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THE INFLUENCE OF MENTAL HEALTH ON JOB
RETENTION

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The influence of mental health on job retention¹

Thomas Barnay² and Éric Defebvre³

Abstract: Our objective is to measure the causal impact of the self-assessed mental health status of 2006 (anxiety disorders and depressive episodes) on employment in 2010. We use data from the French Health and Professional Route survey (Sip, “Santé et itinéraire professionnel”). In order to control for endogeneity biases coming from the mental health indicator, we use bivariate probit models explaining simultaneously employment status and mental health. We control these results by observing the individual, employment, general health status, risky behaviours and professional characteristics. Our main findings are as follow: men suffering from depression or anxiety are up to 13 percentage points less likely to remain in their job. We do not find such a relationship in women, after controlling for general health status. The robustness checks conducted on age and specifically those taking into account for the 2007-2010 period confirm these results.

JEL: I14, I18, C35, C36

Keywords: Mental health, Employment, Instrumental variables

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Introduction

Mental health (covering psychiatric disorders and psychotropic drug treatments without psychiatric pathologies identified in the health insurance database) accounts for 15% of the expenses of the CNAM-TS (National health insurance fund for salaried workers) in 2011, an expenditure superior to that of cancer treatment. More than seven million people are affected in France. Mental health problems are the cause of reduced work productivity and an increase in unemployment and sick-leaves, which would account for 3 to 4% of GDP according to the International Labour Organisation (2000) and explain 40% of physical disabilities in high-income countries according to the World Health Organization (2010). In addition, the Psychiatry and Mental Health Plan 2011-2015 demonstrates the major role of mental health in current social issues. It explicitly states that access to – and retention in – employment for individuals with mental illnesses requires better support.

The issue of job retention for people with mental disorders appears to be essential for several reasons. It is established that overwork deteriorates both physical and mental health (Bell *et al.*, 2012). Moreover, the intensity of work (high pace and lack of autonomy) and job insecurity lead employees to face more arduous situations. In addition part-time, when not chosen, affects mental health (Robone *et al.*, 2011).

The relationship between mental health and employment has been widely documented in the literature, establishing a two-way causality between the two. A precarious job or exposure to detrimental working conditions can affect mental health. Self-reported health indicators are also characterized by justification biases and measurement errors as well as reporting social heterogeneity (Akashi-Ronquest *et al.*, 2011; Etilé and Milcent, 2006; Shmueli, 2003). Mental health, when subjective, is specifically associated with a measurement bias prompting to unravel the links between physical and mental health. Just like for physical health status, selection effects are also at work, an individual with mental disorders being found less often in employment. Mental health measurements are also potentially subject to a specific selection bias linked to the psychological inability to answer questionnaires.

Our goal is to establish a proper causality of mental health on job retention using French data. This study is inspired by Jusot *et al.* (2008) who measure the impact of physical health and risky behaviours on leaving employment four years later. While many studies focus on the role of mental health on employability, not a lot of them acknowledge its impact on workers' capacity to remain in their jobs. We also expand on the literature by considering the endogeneity biases generated by reverse causality (effect of employment on mental health). Another addition is that we take into account for the role of physical health status which may very well act, when unaccounted for, as a confounding factor when analysing the specific effect of mental health on employment outcomes. To our knowledge, no French study has empirically measured the specific effect of mental health on job retention while addressing these biases.

To do this, we use data from the Health and Professional Route survey (Sip), which allows the collection in 2006 of a set of indicators (socio-economic characteristics, health and risky behaviours), but also on the career characteristics from a complete retrospective questionnaire on employment and health events of more than 13,000 individuals. A temporal dimension is allowed by a second wave in 2010. The mental health indicators are based on self-reported measurements for generalized anxiety disorders (GAD) and major depressive episodes (MDE). Using bivariate probit models, we evaluate the causal effect of self-reported mental health in 2006 on employment in 2010 after controlling for reverse causality. The challenge is

then to identify one or more instruments explaining mental health status in 2006 while meeting the validity assumption.

We articulate our article as follows. We expose in a literature review the main empirical results linking mental health and employment status. We then present the database and empirical strategy. A final section presents the results and concludes.

1. The links between mental health and employment

1.1. Mental health measurements

The economic literature establishing the role of mental health on employment mainly retains two definitions of mental health. The first one focuses on heavy mental disorders, such as psychoses (Bartel and Taubman, 1986). Notably, many studies evaluate the ability to enter the labour market of individuals with schizophrenia (Greve and Nielsen, 2013). The second one is based on more common but less disabling disorders such as stress. Often used to assess mental health, these disorders are observed using standardized measures and are presented in the form of scores. Thus, the Kessler Psychological Distress Scale (K-10) allows, from 10 questions about the last 30 days, to evaluate individuals' overall mental state (Dahal and Fertig, 2013; Kessler *et al.*, 2001; Zhang *et al.*, 2009). Like in the K-10 questionnaire, the Short-Form General Health Survey (SF-36) evaluates mental health over the past four weeks with questions about how the individuals feel (excitement, sadness, lack of energy, fatigue, ...) (Frijters *et al.*, 2014). Another, quite similar score was built, this time focusing senior workers (age 50-64): the Center for Epidemiologic Studies Depression Scale (CES-D), with more specific questions such as isolation and self-esteem (Chang and Yen, 2011).

However the simplification risk linked to the aggregate nature of scores justified the setup of other indicators to better approximate the true mental health diagnosis. Indicators of generalized anxiety disorders and major depressive episodes were then used, allowing a further analysis of mental health (Banerjee *et al.*, 2015; Chatterji *et al.*, 2011). They allow to identify the population suffering from these disorders and their symptoms (see Appendix 1 and Appendix 2). Despite their specificity and without being perfect substitutes to a medical diagnosis, these indicators prove robust to detect common mental disorders.

In addition, the subjective nature of the declaration of health in general and particularly of mental health, makes it difficult to make comparisons between two apparently similar declarations (Zhang *et al.*, 2009), notably due to reporting biases (Devaux *et al.*, 2008; Shmueli, 2003). Devaux *et al.* (2008) try to assess the importance of reporting biases in mental health and unveil that a *latent health condition* greatly contributes to mental health: two individuals may declare different mental health conditions depending on their physical health status. A person with a poor physical condition will indeed be more likely to report a more degraded mental health status than a person in good physical health condition. Leach *et al.* (2008) confirm these results and show a strong correlation between physical and mental health, particularly among women.

1.2. The influence of mental health on employment: a short literature review

1.2.1. Methodological difficulties

If the measurement of mental health from declarative data is not trivial, the relationship between mental health and employment is also tainted by endogeneity biases associated with reverse causality and omitted variables. From a structural point, we can quite easily conceive that if mental health and employment are observed simultaneously, the relationship appears to

be bidirectional (Banerjee *et al.*, 2015; Chatterji *et al.*, 2011). In particular, being unemployed may impair individuals' mental health (Mossakowski, 2009).

The omission of variables leads to unobserved heterogeneity, which is also potentially a source of endogeneity when measuring the impact of mental health on employment. Risk preferences (Zhang *et al.*, 2009), workers' involvement at work and the ability to give satisfaction (Nelson and Kim, 2008), personality traits, family background (Banerjee *et al.*, 2015), risky behaviours (smoking, alcohol and overweight) are related to mental health as much as employment. These factors, remaining unobservable for some of them in household surveys, therefore act as confounders. Zhang *et al.* (2009) conclude, from Australian data (pooled data from the National Health Survey – NHS) and multivariate probit methods, that tobacco consumption in men and women as well as overweight in women increase the risk of reporting mental disorders. These behaviours are also shown to have a specific effect on the situation on the labour market (Jusot *et al.*, 2008).

Finally, it is possible to highlight some justification biases. Individuals may alter their health status declarations in order to rationalize their choices on the labour market in front of the interviewer (Zhang *et al.*, 2009). For example, the non-participation to the labour market can be justified *ex-post* by the declaration of a worse health status. Lindeboom and Kerkhofs (2009) showed on Dutch panel data using fixed effects models, that economic incentives are likely to distort health status declarations. This still seems to be the case on Irish panel data and after controlling for unobserved heterogeneity (Gannon, 2009).

1.2.2. *Effects of mental health on employment*

To address these methodological issues, the empirical literature makes use of instrumental variables and panel data models allowing to take care of unobserved heterogeneity by including fixed effects and reverse causality by a time gap between exogenous variables and the outcome.

Whatever the mental health indicators, the various studies appear to converge on a detrimental role of deteriorated mental health on employment outcomes. Thus, Banerjee *et al.* (2015) find, using bivariate Probit models and Two-Stage Least Squares (2SLS) performed on cross-sectional data, that people suffering from mental disorders (major depressive episodes and generalized anxiety disorders) in the 12 last months are much less likely to be in employment than others at the time of the survey. They do not find a significant effect of these mental conditions on the number of weeks worked and days of sick-leaves in individuals in employment after controlling for socioeconomic characteristics, chronic diseases and the area of residence in the U.S. territory. Chatterji *et al.* (2011) show, on cross-sectional data using two-stage (2SLS and bivariate probit) and Altonji Elder and Taber modelling (AET – Altonji *et al.*, 2005) and taking into account unobserved heterogeneity, that these mental disorders appearing in the last 12 months reduce by an average of 15% the likelihood to be in employment at the time of the survey. An American study, resorting in instrumental variable methods, found that most people with mental disorders are in employment, but more pronounced symptoms reduce their participation in the labour market (Ojeda *et al.*, 2010). Finally, simultaneous modelling on Taiwanese pooled data confirms that a degraded mental health decreases the probability of working, while specifying that the prevalence of these disorders is lower among workers, thus inducing a protective effect of work on mental health (Chang and Yen, 2011). Cottini and Lucifora (2013) also confirm reverse causality in the relationship, using instrumental variables in three waves of the European Working Conditions Survey (EWCS), stressing the negative effects of poor working conditions on mental health.

These overall effects are heterogeneous according to age and gender. Zhang *et al.* (2009) conducted stratified regressions on two age groups: the 18-49 years-old on the one hand and the 50-64 years-old on the other hand and find that mental health-related discriminations on the labour market are greater in middle-aged workers than for older workers. Gender effects are also important. The role of mental disorders on employment seems stronger in men (Ojeda *et al.*, 2010; Zhang *et al.*, 2009). However, there is no consensus on this fact in the literature. Frijters *et al.* (2014) show a stronger effect of mental health on women's employment, using Australian panel data (Household, Income and Labour Dynamics in Australia – HILDA) and several models, including bivariate Probit and fixed effects model.

1.3. What instrument(s) for mental health?

It is necessary to identify an instrument whose influence on mental health is established in the empirical literature (1.3.1.) without being correlated to other explanatory factors and unobserved characteristics (1.3.2.).

1.3.1. *The determinants of mental health*

Determinants and other factors related to mental health are numerous in the literature and can be classified into three categories: social determinants, major life events and work-related factors.

Social factors refer to the society role of the individual and to his/her social relationships. Plaisier *et al.* (2008) identify three types of social roles being correlated with a better mental health condition: the role of partner, parent and worker. Being in a relationship is associated with a stronger declaration of good mental health and a lower risk of depression and anxiety (Kelly *et al.*, 2011; Plaisier *et al.*, 2008). Endorsing the two roles of parent and partner seems linked to a better mental health. Professional activity can slow the depreciation rate of one's mental health capital, as shown by a study on panel data taking into account the endogenous nature of the relationship between health and employment (Llena-Nozal *et al.*, 2004). In contrast, Artazcoz *et al.* (2004) show that unemployment is often correlated with worse mental health status among men and in women to a lesser extent. The combinations of these roles correspond to increased chances of reporting good mental health condition by 39% (Artazcoz *et al.*, 2004; Plaisier *et al.*, 2008).

Major life events also play a role in the determination of mental health. Unemployment and furthermore inactivity occurring during the beginning of professional life can induce the onset of depressive symptoms later on, as shown on U.S. panel data by Mossakowski in 2009. Using a fixed effects framework on panel data, Lindeboom *et al.* (2002) establish that events such as illnesses or death of a close relative or partner impairs mental health. Moreover, marital separations and serious disputes within or outside the couple seem correlated with poorer mental health (Dalgard *et al.*, 2006; Kelly *et al.*, 2011). Past or present financial problems are also often associated with the occurrence of common mental disorders such as depression and anxiety (Laaksonen *et al.*, 2008; Weich and Lewis, 1998), as well as the deterioration of physical health (especially in women) (Leach *et al.*, 2008). A poor health status or the presence of disability during childhood also has negative consequences on mental health at older ages and on the declaration of chronic diseases, regardless of the onset age (Llena-Nozal *et al.*, 2004).

Work-related factors may also have an effect on mental health. Atypical labour contracts such as part-time increase the occurrence of depressive symptoms in employees (Santin *et al.*, 2009). Bildt and Michélsen (2002) show, using multivariate models, that exposure to detrimental working conditions can have a deleterious effect on mental health four years later,

with gender-related differences. Men would be most affected by changes in tasks and a lack of recognition at work when in women, other specific conditions such as the role of the lack of training and lack of motivation and support at work are highlighted. Other factors linked to gender and associated with poorer mental health are found by Cohidon *et al.* (2010): the preponderance of work, contacts with the public, repetitive tasks and the lack of cooperation in the work in men and the early beginning of career and involuntary interruptions in women.

1.3.2. Instruments in the literature and choices in our study

In the diversity of explanatory factors for mental health, only some of them have been retained in the economic literature as valid and relevant instruments. Frijters *et al.* (2014) used the death of a close friend intervened in the twelve months preceding the survey as an instrument for mental health. Hamilton *et al.* (1997) used the stressful events in life, the regularity of sport and a lagged mental health indicator, the latter being also used by Banerjee *et al.* (2015). The psychological status of parents (Ettner *et al.*, 1997; Marcotte *et al.*, 2000), that of children (Chatterji *et al.*, 2011; Ettner *et al.*, 1997), social support (Alexandre and French, 2001; Hamilton *et al.*, 1997; Ojeda *et al.*, 2010), or changes in healthcare legislation, job security and flexibility of working time (Cottini and Lucifora, 2013) were also frequently introduced. These factors were privileged because of them being valid determinants of mental health while meeting the exogeneity assumption, either because of their temporal distance from the other factors explaining employment or because of their absence of direct effects on employment. We make use of this literature by choosing proxies of mental health during childhood (violence suffered during this period and having been raised by a single parent) and an indicator for psychological status and social support during adult life (marital breakdowns), with a different approach according to gender, as suggested by the literature. Doing so, we put some temporal distance between these events and employment status (events occurring during childhood are observed up to 18 years-old whereas our working sample includes only individuals aged 30 and older; marital ruptures occur before 2006), and there is a low probability of direct effects of these instruments on the employment status in 2010, the professional route characteristics, employment at the time of the survey and risky behaviour being also controlled for.

2. Empirical analysis

2.1. The Health and Professional Route survey

The Health and Professional Route survey (Sip) used in this study provides access to a particularly detailed individual description. Besides the usual socioeconomic variables (age, gender, activity sector, professional category, educational level, marital status), specific items are provided about physical and mental health. The survey was conducted jointly by the French Ministries in charge of Healthcare and Labour and includes two waves (2006 and 2010), conducted on the same sample of people aged 20-74 years living in private households in metropolitan France. The 2010 wave was granted with an extension to better assess psychosocial risk factors. Two questionnaires are available: the first one is administered by an interviewer and accurately informs the individual and job characteristics and the current health status of the respondents. It also contains a biographical lifegrid to reconstruct individual careers and life events: childhood, education, health, career changes, working conditions and significant life events. The second one is a self-administered questionnaire targeting risky health behaviours (weight, cigarette and alcohol consumption). It informs current or past tobacco and alcohol consumption (frequency, duration, *etc.*). A total of 13,648 people were interviewed in 2006, and 11,016 of them again in 2010.

In this study, we focus on people who responded to the survey both in 2006 and 2010, *i.e.* 11,016 people. We select individuals aged 30-55 years in employment in 2006 to avoid including students (see Appendix 3 and Appendix 4 for a discussion of the initial selection made on the sample in 2006 and a note on attrition between the two waves). The final sample thus consists of 4,133 individuals, including 2,004 men and 2,129 women.

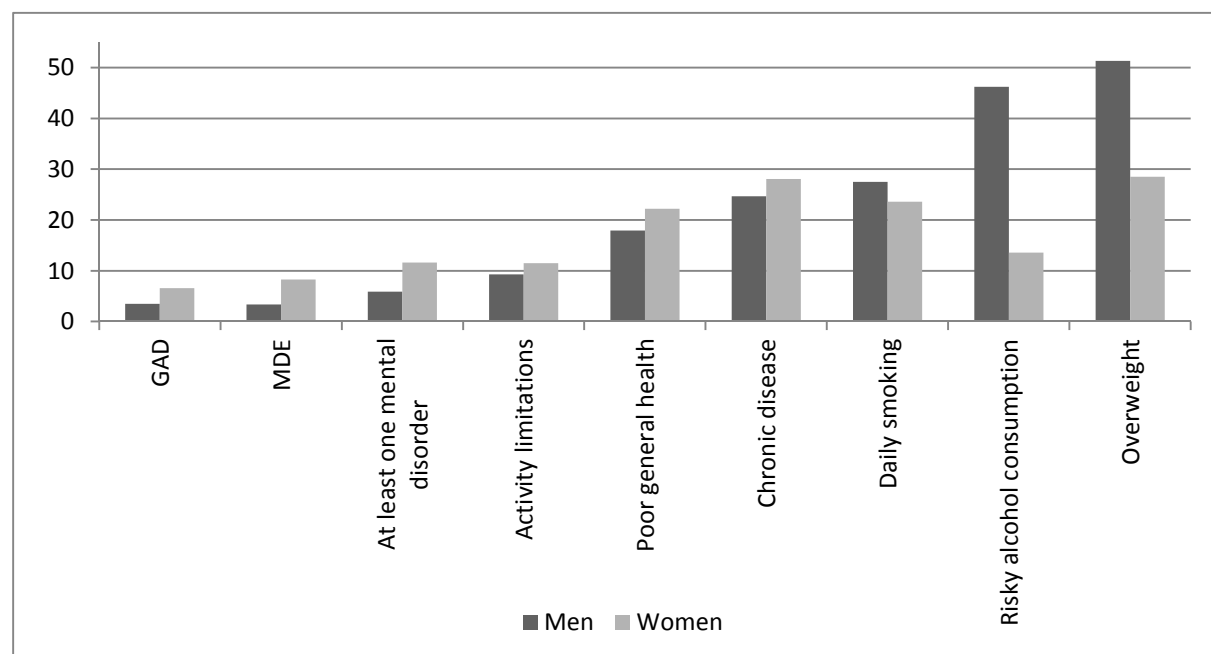
2.2. Descriptive statistics

2.2.1. Health status of the employed population in 2006

The description of the general sample is presented in Table 10. To broadly understand mental health, we use major depressive episodes (MDE) and generalized anxiety disorder (GAD), from the *Mini International Neuropsychiatric Interview* (MINI), based on the *Diagnostic and Statistical Manual of Mental disorders* (DSM-IV). These indicators prove particularly robust in the Sip survey (see Appendix 5). Around 6% of men and 12% of women in employment in 2006 report having at least one mental disorder (Figure I).

Women report more frequent physical or mental health problems: anxiety disorders (7%), depressive episodes (8%), poor perceived health status (22%) and chronic illness (28%) are more widely reported by women than by men (*resp.* 4%, 3 %, 18% and 25%). These response behaviours are frequently raised by the literature and testify at least for some of them of the presence of reporting biases (rather downward for men, and rather on the rise for women), as shown notably in Devaux *et al.* (2008) and Shmueli (2003). Conversely, risky behaviours are substantially more developed in men. It is the case for daily smoking (28% in men *vs.* 24% in women) but it is even more acute for alcohol consumption (46% *vs.* 14%) and overweight (51% *vs.* 29%).

Figure I: Prevalence of health problems in the population in employment in 2006



Reading: 6% of men and 12% of women report having at least one mental disorder (GAD or MDE) in 2006.

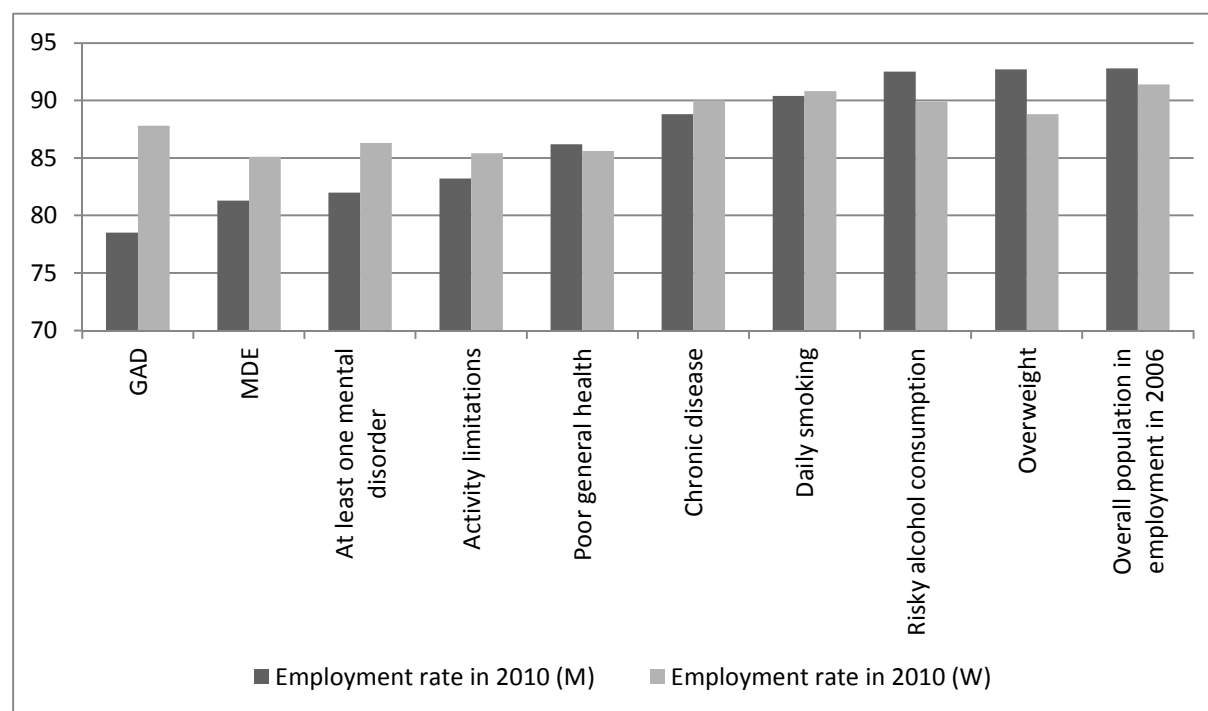
Field: individuals age 30-55 in employment in 2006.

Source: Sip (2006), weighted and calibrated statistics.

2.2.2. Health problems and job retention

82% of men in employment and suffering from at least one mental disorder in 2006 are still in employment in 2010, against 86% of women⁴. Anxiety disorders have the bigger influence: 79% of men are employed (vs. 88% of women). General health status indicators show fairly similar results for men and women. For risky behaviours, daily tobacco consumption showed no significant difference in employment rates between men and women while alcohol (93% vs. 90%) and overweight (93% vs. 89%) are associated with comparatively lower employment rates for women than for men (Figure II).

Figure II: Employment rates in 2010 according to self-reported health status in 2006



Reading: 82% of men in employment and suffering from at least one mental disorder (GAD or MDE) in 2006 are still in employment in 2010, against 86% of women.

Field: individuals age 30-55 in employment in 2006.

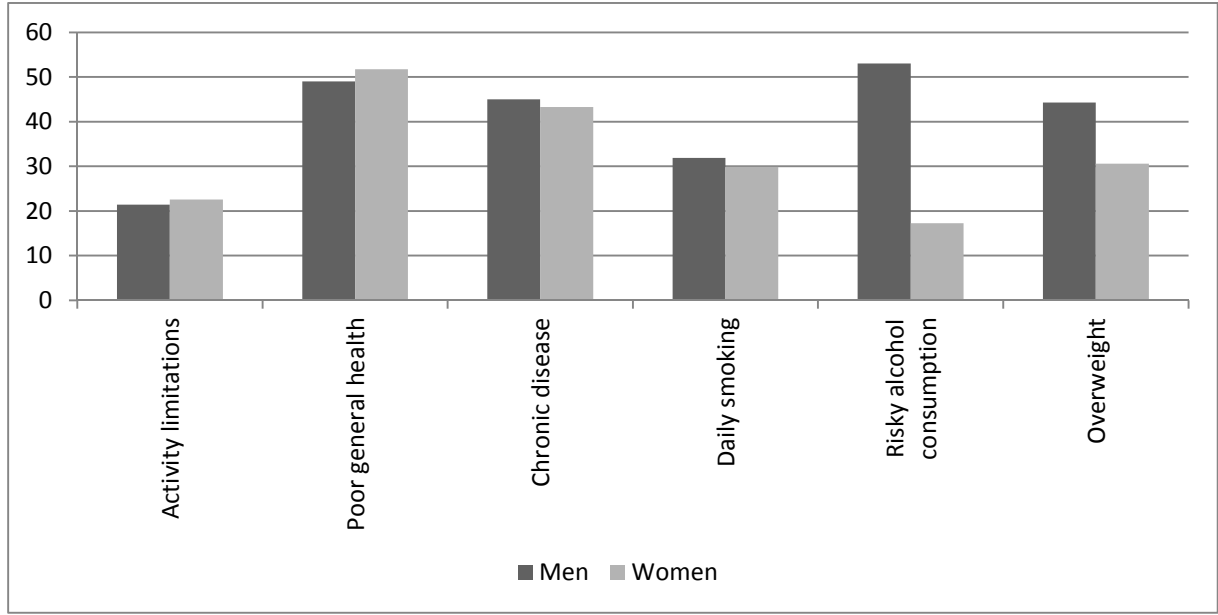
Source: Sip (2006), weighted and calibrated statistics.

2.2.3. Mental health and general health status

A strong correlation between general and mental health status is observed in the sample. About 20% of men and women suffering from at least one mental disorder also reported activity limitations against 10% in the entire sample with normal mental health condition (see Figure I). Nearly 50% of them report poor perceived health (vs. 20% overall). Chronic diseases (45% vs. 25%) and daily tobacco consumption (30% vs. 25%) are also more common among them. 53% of men and 17% of women with mental disorders declare risky alcohol consumption, against 46% and 13% *resp.* in the overall sample. Finally, overweight is declared by 44% of men and 31% of women with mental disorders, against *resp.* 51% and 29%. It is interesting to note that men with a mental disorder are less likely to report being overweight (Figure III).

⁴Given the weakness of some of the subsample sizes, one must be cautious about the conclusions suggested by these descriptive statistics on mental disorders. GAD are faced by 88 men and 195 women and MDE respectively by 91 and 236. 150 men and 335 women declare suffering from at least one mental disorder.

Figure III: General health status of anxious and/or depressed individuals in 2006



Reading: 53% of men reporting mental disorders in 2006 also have risky alcohol consumption in 2006, against 17% of women.

Field: individuals age 30-55 in employment in 2006 who reported having at least one mental health disorder.

Source: Sip (2006), weighted and calibrated statistics.

2.3. Econometric strategy

2.3.1. Univariate models

The econometric strategy is based on two steps to correct individual heterogeneity and the possibility of reverse causality.

In a first step, we initiate binomial univariate probit models to estimate, among people in employment in 2006, the effect of mental health in 2006 on the likelihood to remain in employment in 2010 (in employment *vs.* unemployed – dependent variable y_{i2010}). Several specifications are tested and we stratify by gender for each one of them due to strong gendered differences in mental health linked to social heterogeneity in declarations (Artazcoz *et al.*, 2004; Devaux *et al.*, 2008; Leach *et al.*, 2008). We take a three-step strategy to gradually add relevant variable groups in the model and thus assess the robustness of the correlation between mental health in 2006 and employment in 2010 by gradually identifying confounders.

The first baseline specification (1) explains job retention by mental health status, controlling for a set of standard socioeconomic variables:

$$y_{i2010} = \alpha Ment_{i2006} + \beta SocEco_{i2006} + \varepsilon_i \quad (1)$$

With $Ment_{i2006} = \begin{cases} 1 & \text{if } (GAD = 1) \text{ or } (MDE = 1) \text{ or } (GAD \text{ and } MDE = 1) \\ 0 & \text{otherwise} \end{cases}$

Mental health in 2006 ($Ment_{i2006}$) is represented by a binary variable taking the value 1 when individual i is suffering from a generalized anxiety disorder or a major depressive episode, or both. Socio-economic variables are represented by the vector $SocEco_{i2006}$. They include age (in five-year increments from 30 to 55 years), marital status, presence of children, educational level, professional category, industry sector, type of employment (public, private,

or independent) and part-time work. Age plays a major role on the employability of individuals and in the reporting of mental disorders (Devaux *et al.*, 2008; Shmueli, 2003). Current marital status and the presence of children in the household can also affect employability (especially in women) and reported mental health since people in a relationship with children turn out to be in better health status (Artazcoz *et al.*, 2004; Plaisier *et al.*, 2008). Work characteristics are also integrated (Llena-Nozal *et al.*, 2004).

An intermediate specification (2) is then performed with the addition of three variables from the European Mini-Module about individuals' general health status: their perceived health (taking the value 1 if it is good, and 0 for poor health), the fact that they suffer from chronic diseases or not and whether they are limited in their daily activities. These health status indicators are used in order to effectively isolate the specific effect of mental health on the position on the labour market (to disentangle it from the one of the *latent general health status* – Devaux *et al.*, 2008). This model also includes three variables of risky behaviours: being a daily smoker, a drinker at risk or overweight. The objective of these variables is to determine to which extent the role of mental health does not go partly through risky behaviours (Butterworth *et al.*, 2012; Jusot *et al.*, 2008; Lim *et al.*, 2000). Such behaviours are indeed known to affect the reporting of activity limitations in general (Arterburn *et al.*, 2012), employability (Paraponaris *et al.*, 2005), or the incidence of disease and premature mortality (Teratani *et al.*, 2012) as well as work-related accidents (Bourgakard *et al.*, 2008; Teratani *et al.*, 2012).

Finally, the last specification (3) adds two variables related to the professional route, reconstructed using retrospective information which is likely to play a role on the individual characteristics in 2006 and employment transitions observed between 2006 and 2010. The objective is to control our results of potentially unstable careers (status dependence phenomenon), leading to a greater fragility in the labour market (Kelly *et al.*, 2011; Mossakowski, 2009). These variables include time spent in contracts of more than 5 years and the stability of the employment path, represented by the number of transitions made between jobs over 5 years, short periods of employment, periods of unemployment of more than one year and periods of inactivity.

$$y_{i2010} = \alpha Ment_{i2006} + \beta SocEco_{i2006} + \delta GenHealth_{i2006} + \gamma PR_i + \varepsilon_i \quad (3)$$

$$\text{With } Ment_{i2006} = \begin{cases} 1 & \text{if } (GAD = 1) \text{ or } (MDE = 1) \text{ or } (GAD \text{ and } MDE = 1) \\ 0 & \text{otherwise} \end{cases}$$

General health status variables and risky behaviours in 2006 are presented in vector $GenHealth_{i2006}$ and control variables on the professional route are included in the PR_i vector. Thus, the relationship between the employment status of 2010 and mental health status in 2006 is controlled for general health status, health-related risky behaviours and elements linked to the professional route.

However, as widely explained in the literature, our mental health variable potentially suffers from endogeneity biases. Direct reverse causality is most likely ruled out since there is a time gap between our measure of mental health (2006) and that of employment (2010) and the fact that the nature of the past professional career (and status in employment in 2006 *de facto*) are taken into account. However, some individual characteristics (unobserved individual heterogeneity) linked not only to employment but also to mental health are not included in our model and the measurement of mental health is likely to be biased. We are in the presence of an endogenous mental health variable, due to the likelihood of social heterogeneity in declarations and omitted variables.

2.3.2. Handling endogeneity biases

In order to take into account this endogeneity, we set up a bivariate probit type of modelling. As suggested by the literature (Chatterji *et al.*, 2011; Frijters *et al.*, 2014; Ojeda *et al.*, 2010) dealing with biases related to mental health variables, we set up a methodology using bivariate probit modelling estimated by maximum likelihood. It is somewhat equivalent to the conventional linear two-stage approaches. The two equations to estimate can be written as follow:

$$y_{i2010} = \alpha Ment_{i2006} + \beta SocEco_{i2006} + \delta HealthGen_{i2006} + \gamma PR_i + \varepsilon_i \quad (4)$$

$$Ment_{i2006} = \phi Contr_i + \mu_i \quad (5)$$

Where the vector $Contr_i$ contains the same socio-economic, employment, general health status, risky behaviours and individual professional career characteristics as in specification (4) and where ε_i and μ_i are the respective residuals for equations (4) and (5). Despite the inclusion of these control variables, it is likely that the residuals of these two equations are correlated, inducing $\rho = Corr(\varepsilon_i, \mu_i | SocEco_{i2006}, HealthGen_{i2006}, PR_i) \neq 0$.

Several reasons can be stated. First, in the case of simultaneous observations of health status and employment outcomes, there is a high risk of reverse causality. In our case, to the extent that both are separated by several years, we limit this risk. However, it seems possible that there are unobserved factors that affect not only mental health condition but also the capacity to remain employed, such as individual preferences or personality traits. Notably, an unstable employment path before 2006 is one of the explanatory factors of the mental health of 2006 as well as of the employment status of 2010 (status dependence). Thus, only estimating equation (4) would result in omitting part of the actual model meaning it would not be correctly specified.

In such a case, a bivariate probit modelling is required in the presence of binary outcome and explanatory variables (Lollivier, 2006). A new specification (6) is therefore implemented, taking the form of a bivariate Probit model using specification (3) as the main model and simultaneously explaining mental health by three identifying variables (vector $Ident_i$):

$$\begin{cases} y_{i2010} = \alpha Ment_{i2006} + \beta SocEco_{i2006} + \delta HealthGen_{i2006} + \gamma PR_i + \varepsilon_i \\ Ment_{i2006} = \theta Ident_i + \phi Contr_i + \mu_i \end{cases} \quad (6)$$

We assume that the error terms follow a bivariate normal distribution:

$$\begin{bmatrix} \varepsilon_i \\ \mu_i \end{bmatrix} \rightarrow N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right]$$

In theory it is possible to estimate such a model without resorting to identifying variables (exclusion condition). However it is generally preferred, in the empirical literature, to base estimates on the exclusion criterion and use identifying variables. The identifying variables used in this study are chosen in line with the literature on the determinants of mental health status and are taken from Sip's lifegrid: we use the fact of having been raised by a single parent, having suffered from violence during childhood from relatives or at school and finally having experienced many marital breakdowns. We differentiate our instruments by gender⁵:

⁵ Following the dedicated literature indicating strong gender-linked relationships in the determinants for mental health, we decided to differentiate our instruments for men and women. Initial estimations including all three instruments (available upon request) have still been conducted, indicating similar yet less precise results.

for men, we retain having suffered violence and marital breakdown; for women, having suffered violence and having been raised by a single parent.

Using a binary endogenous variable of mental health, there is no real specialized test to assess the validity of our identifying variables. However, correlation tests have been conducted (presented in Table 13 and Table 14, Appendix 7) to determine if they are likely to meet the validity and relevance assumptions. According to these limited tests, our three identifying variables are likely to meet these assumptions. This intuition also tends to be confirmed by the estimates for ρ , the comparison of univariate and bivariate estimations for employment status (Table 1 and Table 2) and for mental health (Table 15, Appendix 7) (see section 3.2.). On a more theoretical standpoint, because we only consider individuals aged 30 or more in 2006 (*i.e.* being in employment since some time in 2010) and because violence and the fact of being raised by a single parent relate to events occurring during childhood (before age 18), we are confident that these variables should not have a direct impact on employment status in 2010 (especially considering the stability of career path is accounted for and because only individuals in employment are selected in our sample). On the other hand, marital breakdowns should not specifically be correlated with men's behaviour on the labour market.

3. Results

3.1. Poor mental health decreases the likelihood to remain in employment

We test three specifications of the probability of being employed in 2010 among people employed in 2006 in order to decompose the effect of mental health in 2006 but also to try taking into account for confounding factors.

The baseline model (specification 1) shows that men and women suffering from GAD and/or MDE in 2006 are less likely to remain in employment in 2010, after controlling for the individual and employment characteristics of 2006. Men in employment and declaring suffering from at least one mental disorder in 2006 are in average 9 percentage points (pp) less likely to remain in employment in 2010 (5pp less likely in women). The other determinants of employment however differ between men and women in agreement with what other French studies have observed (Barnay, 2005). In addition to mental health, in women, the predictors of unemployment are age (over 45), the presence of children, agricultural or industrial sectors (*vs.* services), belonging to the private or public sectors (*vs.* self-employed) and part time work. It is interesting to note that within this selected population (*i.e.* in employment in 2006), professional categories have no role on employment trajectory between 2006 and 2010. In men, being 50 and over in 2006, the lack of education, celibacy and professional category (blue collars are most likely to leave the labour market) are all significant factors of poor labour market performance. The only common denominator between men and women appears to be the role of mental health and age.

In specification 2, we include general health status (perceived health, chronic diseases and activity limitations) and risky behaviours (daily tobacco consumption, risky alcohol drinking and overweight). This new specification allows the assessment of potential indirect effects of mental health, transiting through the latent health status (Devaux *et al.*, 2008). In the male population, the coefficient associated with mental health declines slightly (the decline in the probability of remaining in employment falls from 9pp to 7pp) but remains very significant. Activity limitations (-3pp) and daily tobacco consumption (-4pp) also play a role in job loss regardless of the effect of mental health. Being observed simultaneously, it is not possible to disentangle the causal relationship between physical health, mental health and risky behaviours in this type of models but the explicit inclusion of these variables tends to reduce

social employment inequalities in our results. In the female population, the impact of health status on employment does not seem to go through mental health as we measure it but more through a poor general health status and activity limitations (-4pp). Risky behaviours however appear to have no impact on job retention in women.

Past professional career information (in terms of security and stability of employment) is added in a third specification. It allows controlling for the nature of the professional career, influencing both mental health and employment. While stable job trajectories (marked by long-term, more secure jobs) favours continued employment between 2006 and 2010, the deleterious effect of poor mental health condition on employment is resilient to this third specification in men. In women, employment stability does not participate to the transitions in employment between 2006 and 2010.

Just like in the empirical literature, it appears that we basically find the most conventional determinants influencing the labour market on our data. Age, the presence of children and part-time work among women, the level of education and professional category in men are found to have a significant impact on the ability of individuals to remain in employment. Mental health is found to be very significant in men but not in women, which again appears to be in line with the literature (Chatterji *et al.*, 2011; Ojeda *et al.*, 2010; Zhang *et al.*, 2009). The study of Frijters *et al.* (2014) however goes in the opposite direction, indicating a stronger effect in women which could possibly be explained by the lack of controls for general health status in this study, while the links between physical and mental health are strong in women (Devaux *et al.*, 2008; Leach *et al.*, 2008). As an illustration, our regressions also find a significant effect of mental health in women when we do not take into account the general health status (Table 2, specification 1). Being a daily smoker is shown to have important consequences on men's employment in 2010, in agreement with the literature (Butterworth *et al.*, 2012; Jusot *et al.*, 2008). Alcohol and overweight do not play a significant role on employment in our regressions.

Table 1: Estimated probability of employment in 2010, male population

	Univar. Probit (M1)		Univar. Probit (M2)		Univar. Probit (M3)		Bivariate Probit (IV)	
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
Mental health in 2006								
At least one mental disorder	-.09***	.02	-.07***	.02	-.07***	.02		
Mental health (instr.) in 2006								
At least one mental disorder							-.13**	.05
Ind. characteristics in 2006								
Age (<i>ref.: 30-35 years-old</i>)								
- 35-39	.02	.02	.01	.03	.01	.03	-.01	.03
- 40-44	-.01	.02	-.03	.02	-.04	.03	-.03	.03
- 45-49	-.02	.02	-.01	.03	-.03	.03	-.03	.03
- 50-55	-.14***	.02	-.15***	.02	-.16***	.02	-.16***	.03
In a relationship (<i>ref.: Single</i>)	.03**	.01	.03**	.01	.03**	.01	.02	.02
Children (<i>ref.: None</i>)	-.02	.02	-.01	.02	-.01	.02	-.02	.02
Education (<i>ref.: French bac.</i>)								
- No diploma	-.06**	.02	-.05**	.02	-.05*	.03	-.06**	.03
- Primary	-.03	.02	-.01	.02	-.01	.02	-.01	.02
- Superior	-.00	.02	-.00	.02	-.00	.02	.01	.02
Employment in 2006								
Act. sector (<i>ref.: Industrial</i>)								
- Agricultural	-.03	.02	-.02	.03	-.02	.03	-.03	.03
- Services	-.00	.01	.00	.01	.00	.01	.01	.02
Activity status (<i>ref.: Private</i>)								
- Public sector	.03*	.02	.02	.02	.02	.02	.01	.02
- Self-employed	.04	.03	.04	.03	.03	.03	.03	.04
Prof. cat. (<i>ref.: Blue collar</i>)								
- Farmers	.15***	.05	.12**	.05	.12**	.05	.12**	.06
- Artisans	.07**	.04	.06*	.04	.06*	.04	.10**	.04
- Managers	.05**	.02	.04**	.02	.04**	.02	.04*	.02
- Intermediate	.03*	.02	.02	.02	.02	.02	.02	.02
- Employees	.01	.02	.00	.02	-.00	.02	-.01	.02
Part time (<i>ref.: Full-time</i>)	-.05	.03	-.04	.02	-.03	.03	-.01	.04
General health status in 2006								
Poor perceived health status			-.02	.02	-.02	.02	-.00	.02
Chronic diseases			.00	.01	.00	.01	.00	.01
Activity limitations			-.03*	.02	-.03*	.02	-.04**	.02
Risky behaviours in 2006								
Daily smoker			-.04***	.01	-.04***	.01	-.05***	.01
Risky alcohol consumption			-.00	.01	.00	.01	.01	.01
Overweight			.01	.01	.01	.01	.01	.01
Professional route								
Maj. of empl. in long jobs					.03*	.02	.02	.01
Stable career path					.01	.01	.00	.01
Rho							.22**	.12
N								
	2004		2004		2004		1860	

*Reading: Marginal effects, standard errors in italics. ***: significant at 1%, **: significant at 5%, *: significant at 10%.*

Field: Health and Professional Route survey, men aged 30-55 in employment in 2006.

Table 2: Estimated probability of employment in 2010, female population

	Univar. Probit (M1)		Univar. Probit (M2)		Univar. Probit (M3)		Bivariate Probit (IV)	
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
Mental health in 2006								
At least one mental disorder	-.05***	.01	-.02	.02	-.02	.02		
Mental health (instr.) in 2006								
At least one mental disorder							-.02	.09
Ind. characteristics in 2006								
Age (<i>ref.: 30-35 years-old</i>)								
- 35-39	.01	.02	.01	.02	.00	.02	.00	.02
- 40-44	.01	.02	.01	.02	.00	.02	.00	.02
- 45-49	-.04**	.02	-.03	.02	-.04	.02	-.04	.02
- 50-55	.10***	.02	-.10***	.02	-.10***	.02	-.10***	.02
In a relationship (<i>ref.: Single</i>)	.00	.01	.01	.01	.01	.01	.01	.01
Children (<i>ref.: None</i>)	-.08***	.02	-.07***	.02	-.07***	.02	-.07***	.02
Education (<i>ref.: French bac.</i>)								
- No diploma	-.03	.03	-.04	.03	-.04	.03	-.04	.03
- Primary	-.02	.02	-.01	.02	-.01	.02	-.01	.02
- Superior	.00	.02	-.00	.02	-.01	.02	-.01	.02
Employment in 2006								
Act. sector (<i>ref.: Industrial</i>)								
- Agricultural	.04	.04	.04	.04	-.04	.04	-.04	.04
- Services	.05***	.02	.06***	.02	.06***	.02	.06***	.02
Activity status (<i>ref.: Private</i>)								
- Public sector	.01	.01	.02*	.01	.02	.01	.02	.01
- Self-employed	.07**	.04	.06*	.04	.06*	.04	.06*	.04
Prof. cat. (<i>ref.: Blue collar</i>)								
- Farmers	.02	.07	.01	.07	-.00	.07	-.00	.07
- Artisans	-.02	.04	-.03	.05	-.03	.05	-.03	.05
- Managers	.00	.03	-.01	.03	-.02	.03	-.02	.03
- Intermediate	-.00	.02	-.01	.02	-.01	.02	-.01	.02
- Employees	.01	.02	.00	.02	.00	.02	-.00	.02
Part time (<i>ref.: Full-time</i>)	-.03**	.01	-.03**	.01	-.02*	.01	-.02*	.01
General health status in 2006								
Poor perceived health status			-.04**	.02	-.03**	.02	-.03*	.02
Chronic diseases			.00	.01	-.00	.01	-.00	.01
Activity limitations			-.04**	.02	-.04**	.02	-.04*	.02
Risky behaviours in 2006								
Daily smoker			-.01	.01	-.00	.01	-.00	.01
Risky alcohol consumption			-.01	.02	-.01	.02	-.01	.02
Overweight			-.02	.01	-.01	.01	-.01	.01
Professional route								
Maj. of empl. in long jobs					.02	.01	.02	.01
Stable career path					.01	.01	.01	.01
Rho								
							.02	.36
N	2129		2129		2129		1982	

Reading: Marginal effects, standard errors in italics. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, women aged 30-55 in employment in 2006.

3.2. Instrumented mental health

The last column of Table 1 and Table 2 presents the results of the bivariate probit models, respectively for men and women. The results for the bivariate mental health models are summarized in Table 3 (complete results of univariate and bivariate probit models for mental health are available in Table 15 in Appendix 7). After controlling for individual and employment-related characteristics, general health status, risky behaviours and professional route, the three identifying variables (being raised by a single parent, having experienced violence during childhood and having experienced many marital breakdowns) are good predictors of mental health. Facing violence during childhood and several marital breakdowns in men respectively increase the probability to experience mental disorders in 2006 of 9pp and 3pp. In women, being raised by a single parent or experiencing violence before age 18 increase the same probability of 7pp and 8pp.

Table 3: Estimation of mental health in 2006 (bivariate probit)

	Men		Women	
	Coeff.	Std. err.	Coeff.	Std. err.
Identifying variables				
Raised by a single parent	N/A	N/A	.07***	.02
Suffered from violence during childhood	.09*	.05	.08***	.02
Experienced many marital breakdowns	.03**	.02	N/A	N/A

After controlling for individual characteristics, employment, general health status and professional career.

Reading: Marginal effects, standard errors in italics. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, individuals aged 30-55 in employment in 2006.

Despite the decrease in the accuracy of the estimates for employment status, the use of identifying variables should enable the establishment of a causal relationship. The use of this type of models seems justified by the significance (for men) of the correlation coefficient (ρ) between the residuals of the two simultaneous equations. In addition, evolutions in the results between univariate and bivariate employment and mental health models (Table 1, Table 2 and Table 15 in Appendix 7) reinforce our analysis. In men, the causal effect of the mental health of 2006 on employment in 2010 seems corroborated by the bivariate analysis, indicating a drop of 13pp in the probability of remaining at work. It is also possible to reaffirm the direct role of smoking on the likelihood of job loss. Mental health remains non-discriminative on women's employment. Ultimately, our main results are confirmed by the bivariate analysis, and fall in line with the literature using the same methodologies.

3.3. Robustness checks

To assess the robustness of our results, we tested two other alternative specifications to better understand mental health (differentiating MDE and GAD and taking into account their cumulative effects), we considered other age groups⁶ and a shorter temporal distance between mental health and employment (it indeed may be questionable to measure the role of poor mental health on employment four years later).

3.3.1. MDE versus GAD

We first wanted to better understand the respective roles of MDE and GAD on job retention. Table 4 shows the results when considering MDE alone (specification 1), GAD alone (specification 2) and a counter of mental disorders (indicating if an individual faced one or

⁶Sensitivity tests were performed by estimating the models on the 25-50, 30-50 and 25-55 years-old groups. These tests, not presented here, confirm our results in all cases.

both mental disorders at once). This decomposition of mental health disorders did not change the results in the female population: even when women report suffering from both MDE and GAD, mental health problems do not significantly affect their employment trajectory. In men, GAD marginally plays the major role on the inability to remain in employment (-10pp compared to -8pp for MDE) and suffering from both mental disorders significantly deteriorates their labour market outcomes (-14pp).

Table 4: Impact of mental health in 2006 on employment in 2010 according to various measures, men and women

	Men		Women	
	Coeff.	Std. err.	Coeff.	Std. err.
Instrumented mental health				
Suffers from MDE	-.08***	.02	-.01	.01
Suffers from GAD	-.10***	.02	-.02	.02
Disorders counter (<i>ref.: None</i>)				
- One disorder	-.05*	.02	-.02	.02
- Two simultaneous disorders	-.14***	.04	-.02	.03

After controlling for individual characteristics, employment, general health status and professional career. Univariate probit models.

Reading: Marginal effects, standard errors in italics. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, men and women aged 30-55 in employment in 2006.

3.3.2. An employment indicator over the period 2007-2010

The measurement of the impact of mental health on employment outcomes is potentially subject to biases given the duration of the observation period. Career paths and mental health between 2006 and 2010 may have been significantly affected by the effects of economic conditions (notably the economic crisis of 2009) regardless of the mental health condition of 2006. To deal with this problem, we set-up a more restrictive approach by considering individuals having been at least 3 years in employment between 2007 and 2010 (and not only in employment in 2010). The results, presented in Table 5, corroborate the negative effect of the declaration of GAD and MDE on job retention, despite a smaller magnitude of the effect (-5pp).

Table 5: Estimated probability of employment (binary variable 2007-2010)

	Men		Women	
	Coeff.	Std. err.	Coeff.	Std. err.
Mental health in 2006				
At least one mental disorder	-.05***	.02	-.00	.02

After controlling for individual characteristics, employment, general health status and professional career. Univariate probit models.

Reading: Marginal effects, standard errors in italics. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, individuals aged 30-55 in employment in 2006.

4. Discussion and conclusion

This study demonstrates that a degraded mental health condition directly reduces the ability of men to remain in employment four years later after controlling for socioeconomic characteristics, employment, general health status, risky behaviours and professional career. A decrease of up to 13pp in the probability of remaining in employment 4 years later for men at work in 2006 can be observed. In the female population, general health status remains predominant in explaining their trajectory on the labour market. Our results, in line with those of the literature, provide original perspectives on French data about the capacity of mentally-

impaired workers to keep their jobs. Considering separately MDE and GAD suggests that the disabling nature of mental health goes through both indicators. In addition, the accumulation of mental disorders (MDE and GAD) greatly increases the risk of leaving employment during the period (-14pp for men facing both disorders compared to -5pp for those only facing one of the two). These results are also supported by specific estimations on the 2007-2010 period, partly allowing to deal with the events occurring between 2006 and 2010.

Our study confirms the importance of mental health when considering work and employment. It appears appropriate to keep on with the implementation of public policies to support people with mental disorders starting from entry into the labour market but by extending them to common mental disorders such as depressive episodes and anxiety disorders, which prevalence is high in France. We bring new elements with respect to gender differences in the impact of mental health, after controlling for general health status. In men, activity limitations and GAD play a specific and independent role on professional path. However in women, only general health indicators (perceived health and activity limitations) are capable of predicting future job situations. This differentiation between men and women is also confirmed in terms of mental health determinants, which is taken into account here by using different identifying variables according to gender. Consequently, accompanying measures for men at work could be involved and helpful in keeping them on the labour market. Notably, the French Psychiatry and Mental Health Plan 2011-2015 affirms the importance of job stress prevention and measures to enable easier job retention and return to work of people with mental disorders.

Following this first step, several extensions may be appropriate. Our results demonstrate a different impact of mental health on job retention. This difference may partly result from selection related to mental health and employment in 2006, differing by gender⁷. It can also be explained by differences in social norms related to the perception of mental disorders and employability, by differences in disease severity and differentiated paths during the 2006-2010 period (as suggested by the health status trajectories for individuals in employment and ill in 2006 – see Table 12). It would therefore be interesting to determine the transmission channels of these differences. The distinction between GAD and MDE demonstrates the sensitivity of our results to the definition of mental health. As such, a mental health score to better assess the nature and intensity of mental health degradations would help to better assess its effect on employment. Yet, no such scores are available in the survey.

⁷ In the male population suffering from at least one mental disorder in 2006, 68.6% are employed against 90.9% in the non-affected population. Among women, the proportions were 64.5% and 77.0% respectively (Table 11).

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Appendix 1: Major Depressive Episodes (MDE)

The MDE are identified in two stages. First, two questions making use of filters are asked:

- Over the past two weeks, have you felt particularly sad, depressed, mostly during the day, and this almost every day? *Yes/No*
- Over the past two weeks, have you almost all the time the feeling of having no interest in anything, to have lost interest or pleasure in things that you usually like? *Yes/No*

Then, if one of the two filter questions receives a positive response, a third question is then asked, in order to know the specific symptoms: Over the past two weeks, when you felt depressed and/or uninterested for most things, have you experienced any of the following situations? *Check as soon as the answer is "yes", several possible positive responses.*

- Your appetite has changed significantly, or you have gained or lost weight without having the intention to (variation in the month of +/- 5%)
- You had trouble sleeping nearly every night (sleep, night or early awakenings, sleep too much)
- You were talking or you moved more slowly than usual, or on the contrary you feel agitated, and you have trouble staying in place, nearly every day
- You felt almost tired all the time, without energy, almost every day
- You feel worthless or guilty, almost every day
- You had a hard time concentrating or making decisions, almost every day
- You have had several dark thoughts (such as thinking it would be better be dead), or you thought about hurting yourself

Using the responses, two algorithms are then implemented in accordance with the criteria of the Diagnostic and Statistical Manual (DSM-IV). An individual suffers from MDE if:

- A positive response to two filter questions and four symptoms are listed
- Two positive answers to two filter questions and three symptoms are listed

Appendix 2: Generalized Anxiety Disorder (GAD)

GAD are identified using a similar filter questions system.

Three questions are asked:

- Over the past six months, have you felt like you were too much concerned about this and that, have you felt overly concerned, worried, anxious about life's every day problems, at work/at school, at home or about your relatives? *Yes/No*

In case of positive answer:

- Do you have such concerns almost every day? *Yes/No*

In case of positive answer:

- Is it difficult to control these concerns or do they prevent you to focus on what you have to do? *Yes/No*

If the interviewee responds positively to the three filter questions, another question is asked in order to know the specific symptoms: "Over the last six months, when you felt particularly concerned, worried, anxious, you often happened:

- To feel restless, tense, the edgy nerves?
- To have tense muscles?
- To feel tired, weak or exhausted easily?
- To have trouble concentrating or vacuum passages?
- To be particularly irritable?
- To have sleep problems (difficulty falling asleep, waking in the middle of the night, waking early or sleeping too much)?

For a person to suffer from generalized anxiety disorder, he/she must respond positively to the three filter questions, then three out of six symptoms described later. This protocol is consistent with that used by the DSM-IV.

Appendix 3: Initial selection of the sample in 2006

This study does not claim to measure the impact of mental health on employment but tries to establish the causal effect of mental health on job retention. The unemployed population in 2006 is therefore discarded, even though their reported prevalence of anxiety disorders and depressive episodes is far superior to those in employment (22% vs. 6% in men and 21% vs. 12% in women; see Table 6 and Table 7, Appendix 6).

Hence, this study does not suffer from selection biases linked to the status in employment in 2006. However, if the goal was to measure the impact of mental health on the participation to the labour market, restricting the sample to individuals in employment in 2006 would lead to an underestimation of the effect of mental health on employment. Socioeconomic and health characteristics of people suffering from mental disorders in 2006 are very different according to employment status. For instance, 24% of workers reporting at least one mental disorder in 2006 report having activity limitations against 52% among the unemployed in 2006.

In addition, such a study working on the whole sample (including the unemployed) would suffer from significant methodological biases (reverse causality and direct simultaneity). A method in two consecutive steps to estimate the probability of being employed in 2006 and the probability of keeping a job conditional on the participation equation could then be conducted. However, identification problems could arise because of the difficulty to rigorously distinguish the explanatory mechanisms between the probability of employment in 2006 and continued employment between 2006 and 2010.

Appendix 4: Attrition between the two waves

Attrition between the 2006 and 2010 waves can induce the selection of a population with specific characteristics. There are no significant differences in demographic, socioeconomic and health characteristics of our sample between respondents and non-respondents to the 2010 survey on the basis of their first wave characteristics (see Tables 8 and 9, Appendix 6). However, differences in the response rate to the 2010 survey exist according to perceived health status, activity limitations, the declaration of major depressive episodes, the 2006 motion or sleep disorders (De Riccardis, 2012). A weighting system to reflect this non-response was thus established. It is calculated using employment situation, urban units, age groups, education, gender and health status. Logit models are used to estimate the response behaviour of interviewees depending on whether they actually have answered the survey in 2010 or not. This procedure allows identifying homogeneous response groups (HRG) in which the individual probability to answer the survey is equivalent and independent between HRG. They are then used as sample stratification, wherein a second sample is then selected with a sample rate equalling the individual probability to respond for each HRG. One can then determine weights assigned to each individual depending on his HRG.

Sample calibration allows the use of a sample matching the characteristics of the general French population. Calibration is performed on the average of the four Quarterly Employment surveys of year 2006. The variables used are urban units, age groups, education, nationality and the number of dwelling inhabitants (De Riccardis, 2012).

Weighting in the Sip survey allows taking into account attrition between the two waves notably related to poor general, physical or mental health status and to match the sample with the general population on a number of socio-demographic characteristics.

Appendix 5: Measurement and validity of mental health indicators in Sip

The mental health protocol for the Sip survey is based on the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV), created in 1952 by the *American Psychiatric Association* (APA). It focuses exclusively on mental illnesses unlike the *International Classification of Diseases* (Cim-10), which covers all types of disease. In Sip, modules regarding major depressive episodes (MDE) and generalized anxiety disorder (GAD) from the *Mini International Neuropsychiatric Interview* (Mini) are complete. The precise construction of MDE and GAD is detailed in Appendix 1 and 2. Through successive filters, it reduces the number of "false positives", *i.e.* people wrongly detected as suffering from these disorders, given the diagnostic criteria.

According to the DSM-IV assessed by the Mini, 6.8% of the surveyed population currently suffers from MDE. Within this population, 45% experience recurrent depressive disorders. According to these criteria, 5.7% of the population undergoes GAD. The comparison with the results of the survey "Life Events and Health Status" (EVS), conducted over the same period in the general population and with an identical protocol, revealed extremely close results to those of the Sip survey (Beck *et al.*, 2010). As expected, this result differs from those from the French Mental Health in General Population survey (11% of MDE in the past two weeks and 13% of GAD). Mental Health in General Population (SMPG) is based on the Cim-10 version of the algorithm (not DSM-IV) and detects more easily MDE or GAD. Measuring mental health in Sip is consistent with a more restrictive definition (DSM-IV) and seems valid in comparison to similar fields in France.

While the questionnaire on mental disorders makes full use of the nomenclature proposed by the Mini, it has no diagnostic value. It can rather be seen as diagnostic interviews conducted by an interviewer, based on all the symptoms described by the DSM-IV and Cim-10. It must not lead to a medical diagnosis (Bahu and Mermilliod, 2014). However, it appears that according to the results of a qualitative post-survey interview about some indicators used in the Sip survey including health indicators (Guiho-Bailly *et al.*, 2009), the over-reporting phenomenon (false positives) of mental disorders in the survey is not widespread, while in contrast under-reporting (false negative) tends to occur. In the study of the impact of mental health on job retention, this would lead to an underestimation of the effect of mental health.

Appendix 6: Descriptive statistics

Table 6: Selection analysis – Population in employment vs. unemployed in 2006

	Men (%)		Women (%)	
	Employed population in 2006	Unemployed population in 2006	Employed population in 2006	Unemployed population in 2006
Mental Health, 2006				
At least one mental disorder	5,9	22,2	11,6	21,0
No mental disorder	94,1	77,8	88,4	79,0
MDE	3,4	16,7	8,3	16,4
No MDE	96,6	83,3	91,7	83,6
GAD	3,5	13,2	6,6	13,1
No GAD	96,5	86,8	93,4	86,9
Individual characteristics, 2006				
30-34	17,3	11,6	16,0	15,9
35-39	21,7	10,9	20,2	15,1
40-44	20,2	16,4	19,9	16,4
45-49	20,1	19,6	21,4	18,5
50-55	20,8	41,5	22,5	34,1
In a relationship	82,1	55,0	77,6	71,5
Single	17,9	45,0	22,4	28,5
At least one child	12,2	5,1	8,3	6,1
No child	87,8	94,9	91,7	93,9
No diploma	8,0	15,1	6,7	15,3
Primary	45,8	53,6	39,1	45,8
Equivalent to French baccalaureat	18,2	14,2	19,1	17,2
Superior	26,3	16,1	33,3	18,5
Job characteristics, 2006				
Agricultural sector	9,0		3,1	
Industrial sector	21,0		9,1	
Services sector	70,0		87,7	
Private sector	66,7		58,9	
Public sector	19,1		29,1	
Self-employed	10,9		6,6	
Farmer	4,7		1,2	
Artisans	7,0		4,3	
Manager	16,4		11,1	
Intermediate	24,1		22,2	
Employee	12,7		45,1	
Blue collar	29,8		9,2	
Part-time job	3,0		30,7	
Full time job	97,0		69,3	
General Health, 2006				
Good perceived health	82,1	48,9	77,8	61,2
Poor perceived health	17,9	51,1	22,2	38,8
No chronic disease	75,3	56,6	71,9	60,3
Chronic disease	24,7	43,4	28,1	39,7
No activity limitation	90,7	59,8	88,5	75,1
Activity limitations	9,3	40,2	11,5	24,9
Risky behaviours, 2006				
Daily smoker	27,5	47,8	23,6	24,5
Not a daily smoker	72,5	52,2	76,4	75,5
Drinker at risk	46,2	42,2	13,6	13,1
Not a drinker at risk	53,8	57,8	86,4	86,9
Overweight	51,3	46,7	28,5	41,6
Normal weight or underweight	48,7	53,3	71,5	58,4
Professional route				

	Men (%)		Women (%)	
	Employed population in 2006	Unemployed population in 2006	Employed population in 2006	Unemployed population in 2006
Majority of employment in long jobs	83,5	45,3	71,7	58,0
Most of the professional route out of job	16,5	54,7	28,3	42,0
Stable career path	74,3	51,5	68,9	27,0
Unstable career path	25,7	48,6	31,1	73,0

Field: Health and Professional Route survey, employed and unemployed individuals aged 30-55 in 2006. Weighted and calibrated statistics.

Table 7: Selection analysis – Main characteristics of individuals reporting at least one mental disorder in 2006, according to their employment status in 2006

	In employment in 2006 (%)	Unemployed in 2006 (%)
Individual characteristics, 2006		
30-34	12,2	19,8
35-39	19,7	16,5
40-44	20,6	15,2
45-49	22,3	15,6
50-55	25,2	32,9
In a relationship	72,3	59,1
Single	27,7	40,9
At least one child	12,2	8,1
No child	87,8	91,9
No diploma	5,2	18,2
Primary	49,3	47,9
Equivalent to French baccalaureat	18,1	13,7
Superior	26,3	14,6
General Health, 2006		
Good perceived health	47,2	27,1
Poor perceived health	52,8	72,9
No chronic disease	56,6	39,1
Chronic disease	43,4	60,9
No activity limitation	75,8	48,5
Activity limitations	24,2	51,5
Risky behaviours, 2006		
Daily smoker	31,7	42,9
Not a daily smoker	68,3	57,1
Drinker at risk	29,2	29,6
Not a drinker at risk	70,8	70,4
Overweight	34,8	48,3
Normal weight or underweight	65,2	51,7
Professional route		
Majority of employment in long jobs	73,9	29,0
Most of the professional route out of job	26,1	71,0
Stable career path	66,7	44,0
Unstable career path	33,3	56,0

Reading: 24.2% of workers declaring at least one mental disorder in 2006 report suffering from activity limitations against 51.5% in the unemployed population in 2006.

Field: Health and Professional Route survey, individuals reporting at least one mental disorder and aged 30-55 in 2006. Weighted and calibrated statistics.

Table 8: Attrition analysis – panel population (interviewed in 2006 and 2010) vs. attrition population (interviewed in 2006 and not in 2010)

	Men (%)		Women (%)	
	Panel pop.	Attrition pop.	Panel pop.	Attrition pop.
Mental Health, 2006				
At least one mental disorder	5,9	5,9	11,6	13,5
No mental disorder	94,1	94,1	88,4	86,5
MDE	3,4	4,41	8,3	9,0
No MDE	96,6	95,2	91,7	91,0
GAD	3,5	3,7	6,6	6,9
No GAD	96,5	96,3	93,4	93,1
Individual characteristics, 2006				
30-34	17,3	18,9	16,0	15,3
35-39	21,7	21,5	20,2	23,5
40-44	20,2	21,3	19,9	21,6
45-49	20,1	17,8	21,4	18,6
50-55	20,8	20,5	22,5	21,0
In a relationship	82,1	71,7	77,6	61,8
Single	17,9	28,3	22,4	38,2
At least one child	12,2	23,8	8,3	18,4
No child	87,8	86,2	91,7	81,6
No diploma	8,0	8,0	6,7	7,8
Primary	45,8	46,7	39,1	40,4
Equivalent to French bac.	18,2	14,8	19,1	21,0
Superior	26,3	29,1	33,3	29,4
Job characteristics, 2006				
Agricultural sector	9,0	4,8	3,1	3,5
Industrial sector	21,0	16,6	9,1	8,2
Services sector	70,0	78,6	87,7	88,3
Private sector	66,7	65,2	58,9	60,2
Public sector	19,1	20,7	29,1	28,4
Self-employed	10,9	10,0	6,6	5,9
Farmer	4,7	1,4	1,2	1,2
Artisans	7,0	9,6	4,3	4,3
Manager	16,4	16,8	11,1	12,0
Intermediate	24,1	20,7	22,2	22,9
Employee	12,7	12,9	45,1	44,7
Blue collar	29,8	32,4	9,2	8,0
Part-time job	3,0	4,1	30,7	25,1
Full time job	97,0	95,9	69,3	75,0
General Health, 2006				
Good perceived health	82,1	79,7	77,8	74,7
Poor perceived health	17,9	20,3	22,2	25,3
No chronic disease	75,3	79,0	71,9	73,5
Chronic disease	24,7	21,1	28,1	26,5
No activity limitation	9,3	88,5	88,5	88,2
Activity limitations	90,7	11,5	11,5	11,8
Risky behaviours, 2006				
Daily smoker	27,5	34,9	23,6	30,1
Not a daily smoker	72,5	65,1	76,4	69,9
Drinker at risk	46,2	44,0	13,6	14,1
Not a drinker at risk	53,8	36,0	86,4	85,9
Overweight	51,3	48,6	28,5	21,3
Normal weight or underweight	48,7	51,4	71,5	78,7
Professional route				
Maj. of empl. in long jobs	83,5	69,9	71,7	69,4
Most of the prof. route out of job	16,5	30,1	28,3	30,6
Stable career path	74,3	76,0	68,9	67,6
Unstable career path	25,7	24,0	31,1	32,5

Field: Health and Professional Route survey, employed individuals aged 30-55 in 2006. Weighted and calibrated statistics.

Table 9: Attrition Analysis – panel population vs. attrition population according to mental health and employment status in 2006

	Attrition (%)	Panel (%)
Mental Health, 2006		
At least one mental disorder	18,6	81,4
No mental disorder	16,9	83,1
MDE	19,5	80,5
No MDE	16,9	83,1
GAD	17,7	82,3
No GAD	17,0	83,0
Employment status in 2006		
In employment	16,0	84,0
Unemployed	22,1	77,9
Health status and employment in 2006		
<u>In employment in 2006</u>		
At least one mental disorder	16,6	83,4
No mental disorder	15,9	84,1
MDE	17,1	82,9
No MDE	15,9	84,1
GAD	15,7	84,3
No GAD	16,0	84,0
<u>Unemployed in 2006</u>		
At least one mental disorder	22,6	77,4
No mental disorder	22,0	78,0
MDE	23,5	78,1
No MDE	21,9	76,5
GAD	21,6	78,4
No GAD	22,2	77,8

Interpretation: Among individuals declaring in 2006 having at least one mental disorder, 18.6% were not re-interviewed in 2010, and 81.4% were. In individuals not reporting any mental disorders in 2006, 16.9% were not re-interviewed.

Field: Health and Professional Route survey, individuals aged 30-55 in 2006. Weighted and calibrated statistics.

Table 10: General descriptive statistics

	Men (%)		Women (%)	
	Prevalence	Employment probability (2010)	Prevalence	Employment probability (2010)
Mental Health, 2006				
At least one mental disorder	5,9	82,0	11,6	86,3
No mental disorder	94,1	93,1	88,4	92,0
MDE	3,4	81,3	8,3	85,1
No MDE	96,6	92,8	91,7	91,9
GAD	3,5	78,5	6,6	87,8
No GAD	96,5	93,0	93,4	91,6
Individual characteristics, 2006				
30-34	17,3	96,3	16,0	92,9
35-39	21,7	96,6	20,2	93,7
40-44	20,2	95,2	19,9	96,2
45-49	20,1	94,8	21,4	91,1
50-55	20,8	79,8	22,5	83,9
In a relationship	82,1	93,1	77,6	91,5
Single	17,9	89,3	22,4	90,6
At least one child	12,2	96,3	8,3	85,6
No child	87,8	91,9	91,7	91,9
No diploma	8,0	86,8	6,7	88,0
Primary	45,8	90,6	39,1	90,5
Equivalent to French baccalaureat	18,2	95,5	19,1	92,5
Superior	26,3	95,1	33,3	92,4

	Men (%)		Women (%)	
	Prevalence	Employment probability (2010)	Prevalence	Employment probability (2010)
Job characteristics, 2006				
Agricultural sector	9,0	94,6	3,1	92,5
Industrial sector	21,0	92,3	9,1	84,3
Services sector	70,0	92,5	87,7	92,6
Private sector	66,7	91,8	58,9	90,8
Public sector	19,1	93,5	29,1	92,8
Self-employed	10,9	97,0	6,6	95,8
Farmer	4,7	98,9	1,2	94,0
Artisans	7,0	96,4	4,3	94,9
Manager	16,4	94,9	11,1	92,3
Intermediate	24,1	92,8	22,2	91,7
Employee	12,7	93,8	45,1	92,5
Blue collar	29,8	89,5	9,2	85,8
Part-time job	3,0	87,5	30,7	90,3
Full time job	97,0	92,9	69,3	92,4
General Health, 2006				
Good perceived health	82,1	93,8	77,8	92,9
Poor perceived health	17,9	86,2	22,2	85,6
No chronic disease	75,3	93,6	71,9	91,8
Chronic disease	24,7	88,8	28,1	90,0
No activity limitation	90,7	93,4	88,5	92,1
Activity limitations	9,3	83,2	11,5	85,4
Risky behaviours, 2006				
Daily smoker	27,5	90,4	23,6	90,8
Not a daily smoker	72,5	93,2	76,4	91,8
Drinker at risk	46,2	92,5	13,6	89,9
Not a drinker at risk	53,8	92,4	86,4	91,6
Overweight	51,3	92,7	28,5	88,8
Normal weight or underweight	48,7	92,5	71,5	92,4
Professional route				
Majority of employment in long jobs	83,5	92,6	71,7	92,4
Most of the professional route out of job	16,5	92,0	28,3	88,5
Stable career path	74,3	92,9	68,9	92,2
Unstable career path	25,7	91,2	31,1	89,4

Field: Health and Professional Route survey, individuals aged 30-55 in 2006. Weighted and calibrated statistics.

Table 11: Employment status in 2006, according to mental health condition

	Men (%)		Women (%)	
	Employed	Unemployed	Employed	Unemployed
Mental Health, 2006				
At least one mental disorder	68,6	31,4	64,5	35,5
No mental disorder	90,9	9,1	77,0	23,0

Reading: 88.6% of men with at least one mental disorder in 2006 are employed at the same date, against only 64.5% of women in the same situation.

Field: Health and Professional Route survey, individuals aged 30-55 in 2006. Weighted and calibrated statistics.

Table 12: Mental Health Status in 2010 of individuals in employment and reporting mental health disorders in 2006

	Men (%)		Women (%)	
	At least one mental disorder in 2010	No mental disorder in 2010	At least one mental disorder in 2010	No mental disorder in 2010
Mental health in 2006				
At least one mental disorder	67,9	32,1	69,6	30,4
- MDE	15,7	84,3	29,8	70,2
- GAD	59,4	40,6	56,6	43,4

Reading: 67.9% of employed men with at least one mental disorder in 2006 are still suffering from mental disorders in 2010, against 69.6% of women in the same situation.

Field: Health and Professional Route survey, individuals aged 30-55, in employment and suffering from at least one mental disorder in 2006. Weighted and calibrated statistics.

Appendix 7: Instruments validation

Table 13: Correlations of identifying variables (men)

	Correlation coefficient		Sample size
	Employment (2010)	Mental health (2006)	
Violence suffered during childhood	-0,04	0,07**	2004
Many marital breakdowns	-0,03	0,08***	2004

Reading: ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, men aged 30-55 in employment in 2006.

Table 14: Correlations of identifying variables (women)

	Correlation coefficient		Sample size
	Employment (2010)	Mental health (2006)	
Violence suffered during childhood	-0,01	0,09***	2129
Raised by a single parent	-0,01	0,07***	2129

Reading: ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, women aged 30-55 in employment in 2006.

Table 15: Mental Health estimations in 2006

	Uniprobit (Men)		Biprobit(Men)		Uniprobit (Women)		Biprobit (Women)	
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
Ident. variables (men)								
Violence during childhood	.08*	.05	.09*	.05				
Many marital breakdowns	.02*	.01	.03**	.02				
Ident. variables (women)								
Violence during childhood					.08***	.03	.07***	.02
Raised by a single parent					.07***	.02	.08***	.02
Ind. characteristics, 2006								
Age (<i>ref.: 30-35 years-old</i>)								
- 35-39	.05**	.02	.05**	.02	-.03	.03	-.03	.03
- 40-44	.01	.02	.01	.02	.02	.02	.02	.02
- 45-49	.02	.02	.02	.02	.00	.03	.00	.03
- 50-55	.02	.02	.02	.02	.01	.03	.01	.03
In a relationship (<i>ref.: Single</i>)	-.05***	.01	-.05***	.01	-.03**	.01	-.03**	.01
Children (<i>ref.: None</i>)	.02	.02	.03	.02	.01	.03	.02	.03
Education (<i>ref.: French bac.</i>)								
- No diploma	-.02	.03	-.02	.03	-.03	.04	-.03	.04
- Primary	.00	.02	-.00	.01	.01	.02	.01	.02
- Superior	-.00	.02	-.01	.02	.00	.02	.00	.02
Employment in 2006								
Act. sector (<i>ref.: Industrial</i>)								
- Agricultural	.01	.03	.01	.02	-.03	.05	-.02	.05
- Services	.02	.01	.02	.01	-.03	.02	-.03	.02
Activity status (<i>ref.: Private</i>)								
- Public sector	-.00	.01	-.01	.01	-.04**	.02	-.03**	.02
- Self-employed	.05**	.02	.04*	.02	-.04	.04	-.04	.04
Prof. cat. (<i>ref.: Blue collar</i>)								
- Farmers	-.08*	.05	-.08*	.05	.05	.07	.05	.07
- Artisans	-.02	.03	-.02	.03	.07	.05	.07	.05
- Managers	.02	.02	.02	.02	.01	.03	.00	.03
- Intermediate	-.00	.01	-.00	.01	-.01	.03	-.01	.03
- Employees	-.03	.02	-.03	.02	.01	.02	.01	.02
Part time (<i>ref.: Full-time</i>)	-.03	.03	-.03	.03	.02*	.01	.02	.01
General health status in 2006								
Poor perceived health status	.09***	.01	.09***	.01	.14***	.02	.14***	.02
Chronic diseases	.00	.01	.00	.01	.02	.02	.02	.02
Activity limitations	.01	.02	.01	.02	.03*	.02	.03	.02
Risky behaviours in 2006								
Daily smoker	.00	.01	.01	.01	.02	.02	.03	.02
Risky alcohol consumption	.01	.01	.01	.01	.03	.02	.03	.02
Overweight	-.01	.02	-.01	.01	-.02	.02	.02	.02
Professional route								
Maj. of empl. in long jobs	-.00	.02	.00	.02	-.01	.02	-.00	.02
Stable career path	-.01	.01	-.01	.01	.01	.02	.01	.02
N	1876		1860		2143		1982	

Reading: ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Field: Health and Professional Route survey, individuals aged 30-55 in employment in 2006.

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