Management of psychosocial risks at work:

An analysis of the findings of the European Survey of Enterprises on New and Emerging Risks (ESENER)

European Risk Observatory
Annexes

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Appendix A: Technical note on empirical analysis

Relationship between model and literature: Analytical strategy

In our analysis of OSH management in LOT 1 we indicated, on the basis of the regulatory and empirical literature, that the exact meaning of what constitutes an OSH management system is lacking. We identified this as a basic definitional problem that represents an obstacle on the way to understanding the determinants of quality of OSH management. To be able to form some idea of what accounts for 'poor' or 'good' management of OSH, one is required to define what constitutes OSH management and to operationalise it, i.e. to link the definition to the empirical indicators provided by surveys or administrative sources. We stated this in relation to the general concept of the OSH management, but this is also true of management of a particular aspect of OSH management: management of psychosocial risks.

In our analysis of management of psychosocial risks we pursue the same analytical strategy as with the analysis of the management of general risks to safety and health, namely:

1. We employ the conceptual framework of OSH management to investigate the possibility of generating an empirical construct which will efficiently summarize features of OSH management within a particular area of psychosocial risks. Such an empirical construct will be, effectively, a single variable capturing the scope of management of psychosocial risks;

2. We model the relationship between that variable (in the status of dependent variable) and selected determinants of OSH management (independent variables) in a multivariate setting. Thereby, we identify the significant predictors of OSH management in the area of psychosocial risks and provide the policy makers with options for interventions.

It is worth referring again in this context to the principal elements identified within a general OSH management system: (a) the existence of OSH regulating policy, (b) existence and operation of decision-making, accountability and communication structures in relation to OSH, (c) allocation of technical and financial resources specifically for OSH management, (d) existence of hazard identification processes and control, (e) training and organizational learning in relation to OSH issues, and (f) monitoring of OSH outcomes.

As we stated in our analysis in Lot 1, this conceptual framework influenced the minds of policy makers in the area of OSH policy and ultimately found its way to the largest ever survey of OSH management in the European Union and selected candidate countries- ESENER. Judging by the relatively low level of non-response in the survey, the key elements of the framework are adequately understood by the managerial level across the surveyed establishments. Specifically in relation to psychosocial risks, we identified 8 questions from the managerial (MM) questionnaire of ESENER (and ESENER electronic dataset) that could be unambiguously identified with the elements of the conceptual framework. These are presented in Table below. The last column of Table 1 identifies the relevant elements of the conceptual framework as outlined above.

Table 1: Aspects of OSH management in the area of psychosocial risks

Question number* (MM questionnaire)	Question content	Element of conceptual framework
MM150_3 (psychol_use)	What health and safety services do you use, be it in-house or contacted externally? Response options: 3. A psychologist (Response options: 1. Yes, 2. No, 3. NA)	(c)
MM250 (procedure_stress)	Does your establishment have a procedure to deal with work-related stress?	(a)

	Response options: 1. Yes, 2. No, 3. Work-related stress is not an issue in our organisation, 4. No Answer	
MM251 (procedure_harass)	Is there a procedure to deal with bullying and harassment? Response options: 1. Yes, 2. No, 3. These problems are not an issue in our organisation, 4. No Answer	(a)
MM252 (procedure_violence)	And do you have a procedure to deal with work-related violence? Response options: 1. Yes, 2. No, 3. Work-related violence is not an issue in our organisation, 4. No Answer	(a)
MM253_6 (training)	In the last 3 years, has your establishment used any of the following measures to deal with psychosocial risks? Measure number 6- provision of training Response options: 1. Yes, 2. No, 3. No Answer	(e)
MM259 (inform_empl)	Do you inform employees about psychosocial risks and their effect on health and safety? Response options: 1. Yes, 2. No, 3. No Answer	(b)
MM260 (whom_to_address)	Have they been informed about whom to address in case of work related psychosocial problems? Response options: 1. Yes, 2. No, 3. No Answer	(b)
MM302 (info_used)	Have you used information or support from external sources on how to deal with psychosocial risks at work? Response options: 1. Yes, 2. No, 3. No Answer	(e)

* informative abbreviation of a question/variable name used throughout this report is given in brackets

We noted that the ESENER questionnaire provides good coverage of the aspects of the conceptual framework when it came to general risks, with approximately 2 questions per aspect. This is not the situation in relation to psychosocial risks. It is obvious that documentation of management of these kinds of risks has been less comprehensive and systematic. First, only four out of six aspects are covered (a,b,c,e), and two important elements (d, f) are not covered in our conceptual framework. However, it has to be mentioned that there were items in the MM questionnaire, such as MM161, MM164 and MM263 that relate to 'd' and 'f, but because they were filtered questions they could not be used in the factor analysis. The client may be well advised to attempt a fuller coverage of different aspects of the conceptual framework, and in particular, to introduce questions on hazard identification processes and monitoring of specific outcome in relation to psychosocial risks asked across all establishments included in ESENER. Second, the client is advised to undertake a more balanced coverage of all aspects, allocating systematically 2-3 questions per aspect.

Introducing the model

In our analysis we pursue two distinct goals. First, we attempt to develop an empirical indicator of scope of management of psychosocial risks which would allow us to create a profile of the management of psychosocial risks and characterise European establishments, with the help of

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this profile. Second, we are trying to understand the determinants of management of psychosocial risks.

The development of an empirical indicator of management of psychosocial risks is the first stage of our analysis. Given the definitional uncertainties of the OSH management system and the normative nature of its characterisation, it is necessary to ask whether the development of a single empirical indicator is at all a sensible goal to pursue. To put it differently, although the literature identifies aspects of the conceptual framework and points out the desirability of their integration, the reality of such integrated existence is something to question, rather than to accept uncritically. We would like to know whether various aspects of OSH management listed in Table 1 tend to co-exist in establishments' 'lives' or, on the contrary, whether these aspects are, in fact, disconnected features of OSH management. Confirmation of the integration of aspects (or lack of it) would have an immediate analytical value, as it will indicate the empirical (rather than normative) presence of a management system of psychosocial risks (or a lack of it). It would also possess a methodological value as it will allow efficient characterisation of the establishment in terms of scope of management of psychosocial risks along a single dimension, instead of laborious characterisation along multiple dimensions. This is because, in cases where integration of aspects is confirmed, various aspects of management of psychosocial risks could be averaged or summed to produce a single indicator (a composite score). Hence, our first practical task is to explore correlations between various aspects involved in the management of psychosocial risks.

Technical Box 1. Factor analysis (FA): technical aspects

Linear factor model for n observed variables and 2 factors (unobserved variables) takes the following form:

$$x_i = \alpha_{i0} + \alpha_{i1}f_1 + \alpha_{i2}f_2 + e_i \quad \text{(i=1,2)}$$

Here f_1 and f_2 are factors (unobserved variables) and α_1 and α_2 are factor loading – effectively these are correlations between x and the factors.

One should be aware that standard FA procedures available in modern statistical packages assume continuous distributions. Application of standard FA analysis directly on non-continuous variables will result in underestimated correlation coefficients. All candidate variables in our case are non-continuous (binary). Due to a non-continuous nature of the candidate variables, pre-processing was carried out by taking polychoric correlations and the FA was carried out on these polychoric correlations instead of the original scale of the variables.

Investigation of the determinants of management of psychosocial risks forms a second stage of our analysis. We are developing a multivariate analytical framework which allows for the isolation of separate effects of establishment characteristics such as size, industry, sector and others on the scope of management of psychosocial risks. Obviously, a multitude of factors affect the scope of management of psychosocial risks just like they affect management of general risks. Some of these relationships (e.g. the negative link between the size of the establishment and the scope of OSH provision) have been well-documented in the literature. Other relationships are less well understood (e.g. the independent effect of being part of a larger firm irrespective of size). Still others (e.g. differential effect of size depending on industry or sector) are largely unknown. It is important to understand whether, and how these factors shape the management of psychosocial risks and what makes a certain establishment a 'good' or 'bad' performer.

The ability of international and national regulatory bodies to develop and implement policy in the area of management of general and psychosocial risks depends critically on such understanding. Hence, our second practical task is to examine the isolated effects of establishments' characteristics and some contextual features on the scope of management of psychosocial risks.

Technical Box 2. Regression model: technical aspects

The estimated model in its generic form can be specified as follows:

$$OSH\_psycho = \alpha_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k + e$$

Here OSH_psycho denotes the outcome and $x's$ are explanatory variables (size of establishment, establishment's sector, demographics, country etc).

The nature of the response variable (approximately normally distributed) is conducive to using linear modelling framework. It is worth pointing out that even when the response variable deviates from a normal distribution, the linear modelling framework will be appropriate for modelling relationships of the basis of datasets with the number of cases exceeding 10,000. Central Limit Theorem applies almost always around 1000-10,000 cases, as long as that 1000-10,000 is the effective sample size.

Therefore, we implement linear modelling (OLS) as a technique of multivariate analysis.

Building on a particular strength of this survey, i.e. its cross-national nature, - ESENER covered 31 countries - our analysis gives special attention to the identification of country-effects. Naturally, there is a great variation in regulatory practices, business environments and culture between countries. Therefore, we propose to capture the 'sum' of all possible country-specific features using 'country' as a special control variable in models of economic performance.

We explicitly favour a fixed-effects modelling framework to estimate country effects. We fully acknowledge the difficulty of work with models including 30 country intercepts, especially in the context of testing for possible interactions. However, the super-population argument, which would make a strong case for the use of a random effects model, is non-applicable here: countries are not sampled from the larger universe; and the distributional assumptions of random effect models are unlikely to be met when the units are countries. Additionally, a fixed-effects modelling framework has advantages when it comes to reporting the results, as it allows straightforward presentation of the main country effects.

Building the model

Task 1: Development of empirical indicator of management of psychosocial risks

Can we use the totality of information obtained through specific questions on management of psychosocial risks (Table 2) to generate a single indicator which can be subsequently used to characterise establishments? One approach to generating such an indicator would be factor analysis (FA). FA and other related methods are implemented when the direct measurement of a phenomenon of interest (e.g. scope of OSH management) is not possible or is difficult due to definitional vagueness, imprecision, or to the difficulty or diversity of constituting aspects.

What makes FA a suitable technique for our purposes? Management of psychosocial risks is indeed a multifaceted and a somewhat vague concept which cannot be sensibly captured with a single question in a survey. ESENER included 8 questions relating to its various aspects. However, we cannot observe the general pattern of management potentially underlying the 8 variables from an examination of these variables separately from each other. The co-existence of all, or selected, aspects of management of psychosocial risks in establishments' lives would represent evidence of the existence of such a system and the ways in which it can be captured in a single indicator. FA, in practical terms, is a correlation test of aspects of the management of psychosocial risks. Through its application we test whether its separate aspects are indeed related to each other (i.e. whether they tend to occur together and to what extent). If the answer is positive, then the information from 8 manifest variables can be combined to render a smaller number of indicators of management of psychosocial risks.

Below we present tabulation of frequencies for 8 candidate variables for FA. As this is the first presentation of these frequencies, we present both unweighted and weighted frequencies side by side, demonstrating that the weighting does not significantly affect the relationships between categories.

Table 2: Candidate variables for factor analysis

MM150_3 What health and safety services do you use, be it in-house or contracted externaly? (psychologist)			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	524399	6633	**15.8**	**23.2**
2 No	2754378	21737	**83.1**	**75.9**
3 DK/ NA	34924	279	**1.1**	**1.0**
Total	3313701	28649	100	100

MM250 Does your establishment have a procedure to deal with work-related stress?			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	842322	8328	**25.4**	**29.1**
2 No	2182924	17306	**65.9**	**60.4**
3 Work-related stress is not an issue in our establishment	256455	2676	**7.7**	**9.3**
4 No answer	32000	339	**1.0**	**1.2**
Total	3313701	28649	100.0	100.0

MM251 Is there a procedure in place to deal with bullying or harassment			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	986534	9412	**29.8**	**32.9**
2 No	1843527	13768	**55.6**	**48.1**
3 These problems are not an issue in our establishment	456851	5198	**13.8**	**18.1**
4 No answer	26789	271	**0.8**	**0.9**
Total	3313701	28649	100.0	100.0

MM252 And do you have a procedure to deal with work-related violence?			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	855398	7849	**25.8**	**27.4**
2 No	1942538	14643	**58.6**	**51.1**
3 Work-related violence is not an issue in our establishment	488713	5890	**14.7**	**20.6**
4 No answer	27052	267	**0.8**	**0.9**
Total	3313701	28649	100.0	100.0

MM253.6 Provision of training / In the last 3 years, has your establishment used any of the following measures to deal with psychosocial risks? (Provision of training)			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	1907720	16674	**57.6**	**58.2**
2 No	1375424	11613	**41.5**	**40.5**
3 DK/ NA	30556	362	**0.9**	**1.3**
Total	3313701	28649	100.0	100.0

MM259 Do you inform employees about psychosocial risks and their effect on health and safety?			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	1751682	16438	**52.9**	**57.4**
2 No	1521226	11730	**45.9**	**40.9**
3 No answer	40793	481	**1.2**	**1.7**
Total	3313701	28649	100.0	100.0

MM260 Have they been informed about whom to address in case of work-related psychosocial problems?			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	2262613	20886	**68.3**	**72.9**
2 No	1000448	7234	**30.2**	**25.3**
3 No answer	50640	529	**1.5**	**1.8**
Total	3313701	28649	100.0	100.0

MM302 Have you used information or support from external sources on how to deal with psychosocial risks at work?			
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	1232185	12638	**37.2**	**44.1**
2 No	2011831	15278	**60.7**	**53.3**
3 No answer	69685	733	**2.1**	**2.6**
Total	3313701	28649	100.0	100.0

There are a few other important observations suggested by these results. First, the actual scope of missing cases (i.e. 'No Answer'/NA category) is rather small. It is at most around 2.5% of total observations. This is a sound indication of good quality of response to these survey questions. Second, three questions addressing the existence of procedures for dealing with various types

of psychosocial risks (MM250-MM252) have a special category allowing the respondents to state that these risks are not an issue in their establishment. This category was used by 8%-15% of the respondents, which is a non-negligible proportion.

This second point deserves further attention. An option of saying that certain risks are not an issue in an establishment has been presented only once in the course of the survey, in relation to questions MM250-MM252. It is not clear what led to the inclusion of this option: the desire of the questionnaire designers to accommodate this type of response or the tendency of the respondents to reply in this way, which ultimately led to creation of a new category *a posteriori*. Whatever the true reason, the existence of this category presents a challenge for analysis. First, it is probably not appropriate to treat it as non-response, i.e. in a manner similar to treating 'No Answer/NA' category. In technical terms, this strategy would result in a loss of a very significant proportion of cases. However, this may not be a sensible course of action given the potential meaning of this type of response. The respondents were asked to answer whether they had a procedure to deal with various types of risks, not whether they had these risks. So, the survey questions address the readiness or preparedness of an establishment, not the actual presence of risks, therefore the answer 'such risks are not an issue' is not a particularly sensible one. It may reflect the sensitive nature of the topic and it may suggest that the respondents trying 'to wave it off' as a non-issue demonstrate in fact low level of awareness of the importance of putting in place appropriate procedure as a preventive measure. This possibility begs the question of whether it is more reasonable to treat 'Not an issue...' as a part of the 'No' category.

Guided by these considerations, we run a test of the relationship between an established set of predictors of OSH management, such as sector to which the establishment belongs and size of establishment and variables MM250-MM252. We calculated the general chi-square test to check the statistical significance of the relationship but also cell-specific contributions to the relationship. This confirmed that (1) the 'Not an issue' category formed a meaningful relationship with major predictors of OSH management'-which was not the case with 'No Answer/NA' category, and (2) 'Not an issue..' resembled 'No' in a pattern of response, e.g. small-size establishments had a larger proportion of 'No' answers to questions MM250-MM252 than larger establishments, and the same was true of a 'Not an issue..' category. This led us to combine 'Not an issue..' and 'No' categories in questions MM250-MM253, and derive a new binary variable taking value 1 if the establishment had procedures for dealing with all three mentioned types of psychological risks and 0 if otherwise. No other candidate variable suggested a need for modification. Frequencies of the new variable based on MM250-MM252, named 'procedures' for brevity, are presented below:

Table 3: Frequencies of 'Procedures' variable

MM250-MM252 (Procedures) Does your establishment have a procedure to deal with work-related stress and bullying/harassment and work related violence				
	Frequency weighted	Frequency unweighted	Percent weighted	Percent unweighted
1 Yes	458076	4400	**13.8**	**15.4**
2 No	2796170	23637	**84.4**	**82.5**
3 No Answer	59455	612	**1.8**	**2.1**
Total	3313701	28649	100.0	100.0

It is obvious that a minority of establishments possess all three procedures.

Thus, for the purpose of factor analysis we ultimately arrived at a list of 6 variables: (1) 'psychol_used' (2) 'procedures'; (3) 'training'; (4) 'inform_empl'; (5) 'whom_to_address'; (6) 'info_used'.

There are two conditions that the candidate variables for factor analysis should meet. First, factor analysis procedures built in the standard software assumes the continuous nature of variables. Initially, this condition was not satisfied, as all of ESENER variables are categorical. Second, all candidate variables should have a single response scheme. The second condition was satisfied after the development of a new 'procedures' variable. To meet the first condition, we calculated polychoric correlations for all binary variables. The polychoric correlation coefficients are calculated based on the assumption that the observed binary variables represent continuous latent variables. Factor analysis is then applied to polychoric correlations.

Initially, we derived 3 factors. We examined the variance accounted for by each factor and found that the first factor alone accounted for over 95% of common variance. This finding can be interpreted as the first indication that data reduction is a sensible technique in relation to 6 selected candidate variables. It further indicates that a single indicator of the scope of management of psychosocial risks could be derived on the basis of the estimated relationship between the 6 selected variables and the first factor.

Table 4 shows the detailed information on factor loadings for the first two derived factors.

Table 4: Factor loadings

Variable (questionnaire)	Abbreviated name	Factor 1	Factor 2
M150_3	psychol_used	0.582	0.181
MM250-MM252	procedures	0.675	0.130
MM253_6	training	0.495	0.028
MM259	inform_empl	0.697	-0.196
MM260	whom_to_address	0.773	-0.096
MM302	info_used	0.690	0.007

Note: N=26,354. All cases with unknown information in at least one candidate variables have been excluded. Sample of 26,354 cases (92% of the original sample) forms the base for all subsequent analyses unless otherwise stated.

As the solutions given by factor analysis procedure are not unique, we experimented with orthogonal rotation to see whether more simple and interpretable matrices of factor loading could be obtained. We found that the unrotated solution (presented in Table 3) is the simplest and the most straightforward to interpret.

What do the results of factor analysis tell us? Factor loadings in Table can be interpreted as measures of correlation between single variables and the underlying pattern of management of psychosocial risks. The higher the absolute value the more important a given variable is for a given factor. High factor loadings (conventionally: absolute values larger or equal to 0.6) suggest that a variable is strongly linked to the underlying pattern. Factor loadings in the range of 0.3-0.6 are considered to be of moderate size. The presence of such factor loadings in a number of variables (as in Factor 1, in Table 4) indicates that the observable variables reflect the same hidden (latent) phenomenon.

In the course of analysis leading to choice of variables for construction of the composite score of the scope of management of psychosocial risks we experimented with additional variables and implemented some alternative definitions of certain variables. Specifically:

1. We experimented with two filtered questions with high level of response (type of occasions on which risk assessment is carried out, MM163, and areas involved in these checks, MM164). Factor loading of these variables were below the conventional threshold allowing inclusion of these variables into the indicator of OSH management. Additionally, the answers to these questions were restricted to those establishments where regular risk assessments had been conducted. Limiting all subsequent analyses to this group only would have introduced a significant positive bias;

2. We experimented with variables relating to general rather than specifically to psychosocial risks (e.g. MM253 1-5, MM152). These variables formed a second factor in FA following rotation. This led us to the conclusion that management of psychosocial risks is a special aspect of OSH management that ought to be captured by a separate variable and analysed on its own.

3. We also experimented with a range of variables from the ER, ER 156, ER159, ER303 and ER402. Again, these variables formed a second factor in FA following rotation. This led us to exclude these factors from inclusion in the index.

We observed that 6 variables were, in conventional terms, strongly linked to each other, thereby forming a system of management of psychosocial risks. On the basis of the insights provided by factor analysis we derived a composite score of the scope of management of psychosocial risks (hereafter the 'OSH_psycho composite score' or simply 'OSH_psycho score'/ 'OSH_psycho variable'). This was done through summing across 6 variables. Thus, the resultant OSH_psycho composite score is a single indicator of the scope of the management of psychosocial risks with 6 as the largest possible value, indicating that a given establishment implements 6 out of 6 possible identified aspects of management of psychosocial risks and 0 as a smallest possible value, indicating that it implements none of these aspects. The distribution of this variable is presented in section *Univariate Analysis* below.

Task 2: Exploration of determinants of scope of management of psychosocial risks

To establish the significant determinants of management of psychosocial risks, we implemented two complementary techniques. First we conducted bivariate analyses, calculation of mean OSH_psycho scores, with 99% confidence intervals, for a number of potential predictors of management of psychosocial risks.

Second, we conducted multivariate analysis of determinants of OSH_psycho composite score. OSH_psycho composite score describing scope of management of psychosocial risks is a dependent variable in this framework. In line with previous research on the determinants of risks, the following variables were treated as predictors of OSH_psycho composite score (independent variables):

1. size of the establishment;
2. whether establishment is a part of a larger entity (company, firm);
3. sector (public or private);
4. gender composition of establishment's workforce;
5. age composition of establishment's workforce;
6. proportion of foreigners in establishment's workforce;
7. industry;
8. country;
9. age of the establishment (for non-public establishments only).

We also introduced controls over (a) the presence of actual psychosocial risks (indicated by variable MM202), (b) the presence of visits by Labour Inspectorate (indicated by variable MM170), and (c) perceived presence of external and internal pressures towards implementation of OSH (indicated by variable MM171).

Second, we implement conventional multivariate modelling. The basic purpose of multivariate models, regardless of a precise technique used to estimate them, is to answer the question of whether various factors (called collectively independent variables) exert independent influence on the behaviour of the variable of interest, an influence 'unpolluted', so to speak, by the presence of other factors. In our application, we would like to establish, for example, whether size of the establishment has an effect on management of psychosocial risks, with other things (sector, being part of a larger firm etc.) being held constant, i.e. whether it has an independent effect.
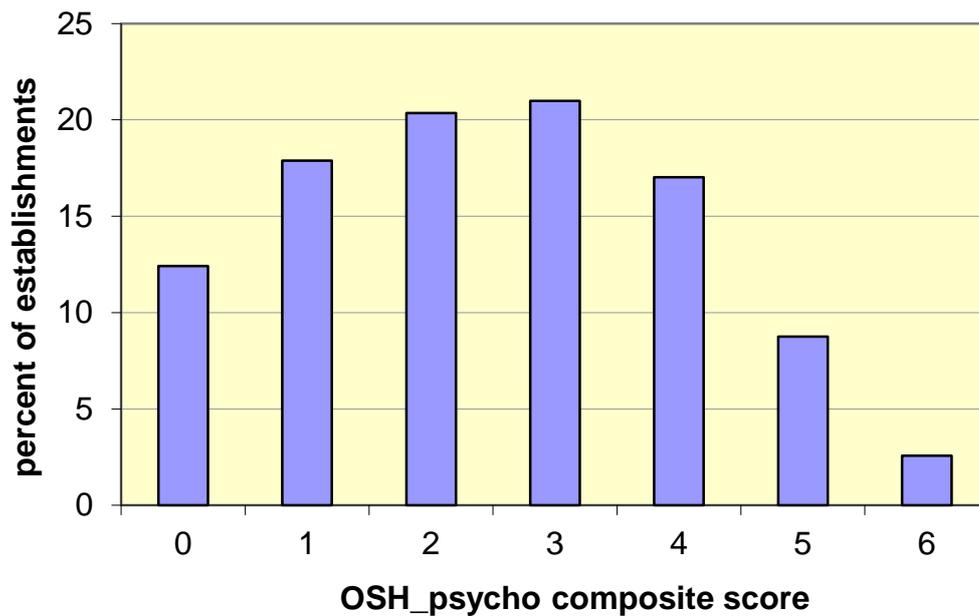
The results of our analyses are presented in the following section.

Findings

Univariate analysis

Figure 1 presents the distribution of the OSH_psycho composite score.

Figure 1: OSH_psycho composite score

Note: weighted results. N=3,079,307 (92% of the original weighted sample). Percentages are largely similar in an unweighted sample.

About one third of all establishments across Europe implement at least 4 aspects of the management system for psychosocial risks, and around 3% of all establishments implement all 6 aspects. Establishments not implementing any aspects are a sizable minority (around 12%). These figures stand in stark contrast to implementation of general OSH management: establishments implementing all elements constituted 20% and establishments not implementing any aspects of OSH constituted less than 1% of the total. Thus, management of psychosocial risks appears to be a relatively problematic aspect of OSH management. Psychosocial risks seem to be less well addressed at an organisational level than general risks.

Therefore, there is a great need to monitor and further improve the state of management of psychosocial risks in European establishments. In contrast to general OSH management, the scope of management of psychosocial risks is hardly satisfactory. It deserves special attention by policy makers in the area of OSH[1].

Is there a relationship between management of general and psychological risks? Are the two types of scores correlated with each other? Can the researcher/policy analyst predict the scope of management of psychological risks on the basis of the knowledge of the scope of management of general risks?

We address this question by running a chi-square test on the relationship between two scores: OSH composite score and OSH_psycho composite score. The results of this test are set below:

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[1] This recommendation only holds under the assumption that management of psychosocial risks is needed in all establishments.

Table 5: Comparison of OSH composite score and OSH_psycho composite score

Unweighted results

Panel A. Absolute figures

		OSH_psycho composite score			
		0-2 elements	3-4 elements	5-6 elements	Total
OSH	0-3 elements	1381	757	16	2154
composite	4-6 elements	2349	3987	289	6625
score	7-9 elements	1345	7430	3239	12014
	Total	5075	12174	3544	20793

Panel B. Percents

	OSH_psycho composite score			
	0-2 elements	3-4 elements	5-6 elements	Total
0-3 elements	64.1	35.1	0.7	100.0
4-6 elements	35.5	60.2	4.4	100.0
7-9 elements	11.2	61.8	27.0	100.0
Total	24.4	58.5	17.0	100.0

Weighted results

Panel C. Absolute figures

		OSH_psycho composite score			
		0-2 elements	3-4 elements	5-6 elements	Total
OSH	0-3 elements	244109	120829	1915	366853
composite	4-6 elements	322219	530629	37267	890115
score	7-9 elements	145969	725137	243879	1114985
	Total	712297	1376595	283061	2371953

Panel B. Percents

	OSH_psycho composite score			
	0-2 elements	3-4 elements	5-6 elements	Total
0-3 elements	66.5	32.9	0.5	100.0
4-6 elements	36.2	59.6	4.2	100.0
7-9 elements	13.1	65.0	21.9	100.0
Total	30.0	58.0	11.9	100.0

Note: (1) Chi-square statistic is significant at level 0.001; (2) the test is applied to a subset of cases (20,793; 73% of the original sample) where both OSH_composite score and OSH_psycho composite score were available.

Indeed, among establishment at the lowest (worst) levels of the general OSH composite score, over 65% also possess the lowest OSH_psycho composite score and less than 1% have the highest OSH_psycho composite score. Among establishment at the highest (best) levels of the general OSH composite score, 30% also possess the highest OSH_psycho composite score and only 12% have the lowest OSH_psycho composite score. So, the better the level of management of general risks the better the level of management of psychosocial risks. This relationship is very significant in statistical terms as is evident from the result of the chi-square test that indicate very low probability of obtaining this result by chance.

Bivariate analysis

Figure 2 presents mean OSH_psycho scores, with 99% confidence intervals, for a number of potential predictors. First, we present mean OSH_psycho scores for well-established predictors of OSH outcomes: size of the establishment, being part of the larger firm, sector, and industry.
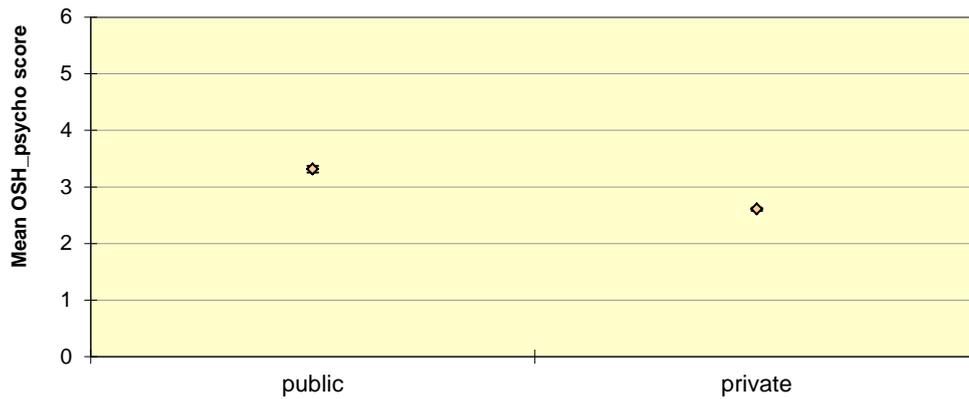
Figure 2: OSH_psycho score by major predictors

Panel A: OSH_psycho score by size
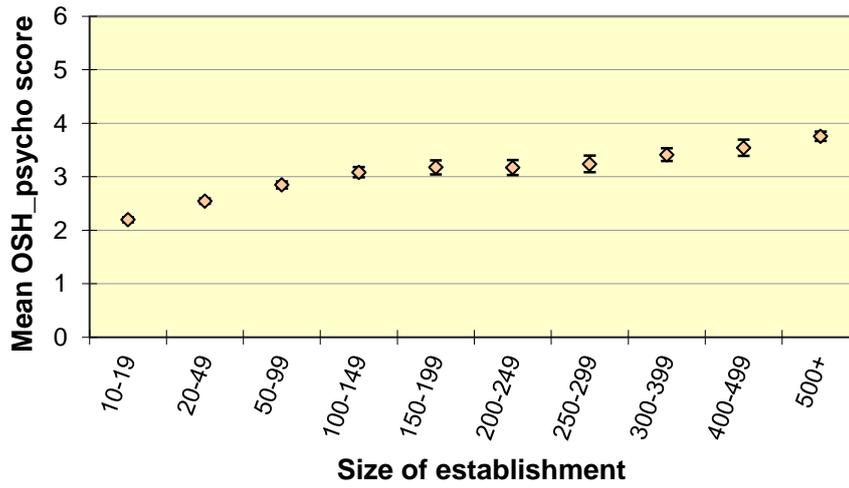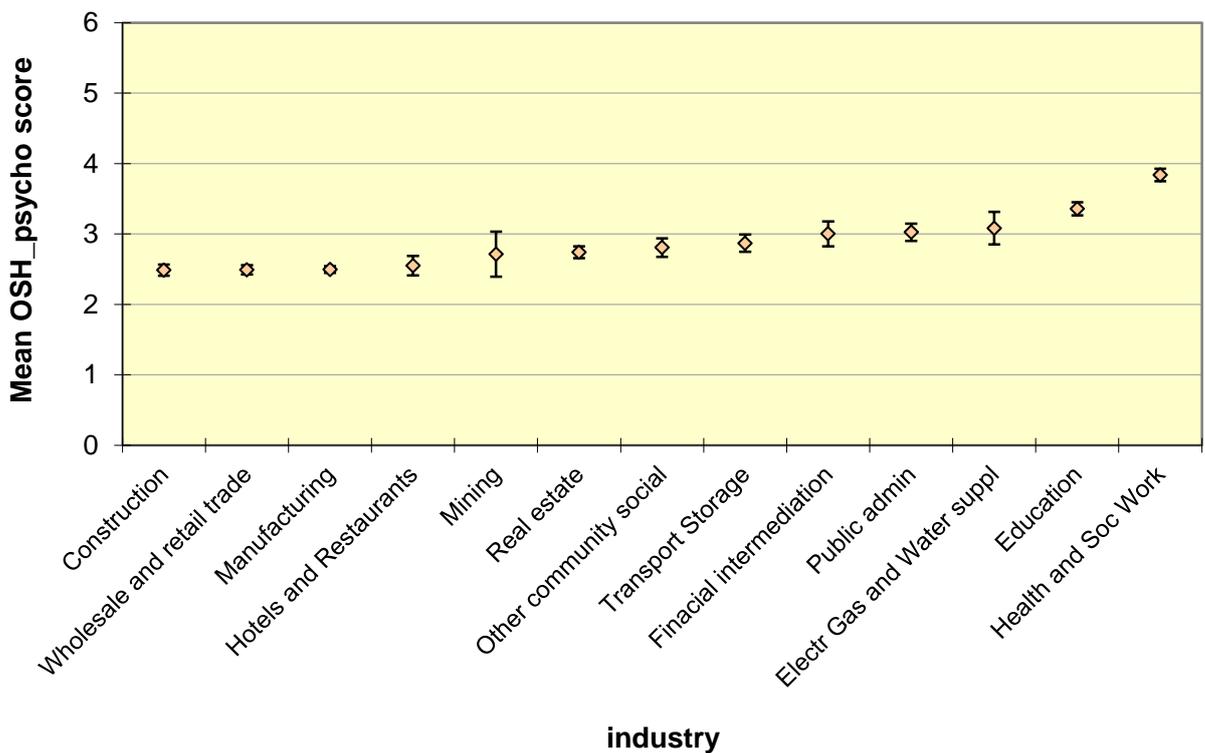

Panel B: OSH_psycho score by independent/non-independent status
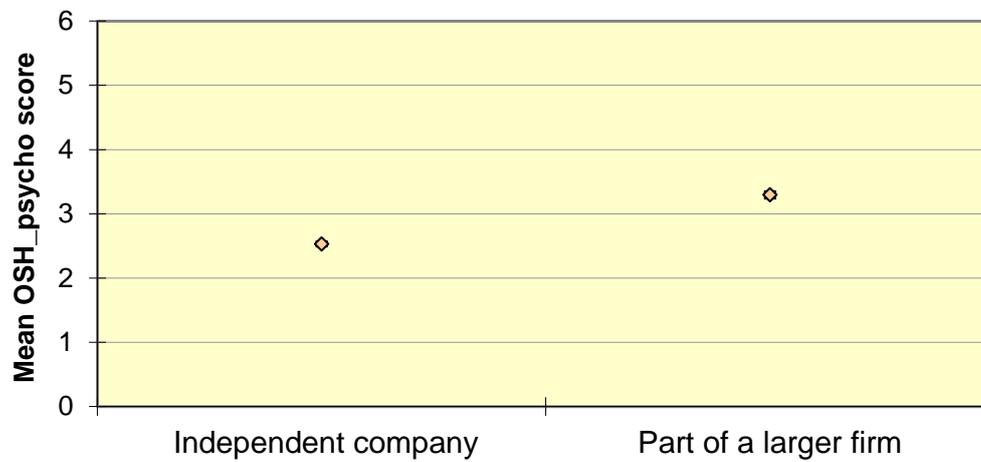
Panel C: OSH_psycho score by public/private

Panel D. OSH psycho score by industry

industry

Note: 99% confidence intervals are presented. Results are unweighted. Sample of 26,354 cases (92% of the original sample) forms the base for these analyses.

All observed relationships are in line with what is known from the literature:

1. poorer management of psychological risks is observed in small establishments, and better management in large establishments;

2. independent companies manage psychosocial risks worse than establishments constituting part of larger firms;

3. public establishments manage psychosocial risks better than private establishments;

4. industries such as construction, wholesale and retail trade as well as manufacturing are the worst managers of psychosocial risks while health and social work, education and electricity, gas and water supply industry appear as the best in terms of their management of psychosocial risks.

Not all relationships appear to be statistically significant (judging by overlapping confidence intervals for some categories) but principal ones are: the difference between the smallest and the largest size of establishments; independent and non-independent establishments, public and private establishments, and 'best' and the 'worst' industries[2].

Figure 3 presents mean OSH_psycho scores for establishments' demographics and country.

Figure 3: OSH_psycho score by establishments' demographics and country

Panel A. OSH_psycho score by percentage of females
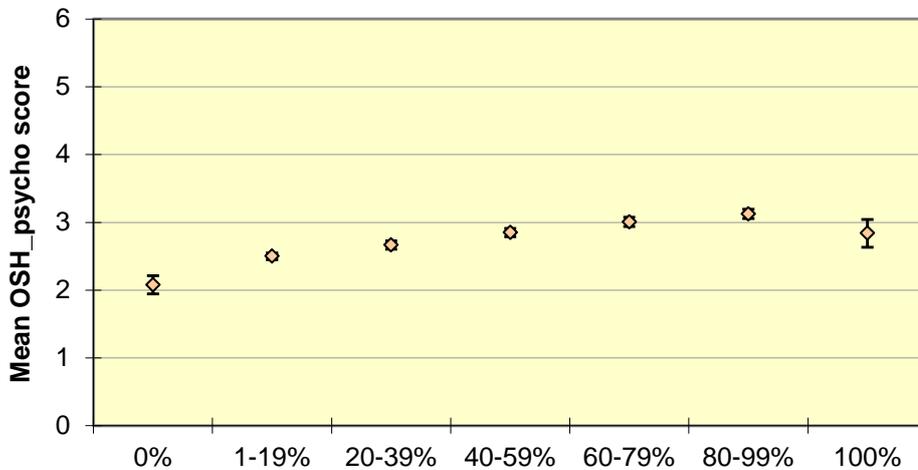
Panel B. OSH_psycho score by proportion of aged (50 years and over)

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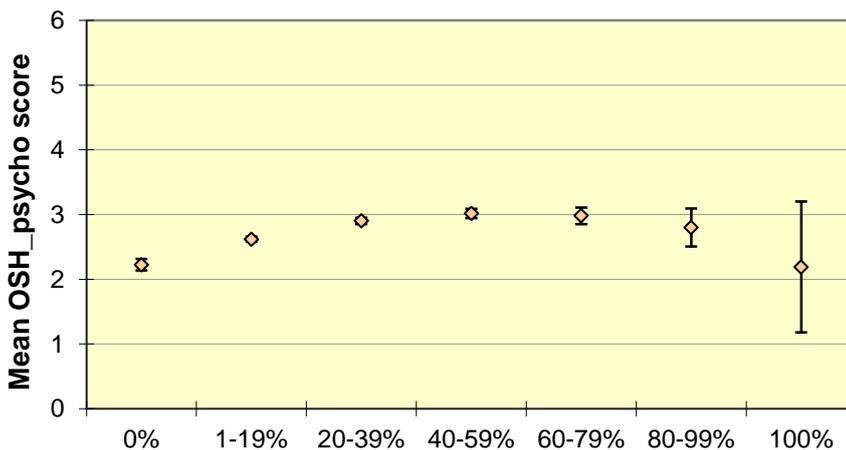
[2] In this report we favour presentation of the confidence intervals over other means of illustration of bivariate relationships. We also conducted t-tests (for 2 level predictors) and ANOVA for categorical and ordinal predictors.

Panel C. OSH_psycho score by proportion of foreigners

Panel D. OSH_psycho score by country

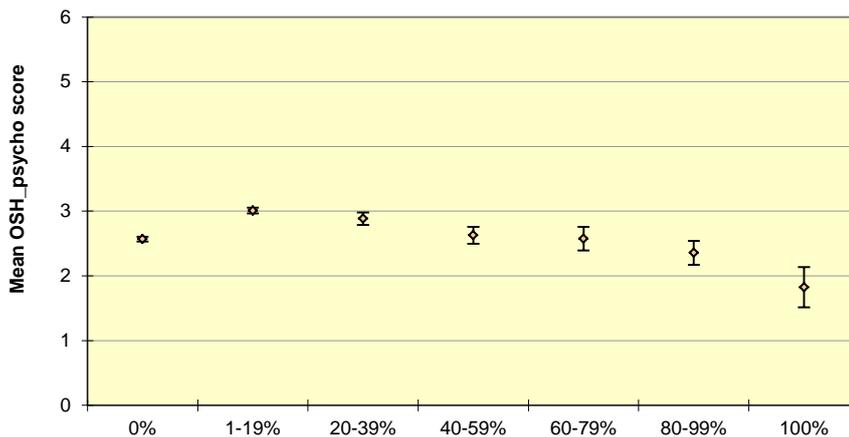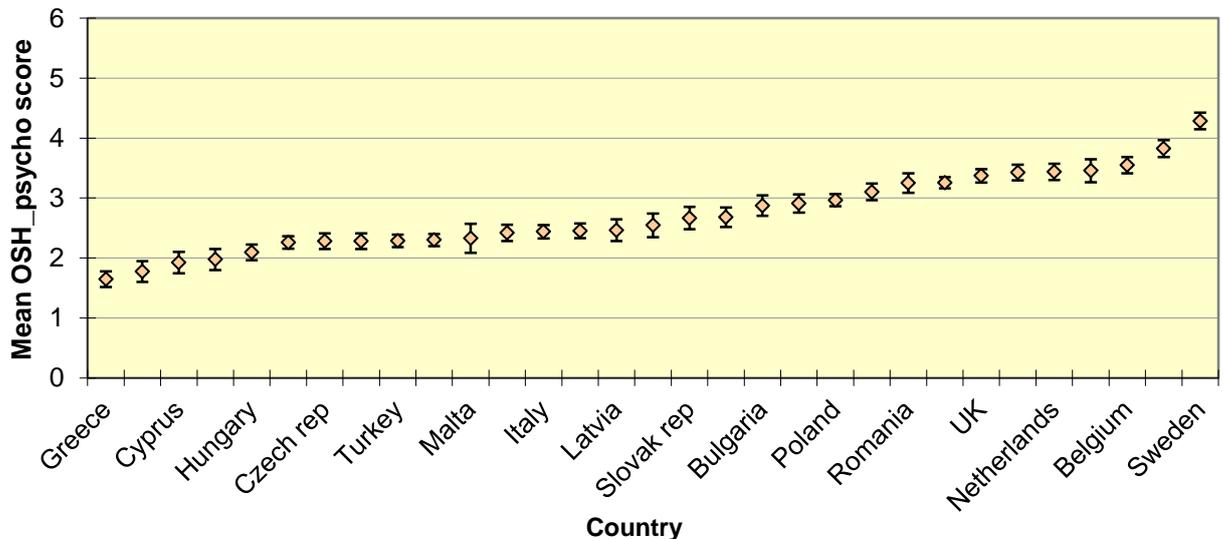Note: 99% confidence intervals are presented. Results are unweighted. Sample of 26,354 cases (92% of the original sample) forms the base for these analyses.

It is quite clear that establishments' demographics are associated with the scope of their management of psychosocial risks:

1. Male-dominated establishments are worse than non-male dominated. OSH_psycho score increases with proportion of female employees. Exclusively female establishments, however, are not the 'best' from the point of view of management of psychosocial risks;

2. A larger proportion of workers over 50 years of age is associated with better management of psychosocial risks. This relationship, however, seems to level off beyond 50% and reverse at around 70%: older-workers dominated establishments perform no better than those without older workers;

3. Larger proportion of foreigners is linked to worse management of psychosocial risks;

4. Selected countries in Southern and Eastern Europe (Greece, Cyprus, Estonia, and Hungary) as well as Luxembourg are the 'worst' managers of psychosocial risks and the Northern European countries (Sweden, Finland, Belgium, and Ireland) are the 'best'.

In the next section we present the results of the modelling of the OSH_psycho score, using all predictors and some control variables in a multivariate setting.

Multivariate analysis

We used linear regression to model the relationship between the OSH_psycho score and a set of predictors. We followed a step by step approach in relation to predictors: we ran 4 models in total gradually adding new predictors. We examined change in size, direction and statistical significance of coefficients in transition from model to model and also change in proportion of variance explained.

We related to establishment size, establishment being part of a large company, sector and industry as 'basic' establishment characteristic predictors. These variables appear in our Model 1. Relationships between these variables and the management of OSH are reasonably well documented in the literature. Guided by the literature and the results of bivariate analyses, we expected size of establishment to be inversely associated with the management of psychosocial risks, and being part of a large company to be positively associated with management of risks. We also expected establishments in the public sector to possess higher OSH_psycho scores (better managements of psychosocial risks), and to find marked differences between industries, with industries such as construction and manufacturing having lower OSH_psycho scores.

In Model 2, we add establishments' employee demographics which are a less well explored domain in the literature and we prefer not to formulate specific hypotheses in relation to these variables. In Model 3, we add country as a way to control for differences in cultural and social background as well as in regulatory environment. Finally, in Model 4, we introduce (1) reported presence of psychosocial risks, (2) whether or not visits are paid to the establishment by labour inspectorate and (3) perceived presence of different types of external (e.g. labour inspectorate) and internal (e.g. employees) pressures towards dealing with OSH risks. The introduction of (1) and (2) represents an attempt to control, to some extent, for 'objective' circumstances (i.e. the presence or absence of real risks) and management perception of the problem of psychosocial risks, and (3) is conceived as capable of capturing some of the regulatory characteristics.

Table 6: **Results of multivariate analysis: Models 1-4**

Variable name in the dataset	Informative name	Categories labels	Model 1		Model 2		Model 3		Model 4	
			Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
size_10D2	size of	20-49 emp	0.319	0.00	0.300	0.00	0.299	0.00	0.263	0.00
size_10D3	establishment	50-99 emp	0.543	0.00	0.502	0.00	0.523	0.00	0.467	0.00
size_10D4		100-149 emp	0.806	0.00	0.754	0.00	0.756	0.00	0.676	0.00
size_10D5		150-199 emp	0.919	0.00	0.860	0.00	0.884	0.00	0.796	0.00
size_10D6		200-249 emp	0.895	0.00	0.830	0.00	0.901	0.00	0.794	0.00
size_10D7		250-299 emp	0.950	0.00	0.880	0.00	0.906	0.00	0.812	0.00
size_10D8		300-399 emp	1.098	0.00	1.031	0.00	1.060	0.00	0.933	0.00
size_10D9		400-499 emp	1.244	0.00	1.161	0.00	1.232	0.00	1.114	0.00
size_10D10		500+ emp	1.365	0.00	1.282	0.00	1.325	0.00	1.182	0.00
MM100D2	whether part of	branch	0.546	0.00	0.525	0.00	0.289	0.00	0.265	0.00
MM100D3	larger estab	No answer	0.036	0.84	0.017	0.92	0.195	0.25	0.220	0.19
MM103D2	Public or private	private	-0.174	0.00	-0.161	0.00	-0.113	0.00	-0.125	0.00
MM103D3		No answer	0.170	0.29	0.183	0.26	0.070	0.64	0.023	0.88
rev1_1diD1	Industry	Mining	-0.015	0.90	-0.027	0.82	0.223	0.05	0.214	0.05
rev1_1diD2		Manufacturing	-0.217	0.00	-0.240	0.00	-0.144	0.00	-0.136	0.00
rev1_1diD3		Electr Gas and Water suppl	0.093	0.31	0.068	0.46	0.245	0.00	0.268	0.00
rev1_1diD5		Wholesale and Retail Trade	-0.095	0.02	-0.122	0.00	-0.022	0.56	0.003	0.94
rev1_1diD6		Hotels and Restaurants	0.002	0.97	-0.025	0.69	0.078	0.18	0.051	0.37
rev1_1diD7		Transport Storage	0.087	0.10	0.074	0.17	0.156	0.00	0.165	0.00
rev1_1diD8		Financial Intermediation	0.105	0.12	0.066	0.35	0.228	0.00	0.334	0.00
rev1_1diD9		Real estate	0.026	0.54	-0.012	0.79	-0.001	0.99	0.061	0.14
rev1_1diD10		Public Admin	0.049	0.40	-0.001	0.99	0.163	0.00	0.287	0.00
rev1_1diD11		Education	0.633	0.00	0.550	0.00	0.659	0.00	0.720	0.00

Variable name	Informative	Categories	Model 1		Model 2		Model 3		Model 4	
in the dataset	name	labels	Coef.	P>t	Coef.	P>t	Coef.	P>t	Coef.	P>t
rev1_1diD12		Health and Soc Work	0.946	0.00	0.843	0.00	0.840	0.00	0.839	0.00
rev1_1diD13		Other community Social	0.125	0.03	0.070	0.23	0.164	0.00	0.217	0.00
MM400C2D2	Percent of female	1-19%			0.063	0.26	0.126	0.02	0.125	0.02
MM400C2D3		20-39%			0.077	0.19	0.186	0.00	0.194	0.00
MM400C2D4		40-59%			0.097	0.10	0.196	0.00	0.220	0.00
MM400C2D5		60-79%			0.111	0.07	0.230	0.00	0.247	0.00
MM400C2D6		80-99%			0.189	0.00	0.284	0.00	0.291	0.00
MM400C2D7		100%			0.094	0.31	0.155	0.08	0.136	0.11
MM400C2D8		missing %			0.194	0.22	0.289	0.05	0.260	0.07
MM401C2D2	Percent of aged 50+	1-19%			0.051	0.17	-0.026	0.47	-0.032	0.35
MM401C2D3		20-39%			0.109	0.01	-0.007	0.86	-0.011	0.77
MM401C2D4		40-59%			0.140	0.00	-0.028	0.50	-0.033	0.41
MM401C2D5		60-79%			0.159	0.01	-0.035	0.53	-0.031	0.57
MM401C2D6		80-99%			0.152	0.15	-0.040	0.69	-0.047	0.63
MM401C2D7		100%			0.112	0.74	-0.065	0.83	0.066	0.83
MM401C2D8		missing %			0.053	0.53	-0.028	0.72	-0.030	0.70
MM405C2D2	Percent of foreigners	1-19%			0.112	0.00	0.069	0.00	0.061	0.01
MM405C2D3		20-39%			0.097	0.01	0.107	0.00	0.080	0.02
MM405C2D4		40-59%			-0.067	0.18	0.052	0.29	0.013	0.79
MM405C2D5		60-79%			-0.094	0.16	0.101	0.13	0.079	0.22
MM405C2D6		80-99%			-0.193	0.01	0.083	0.24	0.055	0.43
MM405C2D7		100%			-0.452	0.00	-0.143	0.26	-0.144	0.24
MM405C2D8		missing %			0.296	0.00	0.299	0.00	0.278	0.00

Note: reference categories are 1-19 employees (size), being independent (whether part of larger establishment), public (whether public of private), construction (industry), 0% (percent of female, percent of age above 50 years, percent of migrants), Italy (country), psychosocial risks represent major concern (whether psychosocial risks represent major concern), establishment visited by labour inspectorate (whether or not visited by labour inspectorate), major reason for dealing with risks (legal obligation, request from employees, staff retention and absence management, economic performance, clients or reputation, pressure from labour inspectorate). Note: N=26,354.

Below is a summary of principal findings from the multivariate analysis. Please note that the findings reported below are 'isolated' effects of each predictor holding the levels of all other predictor variables constant.

1. Larger size of establishment is associated with better management of psychosocial risks; this effect is significant in all models and the introduction of further variables in Models 2-4 has little impact on its effect.

2. Being part of a larger establishment (as opposed to being an independent establishment) is associated with better management of psychosocial risks; this effect is also significant in all models, but in Models 2-4 a significant reduction in the size of its coefficients is observed.

3. Public establishments are better at managing psychosocial risks than private establishments; this effect is significant in all models.

4. Manufacturing, mining, construction, wholesale and retail trade, real estate, and hotels and restaurants businesses are the worst managers of psychosocial risks. The best managers are in the health and social work and education sectors.

5. Age composition of an establishment is not a significant determinant of management of psychosocial risks.

6. The scope of management of psychosocial risks increases with the increase in proportion of female employees, however, both male exclusive and female exclusive establishments are doing worse in terms of management of psychosocial risks than establishments with more balanced sex composition.

7. Establishments having a small to medium proportion of foreigners in their workforces are better in terms of management of psychosocial risk than establishments with no foreigners or establishments numerically dominated by foreigners.

8. Greece, France, Estonia and Cyprus are the worst managers of OSH, while Finland, Sweden, Ireland and Belgium are the best.

9. The perceived presence of psychosocial risks is conducive to their better management, as are visits paid by the labour inspectorate.

10. Perceived pressures from employees, clients, as a result of legal requirements, or reasons related to staff retention or economic performance (but not pressure put by labour inspectorate) are associated with better management of psychosocial risks. Perceived pressure from labour inspectorate is associated with worse performance.

The first model explains about 16% of variance in the response variable, adding employee demographics changes little in the amount of explained variance, adding country adds a very significant amount bringing the proportion of explained variance to nearly 28%. The full model (Model 4) explains 30.5% of variance.

Initially we did not introduce the age of establishment into Models 1-4 simply because public institutions were not asked to provide this information in the survey. We, however, ran additional models on private establishments only. First, we fitted a version of Model 4 to private institutions only to obtain the base for the comparison (hereafter Model 4a). Second, we added age of establishment as a predictor to Model 4 (hereafter Model 4b). Age of establishment proved to not be a significant variable in statistical terms, as Table 7 demonstrates.

Table 7: Results of multivariate analysis: Models 4a-4b (non-public establishments only)

Variable name in the dataset	Informative name	Categories labels	Model 4a		Model 4b	
			Coef.	P>t	Coef.	P>t
size_10D2	size of	20-49 emp	0.261	0.000	0.262	0.000
size_10D3	establishment	50-99 emp	0.462	0.000	0.464	0.000
size_10D4		100-149 emp	0.686	0.000	0.689	0.000
size_10D5		150-199 emp	0.854	0.000	0.857	0.000
size_10D6		200-249 emp	0.852	0.000	0.855	0.000
size_10D7		250-299 emp	0.847	0.000	0.850	0.000
size_10D8		300-399 emp	0.936	0.000	0.941	0.000
size_10D9		400-499 emp	1.133	0.000	1.137	0.000
size_10D10		500+ emp	1.228	0.000	1.232	0.000
MM100D2	whether part of	branch	0.274	0.000	0.273	0.000
MM100D3	larger estab	No answer	0.409	0.158	0.403	0.164
MM106D2	age of	established in 1990-2005			0.011	0.647
MM106D3	establishment	established after 2005			0.061	0.214
MM106D4		No answer			0.051	0.662
rev1_1diD1	Industry	Mining	0.213	0.065	0.215	0.064
rev1_1diD2		Manufacturing	-0.144	0.000	-0.141	0.000
rev1_1diD3		Electr Gas and Water s	0.348	0.001	0.348	0.001
rev1_1diD5		Wholesale and Retail T	-0.006	0.876	-0.004	0.916
rev1_1diD6		Hotels and Restaurants	0.053	0.379	0.053	0.378
rev1_1diD7		Transport Storage	0.142	0.007	0.143	0.006
rev1_1diD8		Financial Intermediation	0.315	0.000	0.318	0.000
rev1_1diD9		Real estate	0.040	0.357	0.040	0.358
rev1_1diD10		Public Admin	0.684	0.000	0.686	0.000
rev1_1diD11		Education	0.754	0.000	0.756	0.000
rev1_1diD12		Health and Soc Work	0.942	0.000	0.942	0.000
rev1_1diD13		Other community Social	0.207	0.001	0.208	0.001
MM400C2D2	Percent of female	1-19%	0.125	0.021	0.127	0.020
MM400C2D3		20-39%	0.195	0.001	0.197	0.001
MM400C2D4		40-59%	0.226	0.000	0.227	0.000
MM400C2D5		60-79%	0.252	0.000	0.253	0.000
MM400C2D6		80-99%	0.268	0.000	0.269	0.000
MM400C2D7		100%	0.016	0.883	0.018	0.868
MM400C2D8		missing %	0.201	0.223	0.201	0.223
MM401C2D2	Percent of aged 50+	1-19%	-0.015	0.690	-0.012	0.736
MM401C2D3		20-39%	-0.002	0.953	0.001	0.972
MM401C2D4		40-59%	0.004	0.933	0.008	0.863
MM401C2D5		60-79%	-0.033	0.611	-0.028	0.667
MM401C2D6		80-99%	-0.025	0.840	-0.020	0.873
MM401C2D7		100%	0.190	0.610	0.198	0.595
MM401C2D8		missing %	0.082	0.359	0.084	0.346
MM405C2D2	Percent of foreigners	1-19%	0.051	0.038	0.050	0.041
MM405C2D3		20-39%	0.061	0.117	0.060	0.124
MM405C2D4		40-59%	0.004	0.943	0.002	0.975
MM405C2D5		60-79%	0.096	0.161	0.095	0.168
MM405C2D6		80-99%	0.083	0.272	0.079	0.292
MM405C2D7		100%	-0.111	0.410	-0.116	0.391
MM405C2D8		missing %	0.224	0.010	0.223	0.011

Table 10 -continued Variable name in the dataset	Informative name	Categories labels	Model 4a		Model 4b	
			Coef.	P>t	Coef.	P>t
countryD1	Country	Belgium	0.949	0.000	0.954	0.000
countryD2		Denmark	0.341	0.000	0.346	0.000
countryD3		Germany	-0.365	0.000	-0.361	0.000
countryD4		Greece	-0.838	0.000	-0.834	0.000
countryD5		Spain	0.699	0.000	0.701	0.000
countryD6		Finland	0.896	0.000	0.898	0.000
countryD7		France	-0.495	0.000	-0.490	0.000
countryD8		Ireland	0.820	0.000	0.825	0.000
countryD10		Luxembourg	-0.317	0.001	-0.316	0.001
countryD11		Netherlands	0.548	0.000	0.551	0.000
countryD12		Austria	-0.292	0.000	-0.286	0.000
countryD13		Portugal	-0.038	0.559	-0.034	0.596
countryD14		Sweden	1.310	0.000	1.312	0.000
countryD15		United Kingdom	0.715	0.000	0.720	0.000
countryD31		Bulgaria	0.475	0.000	0.472	0.000
countryD32		Cyprus	-0.512	0.000	-0.507	0.000
countryD33		Czech Republic	-0.166	0.015	-0.168	0.015
countryD34		Estonia	-0.663	0.000	-0.665	0.000
countryD35		Hungary	-0.324	0.000	-0.326	0.000
countryD36		Latvia	-0.157	0.087	-0.159	0.087
countryD37		Lithuania	0.277	0.002	0.274	0.003
countryD38		Malta	-0.171	0.090	-0.166	0.100
countryD39		Poland	0.259	0.000	0.256	0.000
countryD40		Romania	0.617	0.000	0.614	0.000
countryD41		Slovak Republic	-0.079	0.416	-0.081	0.412
countryD42		Slovenia	0.314	0.000	0.315	0.000
countryD43		Turkey	-0.010	0.875	-0.010	0.868
countryD46		Croatia	0.392	0.000	0.392	0.000
countryD51		Switzerland	-0.281	0.000	-0.273	0.000
countryD52		Norway	0.655	0.000	0.660	0.000
MM202C1	whether psycho risks are major concern	yes	0.170	0.000	0.169	0.000
MM170D2	Visits by Labour inspectorate	no visits by LI	-0.216	0.000	-0.217	0.000
MM170D3		No answer	-0.203	0.000	-0.205	0.000
MM171_1BD2	Reason for dealing -legal	No or Minor	-0.056	0.106	-0.055	0.108
MM171_1BD3	obligation	No answer	-0.142	0.329	-0.141	0.334
MM171_2BD2	Reason for dealing -requests	No or Minor	-0.335	0.000	-0.335	0.000
MM171_2BD3	from employes	No answer	-0.482	0.000	-0.480	0.000
MM171_3BD2	Reason for dealing -staff ret	No or Minor	-0.229	0.000	-0.229	0.000
MM171_3BD3	and absenteesm	No answer	-0.251	0.002	-0.252	0.002
MM171_4BD2	Reason for dealing -	No or Minor	-0.087	0.000	-0.087	0.000
MM171_4BD3	economic perform	No answer	-0.132	0.137	-0.132	0.138
MM171_5BD2	Reason for dealing -	No or Minor	-0.241	0.000	-0.240	0.000
MM171_5BD3	clients or reputation	No answer	-0.210	0.046	-0.210	0.047
MM171_6BD2	Reason for dealing -	No or Minor	0.109	0.000	0.109	0.000
MM171_6BD3	pressure from LI	No answer	0.145	0.029	0.145	0.029
_cons			1.871	0.000	1.855	0.000
R2			27.6		27.6	
N			20652		20652	

Note: reference category for age of establishment is 'established before 1990', for reference categories of other predictors see note to the previous table (6).

All relationships identified in models fitted to all establishments hold good in the models fitted to non-public establishments only.

The table below (Table 8) presents the impact of single predictor variables on change in the amount of variance explained by the model.

Table 8: Quantification of the impact of single predictors (Model 4, all establishments)

Variable	R^2 with variable excluded	Full model (Model 4)	Loss of R^2 relative to full model
country	0.202	0.305	0.103
size of establishment	0.269	0.305	0.036
reasons for dealing with health and safety	0.283	0.305	0.023
industry	0.287	0.305	0.018
visits by labour inspectorate	0.301	0.305	0.005
whether part of larger establishment	0.301	0.305	0.004
whether psycho risk are major con	0.304	0.305	0.002
percent of female	0.304	0.305	0.001
percent of foreigners	0.305	0.305	0.001
public or private	0.305	0.305	0.001
percent of aged 50+	0.305	0.305	0.000

Note: N=26,354.

The table shows the proportion of variance explained by a sequence of models from which single predictors were removed in turn, with all other predictors retained. It helps identification of the most influential predictors. The most influential background variables are therefore country, size of the establishment and industry. Exclusion of these variables from the model reduces 10%, 4% and 2%, respectively, from the amount of explained variance. This is a direct indication of the relative importance of predictors for explaining the scope of management of psychosocial risks.

Typologies

The aim of this section is to cast the main results of this analysis in a form that is informative for policy makers. In a previous section we identified the significant determinants of OSH_psycho score. Here we ask ourselves: what the policy makers need to know in order to develop interventions aiming to increase the scope of management of psychosocial risks.

First, the policy makers would need to know the relative strength of different determinants of OSH_psycho score. Size, sector, industry and other characteristics of establishment were shown to be significant determinants, but are they equally powerful in determining the OSH_psycho score? Which of these predictors should be prioritized if increasing the scope of management of psychosocial risks is a desired goal?
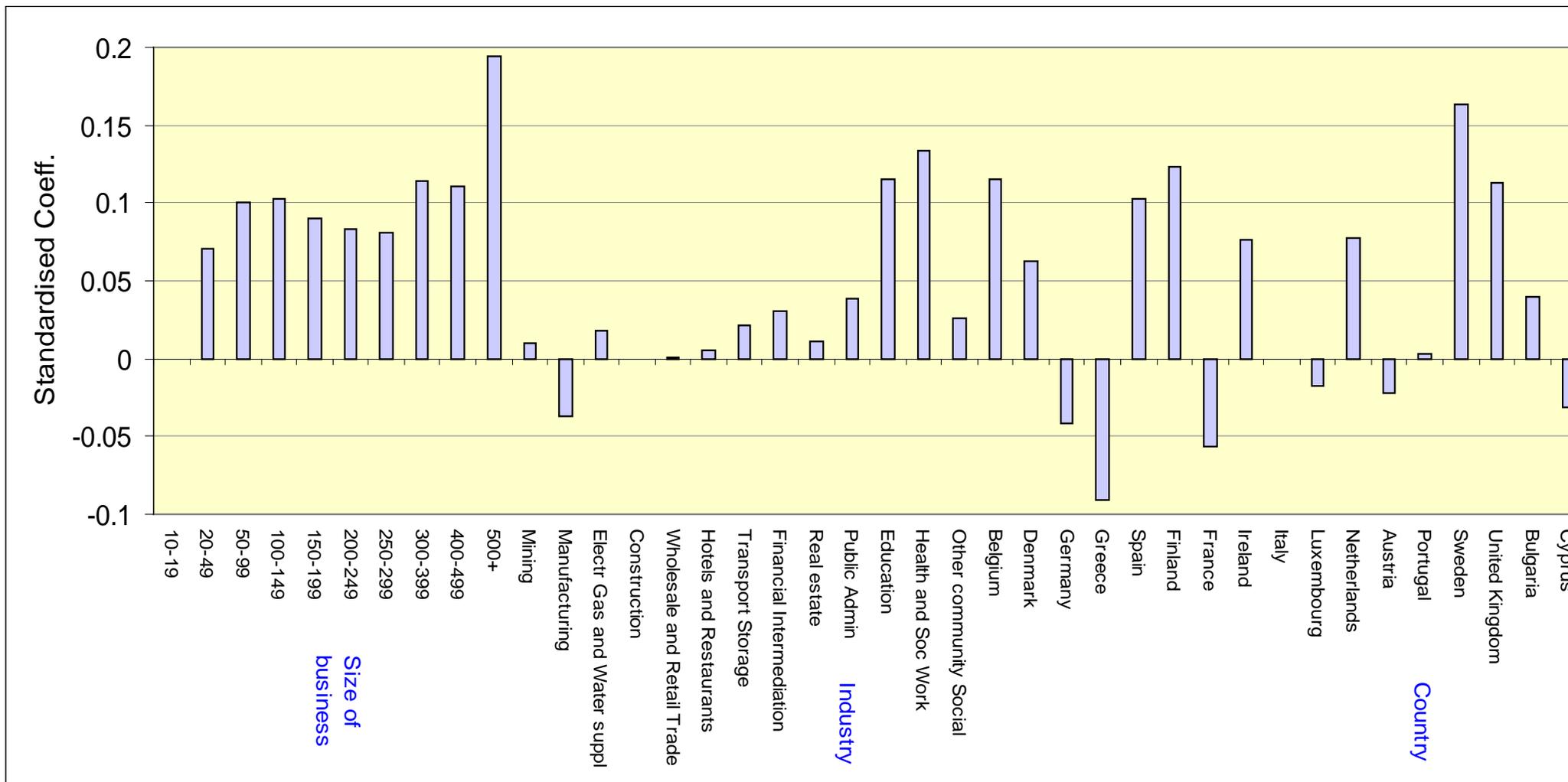
Second, the policy makers would need to know just how large the effect is of manipulating one or more determinants on the OSH_psycho score. We know, for example, that belonging to a particular industry increases/decreases the OSH_psycho score by a certain amount. To put it differently, other things being equal, what would be the OSH _psycho score of the establishments belonging to different types of industries?

To address the first question we present the standardized coefficients of the predictors of OSH_psycho score. Previously presented coefficients (Table 9) express a change in OSH_psycho score as result of a one-unit change in value of a particular predictor, other thing being equal. These coefficients cannot be compared across predictors: from the value of coefficients, one cannot form conclusions about the relative strengths of the predictors in determining the OSH_psycho score. Standardized coefficients allow to just that. A standardized coefficient expresses a change in OSH_psycho score as result of a one-standard deviation change in a particular predictor. Inspection of standardized coefficients immediately answers the question of 'what are the strongest determinants of OSH_psycho score'.
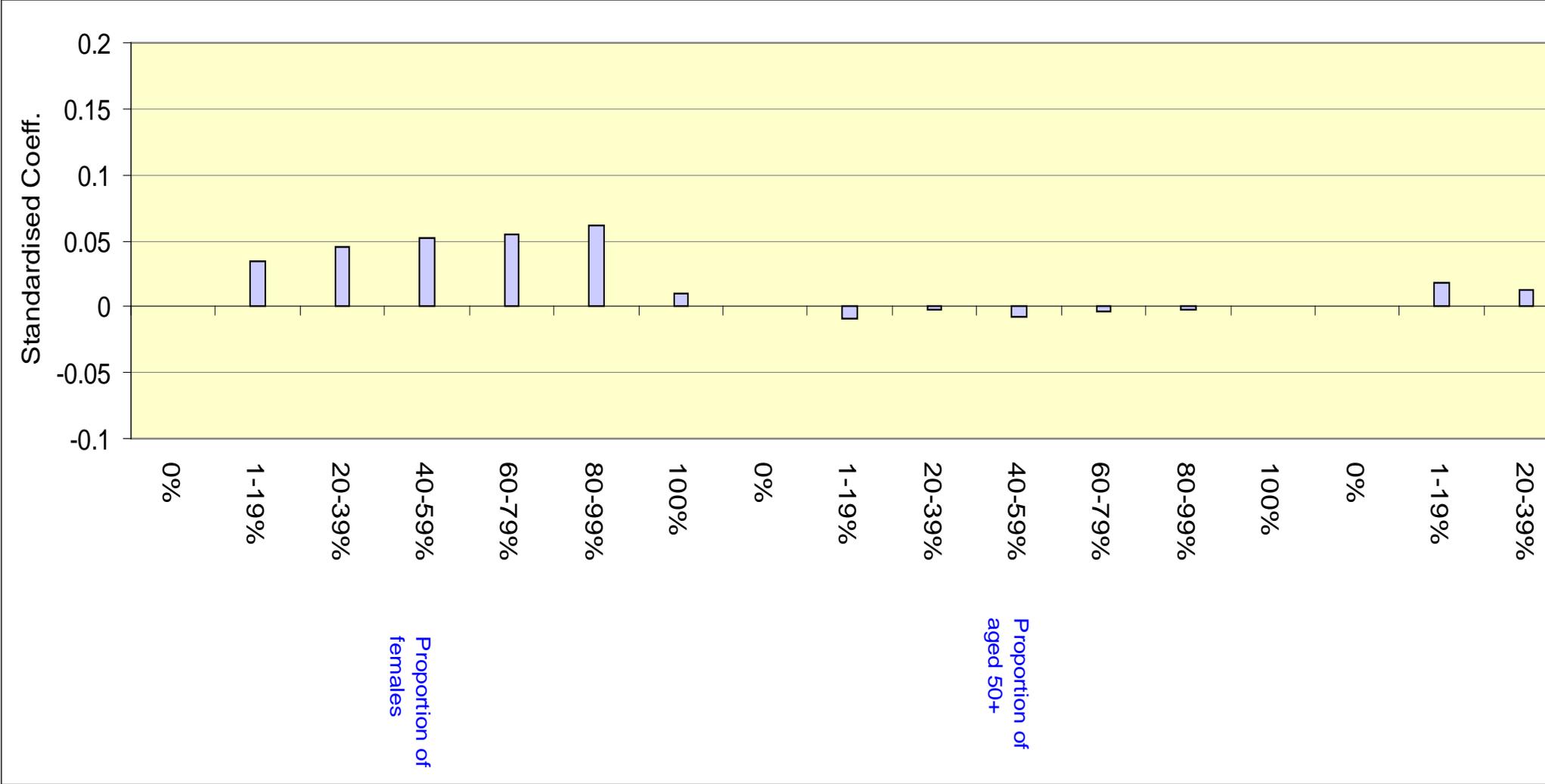
We present the standardized coefficients for all predictors in Model 4 in Figure 4 in three panels. Panel A presents the strongest determinants of OSH_psycho score, Panel B presents the determinants of intermediate strength, and Panel C presents the weakest determinants. The matter of principal interest in this figure is the length of the bars indicating the standardized impact of predictors: the taller the bar, the larger the impact.
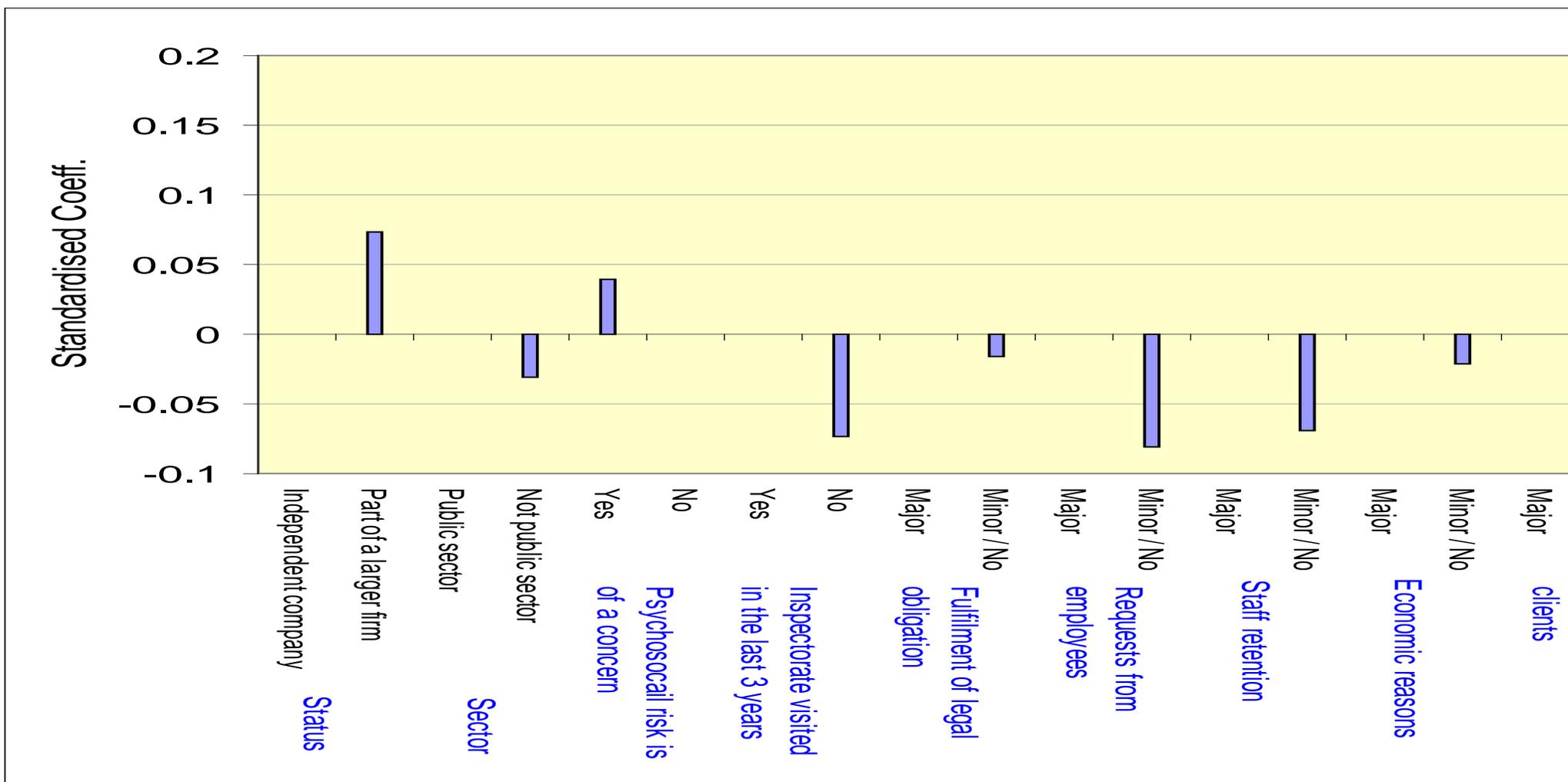
Figure 4: Standardized coefficients –Final model

Panel A. 'Strong' predictors

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Panel B. 'Weak' predictors

EU-OSHA – European Agency for Safety and Health at Work

Panel C. 'Intermediate' predictors

Note: N=26,354.

Size of the establishment, industry and country are the strongest determinants of OSH_psycho score. These findings suggest that policy makers would need to focus their efforts on providing support to small establishments in the management of psychosocial risks, on studying the country-specific infrastructural and legal framework and cultures that may impede or promote OSH management, and on features of particular industries. It is also clear that establishments belonging to private sector should be prioritized and that internal and economic pressures (clients' and employees' requests, worries about staff retention etc.) are quite influential factors to be taken into account by the policy makers. Establishments' employee demographics, on the other hand, are significantly less influential than other predictors.

To address the second question we present typologies of establishments by three major predictors of OSH_psycho score: size of establishment, industry and country. These are effectively adjusted OSH_psycho scores for each category of major predictors, calculated with other predictor variables held at their mean values.

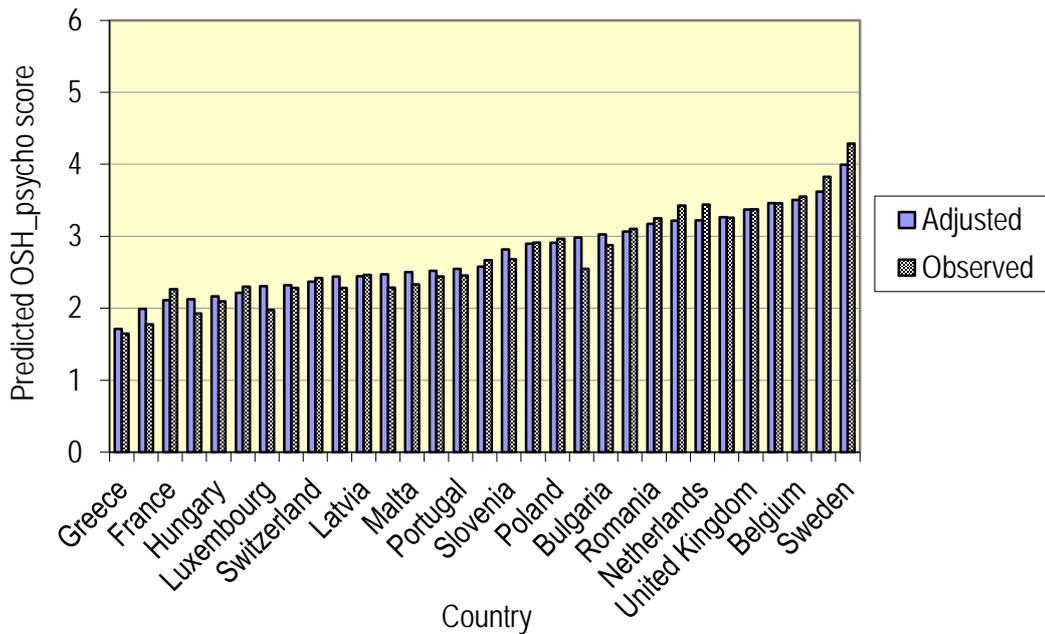Figure 5: Typologies of establishments: adjusted versus observed OSH_psycho scores

Panel A. By size

Panel B. by industry

EU-OSHA – European Agency for Safety and Health at Work
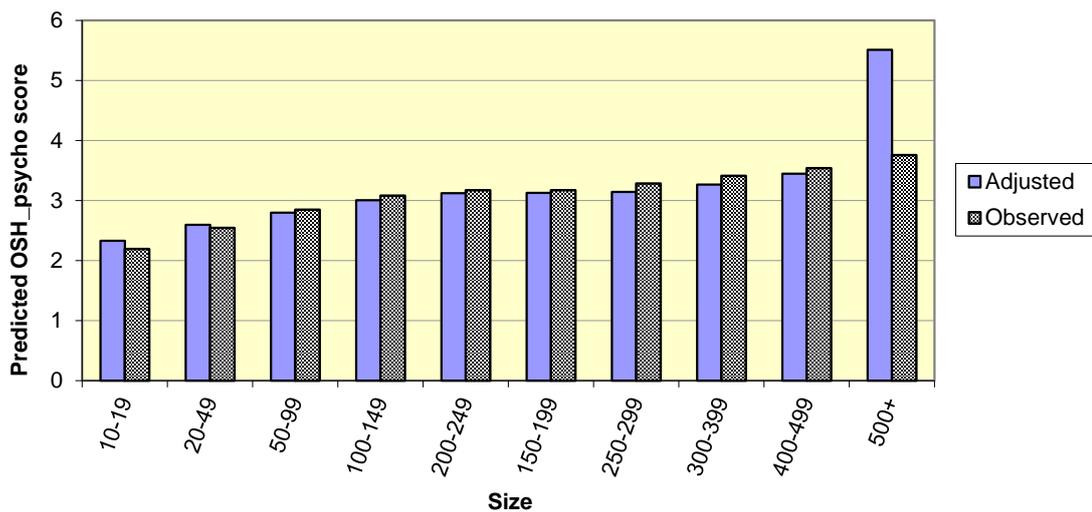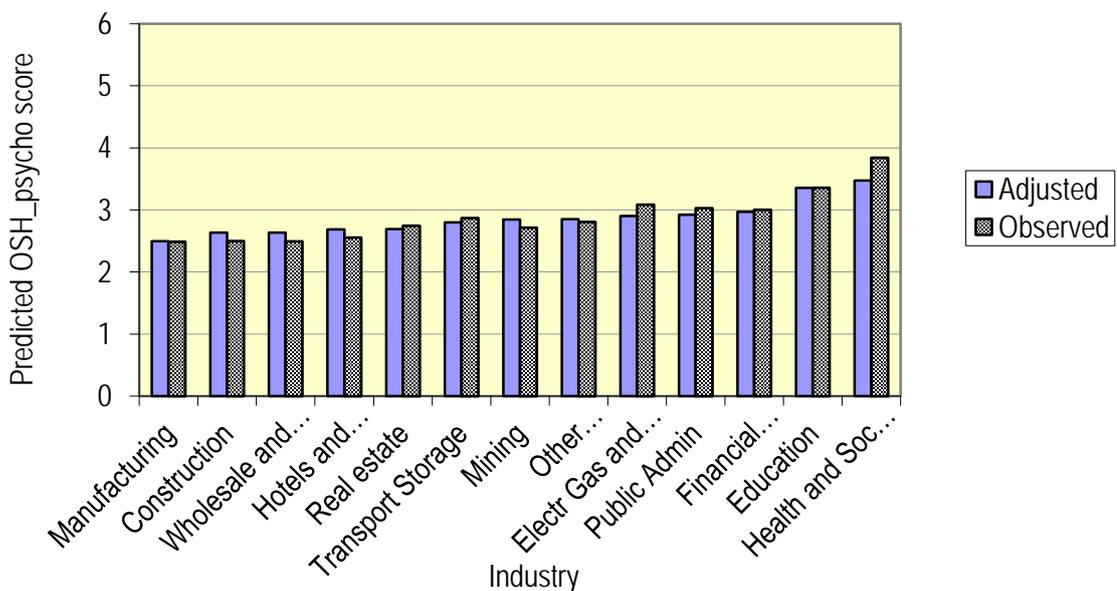
Panel C. by country

Note: N=26,354 (92% of the original unweighted sample).

It is clear that large size alone can be a major factor behind good OSH management: largest establishment possess OSH_psycho scores that are close to maximum (5.5), while smallest establishments possess score of half the value of large establishments. Sweden appears to lead in terms of management of psychosocial risks with OSH_psycho score of 4 and Greece is situated at the bottom with OSH_psycho score of less than 2.0. Education and health and social works present score of around 3.5 while for manufacturing and construction the scores are around 2.5.

Shaded bars in Figure 5 show the OSH_psycho scores observed in the dataset, allowing comparison between adjusted and unadjusted (observed) scores. The unadjusted scores are presented mainly to illustrate the degree to which these scores are useful for deriving conclusion about the relationships between size categories, industries and countries based on the original rather than adjusted data. It shows, for instance, that the difference between adjusted and unadjusted scores is insignificant in relation to size categories, with an exception of the largest size category. Essentially, unadjusted data provides an adequate description of the gradual rise in OSH_score with size. This is, however, not the case with the comparison between different industries and countries where unadjusted scores provide a different picture to adjusted scores.

Finally, we present predicted scores for combinations of industry and size, by country, in Table 9. For this type of presentation, we choose to focus on two selected industries (the best and the worst in terms of management of psychosocial risks) and on three categories of size. Countries have been selected to represent the best (Sweden, UK), the worst (France, Greece) and the intermediate (Spain, Germany) levels of OSH management.

Table 9: Predicted OSH_psycho scores by country, industry and size

	Health and Social Work (best performer)			Manufacturing (worst performer)		
	up to 50 empl.	100-399 empl.	400+ empl.	up to 50 empl.	100-399 empl.	400+ empl.
Sweden	4.3	4.9	5.3	3.3	3.9	4.3
UK	3.6	4.3	4.6	2.7	3.3	3.7
Germany	2.5	3.1	3.5	1.5	2.2	2.5
Spain	3.5	4.2	4.5	2.6	3.2	3.6
France	2.4	3.0	3.4	1.4	2.1	2.4
Greece	2.0	2.6	3.0	1.0	1.7	2.0

Note: N=26,354 (92% of the original unweighted sample).

The key conclusions that can be derived from these results are as follows:

1) Although establishment size matters (difference of just below 1 unit of OSH_psycho score between extreme size categories) it is not a 'destiny': even at small company sizes there is a possibility of having a rather decent coverage of OSH management aspects in certain regulatory contexts: 3-4 (out of 6 possible) in Sweden, UK and Spain in best performing (health and social work) industries. Additionally, even at largest establishment size there are nearly two-fold differences in a number of OSH_psycho aspects implemented by, say, Sweden and Greece;

2) Industry matters, but the differences between best and worst industries are the order of magnitude of 1 unit of OSH_psycho score. This is similar in strength to the impact of size;

3) Country-specific economic, cultural and regulatory context matters the most. In a way, this is the most significant and difficult conclusion, especially from the policy makers' point of view. 'Country context' is a non-specific entity in the context of this study and can include a variety of country characteristics. It is for future research of regulatory environment, economy and culture to elaborate on causal paths making some countries 'good' or 'poor' performers in terms of OSH management;

4) There are especially worrying, from the point of view of policy makers, combinations of 'circumstances': these are pockets of minimal presence of OSH management in Greece and France at small and medium establishment sizes in manufacturing industry.

Comparison of managerial and employees' perspectives on management of psychosocial risks

It is not altogether clear who, at organisational level, is the appropriate respondent to various questions concerning management of OSH. It is known, on the basis of previous research, that some types of information are known better to one of the sides. For example, managers may have a better view of training in OSH issues offered to employees as they are the principal organizers of it and bearers of fiscal responsibility. Employees, on the other hand, may be better positioned to answer questions pertaining to presence of tension and conflicts at the workplace.

ESENER and other surveys focusing on industrial relations asked for both managerial and employees' representative's perspective on selected questions. Specifically in relation to psychosocial risks, ESENER included 2 identical questions for managers and employees' representatives: a question on provision of training on ways to deal with psychosocial risks and a question on informing employees regarding the effects of these risks on health.

As a first step we conducted analysis of compatibility of answers to these questions. We created crosstabulations of managerial (MM) responses against employees' representatives' responses (ER) to all questions, and conducted chi-square tests to see whether there is a relationship between these two perspectives.

Table 10: **Comparison of MM and ER perspectives: MM253.6 vs ER300_6**

Panel A. Absolute figures					
		ER300_6 In the last 3 years, has your establishment used "provision of training" to deal with psychosocial risks?			
MM253.6		1 Yes	2 No	3 NA	Total
In the last 3 years	1 Yes	2852	1734	128	4714
has your establishment	2 No	1078	1296	64	2438
used 'provision of training'	3 NA	36	37	1	74
to deal with psychosocial risks	Total	3966	3067	193	7226

Panel B. Percents					
		ER300_6 In the last 3 years, has your establishment used "provision of training" to deal with psychosocial risks?			
MM253.6		1 Yes	2 No	3 NA	Total
In the last 3 years	1 Yes	60.5	36.8	2.7	100.0
has your establishment	2 No	44.2	53.2	2.6	100.0
used 'provision of training'	3 NA	48.6	50.0	1.4	100.0
to deal with psychosocial risks	Total	54.9	42.4	2.7	100.0

Pearson chi2(4) = 181.2175   Pr = 0.000

Table 11: **Comparison of MM and ER perspectives: MM259 vs ER303**

Panel A. Absolute figures					
		ER303 Does your establishment inform the employees about psychosocial risks and their effect oon health and safety?			
MM259		1 Yes	2 No	3 No Answer	Total
Do you inform employees	1 Yes	2630	1884	136	4650
has your establishment	2 No	1078	1353	54	2485
about psychosocial risks and	3 No Answer	40	48	3	91
their effects on health and safety?	Total	3748	3285	193	7226

Panel B. Percents					
		ER303 Does your establishment inform the employees about psychosocial risks and their effect oon health and safety?			
MM259		1 Yes	2 No	3 No Answer	Total
Do you inform employees	1 Yes	56.6	40.5	2.9	100.0
has your establishment	2 No	43.4	54.4	2.2	100.0
about psychosocial risks and	3 No Answer	44.0	52.7	3.3	100.0
their effects on health and safety	Total	51.9	45.5	2.7	100.0

Pearson chi2(4) = 129.1128   Pr = 0.000

Table 12: **Comparison of MM and ER perspectives: agreeing and disagreeing fractions**

	MM253.6 vs ER300_6 In the last 3 years has your establishment used 'provision of training' to deal with psychosocial risks?	MM259 vs ER303 Do you inform employees has your establishment about psychosocial risks and their effects on health and safety?
MM yes AND ER yes	41%	38%
MM no AND ER no	19%	19%
MM yes AND ER no	25%	27%
MM no and ER yes	15%	16%
'Agreeing' fraction	60%	57%
'Disagreeing' fraction	40%	43%

The analyses presented in the tables above show that responses to the identical questions are significantly correlated: in about 60% of cases MM and ER answers are identical. However, it is also clear that a 'dissenting' fraction is rather large: around 40%. In general, employees tend to provide a somewhat more pessimistic picture of management of psychosocial risks: 55%-60% of employees' representatives agree with the managerial rank that training to deal with psychosocial risks was offered in the past 3 years, and that employees are kept informed about the effects of psychosocial risks on health.

To further assess the difference between the MM and ER perspectives we replaced questions MM253.6 and MM259 with questions ER300_6 and ER303, respectively, in factor analysis. The results are shown in a table below:

Table 13: Factor loadings with ER variables replacing selected MM variables

Variable (questionnaire)	Abbreviated name	Factor 1	Factor 2
MM250-MM252	procedures	0.681	-0.096
ER300_6	training	0.231	0.483
ER303	inform_empl	0.206	0.491
MM260	whom_to_address	0.731	-0.148
MM302	info_used	0.629	-0.060

Note: (1) N=6552; (2) similar results were received after rotation.

The results show that ER responses are weakly correlated with the underlying pattern of MM responses, and that they form their own distinct factor. Thus, ideally, one should measure management of psychosocial risks with the help of two sets of responses covering MM and ER perspectives. The present content of MM and ER questionnaires does not possess fully identical variables for all elements of management of psychosocial risks. As a consequence, it is impossible to fully understand whether the nature of associations between major determinants of management of psychosocial risks and OSH_psycho score would be different for MM and ER based responses.

One way to gain some limited impression about differences and similarities is to calculate a new response variable substituting ER questions ER300_6 and ER303 for MM questions MM253.6 and MM259 and fit the model with all previously used determinants to this new response variable.

Such a new response variable (we call it OSH_psycho_ER) is similar to OSH_psycho score with the value of Spearman's rho coefficient of correlation between two variables in this subsample being at the level of 0.7.

We subsequently run 5 models on a subsample of 6459 cases[3], as follows:

Model 1: with OSH_psycho_ER as a response variable and establishment size, sector, independent status, demographics and country as predictors;

Model 2: with OSH_psycho as a response variable and the same set of predictors as in Model 1. We decided to re-run this model on the same subsample as Model 1, rather than to use for comparison results of the models summarized in 10;

Model 3: with ER300_6 as a response variable and the same set of predictors as in Model 1;

Model 4: with MM253_6 as a response variable and the same set of predictors as in Model 1;

Model 5: with ER303 as a response variable and the same set of predictors as in Model 1;

Model 6: with MM259 as a response variable and the same set of predictors as in Model 1.

Pairwise comparisons of Models 1 and 2/Models 3 and 4/Model 5 and 6 is a key to answering the questions of whether or not adopting MM and ER perspective on management of psychosocial risks would lead us to different conclusions regarding the nature of the relationships between the mentioned determinants and the measure of management of psychosocial risks.

In Figure 6 we plot standardized coefficients for 4 major predictors: size of establishment, industry, proportion of females and proportion of migrants in establishment's workforce.
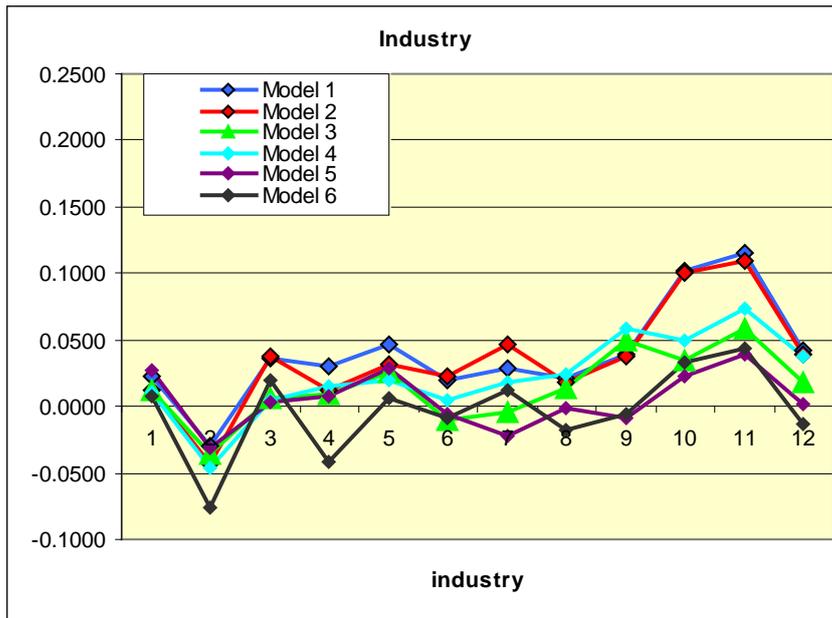
Figure 6: Standardized coefficients for of size, industry, proportion of females and migrants and various MM and ER –based outcomes
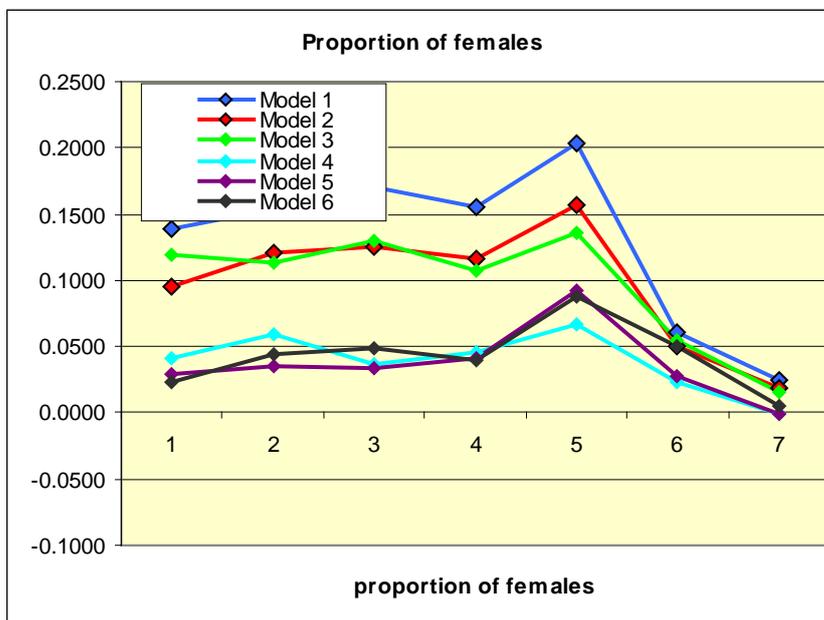

Panel A.
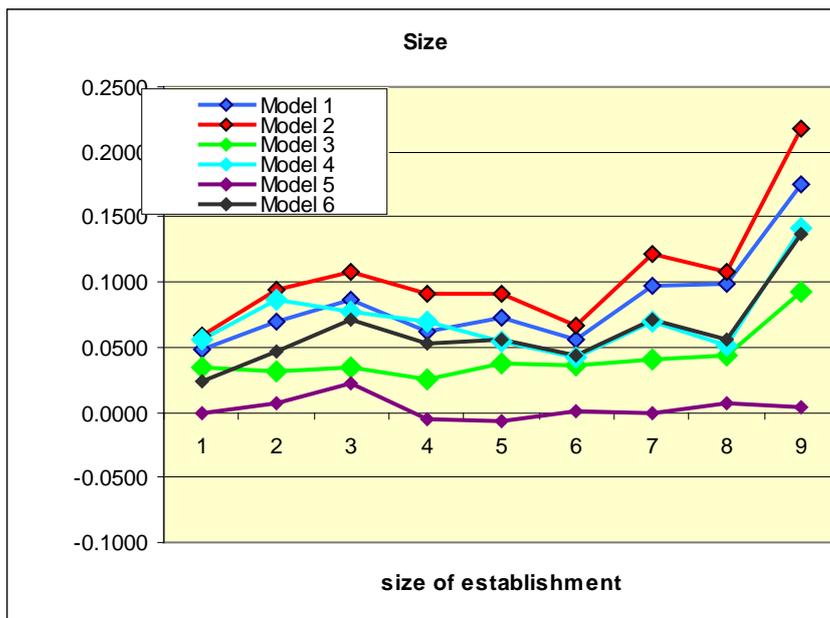
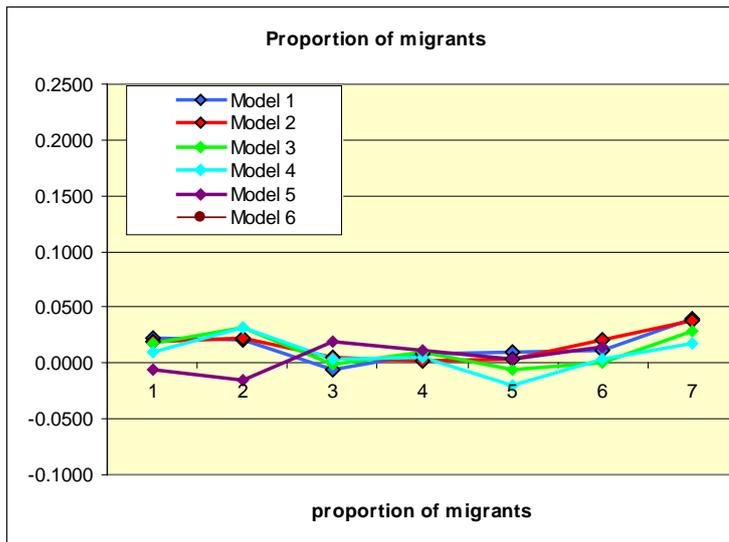[3] The number of cases is identical for all models to allow proper comparison of effects.

Panel B.

Panel C.

EU-OSHA – European Agency for Safety and Health at Work

Panel D.

Note: Axes X relate to categories of predictors variables .N=6459.

It appears that, in most cases, associations between the predictors and the outcome (OSH_psycho score) are similar for ER- and MM-based measures. The association between size and management of OSH, for example, is well-documented in the literature, and both MM- and ER-based measures show this. In contrast, proportion of females in establishment has a greater effect on the ER-based measures. However our empirical analysis shows in general that employees' representative and managers' perspectives in ESENER are correlated, this issue deserves to be further explored as existing differences in the assessment of particular aspects of the management system may reflect the effectiveness of psychosocial risk management.

'Missingness' in ESENER

Item non-response in ESENER appears as a rather insignificant phenomenon. Variables forming a base for computation of the combined measure of management of psychosocial risks (OSH_psycho score) have missing in the range of 1.3%-2.6%. The extent of missing in predictor variables is also rather modest: up to 4% of all cases.

We investigated the impact of non-response in predictors by assigning a separate code to categories with missing information and using it as an additional category in regression analysis. In most cases, the coefficients of 'missing' categories were not statistically significant. When they were statistically significant, no unambiguous interpretation could be applied to this finding. On the basis of these findings there was no reason to suspect that 'missing' categories could be informative, and that their presence compromised the precision of the estimates of the predictors' effects on OSH_psycho score.

We further investigated the impact of another type of missing information: missing in measures of management of psychosocial risks. Our main concern with this type of missing information was that those who are missing an OSH measure are not reporting because they are actually worse in management of risks. We ran logistic regression on selected binary response variables with a set of predictors used in Model 3. This analysis focused on two measures with greatest proportion of missing: whether information or support from external sources on ways to deal with psychosocial risks was used (MM302, 'info_used') and presence of procedures to deal with stress, harassment and violence (MM250-MM252 –based variables, 'procedures'), both with about 2% missing.

The logistic model was fitted to a dataset that excluded cases for which information on response variable was missing. We then used the model equation to calculate predicted values for each case (establishment) in our dataset, including cases with missing information. We compared distributions of predicted values for various categories of response variables. If cases with

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missing information were underperforming in terms of management of risks, their profile of predicted probabilities would resemble the 'No' category of the response variables. If, on the other hand, missing cases were in fact a mix of good and poor performers their profile of predicted probabilities would be somewhere in the middle of 'Yes' and 'No' categories.
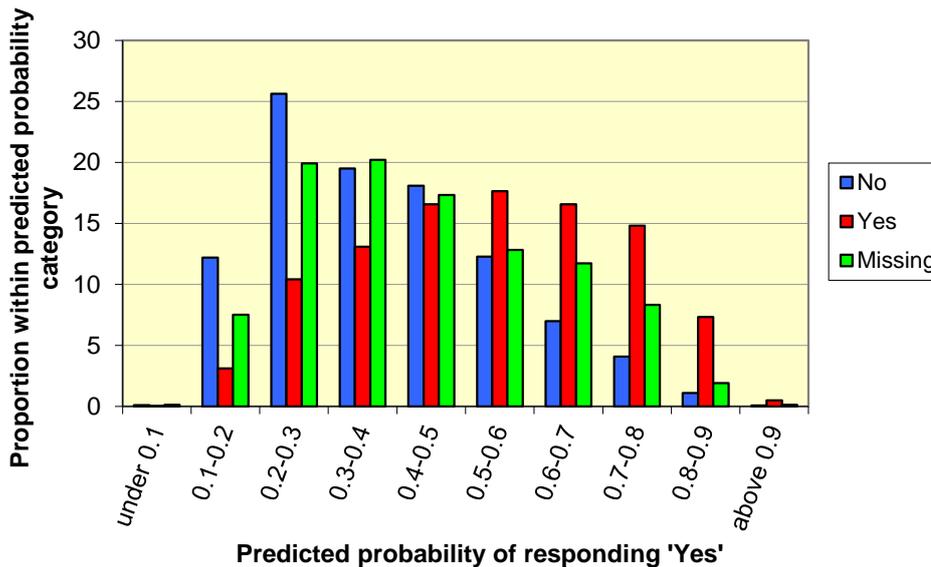
Figure 7 shows the results.

Figure 7: Predicted probabilities for variable 'procedures', by response category

Panel A. Variable 'procedures'
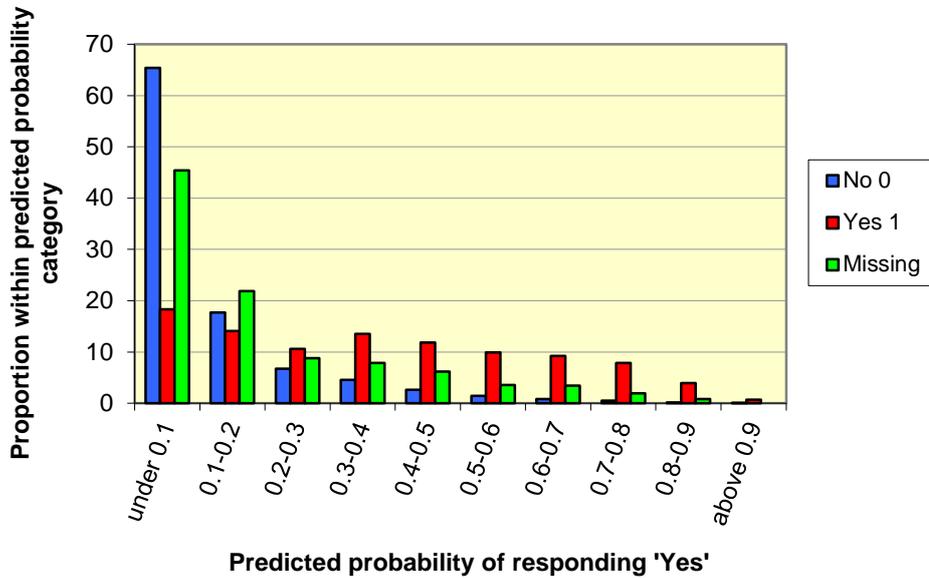
Panel B. Variable 'info_used'

The pattern observed in Figure 7 suggests that 'missingness' in measures of psychosocial risks in this dataset is not a signal of bad performance in terms of management of risks. Predicted probabilities of responding 'Yes' for missing categories are principally in-between 'Yes' and 'No' categories of original variables.

Appendix B: Approach to literature review

The review of literature in this report was not comprehensive or exhaustive. As a first step in identifying literature, we used personal networks and contacts with topic experts at RAND Europe, the RAND Corporation, EU-OSHA, and the Work Foundation to identify any key studies or evaluations written on the issue of psychosocial risks, the problem of psychosocial risks, and the effective management of psychosocial risks. As a second step, we used a number of keyword searches using Google, Google Scholar, and the RAND Library. As this was not a systematic review, we did not capture the exact permutations of keywords used. For instance, searches were based on keywords combinations such as: 'psychosocial risks' and 'workplace'; 'management' and 'psychosocial risks'; 'cost' and 'psychosocial risks'; psychosocial hazards' and 'health' and different permutations of these keywords. The review typically looked at the first 50-100 hits. As a third step, the reference section of documents was used to identify further documents. Studies were included if they gave information (empirical or at times theoretical) on the problem of psychosocial risks, effective ways of managing psychosocial risks. The decision to include was based on the authors' judgment based on experience of working in this topic area. The report did not devise criteria or a scoring system to guide the inclusion of literature.