Advances in Management & Applied Economics, Vol. 16, No. 5, 2026, 89-115
ISSN: 1792-7544 (print version), 1792-7552(online)
https://doi.org/10.47260/amae/1655
Scientific Press International Limited

The Impact of Psychiatric Disorders on Employment Across Sectors in Taiwan

Teng-Yuan Hu[1] and Shih-Hsuan Chang[2*]

Abstract

Taiwan's 1997 Disabled Citizens Protection Act required organizations to meet minimum employment rates for people with physical or psychiatric disabilities, with lower quotas for the private sector. This study investigates whether the impact of psychiatric disorders, including affective and anxiety disorders, on employment differed across sectors in 2005. Data are drawn from Taiwan's 2005 National Health Interview Survey. The analysis primarily adopts a multinomial probit approach to estimate impacts across sectors among adults aged 18 to 64 by gender. To consider potential endogeneity, it pursues an augmented regression approach. The instrumental variable is the community prevalence of psychiatric disorders. Both exogenous and endogenous results consistently indicate serious consequences in the private sector, especially in its subsector of employed, rather than the public sector, for both males and females. Improving employment for individuals with psychiatric disorders in the private sector, especially for private sector employees, remains a challenge.

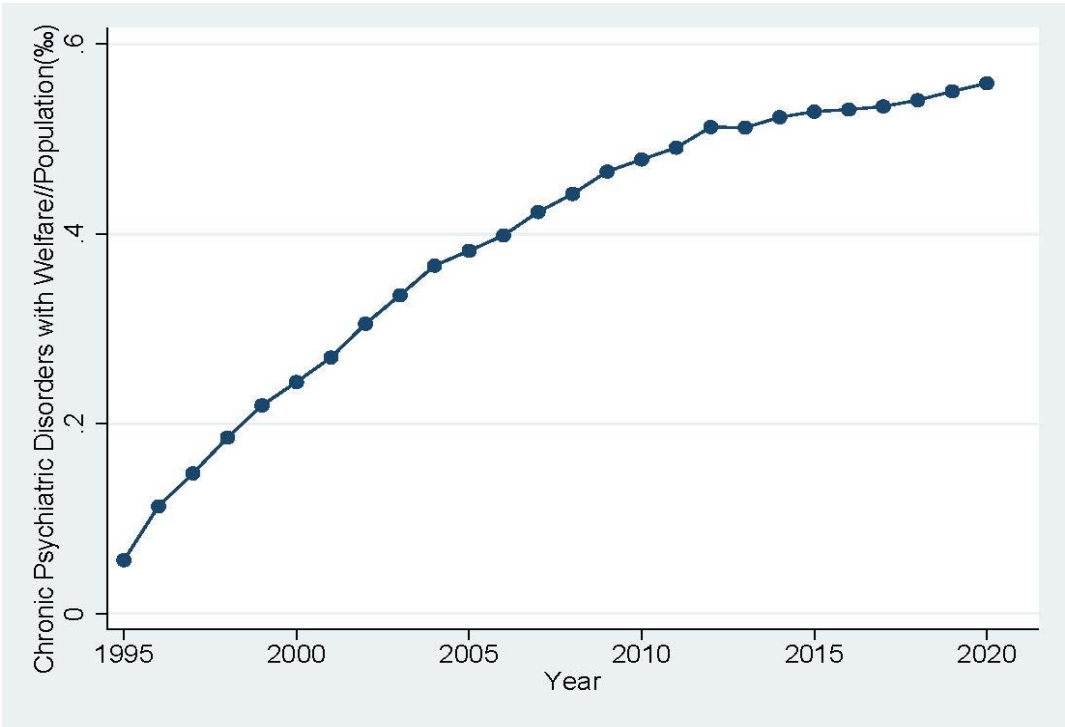
JEL classification numbers: I18, J21, J24.
Keywords: Community prevalence, Disabled Citizens Protection Act, Employment, psychiatric disorders, Taiwan.

[1] Associate Professor, Department of Economics, Tamkang University, New Taipei City, Taiwan.
[2] Ph.D. Student, Department of Economics, Tamkang University, New Taipei City, Taiwan.
*Corresponding Author.

Article Info: *Received:* May 11, 2026. *Revised*: June 2, 2026.
Published online: June 8, 2026.

1. Introduction

Psychiatric disorders is one of the most common diseases in the world. According to the World Health Organization report, approximately 970 million individuals lived with a mental health condition, with anxiety, depression, and bipolar disorders being the most prevalent in 2019 (Kestel et al., 2022). For example, in the United States, an estimated 59.3 million adults (23.1% of the adult population) had any psychiatric disorders in 2022. Notably, the prevalence of depression among adolescents aged 12 to 17 reached as high as 19.5% (Canady, 2023). According to the Institute for Health Metrics and Evaluation (IHME), an estimated 18% of Germany's population—approximately 15 million people—had a mental health condition, with anxiety disorders accounting for 7% and depressive disorders for 4% in 2019 (European Observatory on Health Systems & Policies, 2023). In Japan, the World Mental Health Japan Survey II (WMHJ2, 2013–2015) estimated that the twelve-month prevalence rates of common psychiatric disorder were 5.4%, with 2.7% major depressive disorder (Ishikawa et al., 2018).



Data source: the Ministry of Health and Welfare of the Executive Yuan, Taiwan

Figure 1: Proportion of people with chronic psychiatric disorders receiving welfare in Taiwan (1995-2020)

People in Taiwan have not been immune to psychiatric disorders as its economy develops. The number of people with chronic psychiatric disorders jumped from 12,023 in 1995 to 131,624 in 2020, a growth rate increasing about 11 times, according to the Ministry of Health and Welfare of the Executive Yuan statistics (see the following website: https://dep.mohw.gov.tw/DOS/cp-2976-61106-113.html). Disabled people with chronic psychiatric disorders accounted for 5.59 per thousand of the population in 2020 but only 0.56 per thousand in 1995. The above information indicates that the mental health of people in Taiwan has sustained significant deterioration. However, it increases at a slower rate (see Figure 1). Yet, it considered only those with chronic psychiatric disorders who intended to apply for social welfare benefits and had their applications approved. Although more effective treatments have become available for people with psychiatric disorders (Barrett et al., 2005), psychiatric disorders may continue to cause family economic hardships and social problems.

Affective disorders (mood disorders) and anxiety disorders (AA) are common psychiatric disorders. The two main types of affective disorders are depression and bipolar disorders. The co-occurrence of two or more disorders in the same patient is possible (Ettner et al., 1997).

AA may affect employment through an economic mechanism. It may affect workplace productivity by affecting memory, concentration, decision-making, motivation, and social relationships (Mullahy and Sindelar, 1990). AA may also affect the likelihood of employment through non-economic mechanisms, such as the lack of accommodation and outright discrimination (Chatterji et al., 2011).

More than 100 countries worldwide have incorporated employment quota systems for people with disabilities into their national legislation (International Labour Organization, 2019a). Some countries have enforced such measures for decades, while others have only recently planned to introduce or revise the relevant regulations. In the absence of a unified standard, the prescribed employment ratios vary across countries, including between the public and private sectors. For instance, a 2017 amendment to Section 501 of the U.S. Rehabilitation Act established a 12% hiring target for federal agencies, while the 2014 revision of Section 503 requires federal contractors with more than 50 employees and contracts exceeding USD 50,000 to make good-faith efforts toward achieving a 7% workforce participation rate of individuals with disabilities. According to Germany's Book IX of the German Social Code (Sozialgesetzbuch IX), employers with a workforce of 20 or more are legally required to ensure that at least 5% of their employees are people with disabilities (Lechner and Vazquez-Alvarez, 2011). As for Japan's Act on Employment Promotion of Persons with Disabilities, private companies and governments are required to employ a certain percentage (the legally prescribed minimum employment rate) or above of persons with disabilities (Hasegawa, 2010). In 2021, the legal employment rate for people with disabilities continued to increase to 2.3% in private companies and 2.6% in government sectors since 1976 (Yamada, 2024). In most jurisdictions, disability statutes explicitly include psychiatric disorders, though definitions, assessments, and eligibility thresholds vary across

countries (International Labour Organization, 2019b).

The government showed concern about whether people with psychiatric disorders were effectively protected in 1995. Since that year, people with psychiatric disorders have been covered by an earlier version of the (Physically and Mentally) Disabled Citizens Protection Act. According to the act revised in 1997, any unit in the public sector must hire physically and mentally disabled workers at a rate not less than 2 percent of the total number of employees, provided the total number of employees in the unit is 50 or more. In the private sector, firms must hire physically and mentally disabled workers at a rate of not less than 1 percent of the total number of employees, provided the total number of employees in the firm is 100 or more (see the following website: https://ly.gov.tw). Under the current revised regulations (People with Disabilities Rights Protection Act), this sectoral distinction remains: public sector with 34 or more employees must employ persons with physically and mentally disabled workers at a rate of not less than 3 percent of total employment, whereas private sector with 67 or more employees must employ persons with physically and mentally disabled workers at a rate of at least 1 percent, subject to a minimum of one disabled employee. Accordingly, although disability employment quotas continue to apply to both sectors in Taiwan, the statutory requirement remains substantially stricter in the public sector than in the private sector. Because organizations of different sectors face differential pressure of competition, private sector (including self-employed or employer) units may be unable to employ the same percentage of people with disabilities as public sector units. The self-employed person (or employer) who is suffering from physical and mental disabilities clearly can decide whether to work or not by himself/herself.

Suppose an enterprise or private company does not employ enough employees with disabilities. In that case, it will face a fine calculated based on the difference in the number of employees multiplied by the monthly minimum wage. Current regulations have revised these ratios to 3% for the public sector and 1.5% for the private sector.

Due to law enforcement, the extent to which people with AA are restricted from being employed through economic and non-economic mechanisms may vary across sectors. Thus, this law may make the impact of psychiatric disorders on employment vary across the public and private sectors (including self-employed or employer).

Many pioneering studies analyzing various data in the U.S., EU, Australia, and Asia find that psychiatric disorders have negative impacts on individual labor market outcomes. Most studies are conducted in the U.S. (e.g., Alexandre and French, 2001; Banerjee et al., 2017; Bartel and Taubman, 1979; Benham and Benham, 1982; Burnett-Zeigler et al. 2013; Chatterji et al.,2011; Ettner et al., 1997; Germinario et al., 2022; Marcotte and Wilcox-Gök, 2001; Marcotte et al., 2000; Mitchell and Anderson, 1989; Shen, 2023; Tefft, 2012). Some studies exist in the EU (e.g., Cau et al., 2025; Evans-Lacko et al., 2013; Harber-Aschan et al., 2020; Ringdal and Rootjes, 2022) and Australia (e.g., Frijters et al., 2014; Zhang et al., 2009). Among those pioneering studies, only one has contributed to investigating the impact on Asian Americans (Chatterji et al., 2007). One study has focused on this issue in Asia

(Chang and Yen, 2011; Jirapramukpitak et al., 2018). Chang and Yen (2011) have explored the relationship between depression and employment by analyzing the 1999 and 2003 Survey of Health and Living Status of the Elderly, which is the only study to address the related issues in Taiwan.

Looking at the literature from another angle, it is found that many of those previous studies, with different focuses, cover the impact of the AA type, including depression, bipolar, and anxiety, on employment (Alexandre and French, 2001; Burnett-Zeigler et al., 2013; Chatterji et al., 2007; Marcotte et al., 2000; Tefft, 2012). Some studies analyze the harmful effects of mental illness on a specific work type (e.g., full-time jobs or any work (including part-time work, full-time work, and other / volunteer work)) (Mullahy and Sindelar, 1990; Ojeda et al., 2010). One study finds that full-time workers with AA can also cause a decrease in productivity in terms of work loss and work cutbacks, both of which do not vary significantly by occupation for any disorder (Lim et al., 2000).

At the same time, the disability literature shows that employment inequalities are also influenced by discrimination, gender differences, and institutional settings, including disability employment policies (Bjørnshagen and Ugreninov, 2021; Jones et al., 2006; Lechner and Vazquez-Alvarez, 2011; Mori and Sakamoto, 2018). This broader perspective is important for understanding why the labor market consequences of psychiatric disorders may differ across sectors. In Taiwanese context, where disability quota rules formally apply to both physical and psychiatric disabilities, the employment effects of psychiatric disorders may reflect not only health-related disadvantages but also differences in sectoral accommodation and institutional inclusion.

Nonetheless, the literature still lacks an analysis that investigates the differential effects of suffering from AA on employment across sectors, which could offer valuable policy insights. As public authorities are aware of the role of the protection law for people suffering from AA, particularly those operating in the employment sector, they can develop and improve policies. Hence, this study examines the impact of AA, including affective disorders and anxiety disorders, on employment across sectors in Taiwan.

2. Methods

2.1 Data and variable definitions

This study uses data from the 2005 National Health Interview Survey (NHIS) in Taiwan to set the quantifiable evidence variables for adult males and females. Since 2001, the National Health Research Institute has conducted regular surveys every four years to collect information on the health and medical care of the population in Taiwan. In the first wave (2001), individuals were not clearly asked about psychiatric disorders, lacking details on timing and whether a doctor diagnosed such conditions. The second wave (2005) data was further refined in that regard. In the third wave (2009), there was no information on the employment sector. For this study, the second wave (2005) data was chosen.

The 2005 sample was designed to be nationally representative, and its subsample, drawn from each county or city, was also a representative sample of that county or city. Data from the samples are obtained through face-to-face interviews. The survey adopts the multi-stage stratified systematic sampling design. It covers all 23 cities and counties in Taiwan. Note that those 23 geographical regions do not overlap.

There are three major samples of the 2005 NHIS in Taiwan. We ignore the sample for children (aged below 12) and older people (aged above 65) since they are not in the primary labor force. We start from analyzing a sample of 18,099 individuals aged 12 to 64, including 9,286 males and 8,813 females.

We exclude from our analysis those who are subject to compulsory military service (183), persons under 18 (2,269), and a small number of individuals 65 years old or older (4). Samples are also dropped if they have missing information on any analyzed variables (138) or have had a job but no income in the past year (131). If they have a job but do not answer the question about the employment sector, they are also excluded (18). In the adult sample, aside from excluding individuals who had reached the statutory retirement age, conscripts performing compulsory military service, and observations with missing data, we retained all other categories (e.g., homemakers, early retirees, and people with disabilities). This approach helps prevent underestimation of labor-market exits attributable to psychiatric disorders (Vijan et al., 2004). The chosen variables include the status of the employment sector, the variable of psychiatric disorders in the past year, and the control variables. The control variables reflect human capital and demographic variables. Thus, this study limits the analysis sample to 15,356 individuals, including 7,853 males and 7,503 females aged 18 to 64.

We construct two dichotomous sector variables, including the public and private sectors, based on a reference group (i.e., nonemployment). The dichotomous variable of psychiatric disorders is defined as one if a person was suffering from any of those three diseases, including depressive disorders, bipolar disorders, and anxiety disorders, within the past year, and zero otherwise.

The control variables include (1) age, (2) education, (3) marital status, and (4) offspring (only for females). To undertake robustness checks, we construct dichotomous comorbidity variables that include cancer and heart disease (Derogatis et al., 1983; Mittendorfer-Rutz et al., 2018). The instrumental variable (IV) is the community prevalence of psychiatric disorders. The calculation of community prevalence of psychiatric disorders is based on data from 23 cities and counties, reflecting the area-specific risks of suffering from AA within the past year. See Table 1 for detailed definitions of the variables. The sampling weights are the weights denoted by WT_C in the survey.

Table 1: Definition of variables

Variable	Definition
Public Sector	Dummy variable = 1 if a person is "having a job at present" and employed by the public sector; 0 otherwise.
Private Sector	Dummy variable = 1 if a person is "having a job at present" and employed by the private sector (including employed, employer who also has employees, or a self-employed business without employees); 0 otherwise.
Employed in Private Sector	Dummy variable = 1 if a person is "having a job at present" and employed by the private sector; 0 otherwise.
Employed in Self-employed (or employer)	Dummy variable = 1 if a person is "having a job at present" and an employer with employees or a self-employed business without employees; 0 otherwise.
Nonemployment (Reference Group)	The reference group includes students (336 males, 491 females), homemakers (185 males, 326 females), retired (41 males, 71 females), disabled (26 males, 56 females), specifying other reasons (31 males, 46 females), seasonal (periodic) shutdowns or temporary closures (44 males, 44 females) and those who can work, want to work, and have not yet found a job (224 males, 196 females).
Psychiatric disorders	Dummy variable = 1 if a person was suffering from any one of those three diseases, including depressive disorders, bipolar disorders, and anxiety disorders, within the past year, and a doctor diagnosed it; 0 otherwise.
Education Levels	They are categorized by four educational levels: (1) primary school or junior high dropouts (reference group), (2) junior high school or high school dropouts (dichotomous variable), (3) a graduate from high school but not from university or an associate degree holder (dichotomous variable), (4) a graduate from university or above including master (dichotomous variable).
Age	The actual age (with decimal digits, which is more accurate)
Marital status	Dummy variable = 1 if the respondent is married or living with a partner, and 0 otherwise, which includes widowed, divorced, separated, or never married.
Offspring	Dummy variable = 1 if the answer is "yes" for one of the three questions: if a woman has a child aged six months to two years, has ever given birth (live births), or had a pregnancy during last year; 0 otherwise.
Cancer	Dummy variable = 1 if a person was diagnosed by a doctor as suffering from the respective cancer illness within the past year, and 0 otherwise.
Heart Disease	Dummy variable = 1 if a person was diagnosed by a doctor as suffering from the respective heart disease within the past year, and 0 otherwise.
IV: Community prevalence of Psychiatric disorders	The ratio of the number of disease occurrences (within a given period) to the number of units at risk in the sample in each jurisdiction. Both the numerator and denominator are adjusted by sampling weights. Only those people who are aged from 18 to 64 are considered.

2.2 Potential sources of endogeneity and the IV

On the one hand, the workplace, the job itself (e.g., job complexity or job responsibility), or economic hardship may cause stress accumulation and increase an individual's risk of psychiatric disorders (Evans-Lacko et al., 2013; Godin et al., 2005). The individual can only work after entering the workplace. Due to a lack of time, rest is relatively irregular. Ever-increasing business, irritability, anxiety, and other phenomena will increase. On the other hand, unemployed individuals may experience more significant declines in mental health outcomes (Theodossiou, 1998). Employment can help improve mental health, and supported employment can even be used to treat psychiatric disorders (Drake and Wallach, 2020). In our paper, the employment variable is defined as whether the respondent is currently employed within each sector, and the variable of psychiatric disorders is defined as having received a physician's diagnosis of depression, anxiety, or bipolar disorder within the past year (see Table 1). This strategy mitigates, to some extent, concerns about reverse causality. Thus, a reverse effect may exist, but its net impact may not be substantial. In addition, the other source of endogeneity is the existence of unobserved factors (e.g., poor self-assessed health), which may affect a person's tendency to hold a job and suffer from psychiatric disorders (Böckerman and Ilmakunnas, 2009). Hence, the endogeneity problem may or may not arise.

Four related pioneering studies have explored using a few IVs to deal with the potential endogeneity problem, employing various measures of psychiatric disorders and different models. Despite not estimating the impact of psychiatric disorders on employment across sectors, the information on IVs and their quality is valuable. The first study employs variables indicating psychiatric disorders before age 18, maternal and paternal psychiatric disorders as IVs for psychiatric disorders (Ettner et al., 1997). The second study utilizes a composite measure of religiosity and the number of workers at individual and family services agencies per 10,000 residents in a specific zip code area as IVs (Alexandre and French, 2001). In the third study, IVs include the number of psychiatric disorders with an onset before age 18, religious support (regular attendance at religious services), and religious frequency (frequent use of spiritual means to cope with life's problems) (Chatterji et al., 2007). Notably, only the number of early disorders strictly meets IV requirements. The authors of this study point out that their IVs are all personal characteristics and lack a solid theoretical justification for exogeneity (Chatterji et al., 2007). In the fourth study, the darkness index is the IV for mental health, measured by unhealthy days in a two-stage least-squares model (Tefft, 2012).

We use the community prevalence of psychiatric disorders rather than personal characteristics as an IV to deal with the potential endogeneity of AA. The IV presumably meets the exclusion restriction, as it is unlikely to influence employment sector choice directly but may affect it indirectly through its impact on mental health disorders (Morris, 2007). The relevance condition is also supported because individuals living in communities with high rates of psychiatric disorders are more likely to develop psychiatric conditions due to shared social and

environmental factors. It is interesting to note that the literature regarding the effect of the neighborhood context on mental health also provides a rationale for using the regional prevalence as an IV. For example, Aneshensel and Sucoff (1996) find that the neighborhood context (e.g., socioeconomic status) and adolescent mental health are related through the channel of shaping perceptions of their neighborhoods. They also point out that mental health disorders in adolescence often carry into adulthood. Sui et al. (2022) systematically review 30 articles and find that the composite neighborhood socioeconomic status is negatively associated with levels of depression and pooled mental disorders, while community urbanization is positively related to levels of those diseases. Tampubolon (2011) also finds that neighborhood social capital often benefits an individual's mental health.

2.3 Model

While both multinomial probit and logit models are considered, the analysis primarily adopts the multinomial probit approach to estimate the impacts of psychiatric disorders across sectors among adults aged 18 to 64 by gender.

In studies of occupational choice, the multinomial logit (MNL) model is commonly employed (Boskin, 1974; Schmidt and Strauss, 1975). However, the MNL model requires the assumption of Independence of Irrelevant Alternatives (IIA) to hold (Dow and Endersby, 2004; Kinge, 2016). Our analysis is based on survey data with sampling weights and employs dummy variables, STATA pweighted estimators, and clustered standard errors. Given these features, the assumptions required for the Hausman test to serve as a valid assessment of the IIA property may not be fully satisfied. Although not central to our main specification, we nonetheless conducted the IIA test; the results are presented in the Appendix. Regardless of the IIA test results, both the MNL and MNP models yield a similar pattern of estimates, consistently indicating that the negative impact of psychiatric disorders is more substantial in the private sector than in the public sector. Both models indicate that the adverse impact is especially pronounced among those employed in the private sector.

The MNP model offers an advantage in that it does not rely on the IIA assumption, unlike the MNL model. Therefore, we primarily report the results based on the MNP model in this study. We use Maddala's (1983) solutions for the MNP model. Formally, in a sample, individuals choose an employment sector from the following options: (1) nonemployment, (2) public sector, and (3) private sector, in the baseline model. Let each of V_1, V_2, and V_3 denote a vector of variables that affect the corresponding latent tendency (E_1^*, E_2^*, and E_3^*) of choosing one specific sector (Eqs. (1) - (3)).

$$E_1^* = V_1 + \varepsilon_1 \tag{1}$$

$$E_2^* = V_2 + \varepsilon_2 \tag{2}$$

$$E_3^* = V_3 + \varepsilon_3 \tag{3}$$

This paper utilizes the MNP model to estimate this exogenous model by gender first. The control variables in this baseline model include individual age, age squared, education, marital status, and offspring (only for females). Assuming a trivariate normal distribution for the residuals with a mean vector of zero and considering the possibility of choosing the first alternative solution, the equation is given in Eq. (4).

$$Prob(E_1^* > E_2^*, E_1^* > E_3^*) = Prob(\varepsilon_2 - \varepsilon_1 < V_1 - V_2, \varepsilon_3 - \varepsilon_1 < V_1 - V_3) \quad (4)$$

where
$\eta_{21} = \varepsilon_2 - \varepsilon_1,\ \eta_{31} = \varepsilon_3 - \varepsilon_1,\ V_{12} = V_1 - V_2$, and $V_{13} = V_1 - V_3$

Thus, η_{21} and η_{31} follow bivariate normal distributions with covariance matrices. The probability of choosing an alternative one is determined by Eq. (5).

$$P_1 = \int_{-\infty}^{V_{12}} \int_{-\infty}^{V_{13}} f(\eta_{21}, \eta_{31}) d\eta_{21} d\eta_{31} \quad (5)$$

The probabilities P_2 and P_3 are calculated similarly. The model is estimated by using the maximum likelihood method. It is implemented by using the Stata mprobit command.

To account for potential endogeneity, we adapt Holly and Denis's (1982) augmented regression approach to the MNP context (also known as the control function approach) as Kinge (2016) adapts the augmented regression approach to the MNL context. We run the ordinary least squares (OLS) of the variable of psychiatric disorders on the IV (i.e., the community prevalence) and all exogenous variables to estimate the regression coefficients and keep the residuals (Greene, 2018). After including the residuals as an additional control variable in the MNP models, we also estimate this endogenous specification and test for endogeneity.

Although exclusion and relevance tests are both crucial for identification, the exclusion restriction is particularly difficult to verify empirically in nonlinear probit frameworks (Morris, 2007; Wooldridge, 2002). To assess the validity of the IV, we evaluate the validity of the exclusion restrictions by estimating a bivariate probit model with the IV first. A Wald test is then conducted to assess whether the excluded We then examine the relevance of the IV by estimating a probit model, which allows us to test whether the IV is sufficiently correlated with the variable of psychiatric disorders (Wooldridge, 2002).

We conduct robustness checks for exogenous and endogenous models by including comorbidity variables (cancer and heart disease). We furthermore investigate psychiatric disorder effects in the private sector by categorizing individuals into employed and self-employed (or employer) groups. A person thus has four options. The probabilities P_1', P_2', P_3' and P_4' are also calculated similarly. We also estimate these models with and without the inclusion of comorbidity variables.

The sampling weights are used in all the analyses. We report the weighted sample average of the marginal effects (Cameron and Trivedi, 2005) and clustered standard errors in all models, as we utilize community prevalence data from 23 cities and counties on psychiatric disorders (Aneshensel and Sucoff, 1996; Morris, 2007).

3. Results

3.1 Descriptive statistics

Table 2 provides weighted summary statistics by gender using sampling weights. The private sector dominates, employing 64.87% of males and 51.92% of females, while the public sector employs 8.98% of males and 6.28% of females. The proportion of males exceeds that of females in both sectors.

The proportion of psychiatric disorders is slightly lower for males (1.56%) than for females (2.06%). Probably reflecting these facts, the average area community prevalence of psychiatric disorders is somewhat lower for males (1.45%) than for females (1.85%). The magnitude of the prevalence calculated using the 2005 NHIS is close to the prevalence of corresponding psychiatric disorders among National Health Insurance enrollees in Taiwan (Chien et al., 2004).

Males exhibit higher human capital than females in education. A greater percentage of males (17.50%) hold a college degree or above than females (14.52%). Moreover, more males graduated from high school (48.91%) and junior high school (18.22%) than their female counterparts (45.11% and 14.41%, respectively).

The male respondents (39.46 years old) are slightly younger than females (40.34 years old), on average. The proportion of males being married (or living with a partner) (59.79%) is slightly lower than the proportion of females (63.45%) being married (or living with a partner). Table 2 also reports the weighted summary statistics for the variables used in the robustness checks. They include variables indicating comorbidities—cancer and heart disease.

Table 3 shows the differences in nonemployment and employment rates in various sectors between the psychiatric disorders group and the non-psychiatric disorders group for both males and females. The results indicate that psychiatric disorders are unfavorable to individual labor market outcomes for both males and females, while the severity varies across sectors.

For males, the psychiatric disorders group has a much higher proportion of nonemployment (57.00%) than the non-psychiatric disorders group (25.64%). The psychiatric disorders group has a lower proportion of employed in the public sector (4.46%) than the non-psychiatric disorders group (9.06%). The psychiatric disorders group has a much lower proportion in the private sector (38.54%) than the non-psychiatric disorders group (65.30%). In the subsector of employed in the private sector, the psychiatric disorders group also has a much lower proportion (25.34%) than the non-psychiatric disorders group (44.02%). All these differences are statistically significant at the 0.05 significance level. In the subsector of self-employed (or employer), the psychiatric disorders group also has a lower proportion (13.20%) than the non-psychiatric disorders group (21.28%), but it is insignificant.

Table 2: Weighted summary statistics [a,b,c]

Variables	Males		Females	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
Public	8.982%	28.594%	6.283%	24.267%
Private	64.873%	47.740%	51.918%	49.967%
Employed	43.718%	49.607%	39.585%	48.907%
Self-employed or Employer	21.155%	40.843%	12.333%	32.884%
Nonemployment	26.145%	43.945%	41.799%	49.326%
Psychiatric disorders (1=yes,0=no)	1.560%	12.546%	2.061%	14.207%
Education: Primary school or junior high dropouts (reference group; 1=yes, 0=no)	15.375%	36.073%	25.965%	43.847%
Junior high school (1=yes,0=no)	18.216%	38.600%	14.406%	35.118%
High school (1=yes,0=no)	48.908%	49.991%	45.113%	49.764%
College or above (1=yes,0=no)	17.501%	38.000%	14.516%	35.228%
Age	39.460	13.066	40.340	12.813
Age square	1727.776	1065.071	1791.497	1052.668
Married or living with a partner (1=yes,0=no)	59.785%	49.036%	63.454%	48.159%
Offspring (1=yes,0=no)	n.a.	n.a.	71.446%	45.170%
Cancer (1=yes, 0=no)	0. 671%	8.161%	1.085%	10.359%
Heart Disease (1=yes, 0=no)	3.075%	17.265%	3.739%	18.974%
Community prevalence of Psychiatric disorders	1.450%	0. 556%	1.848%	0. 916%
Obs.	7,853		7,503	

Notes: [a] The sampling weights are used in calculations.
[b] The mean and standard deviation of prevalence are calculated based on the community prevalence of 23 cities and counties. Each of the community prevalences of 23 cities and counties is calculated using the sampling weights.
[c] All statistics are rounded off to four decimal digits.

Table 3: Various employment and nonemployment rates--psychiatric disorders group vs. non-psychiatric disorders group [a,b]

		Psychiatric disorders group	Non-psychiatric disorders group	Difference[c] [t statistic]
Males	Nonemployment	57.001% (0.5018)	25.643% (0.4366)	31.358%* [6.51]
	Public	4.459% (0.2092)	9.056% (0.2869)	-4.597%* [-2.55]
	Private	38.540% (0.4508)	65.301% (0.4759)	-26.761%* [-6.37]
	Employed	25.340% (0.4408)	44.017% (0.4963)	-18.677%* [-5.75]
	Self-employed or employer	13.200% (0.3431)	21.284% (0.4096)	-8.084% [-1.89]
Females	Nonemployment	62,076% (0.4905)	41.372% (0.4924)	20.704%* [5.45]
	Public	5.539% (0.2313)	6.298% (0.2429)	-0.756% [-0.39]
	Private	32.385% (0.4731)	52.329% (0.4994)	-19.944%* [-4.92]
	Employed	26.123% (0.4441)	39.869% (0.4896)	-13.746%* [-4.40]
	Self-employed or employer	6.262% (0.2450)	12.461% (0.3302)	-6.198%* [-3.82]

Notes: [a] *Significant at 5% level. Standard deviations are in parentheses. T statistics are in brackets. All the calculations are based on the sampling weights and the clustered standard errors.
[b] All statistics are rounded off to four decimal digits except for t statistics,
[c] The differences and t statistics are the coefficient estimates and the values of t statistics corresponding to psychiatric disorders in the simple regressions of the zero-one dependent variables (i.e. various employment variables) on the zero-one variable of psychiatric disorders.

A similar pattern holds for females. The results for females who are non-employed, employed in the private sector, and the subsector of employed in the private sector all indicate that individuals with psychiatric disorders are more disadvantaged than those without psychiatric disorders. However, the difference between the proportion of the psychiatric disorders group and that of the non-psychiatric disorders group working in the public sector becomes insignificant, while it is now significant in the subsector of self-employed (or employer).

3.2 The MNP exogenous results

We estimate the baseline model and report the exogenous results for males and females (see Model I in Table 4). The marginal effect of suffering from AA on the probability of being employed in the public sector is insignificant for both males and females. In the private sector, suffering from AA is associated with a 27.74

percentage point reduction in the probability of being employed, and the marginal effect is statistically significant for males. For females, suffering from AA is associated with a decrease of 21.38 percentage points in the probability of being employed, and the marginal effect is statistically significant. Those results of the MNP indicate that suffering from AA in the past year is associated with a lower probability of having a job at present for both males and females in the private sector. The negative impact of the private sector is more pronounced than that of the public sector, and this holds for both males and females.

Table 4: The MNP exogenous results of psychiatric disorders on employment, by sector for males and females[a]

	Model I		**Model II**	
	Public	**Private**	**Public**	**Private**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0385 (0.0211)	-0.2774* (0.0362)	-0.0388 (0.0211)	-0.2588* (0.0361)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes
Obs.	7,853		7,853	
Females: Marginal effect	-0.0165 (0.0140)	-0.2138* (0.0389)	-0.0169 (0.0140)	-0.2117* (0.0390)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes
Obs.	7,503		7,503	

Notes: [a] *Significant at 5% level. Clustered standard errors are reported. The sampling weights are used.

[b] Controlling for personal characteristics variables include individual age, age squared, education, marital status, and offspring (only for females).

[c] Comorbidity variables include cancer and heart disease.

The results are consistent with the hypothesis that public offices protect the employment of people with psychiatric disorders relatively aggressively. Private enterprises may face challenges in complying with the law due to intense competition. Some private companies may have to pay more to create a friendly work environment and workspace. Especially, there are companies in high-tech or technical industries in Taiwan that cannot hire individuals with serious psychiatric disorders to work in production, as production requires great precision (see the China Times (Sep. 10, 2005, A8, in Chinese)).

We also report the exogenous result of robustness checks in Table 4 (see Model II). After the comorbidity variables—cancer and heart disease—are added to control variables, the marginal effect of AA on the probability of being employed in the

public sector remains negative and statistically insignificant (at the 0.05 level) for males and females. In the private sector, the marginal effects of AA on the probability of being employed remain negative and statistically significant, according to the MNP model for males (-25.88 percentage points) and females (-21.17 percentage points).

If the comorbidity variables are added, the results are similar to those of the baseline models, and the marginal effects for both males and females in the private sector remain significantly negative, albeit with smaller magnitudes than those without the comorbidity variables. The negative impact of the private sector is still more pronounced than that of the public sector.

We categorize the private sector into employed and self-employed (or employer), presenting the outcomes of the exogenous model in Table 5. The marginal effect of AA on the likelihood of employment in the public sector is significant for males (-4.15 percentage points), but its magnitude is relatively small compared with that of the subsector of employed in the private sector (see Model III). It remains insignificant in the public sector for females. In the subsector of employed in the private sector, suffering from AA leads to a 19.28 percentage point decrease in employment probability for males and a 14.57 percentage point decrease for females. Similarly, in the subsector of self-employed (or employer), suffering from AA reduces employment probability by 7.64 percentage points for males and 6.44 percentage points for females. All these marginal effects are statistically significant. The negative impact within the employed subsector is more pronounced than that of the public sector and the self-employed (or employers) subsector. This holds for both males and females.

We present results from Model IV, which, furthermore, includes comorbidity variables, showing similarity to the model without these variables. In the public sector, the impact of AA on employment remains statistically significant for males (-4.15 percentage points), while it remains insignificant for females. In the subsector of employed in the private sector, the negative impact of AA on employment is statistically significant for both males (-18.28 percentage points) and females (-14.21 percentage points). Moreover, in the self-employed (or employer) subsector, the effect is statistically insignificant for males, but it is statistically significant for females (-6.62 percentage points).

Table 5: The MNP exogenous results of psychiatric disorders on employment, by sector for males and females: further decomposition

	Model III			Model IV		
	Public	**Private: employed**	**Private: Self-employed or employer**	**Public**	**Private: employed**	**Private: Self-employed or employer**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0415* (0.0203)	-0.1928* (0.0324)	-0.0764* (0.0387)	-0.0415* (0.0203)	-0.1828* (0.0331)	-0.0689 (0.0399)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	No	Yes	Yes	Yes
Obs.	7853			7853		
Females: Marginal effect	-0.0172 (0.0138)	-0.1457* (0.0291)	-0.0644* (0.0149)	-0.0176 (0.0138)	-0.1421* (0.0294)	-0.0662* (0.0144)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	No	Yes	Yes	Yes
Obs.	7,503			7,503		

Notes: Same as the notes in Table 4

The negative impact within the employed subsector is more pronounced than that of the public sector and that within the self-employed (or employers) subsector, regardless of including comorbidity variables. This, again, holds for both males and females.

In summary, the exogenous results indicate that the effect on the private sector, especially within the subsector of employed, remains stronger compared to the public sector, regardless of whether comorbidity variables are included.

3.3 The MNP endogenous results

The MNP endogenous results are reported in the Appendix. The community prevalence of psychiatric disorders meets both the relevance and exclusion conditions for both males and females. We refer to the study of Chatterji et al. (2007) regarding the consideration of the over-identification test and the relevance test at the 0.05 level. The results of the augmented residuals indicate no endogeneity for males and females, regardless of whether comorbidity variables are included and

whether the private sector is categorized as employed and self-employed (or employer). When accounting for endogeneity, the results remain consistent with the exogenous findings. The difference between the exogenous and endogenous results is that the adverse effect is much greater when accounting for endogeneity

4. Conclusion and discussion

Differential impacts of suffering from psychiatric disorders are found in various sectors. The differential impacts reflect the role of the (Physically and Mentally) Disabled Citizens Protection Act implemented in 1997 in Taiwan. The law required the public and private sectors to hire individuals with physical or mental disabilities to meet different minimum employment rates. The results of this paper indicate that improving employment for individuals with psychiatric disorders in the private sector, especially for private sector employees, remains a challenge. While the regulations have been revised since 1997, the private sector is still treated relatively leniently.

It seems that Taiwan can draw from Japan's and Germany's employment policies. One solution is to increase the private sector's required employment rate of individuals with disabilities to match that of the public sector, thereby equalizing the minimum employment rate or narrowing the gap in the minimum rate between the public and private sectors. However, this might increase costs due to potential efficiency losses. Given that Taiwan's National Health Insurance has been in place since 1995, economic barriers to accessing mental health services are generally absent. Enhancing preventive services (e.g., worksite and community consulting) and further promoting access to effective psychiatric disorder treatment are also important to improving mental health and the long-term employability of patients suffering from psychiatric disorders. Both could be complementary policies to the existing Disabled Citizens Protection Act in Taiwan.

Appendix

This appendix reports the endogenous MNP results and the exogenous and endogenous MNL results. It reports the endogenous MNP estimates of the baseline model for males and females (see Model V in Table A1). The marginal effects of AA on the probability of being employed in the public sector are statistically significant (at the 0.05 level). Suffering from AA reduces the probability by 8.83 percentage points for males and 7.46 percentage points for females. The marginal effects of AA on the probability of being employed in the private sector are also statistically significant, and suffering from AA reduces the probability by 65.21 and 51.27 percentage points for males and females.

Table A1: The MNP endogenous results of psychiatric disorders on employment, by sector and gender[a]

	Model V		Model VI	
	Public	**Private**	**Public**	**Private**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0883* (0.0073)	-0.6521* (0.0197)	-0.0883* (0.0073)	-0.6522* (0.0195)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes
Residual	12.5602 (15.1987)	29.4641 (16.0808)	12.4472 (14.7652)	29.0059 (15.7090)
Wald test for IV: [d] Exclusion $\chi^2(1)$ p-value	0.8028 0.370267	3.1876 0.074201	0.8093 0.368321	3.3054 0.069052
Relevance $\chi^2(1)$ p-value	18.4253† 0.000018		23.0620† 0.000000	
Obs.	7,853		7,853	
Females: Marginal effect	-0.0746* (0.0252)	-0.5127* (0.0342)	-0.0754* (0.0238)	-0.5116* (0.0343)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes
Residual	6.5162 (3.6332)	4.0132 (3.7356)	6.6163 (3.6626)	3.9415 (3.7790)
Wald test for IV:[d] Exclusion $\chi^2(1)$ p-value	0.5289 0.467064	0.172283 0.678091	0.7800 0.377141	0.1349 0.713378
Relevance $\chi^2(1)$ p-value	71.3620† 0.000000		70.4228† 0.000000	
Obs.	7,503		7,503	

Notes: [a] *Significant at 5% level; P-value = Prob > $\chi^2(1)$, † P-value<0.05. Clustered standard errors are reported. The sampling weights are used.

[b] Controlling for personal characteristics variables include individual age, age squared, education, marital status, and offspring (only for females).

[c] Comorbidity variables include cancer and heart disease.

[d] The exclusion restriction is tested using a bivariate probit model with IVs, while the relevance condition is assessed through a probit model.

We also report the endogenous results of robustness checks for including morbidity variables (see Model VI in Table A1). Suffering from AA reduces the probability of being employed in the public sector by 8.83 and 7.54 percentage points for males and females. They are negative and statistically significant. In the extended model that includes morbidity variables, suffering from AA reduces the probability of being employed in the private sector by 65.22 percentage points for males and 51.16 percentage points for females. They remain negative and statistically significant.

The community prevalence of psychiatric disorders meets both the relevance and exclusion conditions for both males and females (see Models V and VI). We refer to the study of Chatterji, Alegria, and Takeuchi (2007) regarding the consideration of the over-identification test and the relevance test at the 0.05 level. The results of the augmented residuals indicate no endogeneity for males and females, regardless of whether comorbidity variables are included.

Again, we categorize the private sector into employed and self-employed (or employer), presenting the endogenous outcomes (see Model VII in Table A2). We observe reductions in employment in the public sector for males (8.84 percentage points) and females (7.12 percentage points) due to AA, and both are significant. In the subsector of employed in the private sector, AA results in employment reductions of 44.55 percentage points for males and 38.50 percentage points for females, and both are significant. In the subsector of self-employed (or employer), the adverse effects of AA are also statistically significant, leading to reductions of 20.64 percentage points for males and 12.92 percentage points for females.

Furthermore, adding the comorbidity variables (Model VIII in Table A2) for sensitivity analysis shows similar results. In the public sector, suffering from AA reduces employment by 8.84 percentage points for males and 7.10 percentage points for females. AA reduces employment in the subsector of employed in the private sector, with a 44.56 percentage point reduction for males and 38.32 percentage points for females. In the subsector of self-employed (or employer), AA leads to reductions of 20.66 percentage points for males and 12.99 percentage points for females. All of these are statistically significant.

Similarly, the community prevalence of psychiatric disorders meets both the relevance and exclusion conditions for both males and females (see Models VII and VIII). The augmented residuals again indicate no endogeneity for males and females, regardless of whether comorbidity variables are included.

Table A2: The MNP endogenous results of psychiatric disorders on employment, by sector and gender: further decomposition

	Model VII			Model VIII		
	Public	**Private: employed**	**Private: self- employed or employer**	**Public**	**Private: employed**	**Private: self- employed or employer**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0884* (0.0073)	-0.4455* (0.0169)	-0.2064* (0.0085)	-0.0884* (0.0073)	-0.4456* (0.0168)	-0.2066* (0.0084)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	No	Yes	Yes	Yes
Residual	11.8332 (14.9853)	31.9599 (16.6131)	17.6967 (14.1950)	11.6903 (14.5490)	31.3789 (16.2593)	17.4723 (13.7616)
Wald test for IV:[d] Exclusion $\chi^2(1)$ p-value	0.8028 0.370267	3.0975 0.078413	0.3725 0. 541651	0.8093 0.368321	3.2503 0.071411	0.3934 0.530528
Relevance $\chi^2(1)$ p-value	18.4253† 0.000018			23.0620† 0.000000		
Obs.	7,853			7,853		
Females: Marginal effect	-0.0712* (0.0202)	-0.3850* (0.0358)	-0.1292* (0.0163)	-0.0710* (0.0194)	-0.3832* (0.0419)	-0.1299* (0.0171)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	No	Yes	Yes	Yes
Residual	6.3683 (3.4693)	3.4038 (4.3370)	5.4859 (3.0046)	6.4626 (3.4905)	3.2460 (4.3926)	5.6658 (3.0690)
Wald test for IV:[d] Exclusion $\chi^2(1)$ p-value	0.5289 0.467064	0.0058 0.939113	1.1199 0.289930	0.7800 0.377141	0.0008 0.977692	1.6833 0.194489
Relevance $\chi^2(1)$ p-value	71.3620† 0.000000			70.4228† 0.000000		
Obs.	7,503			7,503		

Notes: Same as the notes in Table A1.

The exogenous and endogenous MNL results are presented in Tables A3 and A4. The assumptions required for the Hausman test to serve as a valid assessment of the IIA property may not be fully satisfied. The force command runs the Hausman test even if its assumptions are not met. Regardless of the IIA test results, the MNL shows a similar pattern of estimates to the MNP, consistently indicating that the negative impact of psychiatric disorders is more substantial in the private sector than in the public sector. It is also especially pronounced among those employed in the private sector.

Table A3: The MNL exogenous results of psychiatric disorders on employment, by sector and gender

	Model I		**Model II**		**Model III**			**Model IV**		
	Public	**Private**	**Public**	**Private**	**Public**	**Private: employed**	**Private: self-employed or employer**	**Public**	**Private: employed**	**Private: self-employed or employer**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0469* (0.0175)	-0.2739* (0.0355)	-0.0466* (0.0175)	-0.2576* (0.0362)	-0.0473* (0.0175)	-0.1947* (0.0341)	-0.0767 (0.0394)	-0.0469* (0.0175)	-0.1865* (0.0353)	-0.0679 (0.0412)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
IIA test $\chi^2(1)$ p-value	-0.27 n.a.	86.06 0.0000	0.91 0.9996	257.85 0.0000	-0.27 n.a.	14.46 0.4163	-1.34 n.a.	0.15 1.0000	-729.03 n.a.	-0.78 n.a.
Obs.	7,853		7,853		7,853			7,853		
Females: Marginal effect	-0.0137 (0.0136)	-0.2157* (0.0393)	-0.0144 (0.0135)	-0.2135* (0.0395)	-0.0137 (0.0136)	-0.1489* (0.0297)	-0.0656* (0.0145)	-0.0144 (0.0135)	-0.1456* (0.0300)	-0.0669* (0.0138)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
IIA test $\chi^2(1)$ p-value	-0.07 n.a.	6.67 0.5724	-0.07 n.a.	50.26 0.0000	-0.14 n.a.	46.54 0.0001	5.61 0.9918	-0.08 n.a.	-6.63 n.a.	0.80 0.0000
Obs.	7,503		7,503		7,503			7,503		

Notes: Same as the notes in Table A1.

Table A4: The MNL endogenous results of psychiatric disorders on employment, by sector and gender

	Model V		Model VI		Model VII			Model VIII		
	Public	**Private**	**Public**	**Private**	**Public**	**Private: employed**	**Private: self-employed or employer**	**Public**	**Private: employed**	**Private: self-employed or employer**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect	-0.0884* (0.0072)	-0.6524* (0.0196)	-0.0884* (0.0072)	-0.6524* (0.0194)	-0.0884* (0.0072)	-0.4451* (0.0168)	-0.2073* (0.0850)	-0.0884* (0.0072)	-0.4451* (0.0167)	-0.2073* (0.084)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Residual	14.1551 (22.1856)	35.0898 (19.5208)	14.0182 (21.5566)	34.4538 (19.0717)	13.6108 (22.3454)	39.2900 (20.6412)	24.4889 (19.2803)	13.4480 (21.7041)	38.5202 (20.2020)	24.0001 (18.6854)
IIA test $\chi^2(1)$ p-value	0.26 0.9999	-56.11 n.a.	-0.02 n.a.	160.31† 0.0000	9.63 0.8421	-22.40 n.a.	0.11 1.0000	0.01 1.0000	356.76† 0.0000	-3.09 n.a.
Obs.	7,853		7,853		7,853			7,853		
Females: Marginal effect	-0.0806* (0.0052)	-0.5018* (0.0263)	-0.0807* (0.0049)	-0.5014* (0.0271)	-0.0793* (0.0085)	-0.3761* (0.0550)	-0.1224* (0.0096)	-0.0793* (0.0084)	-0.3746* (0.0581)	-0.1224* (0.0096)
Controlling for personal characteristics variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity variables[c]	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Residual	11.6718† (5.3185)	4.7992 (4.3583)	11.8505† (5.3894)	4.7459 (4.4046)	11.5680† (5.2388)	3.8968 (5.3082)	7.4389 (4.2900)	11.7543† (5.2988)	3.7685 (5.3884)	7.6188 (4.3890)
IIA test $\chi^2(1)$ p-value	-0.14 n.a.	-24.85 n.a.	-0.36 n.a.	46.72† 0.0000	-0.28 n.a.	-22.59 n.a.	-4.76 n.a.	-0.05 n.a.	9.26 0.9919	-4.33 n.a.

Notes: Same as the notes in Table A1.

The bootstrapped results are shown in Table A5.

Table A5: The MNP and MNL bootstrapped endogenous results of psychiatric disorders on employment, by sector and gender

	Model V		**Model VI**		**Model VII**			**Model VIII**		
	Public	**Private**	**Public**	**Private**	**Public**	**Private: employed**	**Private: self-employed or employer**	**Public**	**Private: employed**	**Private: self-employed or employer**
	Coeff (S.E.)	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**	**Coeff (S.E.)**
Males: Marginal effect using MNP	-0.0905* (0.0083)	-0.6605* (0.0203)	-0.0905* (0.0197)	-0.6606* (0.0230)	-0.0906* (0.0080)	-0.4561* (0.0171)	-0.2042* (0.0083)	-0.0906* (0.0080)	-0.4561* (0.0178)	-0.2043* (0.0080)
Marginal effect using MNL	-0.0905* (0.0078)	-0.6609* (0.0204)	-0.0905* (0.0082)	-0.6609* (0.0208)	-0.0905* (0.0080)	-0.4557* (0.0178)	-0.2051* (0.0081)	-0.0905* (0.0078)	-0.4557* (0.0166)	-0.2051* (0.0084)
Obs.	7,853		7,853		7,853			7,853		
Females: Marginal effect using MNP	-0.0792* (0.0217)	-0.5104* (0.0957)	-0.0798* (0.0214)	-0.5090* (0.1092)	-0.0738* (0.0230)	-0.3728* (0.2105)	-0.1277* (0.0223)	-0.0734* (0.0240)	-0.3678* (0.2635)	-0.1283* (0.0231)
Marginal effect using MNL	-0.0824* (0.0050)	-0.4990* (0.0884)	-0.0825* (0.0053)	-0.4985* (0.0987)	-0.0808* (0.0109)	-0.3585* (0.0232)	-0.1209* (0.0126)	-0.0808* (0.0106)	-0.3551* (0.0273)	-0.1209* (0.0123)
Obs.	7,503		7,503		7,503			7,503		

Notes: *Significant at 5% level. We conduct 1,000 replications, and Stata's *bootstrap* can incorporate *clustered* but cannot incorporate sampling weights.

ACKNOWLEDGEMENTS. We thank the participants of the 2023 Shi Hsin University Conference for their valuable comments on earlier drafts of this paper. We especially thank the National Health Research Institutes for providing the data.

References

[1] Kestel, D., Lewis , S., Freeman, M., Chisholm, D., Siegl , O.G. and van Ommeren, M. (2022). A world report on the transformation needed in mental health care. Bulletin of the World Health Organization, 100(10), p. 583.

[2] Canady, V.A. (2023). NSDUH report highlights MH issues among youth and adults. Mental Health Weekly, 33(45), pp. 5 - 6.

[3] European Observatory on Health Systems and Policies. (2023). State of Health in the EU Germany: Country Health Profile 2023, OECD Publishing.

[4] Ishikawa, H., Tachimori, H., Takeshima, T., Umeda, M., Miyamoto, K., Shimoda, H., Baba, T. and Kawakami, N. (2018). Prevalence, treatment, and the correlates of common mental disorders in the mid 2010′ s in Japan: The results of the world mental health Japan 2nd survey. Journal of affective disorders, 241, pp. 554 - 562.

[5] Barrett, B., Byford, S. and Knapp, M. (2005). Evidence of cost-effective treatments for depression: a systematic review. Journal of affective disorders, 84(1), pp. 1 - 13.

[6] Ettner, S.L., Frank, R.G. and Kessler, R.C. (1997). The impact of psychiatric disorders on labor market outcomes. ILR Review, 51(1), pp. 64 - 81.

[7] Mullahy, J. and Sindelar, J. (1990). Gender differences in the effects of mental health on labor force participation. Research in Human Capital and Development, 6, pp. 125 - 146.

[8] Chatterji, P., Alegria, M. and Takeuchi, D. (2011). Psychiatric disorders and labor market outcomes: Evidence from the National Comorbidity Survey-Replication. Journal of Health Economics, 30(5), pp. 858 - 868.

[9] International Labour Organization. (2019a). Promoting Employment Opportunities for People with Disabilities, Quota Schemes (Vol. 1).

[10] Lechner, M. and Vazquez-Alvarez, R. (2011). The effect of disability on labour market outcomes in Germany. Applied Economics, 43(4), pp. 389 - 412.

[11] Hasegawa, T. (2010). Japan's Employment Measures for Persons with Disabilities: Centered on Quota System of "Act on Employment Promotion of Persons with Disabilities". Japan Labor Review, 7(2), pp. 26 - 42.

[12] Yamada, M. (2024). Human Rights-Based CSR as the Driver for Disability Inclusion in Business Based on the Employment of Persons with Disabilities and Diversity and Inclusion (D&I) in Japanese Corporations. Journal of Japan Society for Business Ethics Study, 31, pp. 251 - 263.

[13] International Labour Organization. (2019b). Promoting Employment Opportunities for People with Disabilities, Quota Schemes (Vol. 2).

[14] Alexandre, P.K. and French, M.T. (2001). Labor Supply of Poor Residents in Metropolitan Miami, Florida: The Role of Depression. The Journal of Mental Health Policy and Economics, 4(4), pp. 161 - 173.

[15] Banerjee, S., Chatterji, P. and Lahiri, K. (2017). Effects of psychiatric disorders on labor market outcomes: a latent variable approach using multiple clinical indicators. Health economics, 26(2), pp. 184 - 205.

[16] Bartel, A. and Taubman, P. (1979). Health and labor market success: The role of various diseases. The Review of Economics and Statistics, 61(1), pp. 1 - 8.
[17] Benham, L. and Benham, A. (1982). Employment, earnings, and psychiatric diagnosis. In Economic Aspects of Health, University of Chicago Press, pp. 203 - 220.
[18] Burnett-Zeigler, I., Ilgen, M.A., Bohnert, K., Miller, E., Islam, K. and Zivin, K. (2013). The impact of psychiatric disorders on employment: Results from a national survey (NESARC). Community Mental Health Journal, 49(3), pp. 303 - 310.
[19] Germinario, G., Amin, V., Flores, C.A. and Flores-Lagunes, A. (2022). What can we learn about the effect of mental health on labor market outcomes under weak assumptions? Evidence from the NLSY79. Labour Economics 79, pp. 102258.
[20] Marcotte, D.E. and Wilcox-Gök, V. (2001). Estimating the employment and earnings costs of mental illness: recent developments in the United States. Social Science & Medicine, 53(1), pp. 21 - 27.
[21] Marcotte, D.E., Wilcox-Gok, V. and Redmon, D.P. (2000). The labor market effects of mental illness: The case of affective disorders. Research in Human Capital and Development, 13, pp. 181 - 210.
[22] Mitchell, J.M. and Anderson, K.H. (1989). Mental health and the labor force participation of older workers. Inquiry, 26(2), pp. 262 - 271.
[23] Shen, Y. (2023). Mental health and labor supply: Evidence from Canada. SSM Population Health, 22, pp. 101414.
[24] Tefft, N. (2012). Mental health and employment: the SAD story. Economics & Human Biology, 10(3), pp. 242 - 255.
[25] Cau, Q., Gandré, C. and Lengagne, P. (2025). Recurrent major depression, employment and transitions to unemployment and disability benefits. Social Science & Medicine, 377, pp. 118056.
[26] Evans-Lacko, S., Knapp, M., McCrone, P., Thornicroft, G. and Mojtabai, R. (2013). The mental health consequences of the recession: Economic hardship and employment of people with mental health problems in 27 European countries. PloS ONE, 8(7), pp. 1 - 7.
[27] Harber-Aschan, L., Chen, W.H., McAllister, A., Koitzsch Jensen, N., Thielen, K., Andersen, I., Diderichsen, F., Barr, B. and Burström, B. (2020). The impact of longstanding illness and common mental disorder on competing employment exits routes in older working age: A longitudinal data-linkage study in Sweden. PloS ONE, 15(2), pp. e0229221.
[28] Ringdal, C. and Rootjes, F. (2022). Depression and labor supply: Evidence from the Netherlands. Economics and Human Biology, 45, pp. 101103.
[29] Frijters, P., Johnston, D.W. and Shields, M.A. (2014). The effect of mental health on employment: Evidence from Australian panel data. Health Economics, 23(9), pp. 1058 - 1071.
[30] Zhang, X., Zhao, X. and Harris, A. (2009). Chronic diseases and labour force participation in Australia. Journal of health economics, 28 (1), pp. 91 - 108.

[31] Chatterji, P., Alegria, M., Lu, M. and Takeuchi, D. (2007). Psychiatric disorders and labor market outcomes: Evidence from the National Latino and Asian American Study. Health Economics, 16(10), pp. 1069 - 1090.
[32] Chang, H.H. and Yen, S.T. (2011). Mental Health and Employment of the Elderly in Taiwan: A Simultaneous Equation Approach. Pacific Economic Review,16(4), pp. 504 - 519.
[33] Jirapramukpitak, T., Pattanaseri, K., Chua, K.C. and Takizawa, P. (2018). Estimating Impact Based on Stages of Mental Illness on Employment and Earnings in Bangkok Metropolitan Region. The Journal of Mental Health Policy and Economics, 21(4), pp. 163 - 170.
[34] Ojeda, V.D., Frank, R.G. McGuire, T.G. and Gilmer, T.P. (2010). Mental illness, nativity, gender and labor supply. Health Economics, 19(4), pp. 396 - 421.
[35] Lim, D., Sanderson, K. and Andrews, G. (2000). Lost productivity among full-time workers with mental disorders. The Journal of Mental Health Policy and Economics, 3(3), pp. 139 - 146.
[36] Bjørnshagen, V. and Ugreninov, E. (2021). Disability disadvantage: experimental evidence of hiring discrimination against wheelchair users. European Sociological Review, 37(5), pp. 818 - 833.
[37] Jones, M.K., Latreille, P.L. and Sloane, P.J. (2006). Disability, gender, and the British labour market. Oxford Economic Papers, 58(3), pp. 407 - 449.
[38] Mori, Y. and Sakamoto, N. (2018). Economic consequences of employment quota system for disabled people: Evidence from a regression discontinuity design in Japan. Journal of the Japanese and International Economies, 48, pp. 1 - 14.
[39] Vijan, S., Hayward, R.A. and Langa, K.M. (2004). The impact of diabetes on workforce participation: results from a national household sample. Health services research, 39(6p1), pp. 1653 - 1670.
[40] Derogatis, L.R., Morrow, G.R., Fetting, J., Penman, D., Piasetsky, S., Schmale, A.M., Henrichs, M. and Carnicke, C.L. (1983). The prevalence of psychiatric disorders among cancer patients. JAMA, 249(6), pp. 751 - 757.
[41] Mittendorfer-Rutz, E., Ivert, T., Vaez, M. and Dorner, T.E. (2018). Synergistic effect between ischaemic heart disease and common mental disorders and the risk of premature exit from the labour market: a nationwide register based study from Sweden. European Heart Journal, 39(7), pp. 578 - 585.
[42] Godin, I., Kittel, F., Coppieters, Y. and Siegrist, J. (2005). A prospective study of cumulative job stress in relation to mental health. BMC Public Health, 5(1), p. 67.
[43] Theodossiou, I. (1998). The effects of low-pay and unemployment on psychological well-being: A logistic regression approach. Journal of Health Economics, 17(1), pp. 85 - 104.
[44] Drake, R.E. and Wallach, M.A. (2020). Employment is a critical mental health intervention. Epidemiology and Psychiatric Sciences, 29(e178), pp. 1 - 3.

[45] Böckerman, P. and Ilmakunnas, P. (2009). Unemployment and self-assessed health: evidence from panel data. Health economics, 18(2), pp. 161 - 179.
[46] Morris, S. (2007). The impact of obesity on employment. Labour Economics, 14(3), 413-433.
[47] Aneshensel, C.S. and Sucoff, C.A. (1996). The neighborhood context of adolescent mental health. Journal of health and social behavior, 37(4), pp. 293 - 310.
[48] Sui, Y., Ettema, D. and Helbich, M. (2022). Longitudinal associations between the neighborhood social, natural, and built environment and mental health: A systematic review with meta-analyses. Health & place, 77, pp. 102893.
[49] Tampubolon, G. (2011). Neighbourhood social capital and individual mental health. In Neighbourhood effects research: New perspectives, pp. 175 - 193. Dordrecht: Springer Netherlands.
[50] Boskin, M.J. (1974). A conditional logit model of occupational choice. Journal of Political Economy, 82(2, Part 1), pp. 389 - 398.
[51] Schmidt, P. and Strauss, R.P. (1975). The prediction of occupation using multiple logit models. International Economic Review, 16(2), pp. 471 - 486.
[52] Dow, J.K. and Endersby, J.W. (2004). Multinomial probit and multinomial logit: a comparison of choice models for voting research. Electoral studies, 23(1), pp. 107 - 122.
[53] Kinge, J.M. (2016). Body mass index and employment status: a new look. Economics & Human Biology, 22, pp. 117 - 125.
[54] Maddala, G. (1983). Limited-Dependent and Qualitative Variables in Econometrics, Cambridge University Press, New York.
[55] Holly, A. and Denis, S.J. (1982). Testing for exogeneity within a limited information framework No. 8204), Ecole des HEC.
[56] Greene, W.H. (2018). Econometric Analysis 8th edition, Pearson Education, USA.
[57] Wooldridge, J.M. (2002). Econometric analysis of cross section and panel data, MIT press.
[58] Cameron, A.C. and Trivedi, P.K. (2005). Microeconometrics: Methods and Applications, New York: Cambridge University Press.
[59] Chien, I.C., Chou, Y.J., Lin, C.H., Bih, S.H. and Chou, P. (2004). Prevalence of psychiatric disorders among National Health Insurance enrollees in Taiwan. Psychiatric Services, 55(6), pp. 691 - 697.