Mobbing and workers' health: An empirical analysis for Spain

M. Ángeles Carnero, Blanca Martínez and Rocío Sánchez-Mangas

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Abstract

This paper analyzes empirically the impact of mobbing on the health of workers in Spain. Based on the Sixth Spanish Survey on Working Conditions, we first describe the differences in health among mobbed and not mobbed workers, sing two different indicators: the worker's self-perception that work affects health and the presence of bad health symptoms. The descriptive evidence shows that mobbing victims perform worse on such health indicators. We estimate the effect of being mobbed on the probability of suffering from health problems, taking into account the potential endogeneity of mobbing. Our estimates show that being a mobbing victim increases significantly the probability of having bad health, independently on the indicator used. Moreover, when bad health is measured by the perception indicator, we find that the effect of mobbing is underestimated if endogeneity is not accounted for.

Keywords: bullying at workplace, moral harassment.
JEL Classification: C20, I10, J28

[**] M.A. Carnero: University of Alicante. Corresponding author: acarnero@merlin.fae.ua.es. B. Martínez: Complutense University of Madrid. R. Sánchez-Mangas: Autonomous University of Madrid.

1   Introduction

Mobbing was quite an unknown phenomena less than twenty years ago. Nowadays the literature studying this problem is big and increasing very rapidly. Leymann (1996) called mobbing a kind of long-term hostile behavior detected in employees at workplaces. Moral harassment, workplace bullying, workplace violence and psychological terror are other terms used in the literature to describe hostile activities at workplace such as verbal aggressions, rumors, humiliations and so on. The identification of mobbing is not a trivial task since hostile activities are sometimes of quite normal interactive behaviors. However, it is when such activities are used frequently and over a long period of time in order to harass, when they turn into dangerous communicative weapons.

There are studies quantifying the importance of mobbing for several European countries. However, the mobbing definition and the samples considered vary across them and therefore the incidence of mobbing is not really comparable. For example, Cowie et al. (2000) focus on workers in international institutions in England and find that 38% of them suffer from mobbing behaviors. Hubert et al. (2001) find an incidence of 1% among workers in the financial sector in Holland. The Fourth European Working Conditions Survey (EWCO, 2005) reports that mobbing affects around 5% of workers in Europe, with important differences across countries (from 2% in Italy and Bulgary to 17% in Finland), due mainly to differences in the sensitivity to the phenomenon and in the level of cultural awareness of it.

For Spain, Carnero et al. (2008) study empirically the problem of mobbing and find that during 2003 around 5% of workers were identified as mobbing victims. Some personal, job characteristics and working conditions were found to be significant at explaining the probability of being a mobbing victim.

Understanding and quantifying the process of mobbing is important because of its socio-economic consequences. In fact, not only the victim is involved in this problem but also the organization and the society. Vega and Comer (2005) argue that mobbing activities can create an environment of psychological threat that diminishes productivity and inhibits individual and group commitment. Links have also been found between mobbing and mental and physical problems. Josipovic-Jelic et al. (2005) argue that mobbing has detrimental effects on the health, work and life of the individual, specially on the work of medical professionals who are exposed to an increased level of stress because of the nature of their job. Agervold and Mikkelsen (2004) use data on blue-collar employees from a Danish manufacturing company and find that mobbed employees reported significantly more symptoms of psychological stress and mental fatigue than non-mobbed em-

ployees. Hoel et al. (2004) also investigate empirically the impact of mobbing on the health and well-being of employees and find that those who labeled their experience as bullying had substantially worse health than those who were not bullied. For Spain, Piñuel y Zabala and Oñate (2002), using a survey where 2410 workers from an industrial area near Madrid are interviewed, find that around 16% of workers report being subjected to moral harassment or mobbing. Over half of the mobbing victims also answer that mobbing affects their physical and mental health. More recently, Meseguer et al. (2008) analyze data from a sample of 396 workers belonging to the agro-fruit sector in one of the Spanish regions and show evidence that mobbing is positively related to psychosomatic symptoms.

Unambiguously, health is an important component of human capital in which workers will invest in order to increase their productivity and wages. There are some literature concerning with the impact of health on wages. Jäckle and Himmler (2010) points out that health, as part of a person's human capital, may affect labor market productivity and hence wages. Also Haveman et al. (1994) analyzing a male sample for the US find that poor health affects wages negatively. Finally, Contoyannis and Rice (2001) conclude that reduced psychological health decreases male wages, while positive self-assessed health increases hourly wages for women. Therefore, if mobbing affects negatively the worker's health, such hostile behaviors could be considered as negative inputs in human capital with consequences on productivity and wages.

The objective of this paper is to study the impact that mobbing has on workers' health in Spain. To this aim, we use the Sixth Spanish Survey on Working Conditions (VIENCT 2006) which was conducted by the INSHT (*Instituto Nacional de Seguridad e Higiene en el Trabajo*)[1]. Our results suggest that suffering from mobbing has negative effects on the workers' health. More precisely, when two different health indicators are considered, the worker's perception that job affects health and the presence of bad health symptoms, we find that the prevalence of these indicators is higher among those workers who have been identified as mobbing victims. Based on this empirical evidence, we formulate an econometric model to quantify the impact of mobbing on health. Taking into account that mobbing can be an endogenous variable in a health equation, we estimate a bivariate model with equations for bad health and mobbing simultaneously. We include personal and job characteristics and also working conditions, with some exclusion restrictions that allow us to identity the effect of mobbing on health.

Our results show that being a mobbing victim significantly increases the av-

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[1]INSHT is an institution which belongs to the Spanish Ministry of Labour and it is in charge of the analysis of safety and health conditions at the workplace.

erage probability of suffering from bad health symptoms in around 26 percentage points. The effect is even higher when bad health is measured through the perception indicator. We estimate that the probability of perceiving that job affects health is about 50 percentage points higher for mobbed workers. Moreover, this effect is underestimated when the potential endogeneity of mobbing on health is not accounted for.

The rest of the paper is organized as follows. Section 2 describes the data analyzed and show some figures of mobbing and health in Spain during 2006. It also gives empirical evidence of positive correlation between being a mobbing victim and having bad health. Section 3 contains the formulation and estimation of an econometric model to measure the impact of mobbing on health. Finally, Section 4 contains the conclusions.

2 Data description

In this section we use data from the VIENCT 2006 which covers 11.054 workers and provides detailed information on working conditions, work and job characteristics, psychological factors, violence at work and health indicators. The main difference of this survey compared to the previous wave, the Fifth Spanish Survey on Working Conditions, VENCT 2003, is that the questionnaire is filled up at workers' home and not at the workplace as it was before. A key point of interviewing workers at home is that workers on sick leave, on maternity leave and on holidays are also included in the survey. This is important for this study since we have access to more precise information related to health and work. Next, we perform some descriptive analysis of the variables of main interest.[2]

2.1 Violence at work

Following Carnero et al. (2008) we identify mobbing victims using the 45 activities contained in the LIPT -Leymann Inventory of Psychological Terrorization-questionnaire and the information available in the survey. Specifically, there are two questions included in the VIENCT 2006 that are related to violence behavior at work.

P.57. *During the last* 12 *months, have you been subjected at work to: physical violence from people from your workplace, from other people or unwanted sexual attention?*

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[2]Definition and descriptive statistics for all the variables used in this paper are provided in the Appendix.

P.58. *During the last* 12 *months, have you and how often, while working, been silenced, ignored, isolated, humiliated or ridiculed in connection with your work or personal life, suffering from verbal and written threats, or other similar behaviors?*

P.57 is a yes/no question and does not give information about the frequency of the violent behavior. **P.58** is a multiple choice question. The possible answers are: *yes, daily; yes, at least once per week; yes, several times per month; yes, several times per year; no.* Notice also that we do not know the duration of these hostile behaviors. We select the mobbing victims as those workers answering *yes* to **P.57** together with those workers who answer *yes, daily* or *yes, at least once per week* to **P.58**.

Among 10887 respondents, 636 workers are identified as mobbing victims, meaning that, during 2006, 5.84% of the Spanish workers suffered from this problem at their workplace. This percentage is one point higher than the corresponding to the VENCT 2003, which was 4.87%. This difference could be explained by several reasons. The first one is the three years difference between both surveys. During this period, mass media and society in general have learnt and talked about the mobbing phenomenon, and therefore, workers might detect it easily. Another possible explanation is that the two percentages are obtained from two different samples of workers and the recent one includes those workers who are on leave.

As discussed in Carnero et al. (2008), the causes of mobbing could arise from the organization, the perpetrator or even from the victim. Figure 1 shows the percentage of mobbing victims by personal and job characteristics and working conditions, in order to illustrate which variables might determine mobbing behaviors. The horizontal line represents the average prevalence of mobbing, 5.84%. Among personal characteristics, the percentage of mobbing victims increases with the education level: 4.3% of workers having elementary education compared to 7.5% of workers with college education level. Other factors such as nationality, age and gender are found to be nonsignificant and thus, they are dropped out from the specification. When we look at job characteristics, we find important differences in the prevalence of mobbing by company size: those individuals working for large firms (over 500 workers) declare the highest incidence (13.86%). Moreover, data suggest sectoral differences in the incidence of hostile behaviors, being more prevalent in the public administration, bank and social services sectors. Regarding working conditions, two variables merit attention: living in Madrid and working during the weekends. Those individuals working during the weekend report higher levels (8.03%) compared to those who do not (3.58%). Madrid is the

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Figure 1: Percentage of mobbing victims in terms of some characteristics
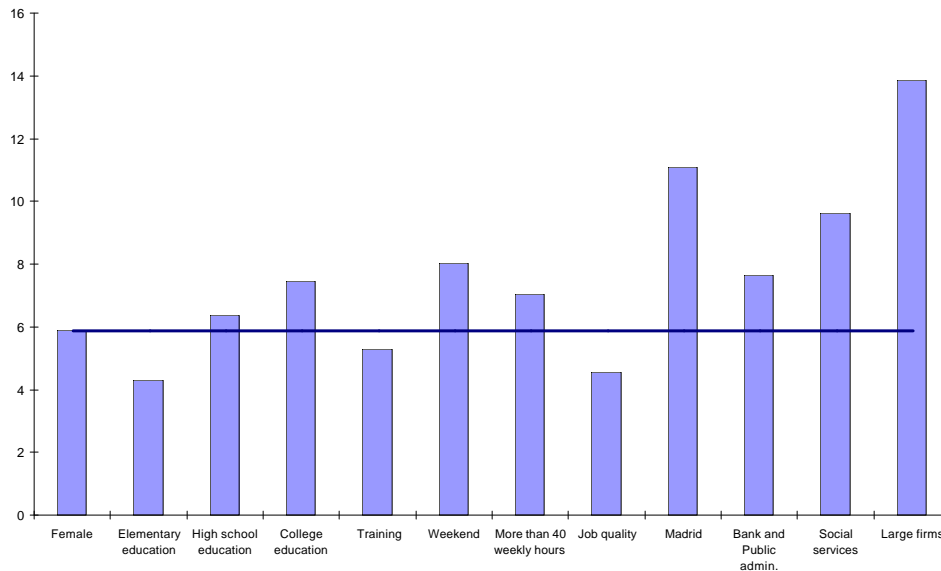
Spanish region where a higher percentage of workers (11%) report having been exposed to violence at work.

2.2 Health Indicators

Previous studies point out that mobbing deteriorates mental and physical health of the affected workers; see, for example, Agervold and Mikkelsen (2004), Hoel et al. (2004) and Josipovic-Jelic et al. (2005) among others. Most of these results are based on comparing the health of mobbed and not mobbed workers, finding that mobbing victims tend to exhibit worse health than the rest of workers. Once the mobbing victims are identified, it is difficult to determine how many of them develop health problems due to the mobbing process. This probably depends, on one hand, on the intensity and length of the mobbing period and on the other hand, on the personality of the victim.

In addition to the information about psychological factors and violence at work, the VIENCT 2006 contains information related to health damages. We next use this information to show evidence of the positive correlation between

being a mobbing victim and suffering from health problems. More precisely, we use the two following questions included in the survey:

P.63. *Do you think that your work affects your health?*

P.66. *Lately, do you frequently suffer from any of the following symptoms?: Sleeping problems, Overall fatigue, Headache, Dizziness, Concentration difficulties, Memory problems, Irritability, Emotional extenuation, Obsession with work, Gastrointestinal disorders, Vision problems, Discouragement, None.*

The first question measures the worker's individual perception of the impact that work has on health. **P.66** gives information about physical, emotional and behavioral disorders that workers could suffer from, due to work or other reasons.

To analyze the relationship between work and health, we define two health indicators: perceived impact of work on health and incidence of bad health symptoms. We next study the differences in the previous health indicators among mobbed and not mobbed workers.

2.2.1 Perceived impact of work on health

Figure 2 shows that 23% of the respondents perceive that there is a relationship between work and health; however this percentage is much higher among mobbed workers (51.9%)

Concerning working conditions, having suffered an accident at the workplace in the last two years or being exposed to the risk of having an accident due to lack of safety at the workplace, increases the perception that work influences health. We have also considered two variables reflecting physical and chemical conditions at the workplace. Physical conditions refer to temperature, noise, air quality, vibrations and light emissions the worker is exposed to. We have defined to have bad physical conditions when more than half of these elements have been reported by the worker as being annoying. Chemical conditions refer to the presence of harmful gas emissions or any toxic chemical component. Analogously, we define to have bad chemical conditions when the worker reports being subjected to these kind of elements. As we can see, workers being exposed to bad physical or chemical conditions perceive that work affects health in a percentage larger than the average, 36.48% and 34.44% respectively. Living in Madrid, compared to do it in another Spanish region, is another factor that increases the average perception that work has an impact on worker's health. Having good organizational factors, defined in terms of adequate workload and autonomy at work, reduces

this perception. We do not find relevant differences related to other personal or job characteristics.

Figure 2: Percentage of workers reporting that work affects health
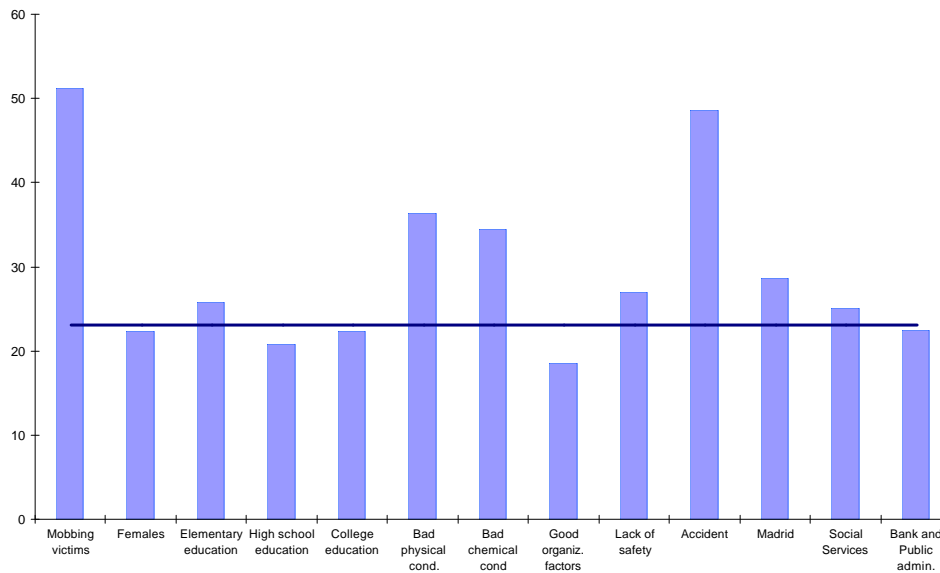
2.2.2 Bad health symptoms

Figure 3 shows the percentage of workers suffering from the symptoms contained in **P.66**. The most often reported symptoms, for mobbed and not mobbed workers, are sleeping problems and overall fatigue. As we can see, the percentage of workers suffering from specific symptoms is significantly higher among mobbed than among not mobbed workers. For some symptoms, the differences are huge. For example, 30% of the mobbing victims suffer from sleeping problems, while this percentage is 11% among the not mobbed workers. The differences are also large for overall fatigue (around 27% for mobbed workers and 11% for not mobbed) and for headache (22% and 10% respectively). Other symptoms for which we find important differences between mobbing victims and the rest of workers are:

irritability, emotional extenuation, work obsession and discouragement. As expected, the percentage of not mobbed workers who suffer none of the symptoms is much higher than the percentage of mobbing workers suffering none of the symptoms: 67% among not mobbed workers and less than 40% among the mobbed ones.

Figure 3: Percentage of workers suffering specific symptoms
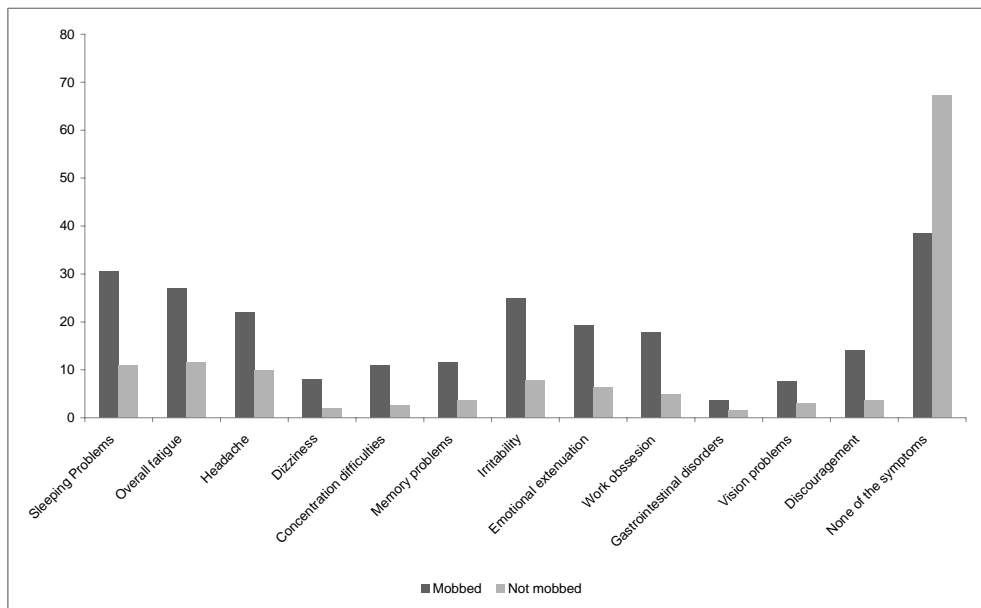
3   The impact of mobbing on health

As we have seen in the previous section, preliminary descriptive analysis indicates that mobbing victims' health seems to be worse than it is for the rest of the workers. Whether or not the mobbing process can help to explain this difference is the objective of this section. To this aim, we formulate and estimate an econometric model to quantify the relationship between suffering from health problems and being a mobbing victim. According to the health indicators considered in the previous section, we define two binary variables as follows:

$$\text{Bad Health Indicator } 1_i = \begin{cases} 1 & \text{if worker } i \text{ reports that work affects health} \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Bad Health Indicator } 2_i = \begin{cases} 1 & \text{if worker } i \text{ suffers from any of the bad health symptoms} \\ 0 & \text{otherwise} \end{cases}$$

For each of these indicators we formulate a probit model in terms of personal and job characteristics, working conditions and whether the worker is a mobbing victim or not, i.e., for a sample of workers indexed by $i = 1, ..., n$, we define, for indicators $j = 1, 2$:

$$\Pr(\text{Bad Health Indicator } j_i = 1) = \Phi(\beta_0 + \beta_1 \ Mobbed_i + \beta'_P \ X_i^P + \beta'_W \ X_i^W + \beta'_J \ X_i^J) \tag{1}$$

where $Mobbed$ is an indicator that takes on the value 1 if the worker is a mobbing victim. We consider the following set of explanatory variables:

- X^P is a vector of personal characteristics such as gender, education and age.

- X^W is a vector of variables related to working conditions, such as physical and chemical conditions, risk factors and organizational factors.

- X^J contains information on the job characteristics, such as the industrial sector and the location.

There is an important econometric issue to consider in this type of model. There can be simultaneity in the relationship between being a mobbing victim and suffering bad health. That is, the variable $Mobbed$ can be endogenous in equation (1). The endogeneity bias in this kind of nonlinear models has been widely studied in the literature. For the case that the potential endogenous variable is continuous, Rivers and Vuong (1998) develop a type of 2-step estimation method and an exogeneity test. However, this approach is not valid when the potential endogenous variable is discrete, as it is in our model. In this context, the approach consists of specifying an additional equation for the endogenous variable and jointly estimate both equations. For examples of this estimation approach, in a variety of contexts, see Carrasco (2001) and De la Rica and Ferrero (2003) among others.

Accordingly, we formulate a standard probit model for the indicator of being a mobbing victim, as follows:

$$\text{Pr}(\text{Mobbed}_i = 1) = \Phi(\gamma_0 + \gamma_P' \ Z_i^P + \gamma_W' \ Z_i^W + \gamma_J' \ Z_i^J) \qquad (2)$$

where Z^P, Z^W and Z^J are vectors of variables of personal characteristics, working conditions and job characteristics, respectively. We need to consider some exclusion restrictions such that we can identify the effect of mobbing on health, i.e., there must be some instruments, some explanatory variables in (2) that do not appear as regresors in (1). We will go back later to the issue of the existence of valid instruments.

Let us denote by u_1 and u_2 respectively the error terms of the latent variable models underlying equations (1) and (2). We assume they follow a bivariate normal distribution with zero mean, unit variances and covariance given by the parameter ρ. An standard assumption in probit models is to consider unit variance, given the lack of identification of the variance of the error term. This implies that the covariance parameter ρ is in fact the correlation parameter between the error terms of both equations. If $\rho \neq 0$, there is evidence of endogeneity and thus, the estimation of the health equation (1) under the exogeneity assumption would be inconsistent. In that case, the sign of the correlation parameter provides information about the sign of the bias.

Tables 1 and 2 show the estimation results, which are very similar for the mobbing equation. Regarding personal characteristics, it is worth noting that the higher the educational attainment, the higher the probability of being a mobbing victim. Other personal characteristics, such as gender or age are not statistically significant. With respect to working conditions, results suggest that receiving training provided by the firm as well as having good job quality lowers the probability of being mobbed. However, working on weekends as well as more than 40 weekly hours increases this probability. About job characteristics, note that working in Madrid also increases the probability of being mobbed, as it is the case if the worker belongs to the bank sector, public administration or social services, as well as if she works for a large firm. Summarizing, among the set of explanatory variables, those related to job characteristics, and especially, working in Madrid or in social services, are found to be important factors in explaining the probability of being a mobbing victim.

Next, we focus on the health equation estimates in Table 1. We find that the main variable of interest, being a mobbing victim, is significant and has a positive effect on the probability of reporting that job affects health. About personal characteristics, this probability is, other things equal, higher for females. Having college education has also a positive and significant effect on the probability of this perception, as it happens with age.

Table 1: Bivariate probit estimates. Health indicator 1 (Job affecting health)

Bad Health equation		Mobbing equation	
Mobbing victim	1.374 (0.209)***		
		Personal characteristics	
Personal characteristics		High School education	0.121 (0.068)*
Female	0.139 (0.041)***	College education	0.238 (0.078)***
High School education	-0.041 (0.046)		
College education	0.099 (0.056)*	Working conditions	
Age	0.013 (0.001)***	Training	-0.343 (0.072)***
		Weekend	0.298 (0.060)***
Working conditions		Good job quality	-0.239 (0.058)***
Bad physical conditions	0.350 (0.051)***	More than 40 weekly hours	0.130 (0.069)*
Bad chemical conditions	0.334 (0.046)***		
Lack of safety	0.296 (0.048)***	Job characteristics	
Accident	0.569 (0.059)***	Madrid	0.420 (0.063)***
Good organizational factors	-0.156 (0.050)***	Bank and Public admin	0.191 (0.075)**
More than 40 weekly hours	0.158 (0.049)***	Social services	0.398 (0.076)***
		Large firm	0.160 (0.089)*
Job characteristics			
Bank and Public admin	0.130 (0.052)**		
Social services	-0.017 (0.063)		
Constant	-1.882 (0.096)***	Constant	-1.676 (0.093)***

Number of observations: 5452   Log-likelihood: -3859.78

Wald joint significance test, p-value: 0.000

Correlation coefficient $\hat{\rho}$:   -0.354 (0.097)

Wald test $(H_0 : \rho = 0)$: $\chi_1^2 = 11.043$ p-value: 0.0009

Notes: Robust standard errors in parenthesis.

*, **, *** : significant variables at 10%, 5% and 1% respectively.

Table 2: Bivariate probit estimates. Health indicator 2 (Bad health symptoms)

Bad Health equation		Mobbing equation	
Mobbing victim	0.946 (0.308)***		
		Personal characteristics	
Personal characteristics		High School education	0.131 (0.068)*
Female	0.314 (0.038)***	College education	0.242 (0.078)***
High School education	0.026 (0.043)		
College education	0.211 (0.052)***	**Working conditions**	
Age	0.010 (0.001)***	Training	-0.309 (0.072)***
		Weekend	0.297 (0.060)***
Working conditions		Good job quality	-0.242 (0.061)***
Bad physical conditions	0.265 (0.049)***	More than 40 weekly hours	0.141 (0.068)**
Bad chemical conditions	0.142 (0.044)***		
Lack of safety	0.299 (0.043)***	**Job characteristics**	
Accident	0.412 (0.057)***	Madrid	0.417 (0.066)***
Good organizational factors	-0.137 (0.045)***	Bank and Public admin	0.219 (0.074)***
More than 40 weekly hours	0.251 (0.046)***	Social services	0.414 (0.075)***
		Large firm	0.164 (0.090)*
Job characteristics			
Madrid	-0.314 (0.053)***		
Bank and Public admin	0.163 (0.048)***		
Social services	-0.065 (0.060)		
Constant	-1.421 (0.089)***	Constant	-1.716 (0.094)***

Number of observations: 5450   Log-likelihood: -4480.26

Wald joint significance test, p-value: 0.000

Correlation coefficient $\hat{\rho}$:   -0.142 (0.148)

Wald test $(H_0 : \rho = 0)$: $\chi_1^2 = 0.901$ p-value: 0.342

Notes: Robust standard errors in parenthesis.

*, **, *** : significant variables at 10%, 5% and 1% respectively.

Regarding working conditions, all the variables considered are found to have a significant effect on the probability of the worker's perception that work affects health. It is worth mentioning that one of the most relevant factors is to have suffered an accident in the last two years.

With respect to job characteristics, we find that working in the bank sector or public administration has a positive effect on the probability of bad health, in terms of this indicator.

The potential endogeneity of mobbing in the health equation has motivated the joint estimation of health and mobbing equations. There are some exclusion restrictions we have considered: working in Madrid and for a large firm. These variables affect the probability of being a mobbing victim, but are not related to the probability of suffering bad health, in terms of the perception indicator. When both two variables are included in the health equation, they are not found to be significant. Therefore, they can be considered as instruments for the mobbing variable.

The estimated correlation coefficient between the error terms of both equations, ρ, is negative, -0.354. The p-value of the Wald exogeneity test shows that the exogeneity assumption can be rejected at the usual levels. This indicates an endogeneity problem when considering mobbing as a factor to explain bad health in terms of the perception indicator. Thus, the univariate estimation of the health equation would be inconsistent. The negative sign of the coefficient means that there are unobservable factors that increase the probability of being a mobbing victim and simultaneously decrease the probability of reporting that job is affecting health. One possible explanation could be related to being a successful person (high-achieving professionals, self-confident people or in some way attractive individuals). On one hand, those people who are successful, attractive, etc., are more likely to be subjected to the envy of other people, and among them, the individuals they work with. Then, their attractiveness could raise their success in life, becoming a source of mobbing behaviors against them, since one of the sources of mobbing could be envy. There are some works supporting this kind of argument. For example, Mulford et al. (1998) find that physical attractiveness is a contributing factor to success in everyday exchange, Hamermesh (2005) analyzes beauty in electoral candidates and finds that more beauty can raise chances of electoral success. Furthermore, Westhues (2005), focusing on high-achieving professors, argues that envy (in this case, the "envy of excellence") is a main cause that yield workers to perpetrate mobbing behaviors against those workmates who are specially successful. On the other hand, it is well known that those self-confident, in some way attractive individuals, have a better self-perception on health than

the average. This could decrease the probability that these workers report that their job affect their health. In this line, Shackelford and Larsen (1999), using self-reports on a sample of individuals, find evidence that more facially attractive people may be physically healthier than unattractive ones. Then, unobservable factors related to personal success or attractiveness can increase the probability of being a mobbing victim and decrease the probability of reporting bad health, measured as the perception that job affects health.

Table 2 shows the estimates of the bivariate probit model using the second bad health indicator: the presence of any of the symptoms reported in Figure 3. As we said before, the estimated coefficients for the mobbing equation are very similar to those reported in Table 1. About the estimates for the health equation, we find that being a mobbing victim significantly increases the probability of suffering bad health symptoms. Concerning personal characteristics, being a female implies, other things equal, a higher probability of bad health. This probability also increases with age and educational attainment. Regarding working conditions, we find again that being exposed to bad physical or chemical conditions, as expected, increases the probability of suffering symptoms. The same evidence is found if the workplace is not safe and if the worker has had an accident in the last 2 years. Working more than 40 weekly hours also increases this probability. On the contrary, having good organizational factors lowers the probability of having bad health. These findings are similar to those based on the perception indicator. With respect to job characteristics, the results are the same as in Table 1 in terms of the industrial sector: working in the bank sector or public administration raises the probability of suffering bad health symptoms. However, Table 2 suggests that working in Madrid significantly decreases that probability. This regional effect is not found to be significant when the perception indicator is considered. In our opinion, this is an interesting finding, since working in Madrid is a factor that positively contributes to being a mobbing victim but negatively affects the probability of having bad health symptoms.

To identify the effect of mobbing in the health equation, we consider as exclusion restrictions working during the weekends and for a large firm. These variable are not significant when they are included in the health equation.
It is worth noting that the correlation coefficient between the error terms of health and mobbing equations is not statistically different from zero (see the p-value of the Wald exogeneity test in Table 2). Then, we cannot reject the exogeneity assumption, which means that the effect of mobbing on health can be consistently estimated through a univariate probit model.

Rejecting the mobbing exogeneity assumption when using the perception in-

dicator, and not doing it when using the bad health symptoms indicator is, in our opinion, an expected result. And the reason is that the first indicator is related to job aspects which is not the case for the second one. When we consider the presence of bad health symptoms, the worker is asked whether she suffers from any of the symptoms, but the question does not relate to work, i.e., the worker can suffer bad health symptoms due to work, but also due to many other different reasons that have nothing to do with work. So, the perception indicator is containing information on the pair health-work, while in the symptoms indicator, the information is only based on health (related or not to work). This can explain why there can be simultaneity (and thus, an endogeneity issue) between mobbing and health with the perception indicator, but not with the symptoms indicator.

Based on the exogeneity test result in Table 2, a univariate probit model is estimated and the results appear in Table 3. As we can see, the main findings in terms of the qualitative effect and significance of all the explanatory variables are very similar to those reported in the left panel of Table 2.

Previous tables report estimated coefficients, however we are dealing with nonlinear models and consequently those coefficients do not report the average effect of the explanatory variables. Table 4 shows the average effect on health of our main variable of interest, being a mobbing victim, evaluated at the mean value of the rest of the variables. When using the perception indicator we report the effect both under the exogeneity and endogeneity assumption. When using the symptoms indicator, we report the average effect under exogeneity, since this assumption was not rejected.

When exogeneity of mobbing is assumed, we find that being a mobbing victim increases the probability of reporting that work affects health by 24 percentage points. However, taking into account the potential endogeneity of mobbing yields to a very different result: being a mobbing victim increases this probability by 50 percentage points. Thus, not taking into account the endogeneity of mobbing induces a very important downward bias, i.e, the effect of mobbing is clearly underestimated. If we focus on the probability of having bad health symptoms, we find that being a mobbing victim increases this probability by 26 percentage points.

As a robustness check of our results, we consider and estimate alternative specifications, with some additional explanatory variables. For example, in terms of personal characteristics, we include the worker's nationality. In terms of working and job characteristics, we consider some additional variables related to the job contract and schedule: fixed or permanent contract, part-time or full-time work, shifts working. None of these variables are found to be significant. Furthermore,

Table 3: Univariate probit estimates

Health indicator 2 (Bad health symptoms)	
Mobbing victim	0.669 (0.074)***
Personal characteristics	
Female	0.305 (0.038)***
High School education	0.027 (0.042)
College education	0.221 (0.051)***
Age	0.009 (0.001)***
Working conditions	
Bad physical conditions	0.269 (0.048)***
Bad chemical conditions	0.159 (0.043)***
Lack of safety	0.290 (0.042)***
Accident	0.419 (0.056)***
Good organizational factors	-0.141 (0.043)***
More than 40 weekly hours	0.259 (0.044)***
Job characteristics	
Madrid	-0.290 (0.049)***
Bank and Public admin	0.160 (0.047)***
Social services	-0.031 (0.056)
Constant	-1.399 (0.087)***
Number of observations: 5679	
Log-likelihood: -3429.38	

Notes: Robust standard errors in parenthesis.

*, **, *** : significant at 10%, 5% and 1% respectively.

Table 4: Average effect of mobbing on bad health

Bad health indicators	Under exogeneity	Under endogeneity
1. Job affects health	0.240 (0.029)***	0.501 (0.072)***
2. Symptoms	0.260 (0.028)***	

Note: Standard errors in parentheses

although gender is not significant in the mobbing equation, it is significant in the health equation. Therefore we include its interaction to analyze whether or not the effect of mobbing on health is different for males and females. This interaction effect is not significant.

We also consider a third health indicator: being on a sick leave. However, only 3.52% of individuals in our sample are in this situation. This prevents us to estimate a model similar to those reported in Tables 1 and 2, since we do not have enough variability in the explanatory variables for the subsample of workers on a sick leave. Nevertheless, the descriptive evidence shows a positive correlation between this variable and being a mobbing victim. The percentage of workers who are on a sick leave is much higher among mobbed workers (7.16%) than among not mobbed ones (3.30%).

4 Conclusions

This paper analyzes empirically the impact of mobbing on the workers' health. Recognizing that mobbing can be an endogenous variable in a health equation, we have estimated a bivariate probit model. Results indicate that being a mobbing victim increases significantly the probability of perceiving that job affects health and also the probability of suffering from bad health symptoms. When the health indicator is the worker's perception that job affects health, we find evidence of the endogeneity of mobbing. Estimating its effect on health without accounting for this issue yields to underestimation. When endogeneity is considered, our results show that being a mobbing victim increases the probability of reporting that job affects health by 50 percentage points. When the health indicator is the presence of bad health symptoms, the exogeneity assumption cannot be rejected. In this case, being a mobbing victim increases the probability of suffering from bad health symptoms by 26 percentage points.

Appendix

A. Variables definition

Female: Dummy variable taking the value 1 if female and 0 if male.

Age: Age of the worker in years.

Primary education: Dummy variable taking the value 1 if worker's education is primary school and 0 otherwise.

High school education: Dummy variable taking the value 1 if worker's education is high school and 0 otherwise.

College education: Dummy variable taking the value 1 if worker's education is college and 0 otherwise.

Training: Dummy variable taking the value 1 if the worker has been trained for the job at the organization and 0 otherwise.

Weekend: Dummy variable taking the value 1 if working during the weekends and 0 otherwise.

More than 40 hours: Dummy variable taking the value 1 if working more than 40 hours per week, and 0 otherwise.

Good job quality: Dummy variable taking the value 1 when temperature and noise are adequate at workplace and 0 otherwise.

Bad physical conditions: Dummy variable taking the value 1 if the worker declares being exposed to more than half of the following physical risk factors at the workplace: uncomfortable temperature, noise, uncomfortable indoor air quality, vibrations, light emissions, and 0 otherwise.

Bad chemical conditions: Dummy variable taking the value 1 if the worker reports being exposed to harmful gas emissions or toxic chemical components, and 0 otherwise.

Lack of safety: Dummy variable taking the value 1 if there is risk of any type of accident at the workplace and 0 otherwise.

Accident: Dummy variable taking the value 1 if the worker reports to have had an accident at the workplace in the last two years and 0 otherwise.

Good organizational factors: Dummy variable taking value 1 if the worker reports to have certain autonomy to choose how to do the work in terms of method and the workload has not been too low neither too high during the last 3 months, and 0 otherwise.

Madrid: Dummy variable taking the value 1 if working in *Comunidad de Madrid*, and 0 otherwise.

Bank and Public administration Dummy variable taking the value 1 if the individual works in Public Administration or in the bank sector and 0 otherwise.

Social services: Dummy variable taking the value 1 if the individual works in Social Services and 0 otherwise.

Large firm: Dummy variable taking the value 1 if working for a large firm (more than 500 workers), and 0 otherwise.

Mobbing victim: Dummy variable taking the value 1 if the individual has been identified as as mobbing victim and 0 otherwise.

Perception that work affects health: Dummy variable taking the value 1 if the worker reports that work affects health and 0 otherwise.

Sleeping problems: Dummy variable taking the value 1 if the worker reports to suffer frequently from sleeping problems and 0 otherwise.

Overall fatigue: Dummy variable taking the value 1 if the worker reports to suffer frequently from overall fatigue and 0 otherwise.

Headache: Dummy variable taking the value 1 if the worker reports to suffer frequently from dizziness and 0 otherwise.

Dizziness: Dummy variable taking the value 1 if the worker reports to suffer frequently from headache and 0 otherwise.

Concentration difficulties: Dummy variable taking the value 1 if the worker reports to have frequently concentration difficulties and 0 otherwise.

Memory problems: Dummy variable taking the value 1 if the worker reports to have frequently memory problems and 0 otherwise.

Irritability: Dummy variable taking the value 1 if the worker reports to suffer frequently from irritability and 0 otherwise.

Emotional extenuation: Dummy variable taking the value 1 if the worker reports being emotionally exhausted and 0 otherwise.

Obsession with work: Dummy variable taking the value 1 if the worker reports being obsessed with work and 0 otherwise.

Gastrointestinal disorders: Dummy variable taking the value 1 if the worker reports to suffer frequently from gastrointestinal disorders and 0 otherwise.

Vision problems: Dummy variable taking the value 1 if the worker reports to have frequently vision problems and 0 otherwise.

Discouragement: Dummy variable taking the value 1 if the worker reports to suffer frequently from discouragement and 0 otherwise.

No symptoms: Dummy variable taking the value 1 if the worker reports to suffer frequently none of the previous health symptoms and 0 otherwise.

B. Descriptive statistics

Variables description	# obs	Mean	Std. dev.
Mobbing incidence			
Mobbing victim	10887	0.0584	0.2345
Health indicators			
Indicator 1: Perception indicator			
Work impact on health	10861	0.2295	0.4205
Indicator 2: Bad health symptoms			
Sleeping problems	10720	0.1215	0.3267
Overall fatigue	10720	0.1243	0.3299
Headache	10720	0.1053	0.3070
Dizziness	10720	0.0242	0.1537
Concentration difficulties	10720	0.0315	0.1746
Memory problems	10720	0.0418	0.2002
Irritability	10720	0.0877	0.2829
Emotional extenuation	10720	0.0720	0.2585
Obsession with work	10720	0.0565	0.2308
Gastrointestinal disorders	10720	0.0162	0.1264
Vision problems	10720	0.0334	0.1797
Discouragement	10720	0.0427	0.2023
No symptoms	10720	0.6555	0.4752
Personal characteristics			
Female	11054	0.4146	0.4927
Age	11054	38.639	11.382
High school education	10754	0.3863	0.4869
College education	10754	0.2298	0.4207
Working conditions			
Training	10819	0.7361	0.4408
Weekend	10957	0.5042	0.5000
More than 40 hours	10942	0.2751	0.4466
Good job quality	9901	0.4868	0.4998
Bad physical conditions	8498	0.16638	0.3724
Bad chemical conditions	10980	0.2754	0.4467
Lack of safety	10998	0.7128	0.4525
Accident	11025	0.1058	0.3076
Good organizational factors	7907	0.2132	0.4096
Job characteristics			
Madrid	11054	0.1615	0.3680
Bank and Public administration	11054	0.2487	0.4323
Social services	11054	0.1254	0.3312
Large firm	9657	0.0435	.2041

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Guardia Civil, 22 - Esc. 2, 1°
46020 Valencia - Spain
Phone: +34 963 190 050
Fax: +34 963 190 055

Department of Economics
University of Alicante

Campus San Vicente del Raspeig
03071 Alicante - Spain
Phone: +34 965 903 563
Fax: +34 965 903 898

Website: www.ivie.es
E-mail: publicaciones@ivie.es