =1 if respondent has 2 or more shyness reactions/ severe or very severe social fear if faced today/ fear of panic attack in past 12 months; 0 otherwise	0.08		0.11	
Recent occurrence after age 18	Binary variable =1 if age of recent occurrence of feared/ avoided social situation is at least 18 years and it occurred in past 12 months; 0 otherwise	0.10		0.12	

Excess anxiety	Binary variable =1 if respondent worried more than others about same problems/ more nervous/anxious than most with same problems / anxious/worried most days for one month or more in past 12 months; 0 otherwise	0.06		0.11	
Length of GAD episode	Length of episode when respondent was worried most days in past 12 months; 0 otherwise	76.13	(14.29)	122.47	(21.25)
Difficult to control worry	Binary variable =1 if find hard to control worry/anxiousness/nervousness often/sometimes in past 12 months; 0 otherwise	0.06		0.10	
Restlessness	Binary variable =1 if often feel restless, keyed up, or on edge in past 12 months; 0 otherwise	0.06		0.10	
Tired	Binary variable =1 if often get tired easily in past 12 months; 0 otherwise	0.04		0.09	
Irritable	Binary variable =1 if often more irritable than usual in past 12 months; 0 otherwise	0.05		0.09	
Difficulty concentrating	Binary variable =1 if often have difficulty concentrating or keeping ones mind on what one was doing in past 12 months; 0 otherwise	0.05		0.09	
Tense muscles	Binary variable =1 if often have tense, sore, or aching muscles in past 12 months; 0 otherwise	0.04		0.07	
Sleeping problems	Binary variable =1 if often have trouble falling or staying asleep in past 12 months; 0 otherwise	0.05		0.09	
Excessive nervousness	Binary variable =1 if frequently so nervous that could not think of else regardless of effort in past 12 months; 0 otherwise	0.05		0.09	
Significant emotional distress	Binary variable =1 if worry/anxiety/nervousness cause moderate/ severe/ very severe distress in past 12 months; 0 otherwise	0.06		0.10	
Worry not always due to physical causes	Binary variable =1 if worry/anxiousness/nervousness <i>not</i> always due to physical causes in past 12 months; 0 otherwise	0.02		0.02	
<i>Socio-demographic variables</i>					
Age	Age of respondent	42.78	(0.37)	43.40	(0.34)
Asian	Binary variable =1 if respondent is Asian (Vietnamese, Filipino, Chinese, all other Asians) ; 0 otherwise	0.05		0.05	

Latino	Binary variable =1 if respondent is Latino (Cuban, Puerto Rican, Mexican , all other Hispanic) ; 0 otherwise	0.13		0.12	
African American	Binary variable =1 if respondent is African American ; 0 otherwise	0.10		0.12	
Married	Binary variable =1 if married/cohabiting ; 0 otherwise	0.70		0.64	
Divorced	Binary variable =1 if divorced/ separated/ widowed ; 0 otherwise	0.15		0.21	
12 years of education	Binary variable =1 if respondent had 12 years of education ; 0 otherwise	0.30		0.29	
13-15 years of education	Binary variable =1 if respondent had 13 to 15 years of education ; 0 otherwise	0.27		0.30	
16 or more years of education	Binary variable =1 if respondent had 16 or more years of education ; 0 otherwise	0.28		0.29	
Midwest	Binary variable =1 if region of residence is midwest ; 0 otherwise	0.24		0.22	
South	Binary variable =1 if region of residence is south ; 0 otherwise	0.33		0.35	
West	Binary variable =1 if region of residence is west ; 0 otherwise	0.24		0.24	
Physical chronic conditions					
Chronic conditions	Binary variable =1 if respondent had either Arthritis/Rheumatism , Stroke, Heart Attack, Diabetes, Ulcer or Cancer at any point in one's life ; 0 otherwise	0.34		0.38	
Instrumental variable					
# early onset of psychiatric disorders	Number of psychiatric disorders (Dysthymia , Major Depressive Disorder, Major Depressive Episode, Agoraphobia, Generalized Anxiety Disorder, Panic Attack, Panic Disorder, Post-Traumatic Stress Disorder, Social Phobia, Alcohol Abuse, Alcohol Dependence, Drug Abuse, Drug Dependence, Anorexia, Binge Eating Disorder, Bulimia, Intermittent Explosive Disorder) with onset before age 18	0.57	(0.03)	0.60	(0.02)
Notes: Standard errors in parentheses for continuous variables; Statistics are adjusted for complex survey design					

Table 2: Effect of mental illness on employment										
		Male					Female			
		(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
		No instrumen ts	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument		No instrume nts	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument
Labor market equation										
Employed										
	Mental Illness*	-0.253***	-0.327***	-0.330***	-0.329***		-0.135***	-0.187***	-0.232***	-0.226***
		(0.04)	(0.10)	(0.08)	(0.07)		(0.03)	(0.06)	(0.04)	(0.04)
Mental Illness equation										
Mental Illness*										
	# early onset of psychiatric disorders		0.070***		0.032***			0.093***		0.033***
			(0.01)		(0.00)			(0.01)		(0.00)
	Cov instrument early onset of disorders			0.198***	0.174***				0.204***	0.175***
				(0.02)	(0.02)				(0.01)	(0.01)
	Cov instrument married			-0.335***	-0.330***				-0.448***	-0.444***
				(0.11)	(0.11)				(0.06)	(0.06)
Measurement model equations										
Depressed mood										
	Mental Illness*	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000
		(.)	(.)	(.)	(.)		(.)	(.)	(.)	(.)
Diminished pleasure										
	Mental Illness*	0.776***	0.777***	0.777***	0.777***		0.774***	0.774***	0.774***	0.775***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.02)	(0.02)	(0.02)	(0.02)

<i>Significant weight change</i>									
	Mental Illness*	0.735***	0.735***	0.736***	0.736***	0.870***	0.870***	0.871***	0.871***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Insomnia or Hypersomnia</i>									
	Mental Illness*	0.955***	0.955***	0.955***	0.955***	0.940***	0.940***	0.940***	0.940***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Restlessness or retardation</i>									
	Mental Illness*	0.574***	0.574***	0.574***	0.574***	0.542***	0.543***	0.543***	0.543***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Fatigue</i>									
	Mental Illness*	0.869***	0.869***	0.869***	0.869***	0.944***	0.944***	0.944***	0.944***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Worthlessness</i>									
	Mental Illness*	0.518***	0.519***	0.520***	0.520***	0.536***	0.537***	0.538***	0.538***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Indecisiveness</i>									
	Mental Illness*	0.934***	0.934***	0.934***	0.934***	0.935***	0.935***	0.935***	0.935***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Suicidal thoughts</i>									
	Mental Illness*	0.742***	0.742***	0.743***	0.743***	0.779***	0.779***	0.780***	0.780***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Frequently severe emotional distress</i>									
	Mental Illness*	0.872***	0.872***	0.872***	0.872***	0.859***	0.859***	0.859***	0.859***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Severe emotional distress</i>									
	Mental Illness*	0.973***	0.973***	0.973***	0.973***	0.966***	0.966***	0.966***	0.966***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Length of Depressive episode</i>									
	Mental Illness*	1.017***	1.018***	1.018***	1.019***	0.971***	0.972***	0.974***	0.975***

		(0.17)	(0.17)	(0.17)	(0.17)	(0.12)	(0.12)	(0.12)	(0.12)
<i>Sweating</i>									
	Mental Illness*	0.172***	0.173***	0.173***	0.173***	0.121***	0.121***	0.121***	0.121***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Trembling</i>									
	Mental Illness*	0.087***	0.087***	0.087***	0.087***	0.061***	0.061***	0.061***	0.061***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Choking</i>									
	Mental Illness*	0.246***	0.247***	0.247***	0.248***	0.243***	0.243***	0.243***	0.244***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Chest pain or nausea</i>									
	Mental Illness*	0.252***	0.253***	0.253***	0.254***	0.235***	0.235***	0.235***	0.236***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Dizziness or unreality</i>									
	Mental Illness*	0.237***	0.238***	0.238***	0.238***	0.196***	0.196***	0.196***	0.196***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Afraid meeting new people</i>									
	Mental Illness*	0.345***	0.348***	0.348***	0.349***	0.230***	0.231***	0.232***	0.232***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Afraid talking to authority</i>									
	Mental Illness*	0.284***	0.286***	0.286***	0.287***	0.201***	0.202***	0.202***	0.203***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at social gathering</i>									
	Mental Illness*	0.303***	0.305***	0.305***	0.306***	0.211***	0.212***	0.212***	0.212***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy performing</i>									
	Mental Illness*	0.300***	0.302***	0.302***	0.303***	0.236***	0.237***	0.237***	0.237***
		(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy of unknown people</i>									
	Mental Illness*	0.276***	0.278***	0.278***	0.279***	0.182***	0.183***	0.184***	0.184***

		(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at disagreement</i>									
	Mental Illness*	0.264***	0.266***	0.266***	0.267***	0.168***	0.169***	0.169***	0.169***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy with others watching</i>									
	Mental Illness*	0.206***	0.207***	0.208***	0.208***	0.145***	0.146***	0.146***	0.146***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy using public restroom</i>									
	Mental Illness*	0.157***	0.158***	0.158***	0.158***	0.120***	0.120***	0.120***	0.121***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy in dating situation</i>									
	Mental Illness*	0.243***	0.245***	0.245***	0.246***	0.162***	0.163***	0.163***	0.163***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Uncomfortable getting attention</i>									
	Mental Illness*	0.312***	0.314***	0.314***	0.315***	0.220***	0.221***	0.221***	0.222***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Fear of embarrassment</i>									
	Mental Illness*	0.349***	0.352***	0.351***	0.353***	0.261***	0.262***	0.263***	0.263***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Fear of social situation</i>									
	Mental Illness*	0.332***	0.334***	0.334***	0.335***	0.250***	0.252***	0.252***	0.253***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Avoid social situations</i>									
	Mental Illness*	0.363***	0.366***	0.365***	0.367***	0.254***	0.256***	0.256***	0.256***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Social situations cause intense anxiety</i>									
	Mental Illness*	0.335***	0.338***	0.338***	0.339***	0.248***	0.250***	0.250***	0.250***
		(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Recent occurrence after age 18</i>									

	Mental Illness*	0.365***	0.368***	0.368***	0.369***	0.258***	0.260***	0.260***	0.260***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Excess anxiety</i>									
	Mental Illness*	0.469***	0.471***	0.471***	0.472***	0.408***	0.409***	0.409***	0.410***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Length of GAD episode</i>									
	Mental Illness*	0.786***	0.788***	0.788***	0.789***	0.582***	0.584***	0.584***	0.585***
		(0.19)	(0.19)	(0.19)	(0.19)	(0.12)	(0.12)	(0.12)	(0.12)
<i>Difficult to control worry</i>									
	Mental Illness*	0.449***	0.450***	0.451***	0.452***	0.388***	0.389***	0.389***	0.390***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Restlessness</i>									
	Mental Illness*	0.431***	0.432***	0.433***	0.434***	0.373***	0.374***	0.374***	0.374***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Tired</i>									
	Mental Illness*	0.342***	0.343***	0.343***	0.344***	0.366***	0.367***	0.367***	0.367***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Irritable</i>									
	Mental Illness*	0.406***	0.407***	0.408***	0.408***	0.363***	0.364***	0.364***	0.364***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Difficulty concentrating</i>									
	Mental Illness*	0.406***	0.407***	0.408***	0.408***	0.363***	0.364***	0.365***	0.365***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Tense muscles</i>									
	Mental Illness*	0.300***	0.301***	0.301***	0.301***	0.324***	0.325***	0.325***	0.325***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Sleeping problems</i>									
	Mental Illness*	0.419***	0.421***	0.421***	0.422***	0.373***	0.374***	0.374***	0.374***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Excessive nervousness</i>									

	Mental Illness*	0.379***	0.381***	0.381***	0.382***	0.358***	0.359***	0.359***	0.359***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Significant emotional distress</i>									
	Mental Illness*	0.441***	0.443***	0.443***	0.444***	0.396***	0.397***	0.397***	0.398***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Worry not always due to physical causes</i>									
	Mental Illness*	0.189***	0.189***	0.190***	0.190***	0.109***	0.109***	0.109***	0.110***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
N		3331	3331	3331	3331	4235	4235	4235	4235
Notes: Standard errors in parentheses ; * p<0.10 ** p<0.05 *** p<0.01; Results are adjusted for complex survey design; covariates in Labor market and Mental illness equation not reported for brevity; <i>Length of Depressive Episode</i> and <i>Length of GAD episode</i> indicator variables standardized to mean 0 and standard deviation 1; columns (1) and (5) represent model which do not account for endogeneity of mental illness; columns (2) and (5) use number of early onset of psychiatric disorders as an instrument; columns (3) and (7) use covariance instruments suggested in Lewbel (2012); columns (4) and (8) use covariance instruments suggested in Lewbel (2012) and an external instrument number of early onset of psychiatric disorders; the coefficient on Mental Illness* for the first equation of the Measurement model is constrained to 1 as a normalization.									

Table 3: Effect of mental illness on labor force participation										
		Male					Female			
		(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
		No instrume nts	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument		No instrumen ts	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument
Labor market equation										
In labor force										
	Mental Illness*	-0.231***	-0.322***	-0.295***	-0.298***		-0.138***	-0.189***	-0.216***	-0.211***
		(0.04)	(0.09)	(0.07)	(0.07)		(0.02)	(0.06)	(0.04)	(0.04)
Mental Illness equation										
Mental Illness*										
	# early onset of psychiatric disorders		0.070***		0.032***			0.093***		0.033***
			(0.01)		(0.00)			(0.01)		(0.00)
	Cov instrument early onset of disorders			0.199***	0.174***				0.204***	0.175***
				(0.02)	(0.02)				(0.01)	(0.01)
	Cov instrument married			-0.334***	-0.328***				-0.447***	-0.442***
				(0.11)	(0.11)				(0.06)	(0.06)
Measurement model equations										
Depressed mood										
	Mental Illness*	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000
		(.)	(.)	(.)	(.)		(.)	(.)	(.)	(.)
Diminished pleasure										
	Mental Illness*	0.776***	0.777***	0.777***	0.777***		0.774***	0.774***	0.774***	0.775***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.02)	(0.02)	(0.02)	(0.02)

<i>Significant weight change</i>									
	Mental Illness*	0.735***	0.735***	0.736***	0.736***	0.870***	0.870***	0.871***	0.871***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Insomnia or Hypersomnia</i>									
	Mental Illness*	0.955***	0.955***	0.955***	0.955***	0.940***	0.940***	0.940***	0.940***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Restlessness or retardation</i>									
	Mental Illness*	0.574***	0.574***	0.574***	0.574***	0.542***	0.543***	0.543***	0.543***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Fatigue</i>									
	Mental Illness*	0.869***	0.869***	0.869***	0.869***	0.944***	0.944***	0.944***	0.944***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Worthlessness</i>									
	Mental Illness*	0.518***	0.519***	0.520***	0.520***	0.536***	0.537***	0.538***	0.538***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Indecisiveness</i>									
	Mental Illness*	0.934***	0.934***	0.934***	0.934***	0.935***	0.935***	0.935***	0.935***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Suicidal thoughts</i>									
	Mental Illness*	0.742***	0.742***	0.743***	0.743***	0.779***	0.779***	0.780***	0.780***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Frequently severe emotional distress</i>									
	Mental Illness*	0.872***	0.872***	0.872***	0.872***	0.859***	0.859***	0.859***	0.859***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Severe emotional distress</i>									
	Mental Illness*	0.973***	0.973***	0.973***	0.973***	0.966***	0.966***	0.966***	0.966***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
<i>Length of Depressive episode</i>									
	Mental Illness*	1.017***	1.018***	1.019***	1.019***	0.971***	0.972***	0.974***	0.975***

		(0.17)	(0.17)	(0.17)	(0.17)		(0.12)	(0.12)	(0.12)	(0.12)
<i>Sweating</i>										
	Mental Illness*	0.172***	0.173***	0.173***	0.173***		0.121***	0.121***	0.121***	0.121***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Trembling</i>										
	Mental Illness*	0.087***	0.087***	0.087***	0.087***		0.061***	0.061***	0.061***	0.061***
		(0.02)	(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Choking</i>										
	Mental Illness*	0.246***	0.247***	0.247***	0.248***		0.243***	0.243***	0.243***	0.244***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Chest pain or nausea</i>										
	Mental Illness*	0.252***	0.253***	0.253***	0.254***		0.235***	0.235***	0.235***	0.236***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Dizziness or unreality</i>										
	Mental Illness*	0.237***	0.238***	0.238***	0.238***		0.196***	0.196***	0.196***	0.196***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Afraid meeting new people</i>										
	Mental Illness*	0.345***	0.348***	0.348***	0.349***		0.230***	0.231***	0.232***	0.232***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Afraid talking to authority</i>										
	Mental Illness*	0.284***	0.286***	0.286***	0.287***		0.201***	0.202***	0.203***	0.203***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at social gathering</i>										
	Mental Illness*	0.303***	0.305***	0.305***	0.306***		0.211***	0.212***	0.212***	0.212***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy performing</i>										
	Mental Illness*	0.300***	0.302***	0.302***	0.303***		0.236***	0.237***	0.237***	0.237***
		(0.04)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy of unknown people</i>										
	Mental Illness*	0.276***	0.278***	0.278***	0.279***		0.182***	0.183***	0.184***	0.184***

		(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at disagreement</i>									
	Mental Illness*	0.264***	0.266***	0.266***	0.267***	0.168***	0.169***	0.169***	0.169***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy with others watching</i>									
	Mental Illness*	0.206***	0.207***	0.208***	0.208***	0.145***	0.146***	0.146***	0.146***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy using public restroom</i>									
	Mental Illness*	0.157***	0.158***	0.158***	0.158***	0.120***	0.120***	0.120***	0.121***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy in dating situation</i>									
	Mental Illness*	0.243***	0.245***	0.245***	0.246***	0.162***	0.163***	0.163***	0.163***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Uncomfortable getting attention</i>									
	Mental Illness*	0.312***	0.314***	0.314***	0.315***	0.220***	0.221***	0.221***	0.222***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Fear of embarrassment</i>									
	Mental Illness*	0.349***	0.352***	0.352***	0.353***	0.261***	0.262***	0.263***	0.263***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Fear of social situation</i>									
	Mental Illness*	0.332***	0.334***	0.334***	0.336***	0.250***	0.252***	0.252***	0.253***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Avoid social situations</i>									
	Mental Illness*	0.363***	0.366***	0.366***	0.367***	0.254***	0.256***	0.256***	0.256***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Social situations cause intense anxiety</i>									
	Mental Illness*	0.335***	0.338***	0.338***	0.339***	0.248***	0.250***	0.250***	0.250***
		(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)

<i>Recent occurrence after age 18</i>									
	Mental Illness*	0.365***	0.368***	0.368***	0.369***		0.258***	0.260***	0.260***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)
<i>Excess anxiety</i>									
	Mental Illness*	0.469***	0.471***	0.471***	0.472***		0.408***	0.409***	0.410***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Length of GAD episode</i>									
	Mental Illness*	0.786***	0.788***	0.788***	0.789***		0.582***	0.584***	0.585***
		(0.19)	(0.19)	(0.19)	(0.19)		(0.12)	(0.12)	(0.12)
<i>Difficult to control worry</i>									
	Mental Illness*	0.449***	0.451***	0.451***	0.452***		0.388***	0.389***	0.390***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Restlessness</i>									
	Mental Illness*	0.431***	0.433***	0.433***	0.434***		0.373***	0.374***	0.374***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)
<i>Tired</i>									
	Mental Illness*	0.342***	0.343***	0.343***	0.344***		0.366***	0.367***	0.367***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)
<i>Irritable</i>									
	Mental Illness*	0.406***	0.407***	0.408***	0.408***		0.363***	0.364***	0.364***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Difficulty concentrating</i>									
	Mental Illness*	0.406***	0.407***	0.408***	0.409***		0.363***	0.364***	0.365***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)
<i>Tense muscles</i>									
	Mental Illness*	0.300***	0.301***	0.301***	0.302***		0.324***	0.325***	0.325***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)
<i>Sleeping problems</i>									
	Mental Illness*	0.419***	0.421***	0.421***	0.422***		0.373***	0.374***	0.374***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)

<i>Excessive nervousness</i>									
	Mental Illness*	0.379***	0.381***	0.381***	0.382***		0.358***	0.359***	0.359***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)
<i>Significant emotional distress</i>									
	Mental Illness*	0.441***	0.443***	0.443***	0.444***		0.396***	0.397***	0.397***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Worry not always due to physical causes</i>									
	Mental Illness*	0.189***	0.189***	0.190***	0.190***		0.109***	0.109***	0.109***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)
N		3331	3331	3331	3331		4235	4235	4235
Notes: Standard errors in parentheses ; * p<0.10 ** p<0.05 *** p<0.01; Results are adjusted for complex survey design; covariates in Labor market and Mental illness equation not reported for brevity; <i>Length of Depressive Episode</i> and <i>Length of GAD episode</i> indicator variables standardized to mean 0 and standard deviation 1; columns (1) and (5) represent model which do not account for endogeneity of mental illness; columns (2) and (5) use number of early onset of psychiatric disorders as an instrument; columns (3) and (7) use covariance instruments suggested in Lewbel (2012); columns (4) and (8) use covariance instruments suggested in Lewbel (2012) and an external instrument number of early onset of psychiatric disorders; the coefficient on Mental Illness* for the first equation of the Measurement model is constrained to 1 as a normalization.									

Table 4: Effect of mental illness on number of weeks worked in past year conditional on being employed										
		Male					Female			
		(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
		No instru- ments	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument		No instru- ments	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument
Labor market equation										
Weeks worked in past year conditional on employment										
	Mental Illness*	-2.558**	-4.673	-6.846**	-6.580**		-1.449*	-6.579***	-1.357	-1.880
		(1.04)	(3.39)	(3.08)	(3.05)		(0.78)	(2.50)	(1.52)	(1.50)
Mental Illness equation										
Mental Illness*										
	# early onset of psychiatric disorders		0.050***		0.031***			0.075***		0.029***
			(0.01)		(0.00)			(0.01)		(0.00)
	Cov instrument early onset of disorders			0.201***	0.185***				0.206***	0.183***
				(0.03)	(0.03)				(0.01)	(0.02)
	Cov instrument married			-0.370***	-0.366***				-0.546***	-0.543***
				(0.13)	(0.13)				(0.07)	(0.07)
Measurement model equations										
Depressed mood										
	Mental Illness*	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000
		(.)	(.)	(.)	(.)		(.)	(.)	(.)	(.)
Diminished pleasure										
	Mental Illness*	0.744***	0.744***	0.745***	0.745***		0.751***	0.751***	0.751***	0.751***

		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Significant weight change</i>										
	Mental Illness*	0.666***	0.666***	0.667***	0.667***		0.879***	0.879***	0.879***	0.879***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Insomnia or Hypersomnia</i>										
	Mental Illness*	0.932***	0.932***	0.932***	0.933***		0.945***	0.945***	0.945***	0.945***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Restlessness or retardation</i>										
	Mental Illness*	0.567***	0.567***	0.567***	0.568***		0.523***	0.523***	0.523***	0.523***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Fatigue</i>										
	Mental Illness*	0.818***	0.818***	0.818***	0.818***		0.957***	0.957***	0.957***	0.957***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Worthlessness</i>										
	Mental Illness*	0.468***	0.468***	0.469***	0.470***		0.523***	0.523***	0.524***	0.524***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Indecisiveness</i>										
	Mental Illness*	0.915***	0.915***	0.916***	0.916***		0.958***	0.958***	0.958***	0.958***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Suicidal thoughts</i>										
	Mental Illness*	0.707***	0.707***	0.708***	0.708***		0.750***	0.750***	0.750***	0.750***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Frequently severe emotional distress</i>										
	Mental Illness*	0.885***	0.885***	0.885***	0.886***		0.837***	0.837***	0.837***	0.837***
		(0.02)	(0.02)	(0.02)	(0.02)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Severe emotional distress</i>										
	Mental Illness*	0.967***	0.967***	0.968***	0.968***		0.964***	0.964***	0.964***	0.964***
		(0.01)	(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Length of Depressive episode</i>										

	Mental Illness*	0.776***	0.776***	0.775***	0.775***		0.648***	0.649***	0.650***	0.650***
		(0.25)	(0.25)	(0.25)	(0.25)		(0.10)	(0.10)	(0.10)	(0.10)
<i>Sweating</i>										
	Mental Illness*	0.131***	0.131***	0.131***	0.131***		0.090***	0.090***	0.090***	0.090***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Trembling</i>										
	Mental Illness*	0.111***	0.111***	0.111***	0.111***		0.059***	0.060***	0.059***	0.060***
		(0.03)	(0.03)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Choking</i>										
	Mental Illness*	0.221***	0.222***	0.222***	0.223***		0.165***	0.165***	0.165***	0.165***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Chest pain or nausea</i>										
	Mental Illness*	0.204***	0.205***	0.205***	0.206***		0.196***	0.196***	0.196***	0.196***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Dizziness or unreality</i>										
	Mental Illness*	0.203***	0.204***	0.204***	0.204***		0.156***	0.156***	0.156***	0.156***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Afraid meeting new people</i>										
	Mental Illness*	0.299***	0.301***	0.300***	0.302***		0.187***	0.188***	0.188***	0.188***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Afraid talking to authority</i>										
	Mental Illness*	0.244***	0.245***	0.245***	0.246***		0.144***	0.145***	0.145***	0.145***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy at social gathering</i>										
	Mental Illness*	0.253***	0.254***	0.254***	0.255***		0.170***	0.170***	0.170***	0.171***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy performing</i>										
	Mental Illness*	0.253***	0.255***	0.254***	0.256***		0.184***	0.185***	0.185***	0.185***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy of unknown people</i>										

	Mental Illness*	0.229***	0.230***	0.230***	0.231***		0.140***	0.141***	0.141***	0.141***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at disagreement</i>										
	Mental Illness*	0.235***	0.236***	0.236***	0.237***		0.130***	0.131***	0.131***	0.131***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy with others watching</i>										
	Mental Illness*	0.174***	0.174***	0.174***	0.175***		0.112***	0.113***	0.113***	0.113***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy using public restroom</i>										
	Mental Illness*	0.150***	0.151***	0.151***	0.152***		0.102***	0.102***	0.102***	0.102***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy in dating situation</i>										
	Mental Illness*	0.199***	0.201***	0.200***	0.201***		0.150***	0.150***	0.150***	0.151***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Uncomfortable getting attention</i>										
	Mental Illness*	0.270***	0.271***	0.271***	0.272***		0.172***	0.173***	0.173***	0.173***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Fear of embarrassment</i>										
	Mental Illness*	0.305***	0.308***	0.307***	0.309***		0.199***	0.200***	0.200***	0.201***
		(0.07)	(0.07)	(0.07)	(0.07)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Fear of social situation</i>										
	Mental Illness*	0.270***	0.272***	0.272***	0.274***		0.182***	0.183***	0.183***	0.183***
		(0.06)	(0.07)	(0.07)	(0.07)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Avoid social situations</i>										
	Mental Illness*	0.328***	0.330***	0.329***	0.331***		0.196***	0.197***	0.197***	0.197***
		(0.06)	(0.07)	(0.07)	(0.07)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Social situations cause intense anxiety</i>										
	Mental Illness*	0.279***	0.282***	0.281***	0.283***		0.192***	0.193***	0.193***	0.193***
		(0.06)	(0.06)	(0.06)	(0.07)		(0.03)	(0.03)	(0.03)	(0.03)

<i>Recent occurrence after age 18</i>									
	Mental Illness*	0.330***	0.332***	0.331***	0.333***		0.196***	0.197***	0.197***
		(0.07)	(0.07)	(0.07)	(0.07)		(0.03)	(0.03)	(0.03)
<i>Excess anxiety</i>									
	Mental Illness*	0.396***	0.397***	0.398***	0.398***		0.344***	0.344***	0.345***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Length of GAD episode</i>									
	Mental Illness*	0.543**	0.544**	0.542**	0.543**		0.380***	0.381***	0.381***
		(0.23)	(0.23)	(0.23)	(0.23)		(0.12)	(0.12)	(0.12)
<i>Difficult to control worry</i>									
	Mental Illness*	0.384***	0.385***	0.385***	0.386***		0.328***	0.328***	0.328***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Restlessness</i>									
	Mental Illness*	0.366***	0.368***	0.368***	0.369***		0.306***	0.307***	0.307***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Tired</i>									
	Mental Illness*	0.294***	0.296***	0.296***	0.297***		0.310***	0.311***	0.311***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.04)	(0.03)
<i>Irritable</i>									
	Mental Illness*	0.336***	0.338***	0.338***	0.339***		0.303***	0.303***	0.304***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Difficulty concentrating</i>									
	Mental Illness*	0.367***	0.368***	0.368***	0.369***		0.302***	0.303***	0.303***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Tense muscles</i>									
	Mental Illness*	0.206***	0.207***	0.207***	0.208***		0.266***	0.266***	0.266***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)
<i>Sleeping problems</i>									
	Mental Illness*	0.332***	0.334***	0.334***	0.334***		0.301***	0.301***	0.302***
		(0.05)	(0.05)	(0.05)	(0.06)		(0.04)	(0.04)	(0.04)

<i>Excessive nervousness</i>									
	Mental Illness*	0.319***	0.320***	0.320***	0.321***		0.294***	0.294***	0.295***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Significant emotional distress</i>									
	Mental Illness*	0.378***	0.380***	0.380***	0.381***		0.333***	0.333***	0.334***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)
<i>Worry not always due to physical causes</i>									
	Mental Illness*	0.161***	0.161***	0.161***	0.162***		0.054***	0.054***	0.054***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)
<i>N</i>		2710	2710	2710	2710		2815	2815	2815
<p>Notes: Standard errors in parentheses ; * p<0.10 ** p<0.05 *** p<0.01; Results are adjusted for complex survey design; covariates in Labor market and Mental illness equation not reported for brevity; <i>Length of Depressive Episode</i> and <i>Length of GAD episode</i> indicator variables standardized to mean 0 and standard deviation 1; columns (1) and (5) represent model which do not account for endogeneity of mental illness; columns (2) and (5) use number of early onset of psychiatric disorders as an instrument; columns (3) and (7) use covariance instruments suggested in Lewbel (2012); columns (4) and (8) use covariance instruments suggested in Lewbel (2012) and an external instrument number of early onset of psychiatric disorders; the coefficient on Mental Illness* for the first equation of the Measurement model is constrained to 1 as a normalization.</p>									

Table 5: Effect of mental illness on number of days missed in past month conditional on being employed										
		Male					Female			
		(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
		No instruments	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument		No instruments	IV	Lewbel IV, no external instrument	Lewbel IV with external instrument
Labor market equation										
Days missed in past month conditional on employment										
	Mental Illness*	1.431***	1.363	3.238***	3.012***		0.313	1.259	0.769	0.785
		(0.53)	(1.70)	(1.19)	(1.15)		(0.26)	(0.94)	(0.57)	(0.58)
Mental Illness equation										
Mental Illness*										
	# early onset of psychiatric disorders		0.050***		0.030***			0.076***		0.028***
			(0.01)		(0.00)			(0.01)		(0.00)
	Covariance instrument early onset of disorders			0.200***	0.184***				0.208***	0.184***
				(0.03)	(0.03)				(0.01)	(0.01)
	Covariance instrument married			-0.367***	-0.362***				-0.537***	-0.535***
				(0.13)	(0.13)				(0.07)	(0.07)
Measurement model equations										
Depressed mood										
	Mental Illness*	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000
		(.)	(.)	(.)	(.)		(.)	(.)	(.)	(.)
Diminished pleasure										

	Mental Illness*	0.748***	0.748***	0.749***	0.749***		0.754***	0.754***	0.754***	0.754***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Significant weight change</i>										
	Mental Illness*	0.661***	0.661***	0.661***	0.661***		0.877***	0.877***	0.877***	0.877***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)	(0.02)
<i>Insomnia or Hypersomnia</i>										
	Mental Illness*	0.934***	0.934***	0.934***	0.934***		0.943***	0.943***	0.943***	0.943***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Restlessness or retardation</i>										
	Mental Illness*	0.567***	0.567***	0.567***	0.568***		0.525***	0.525***	0.525***	0.525***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Fatigue</i>										
	Mental Illness*	0.814***	0.814***	0.814***	0.814***		0.955***	0.955***	0.955***	0.955***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Worthlessness</i>										
	Mental Illness*	0.469***	0.470***	0.471***	0.471***		0.525***	0.525***	0.526***	0.526***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Indecisiveness</i>										
	Mental Illness*	0.918***	0.918***	0.918***	0.919***		0.956***	0.956***	0.956***	0.956***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)
<i>Suicidal thoughts</i>										
	Mental Illness*	0.710***	0.711***	0.711***	0.711***		0.748***	0.748***	0.748***	0.748***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Frequently severe emotional distress</i>										
	Mental Illness*	0.883***	0.883***	0.883***	0.883***		0.834***	0.834***	0.834***	0.834***
		(0.02)	(0.02)	(0.02)	(0.02)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Severe emotional distress</i>										
	Mental Illness*	0.976***	0.977***	0.977***	0.977***		0.963***	0.963***	0.963***	0.963***
		(0.01)	(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)

<i>Length of Depressive episode</i>									
	Mental Illness*	0.763***	0.763***	0.762***	0.763***		0.648***	0.649***	0.650***
		(0.25)	(0.25)	(0.25)	(0.25)		(0.10)	(0.10)	(0.10)
<i>Sweating</i>									
	Mental Illness*	0.132***	0.132***	0.132***	0.132***		0.085***	0.085***	0.085***
		(0.03)	(0.03)	(0.03)	(0.03)		(0.02)	(0.02)	(0.02)
<i>Trembling</i>									
	Mental Illness*	0.111***	0.111***	0.111***	0.111***		0.054***	0.054***	0.054***
		(0.03)	(0.03)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)
<i>Choking</i>									
	Mental Illness*	0.221***	0.222***	0.222***	0.222***		0.165***	0.165***	0.165***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)
<i>Chest pain or nausea</i>									
	Mental Illness*	0.204***	0.204***	0.204***	0.205***		0.191***	0.191***	0.191***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.03)	(0.03)	(0.03)
<i>Dizziness or unreality</i>									
	Mental Illness*	0.203***	0.204***	0.203***	0.204***		0.156***	0.156***	0.156***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)
<i>Afraid meeting new people</i>									
	Mental Illness*	0.295***	0.297***	0.296***	0.298***		0.186***	0.187***	0.187***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Afraid talking to authority</i>									
	Mental Illness*	0.240***	0.242***	0.241***	0.242***		0.144***	0.145***	0.145***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)
<i>Shy at social gathering</i>									
	Mental Illness*	0.249***	0.251***	0.251***	0.252***		0.169***	0.169***	0.170***
		(0.05)	(0.05)	(0.05)	(0.05)		(0.02)	(0.02)	(0.02)
<i>Shy performing</i>									
	Mental Illness*	0.249***	0.250***	0.250***	0.251***		0.184***	0.184***	0.185***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)

<i>Shy of unknown people</i>									
	Mental Illness*	0.226***	0.227***	0.227***	0.228***	0.139***	0.140***	0.140***	0.140***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy at disagreement</i>									
	Mental Illness*	0.233***	0.234***	0.235***	0.235***	0.129***	0.130***	0.130***	0.130***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy with others watching</i>									
	Mental Illness*	0.172***	0.173***	0.173***	0.173***	0.112***	0.112***	0.112***	0.113***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Shy using public restroom</i>									
	Mental Illness*	0.150***	0.150***	0.150***	0.151***	0.101***	0.102***	0.102***	0.102***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
<i>Shy in dating situation</i>									
	Mental Illness*	0.196***	0.197***	0.197***	0.198***	0.149***	0.150***	0.150***	0.150***
		(0.05)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Uncomfortable getting attention</i>									
	Mental Illness*	0.266***	0.268***	0.267***	0.269***	0.172***	0.172***	0.172***	0.173***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Fear of embarrassment</i>									
	Mental Illness*	0.300***	0.302***	0.302***	0.303***	0.199***	0.200***	0.200***	0.200***
		(0.06)	(0.06)	(0.06)	(0.07)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Fear of social situation</i>									
	Mental Illness*	0.266***	0.268***	0.268***	0.269***	0.182***	0.182***	0.183***	0.183***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Avoid social situations</i>									
	Mental Illness*	0.323***	0.325***	0.325***	0.326***	0.196***	0.196***	0.196***	0.197***
		(0.06)	(0.06)	(0.06)	(0.07)	(0.03)	(0.03)	(0.03)	(0.03)
<i>Social situations cause intense anxiety</i>									
	Mental Illness*	0.274***	0.276***	0.276***	0.277***	0.192***	0.193***	0.193***	0.193***

		(0.06)	(0.06)	(0.06)	(0.06)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Recent occurrence after age 18</i>										
	Mental Illness*	0.325***	0.327***	0.327***	0.328***		0.196***	0.197***	0.197***	0.197***
		(0.06)	(0.07)	(0.07)	(0.07)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Excess anxiety</i>										
	Mental Illness*	0.392***	0.393***	0.394***	0.394***		0.344***	0.344***	0.344***	0.344***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Length of GAD episode</i>										
	Mental Illness*	0.537**	0.538**	0.536**	0.537**		0.379***	0.380***	0.381***	0.381***
		(0.23)	(0.23)	(0.23)	(0.23)		(0.12)	(0.12)	(0.12)	(0.12)
<i>Difficult to control worry</i>										
	Mental Illness*	0.380***	0.381***	0.382***	0.382***		0.327***	0.328***	0.328***	0.328***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Restlessness</i>										
	Mental Illness*	0.363***	0.364***	0.364***	0.365***		0.306***	0.306***	0.306***	0.307***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Tired</i>										
	Mental Illness*	0.291***	0.292***	0.292***	0.293***		0.310***	0.311***	0.311***	0.311***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Irritable</i>										
	Mental Illness*	0.333***	0.334***	0.334***	0.335***		0.303***	0.303***	0.303***	0.303***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Difficulty concentrating</i>										
	Mental Illness*	0.363***	0.365***	0.365***	0.366***		0.302***	0.302***	0.302***	0.303***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Tense muscles</i>										
	Mental Illness*	0.204***	0.205***	0.205***	0.205***		0.266***	0.266***	0.266***	0.266***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.03)	(0.03)	(0.03)	(0.03)
<i>Sleeping problems</i>										
	Mental Illness*	0.329***	0.330***	0.330***	0.331***		0.301***	0.301***	0.301***	0.301***

		(0.05)	(0.05)	(0.05)	(0.05)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Excessive nervousness</i>										
	Mental Illness*	0.316***	0.317***	0.317***	0.318***		0.293***	0.294***	0.294***	0.294***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Significant emotional distress</i>										
	Mental Illness*	0.375***	0.376***	0.376***	0.377***		0.333***	0.333***	0.333***	0.334***
		(0.06)	(0.06)	(0.06)	(0.06)		(0.04)	(0.04)	(0.04)	(0.04)
<i>Worry not always due to physical causes</i>										
	Mental Illness*	0.160***	0.161***	0.161***	0.161***		0.053***	0.054***	0.054***	0.054***
		(0.04)	(0.04)	(0.04)	(0.04)		(0.02)	(0.02)	(0.02)	(0.02)
<i>N</i>		2698	2698	2698	2698		2779	2779	2779	2779

Notes: Standard errors in parentheses ; * p<0.10 ** p<0.05 *** p<0.01; Results are adjusted for complex survey design; covariates in Labor market and Mental illness equation not reported for brevity; *Length of Depressive Episode* and *Length of GAD episode* indicator variables standardized to mean 0 and standard deviation 1; columns (1) and (5) represent model which do not account for endogeneity of mental illness; columns (2) and (5) use number of early onset of psychiatric disorders as an instrument; columns (3) and (7) use covariance instruments suggested in Lewbel (2012); columns (4) and (8) use covariance instruments suggested in Lewbel (2012) and an external instrument number of early onset of psychiatric disorders; the coefficient on Mental Illness* for the first equation of the Measurement model is constrained to 1 as a normalization.

Table 6: Validity of the instrumental variables

Hausman statistic					Critical value
	Employed	In labor force	Weeks worked in past year conditional on employment	Days missed in past month conditional on employment	
Male:					
IV ^a	0.0075	0.0351	2.6834	0.3716	$\chi^2_{16} = 26.30$
Lewbel IV ^b	0.0007	2.1520	0.9050	0.1827	$\chi^2_{17} = 27.59$
Female:					
IV ^a	0.2185	0.0912	0.0236	0.2267	$\chi^2_{16} = 26.30$
Lewbel IV ^b	0.7666	0.2045	0.1988	1.2890	$\chi^2_{17} = 27.59$

Notes:

a: Instrumental variable - Number of early onset of psychiatric disorders

b: Lewbel instruments - (i) Covariance instrument early onset of disorders, (ii) Covariance instrument married

Table 7.1: Contingency table

		Clinical diagnosis		
MIMIC diagnosis		Yes	No	Total
	Yes	a (hit)	b (false alarm)	a+b
	No	c (miss)	d (correct rejection)	c+d
	Total	a+c	b+d	a+b+c+d

Table 7.2. Concordance measures for psychiatric disorders

τ	MDE				Panic Attack				Social Phobia				GAD			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	H	F	PS	OR	H	F	PS	OR	H	F	PS	OR	H	F	PS	OR
0.1	0.9953	0.0262	0.9691	7907.63	0.9956	0.0029	0.9927	78742.66	0.9843	0.0457	0.9385	1305.91	0.9896	0.0517	0.938	1752.72
0.2	0.9953	0.0262	0.9691	7907.63	0.9956	0.0029	0.9927	78742.66	0.9843	0.0457	0.9385	1305.91	0.9896	0.0517	0.938	1752.72
0.3	0.9953	0.0262	0.9691	7907.63	0.9768	0.0029	0.9739	14715.61	0.9843	0.0457	0.9385	1305.91	0.9896	0.0513	0.9384	1767.79
0.4	0.9930	0.0258	0.9672	5353.03	0.9127	0.0027	0.91	3858.733	0.9843	0.0457	0.9385	1305.91	0.9896	0.0511	0.9385	1772.87
0.5	0.9918	0.0252	0.9666	4694.26	0.7867	0.0024	0.7843	1532.137	0.9843	0.0447	0.9395	1336.81	0.9896	0.0511	0.9385	1772.87
0.6	0.9860	0.0243	0.9617	2824.98	0.6917	0.0021	0.6896	1065.29	0.9843	0.0418	0.9424	1433.32	0.9896	0.0511	0.9385	1772.87
0.7	0.9661	0.0204	0.9457	1368.2	0.6044	0.0018	0.6026	846.6022	0.9827	0.0378	0.9449	1446.04	0.9896	0.0511	0.9385	1772.87
0.8	0.9019	0.0145	0.8874	626.563	0.3050	0.0011	0.3039	417.1029	0.9135	0.0248	0.8887	415.053	0.9870	0.0496	0.9375	1460.64
0.9	0.6624	0.0101	0.6522	191.635	0.0066	0.0002	0.0065	44.44939	0.6132	0.0113	0.602	139.268	0.8808	0.0358	0.845	199.105

Notes: τ =cutoff point, H= Hit rate, F= False Alarm rate, PS= Peirce Score, OR= Odds Ratio

Table 8. Contingency tables for psychiatric disorders

Depression ($\tau = 0.1$)

Clinical diagnosis

MIMIC diagnosis		Yes	No	Total
	Yes	852	176	1028
	No	4	6534	6538
	Total	856	6710	7566

Panic Attack ($\tau = 0.1$)

Clinical diagnosis

MIMIC diagnosis		Yes	No	Total
	Yes	901	19	920
	No	4	6642	6646
	Total	905	6661	7566

Social Phobia ($\tau = 0.7$)

Clinical diagnosis

MIMIC diagnosis		Yes	No	Total
	Yes	625	262	887
	No	11	6668	6679
	Total	636	6930	7566

Generalized Anxiety Disorder ($\tau = 0.4$)

Clinical diagnosis

MIMIC diagnosis		Yes	No	Total
	Yes	382	367	749
	No	4	6813	6817
	Total	386	7180	7566

Table 9: Labor market benefits from improved mental health of diagnosed individuals (D=1)					
	Males			Females	
	Symptoms of D=1	Symptoms of D=0		Symptoms of D=1	Symptoms of D=0
Mean predicted outcome	(Original mental health profile)	(Simulated mental health profile)		(Original mental health profile)	(Simulated mental health profile)
Employment	0.72	0.87		0.63	0.74
	(0.01)	(0.01)		(0.01)	(0.01)
Laborforce participation	0.75	0.88		0.69	0.79
	(0.01)	(0.01)		(0.01)	(0.00)
# weeks worked among employed	48.22	50.74		48.80	49.61
	(0.24)	(0.11)		(0.08)	(0.06)
# days missed among employed	2.03	0.89		1.50	1.16
	(0.10)	(0.04)		(0.03)	(0.02)
Note: Standard errors in parentheses; mental disorders considered are MDE, Panic Attack, Social Phobia and GAD.					

Table 10: Adverse labor market outcomes due to worsening mental health of undiagnosed individuals (D=0)					
	Males			Females	
	Symptoms of D=0	Symptoms of D=1		Symptoms of D=0	Symptoms of D=1
Mean predicted outcome	<i>(Original mental health profile)</i>	<i>(Simulated mental health profile)</i>		<i>(Original mental health profile)</i>	<i>(Simulated mental health profile)</i>
<i>Employment</i>	0.87	0.71		0.71	0.60
	(0.00)	(0.01)		(0.01)	(0.01)
<i>Labor force participation</i>	0.88	0.75		0.77	0.67
	(0.00)	(0.01)		(0.01)	(0.01)
<i># weeks worked among employed</i>	50.85	47.77		49.62	48.68
	(0.06)	(0.13)		(0.04)	(0.06)
<i># days missed among employed</i>	0.91	2.31		1.12	1.51
	(0.02)	(0.05)		(0.02)	(0.02)
Note: Standard errors in parentheses; mental disorders considered are MDE, Panic Attack, Social Phobia and GAD.					