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**How did the 2008-11 financial crisis affect work-related common mental distress? Evidence from 393 workplaces in Great Britain**

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1                   How did the 2008-11 financial crisis affect work-related common mental  
2                   distress? Evidence from 393 workplaces in Great Britain

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12                   Manuscript word count: 8821 words – Abstract: 134 words

13                   This paper analyses how the 2008-11 financial crisis relates to work-related common mental distress  
14                   of those with continuous employment during the crisis. The literature connecting the 2008-11 financial  
15                   crisis to common mental distress (anti-depressant drug use, suicide, etc.) generally estimates a  
16                   negative effect. We used a sample of 393 workplaces from the 2011 Work and Employment Relations  
17                   Study (WERS) for which employers and worker representatives agreed on that the crisis affected the  
18                   workplace. WERS then provides detailed questions about how the financial crisis affected the  
19                   workplace. We use these questions to show which crisis-induced work-changes are important for  
20                   work-related common mental distress. In the British-context, increased workload and changes in non-  
21                   financial benefits of work are most relevant worsening work-related common mental distress by 1.8  
22                   and 0.9 on a scale from 0-30 respectively.

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# 1. INTRODUCTION

43 There is a recent and growing health economics literature that analyses how macro-level economic  
44 development affects individual health (Cawley et al., 2015; Miller et al., 2009; Ruhm, 2015, 2016;  
45 Wang et al., 2018). Bradford and Lastrapes (2014) show that a one percent decline in employment is  
46 associated with a ten percent increase in the prescription of anti-depressants in the US. The systematic  
47 review by Parmar et al. (2016) confirm these findings for Europe, concluding that suicides increased  
48 and common mental distress generally worsened due to the 2008-11 financial crisis.

49 The World Bank estimates that the UK GDP in 2007 was \$3.074 trillion dropping to \$2.383 trillion in  
50 2009 and only recovering to roughly the pre-crisis level by 2014 (\$ 3.023 trillion)<sup>1</sup>. During the  
51 financial year 2008/09, 11.42 million working days were lost due to stress, depression and anxiety  
52 (UK Health and Safety Executive)<sup>2</sup>. So it is understandable that there is a large literature studying the  
53 (mental) health effects of the 2008-11 financial crisis (for brevity hereafter just referred to as crisis).

54 The focus of most of the present research addresses that the crisis affected common mental distress  
55 (Askitas and Zimmermann, 2015; Ayers et al., 2012; Deaton, 2012). A smaller but growing part of the  
56 literature tries to unpick the underlying mechanisms. The first part of this subset is focused on  
57 identifying how business cycles movements affect individual level wealth and income and how those  
58 changes translates into mental health changes. McInerney et al. (2013) show for example that the crisis  
59 lead to worse common mental distress and increase antidepressant use of those aged over 50. They  
60 identify lost wealth (retirement savings) as the driving factor. Currie and Tekin (2015) provide  
61 evidence that spikes in foreclosures due the crisis lead to unscheduled hospitalizations including for  
62 common mental distress problems. This literature also links these changes in individual level income  
63 and wealth to health behaviours that can affect mental health. Examples are the works by Dávalos et  
64 al. (2012) and Ásgeirsdóttir et al. (2016) who link the 2008-11 financial crisis to excessive alcohol  
65 consumption and report that alcohol consumption (in contrast to other health behaviours) did not  
66 return its pre-crisis level, respectively.

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<sup>1</sup> The unit is 2016 dollars and conversion from Great British Pound to US dollar is done with yearly official exchange rates. The data and more information on the underlying calculations can be accessed here:

[https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?cid=GPD\\_29&end=2016&locations=GB&start=2002](https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?cid=GPD_29&end=2016&locations=GB&start=2002) (last accessed 20<sup>th</sup> of June 2018).

<sup>2</sup> The 2008/09 financial year had 255 working days, so the equivalent of 44,784 full-time jobs were lost to society due to common mental health problems. The UK Health and Safety Executive provides working days lost in full-day equivalents already accounting for variation in working hours.

67 The second part of this literature links business cycle movements to changes in individual employment  
68 and seeks to understand how this affects mental health. The most influential study in this area is Ruhm  
69 (2000) who estimates the effect of economic conditions on suicide (and other health outcomes) using  
70 US data from 1972-1991 and state level unemployment. He finds a counter-cyclically relationship  
71 between unemployment and suicide (Ruhm, 2000). Ruhm and others then reanalyze this finding with  
72 mostly consistent results for suicides (Charles and DeCicca, 2008; Gerdtham and Ruhm, 2006; Ruhm,  
73 2015, 2016). One of the exceptions is Haaland and Telle (2015) who find a pro-cyclical relationship in  
74 Norway. This leads to the third-strain of literature where this work fits best.

75 This part of the literature tries to build on the first two, and asks what it is about work that affects  
76 mental health. Fishback et al. (2007) and Gerdtham and Ruhm (2006) report findings indicating that  
77 social security systems buffer the health-effects of recessions. Ólafsdóttir et al. (2015) and Xu (2013)  
78 look at working hours as a mechanism between the financial crisis and health. Ólafsdóttir et al. (2015)  
79 analyse the effect of the crisis on smoking (not mental health) in Iceland. They consider the labour  
80 market mechanism through which the crisis could affect smoking, but their data is limited to real  
81 income and working hours as potential mechanisms. They find no evidence that links working hours  
82 or real income to the observed reduction in smoking, rather the reduction is driven by an increase in  
83 prices due to the devaluation of Icelandic currency during the crisis, as tobacco is an import product.  
84 Xu (2013) using US data finds that increases in the number of hours worked are linked with higher  
85 cigarette use, less exercise and a lower number of physician visits.

86 To our knowledge no study has looked at a larger number of changes within the workplace and their  
87 effects on common mental distress. This paper aims to fill this gap by using detailed questions on how  
88 the crisis affected the workplace and how employees' work-related common mental distress was  
89 affected by this. Further, while most previous work relied on surveyed individuals reporting whether  
90 or not they were affected by the crisis (Deaton, 2012; Jones et al., 2016; McInerney et al., 2013;  
91 Ólafsdóttir et al., 2015), we leverage data from three perspectives on the impact of the 2008-11  
92 financial crisis (employees, worker representatives, managers) to reduce the potential impact of  
93 justification bias. Finally, in the absence of causal estimates in the literature and the absence of cohort  
94 and longitudinal data, our fixed effects approach offers insights into the range of relationships between  
95 specific crisis-induced changes in the workplace and common mental distress in the workplace  
96 currently not available in the literature.

97

## 2. DATA

99 The analysis is conducted on the 2011 Workplace Employment Relations Study (2011 WERS) which  
100 was conducted between spring 2011 and summer 2012 (Van Wanrooy et al., 2013). The 2011 WERS  
101 covered 2,680 workplaces in Britain employing 21,981 employees. Interviews were conducted with  
102 senior human resource managers and worker representatives as well as sample of up to 25 employees  
103 per workplace. The WERS 2011 asked human resource managers (for brevity referred to as managers  
104 hereafter), worker representatives and employees if and how they thought the workplace was affected  
105 by the crisis. Each of these groups was provided with a number of possible effects the crisis had on  
106 their workplace. We use the perspectives of managers and worker representatives to establish whether  
107 workplaces were affected by the 2008-11 financial crisis: if for a given workplace both managers and  
108 workplace representatives indicate that at least one change happened due to the crisis (and they did not  
109 tick the option that no changes happened), then we classified a given workplace as affected by the  
110 crisis. The motivation behind this approach is the concern that workers might try to justify their worse  
111 common mental distress with the financial crisis, even if the financial crisis was not felt at their  
112 workplace. This process is known as justification bias and has been a concern in research estimating  
113 the association of changes in the labour market on health for decades (Butler et al., 1987; Currie and  
114 Madrian, 1999; Martin, 2009; McGarry, 2004). Our approach is likely to reduce the problem of  
115 justification bias but does not necessarily solve it as employees within affected workplaces might still  
116 over-report the financial crisis to justify their state of common mental distress. Worker representatives  
117 and managers have opposing incentives to misreport whether the financial crisis affected their  
118 workplace. Therefore we assume that agreement between the two implies with more certainty that the  
119 workplace was indeed affected.

120 Selecting only workplaces for which worker representatives and manager report a crisis effect reduces  
121 the sample to 4,802 employees in 393 workplaces. The two main reasons for this reduction is that for  
122 13,728 employees from 1,240 workplaces the crises was not felt, this includes employees who did not  
123 work at the surveyed workplace during the crisis. While for another 10,849 employees from 1,124  
124 workplaces, no data for worker representatives was available. Of course, these criteria are not mutually  
125 exclusive and therefore the sample is reduced by less than the sum of the two cleaning rules.  
126 Furthermore, for 231 employees some information on key variables (gender, age, ethnicity, etc.) is  
127 missing. This leaves us with a sample of 4,802 employees and 393 workplaces that report to have been  
128 affected by the crisis giving us a sample of crisis-survivors.

129 Work-related common mental distress is measured at employee level with the question “Thinking of  
130 the past few weeks, how much of the time has your job made you feel each of the following?” with the  
131 possible options of tense, depressed, worried, gloomy, uneasy and miserable (Jones et al., 2016; Warr,  
132 1990). The possible answers are then rated with the following response options and the respective  
133 value given in square brackets: “All of the time” [1], “Most of the time” [2], “Some of the Time” [3],

134 “Occasionally” [4] and “Never” [5]. Based on these questions a measure of work-related common  
135 mental distress is created, which ranges from 0 to 30 with higher values indicating lower levels of  
136 common mental distress.<sup>3</sup>

137 Table I presents how employees, managers and worker representatives reported how the crisis affected  
138 their workplace. The most common reaction to the crisis from an employee perspective were frozen or  
139 cut wages with a share of nearly 47% of employees reporting it. Other common reactions were  
140 increased workload with 38% or reorganized work with about a quarter of employees reporting this.  
141 The replies by managers and worker representatives are hard to compare, but the one identical  
142 category “Wages frozen or cut” is at the top of all three lists.

143 Further variables considered in the analysis are region (8 regions covering England, Scotland and  
144 Wales), age from 16 onwards grouped in 9 categories, whether the person is white or non-white, male  
145 or female, works in the private or public sector<sup>4</sup>, and whether the employee submitted the survey  
146 online or via paper.

147 Table II offers descriptive statistics for the sample. The majority of the sample is white (93%), less  
148 than half of the sample is male and only 14% of the employees submitted the survey online.

149 To explore whether employees can influence how their workplace reacted to the crisis we also employ  
150 a question asked to the worker representative about their involvement in changes: “At this workplace  
151 [union / employee] representatives work closely with management when changes are being  
152 introduced.” We code “Agree” and “Strongly Agree” as high-involvement workplaces and “Neither  
153 agree nor disagree”, “Disagree” and “Strongly disagree” as low-involvement workplaces.

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<sup>3</sup> We used several approaches to evaluate the suitability of the score for further analysis. We determined the intraclass correlations (ICCs) for the individual questions to gauge the size of the effect workplaces had on employees' responses. The ICCs ranged from ICC = .033 (*depressed*) to .053 (*misery*), indicating small cluster effects. We then used a principal component analysis to evaluate how much variance in the responses to the six questions would maximally be attributable to a single component, both for the original variables as well as for the responses centred around the workplace average (analogue to our fixed effects analysis). The amount of explained variance was  $\rho = .69$  ( $\rho = .68$  for workplace-centred variables, respectively). The results indicate that a score captures substantial parts of the inter-individual variance across the six variables and is hardly influenced by the clustered nature of the data.

<sup>4</sup> Private sector is defined as the workplace being part of company that has one of the following statuses: Public Limited Company, Private Limited Company, Company limited by guarantee, Partnership/ Self-proprietorship, Trust/Charity, Body established by Royal Charter or Co-operative/Mutual/Friendly society. Public sector is defined as the workplace being part of company that has one of the following statuses: Government-owned limited company/Nationalised industry/Trading Public Corporation, Public service agency, Other non-trading public corporation, Quasi Autonomous National Government Organisation as well as Local/Central Government (inc. NHS and Local Education Authorities). The status is reported by the manager and the assignment into private and public sector is adopted from the codebook for the Management Questionnaire of WERS 2011.

154 Table I – Workplace Changes Due To The Crisis

Change That Occurred	Mean
<b>Employees</b>	
Workload increased	0.377
Work was reorganized	0.271
Moved to another job	0.079
Wages frozen or cut	0.472
Non-wage benefits reduced	0.084
Contracted working hours reduced	0.026
Access to paid overtime restricted	0.226
Required to take unpaid leave	0.021
Access to training restricted	0.176
<b>Managers</b>	
Compulsory redundancies	0.323
Voluntary redundancies	0.453
Temporary freeze on recruitment	0.659
Postponement of plans for expansion	0.364
Wages frozen or cut	0.656
Reduction in non-wage benefits	0.150
Reduction in basic hours	0.081
Reduction in paid overtime	0.346
Required to take unpaid leave	0.043
Reduction in the use of agency staff	0.517
Increase in the use of agency staff	0.092
Reduction in training expenditure	0.425
Other action	0.565
<b>Worker Representatives</b>	
Redundancies	0.588
Change agency staff	0.468
Wages frozen or cut	0.707
Introduction of performance pay	0.048
Change working time arrangements	0.293
Change organization of work	0.534
Other action	0.064

155 Note: All options for each group are presented here. The number of employees observed is 4,802 and the number of workplaces is 393.

156 Table II – Descriptive Statistics for employees

	Mean	S.D.
Common mental distress	23.291	5.201
Tense	3.311	1.011
Depressed	4.121	1.051
Worried	3.751	1.041
Gloomy	3.991	1.061
Uneasy	3.941	1.051
Miserable	4.181	1.051
Region		
North East	0.061	0.231
Yorkshire and Humber	0.091	0.291
East Midlands	0.071	0.261
East Anglia	0.031	0.181
South East	0.241	0.431
South West	0.091	0.291
West Midlands	0.071	0.251
North West	0.121	0.331
Wales	0.081	0.271
Scotland	0.141	0.351
Age Groups		
16-17	0.001	0.031
18-19	0.001	0.061
20-21	0.011	0.081
22-29	0.111	0.311
30-39	0.211	0.411
40-49	0.321	0.461
50-59	0.291	0.451
60-64	0.061	0.231
>64	0.011	0.101
Ethnicity	0.931	0.261
Gender: Male	0.461	0.501
Private Sector	0.351	0.481
Online	0.141	0.351
Worker Rep. Involvement	0.741	0.441

157 Note: Our common mental distress variable has a minimum of 0 and a maximum of 30, the underlying questions have five levels. All other  
158 variables are binary and are therefore limited between 0 and 1. The number of employees observed is 4,802 and the number of workplaces is  
159 393.



### 3. METHODS

160

161 The baseline methodological approach is an OLS regression.

$$M_{iw} = \alpha + \beta \mathbf{crisis}'_{iw} + \gamma \mathbf{x}'_{iw} + \varepsilon_{iw} \quad (1)$$

162 In all equations subscript  $i$  indicates individual employees and subscript  $w$  indicates workplaces. The  
163 coefficients of interest in equation (1) are the vector of crisis effects (**crisis**) and its association with  
164 common mental distress ( $M$ ). When employing the responses from managers and worker  
165 representatives on how the crisis affected the workplace the vector of crisis effects loses the subscript  $i$   
166 as this information is only available on workplace level. The model furthermore includes a vector of  
167 control variables ( $\mathbf{x}$ ) outlined in the previous section.

168 The usual concern in such a model is that the variable of interest is endogenous as common mental  
169 distress could affect for example the wage of the individual (Kronenberg et al., 2017). For example  
170 some workplaces could be more resilient to recessions given workplace level characteristics such as  
171 workplace culture. Workplace culture is inherently unobservable, but given that workplace level  
172 factors are identical for all employees, a workplace fixed effect model can be estimated to account for  
173 this. In essence we are saying that workplace culture was an unobserved variable in equation (1) that  
174 was absorbed by the error term  $\varepsilon_{iw}$ . The aim is therefore to rid  $\varepsilon_{iw}$  of workplace level invariant  
175 characteristics represented by  $\theta_w$  in equation (2).

$$\varepsilon_{iw} = \theta_w + \sigma_{iw} \quad (2)$$

176 By subtracting the workplace averages from equation (2) is transformed to:

$$\varepsilon_{iw} - \bar{\varepsilon}_{iw} = \theta_w - \bar{\theta}_w + \sigma_{iw} - \bar{\sigma}_{iw} \quad (3)$$

177 If  $\theta_w$  is the same for the entire workplace  $\theta_w = \bar{\theta}_w \rightarrow \theta_w - \bar{\theta}_w = 0$  and therefore all workplace-  
178 invariant factors, including unobservable factors like workplace culture, drop out leaving us with:

$$\dot{M}_{iw} = \beta \mathbf{crisis}'_{iw} + \gamma \dot{\mathbf{x}}'_{iw} + \ddot{\sigma}_{iw} \quad (4)$$

179 Reichert and Tauchmann (2017) have previously explored another concern, namely that employees in  
180 small firms are able to influence how their workplace reacts to economic shocks. They test this by  
181 splitting their sample by firm size as they have no measure of the degree of worker-involvement in  
182 managerial decision making. The exclusion of employees from small firms hardly affected their  
183 results. However, if employees can really influence how their firm reacted to the crisis, they might  
184 have included the expected effect of potential changes on their common mental distress and influenced  
185 the workplace in such a way as to minimize these. This would lead to reverse causality in which not  
186 only the reactions to the crisis affect common mental distress, but common mental distress also

187 determined how the workplace reacted to the crisis. WERS 2011 is a unique data source to explore the  
188 hypothesis that employees are able to or at least perceive themselves to be able to influence  
189 managerial questions. Instead of only proxying the (perceived) ability to influence managerial  
190 decisions by workplace or firm size we also test this hypothesis with questions that directly ask worker  
191 representatives about their involvement in changes at the workplace (see the last paragraph in section  
192 2). Based on this question we can test within small and large workplaces whether or not differential  
193 relationships are found.

194 In all cases the error term is clustered at workplace level. It is necessary to adjust the error-  
195 term, as it is likely that the errors are correlated within workplaces, which unadjusted for  
196 could lead to misleadingly small standard errors. We assume that the error-terms between  
197 workplaces are uncorrelated. We also apply this procedure in the fixed effect estimation,  
198 because the fixed effect approach will control only for a share of the within-workplace  
199 correlation of the error-term. However, it is possible that it will not control for the entire  
200 within-workplace error correlation (Cameron and Miller, 2015). Cameron and Miller (2015) also  
201 report that if cluster sizes are small (1-25 in our case) standard errors should be based on a  
202 within-estimator compared to a least squares dummy variable estimator. To use the correct  
203 degrees of freedom for the within estimator, the xtreg command in Stata with the vce(robust)  
204 option was used (Cameron and Miller (2015), p. 331).

205

206

## 4. RESULTS

207 Table III presents the baseline results using OLS with and without controls in the model. The results  
208 show that employee-perceived crisis effects are strongly associated with employee common mental  
209 distress while manager and worker representative reported crisis effects are substantially smaller and  
210 rarely statistically distinguishable from zero. For employees the difference between estimates with and  
211 without controls is very small, we will therefore focus on the presentation with controls. In employees  
212 who remained in employment during the crisis, nearly all crisis-induced changes worsen employees'  
213 common mental distress as indicated by negative coefficients. The three strongest relationships are  
214 found for increased workload, access to training restricted, and having moved to another (internal) job.  
215 What might be surprising is that the associations relating to financial reductions (wages frozen or cut,  
216 contracted working hours reduced, access to paid overtime restricted, required to take unpaid leave)  
217 are comparatively small with some insignificant and positive signed. For the two non-significant  
218 coefficients it must be noted though, that they were very rare occurrences in our sample (reduced  
219 contracted working hours  $n = 125$ ; unpaid leave  $n = 101$ ), which may have reduced the precision for  
220 estimating this specific effect.

221 For the manager part of Table III only taking unpaid leave, reducing agency staff and reduction  
222 training expenditure are statistically significant in both the regression with and without controls, while  
223 compulsory redundancies is only statistically significant in the regression without controls. We remind  
224 the reader that in these models the crisis vector in equation (1) loses the  $i$  subscript – although the  
225 model still estimates the average association on all survey responses, the crisis-induced changes are  
226 only measured once per workplace and are the same for all individuals for one workplace. The  
227 coefficient of compulsory redundancies is positive implying that compulsory redundancies improve  
228 the common mental distress of the remaining employees, potentially because the remaining employees  
229 perceive their jobs to be safer after the departure of their colleagues. This is opposite to the findings in  
230 Reichert and Tauchmann (2017) but they analyse plant closures in Germany, which might be different  
231 from the crisis in Great Britain (GB) given the differential social security systems and labour market  
232 situations of the two countries. Reductions in training expenditure have a negative sign, i.e. the  
233 remaining employees' common mental distress is increased by this measure, which could be seen as an  
234 objective indicator of reductions in cash-flow in the company and therefore an indicator of insecurity.

235 In the worker representative part of Table III only one crisis-induced change shows a significant  
236 association in both regressions with and without controls, the change in agency staff worsen common  
237 mental distress. The remaining coefficients are all negative with the exception of “change organization  
238 of work” and “other action”, which is also statistically significant in the without controls regression.

239

240 Table III – OLS baseline results for the change in common mental distress due to workplace changes  
 241 caused by the 2008-11 financial crisis

Change due to crisis	Without controls	With controls
<b>Employees</b>		
Workload increased	-1.874*** [0.170]	-1.842*** [0.168]
Work was reorganised	-0.600*** [0.190]	-0.622*** [0.187]
Moved to another job	-1.035*** [0.308]	-0.938*** [0.307]
Wages frozen or cut	-0.416*** [0.156]	-0.430*** [0.157]
Non-wage benefits reduced	-0.808*** [0.282]	-0.846*** [0.289]
Contracted working hours reduced	0.355 [0.539]	0.251 [0.538]
Access to paid overtime restricted	-0.678*** [0.188]	-0.677*** [0.186]
Required to take unpaid leave	-0.473 [0.601]	-0.399 [0.627]
Access to training restricted	-0.973*** [0.206]	-0.987*** [0.205]
<b>Managers</b>		
Compulsory redundancies	0.326* [0.192]	0.308 [0.211]
Voluntary redundancies	-0.207 [0.194]	-0.149 [0.200]
Temporary freeze on recruitment	-0.228 [0.218]	-0.268 [0.219]
Postponement of plans for expansion	0.201 [0.206]	0.174 [0.200]
Wages frozen or cut	-0.069 [0.196]	-0.045 [0.199]
Reduction in non-wage benefits	0.122 [0.258]	0.074 [0.270]
Reduction in basic hours	0.217 [0.290]	0.173 [0.308]
Reduction in paid overtime	-0.171 [0.200]	-0.169 [0.194]
Required to take unpaid leave	-0.78* [0.454]	-0.777* [0.455]
Reduction in the use of agency staff	-0.395* [0.204]	-0.366* [0.201]
Increase in the use of agency staff	-0.326 [0.322]	-0.289 [0.316]
Reduction in training expenditure	-0.484** [0.193]	-0.449** [0.196]
Other action	-0.207 [0.196]	-0.135 [0.190]
<b>Worker Representatives</b>		
Redundancies	-0.080 [0.202]	-0.058 [0.197]
Change agency staff	-0.368* [0.196]	-0.332* [0.193]
Wages frozen or cut	-0.172 [0.205]	-0.256 [0.202]
Introduction of performance pay	-0.281 [0.477]	-0.227 [0.454]
Change working time arrangements	-0.328 [0.242]	-0.265 [0.238]
Change organisation of work	0.017 [0.200]	0.027 [0.198]
Other action	0.539* [0.320]	0.292 [0.318]

242 Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard error reported in square brackets. The error term is clustered at workplace level. Each  
 243 section (employees, managers and worker representatives) represent two separate regression on employee level with and without controls. The  
 244 dependent variable is a measure of common mental distress ranging from 0 to 30. Lower values of the dependent variable indicate worse  
 245 common mental distress. The controls are region (8 regions for England, Scotland and Wales), age from 16 onwards grouped in 9 categories,  
 246 whether the person is white or non-white, male or female, works in the private or public sector, and whether the employee submitted the  
 247 survey online or via paper. The number of employees observed is 4,802 and the number of workplaces is 393.

248 It is possible that some workplaces have better or worse workplace cultures that affected the results or  
249 particularly gifted managers or worker representatives. All of these factors, while difficult to observe,  
250 are fixed within workplaces and therefore can be accounted for by introducing workplace fixed effects.

251 Table IV presents the results for this fixed effect estimation. Given that workplace representative and  
252 manager replies do not vary within workplaces that part of the table drops out and only the top part  
253 relating to employee reported crisis effects remains. The share of the estimated variance of the overall  
254 error accounted for by the workplace effect ( $\rho$ ) is 0.135 and 0.134 respectively, which indicates that  
255 the workplace fixed effect is not extremely important and thus unobservable workplace-invariant  
256 factors such as workplace culture or particularly gifted managers or worker representatives are not  
257 likely to bias the estimation substantially. It appears that in most instances the same aspects of work  
258 matter for mental distress whether or not we account for unobservable factors workplace-invariant  
259 factors. On page 188 of their work Reichert and Tauchmann (2017) for example state that one of their  
260 key assumptions is “that firm-level changes in the workforce are exogenous events from the  
261 perspective of an individual employee”. Even though, we observe workplaces and not firms, our  
262 results appear to support that assumption.

263 The three largest associations from the OLS regression (Table III) remain important and relatively  
264 unchanged in size, even when only considering within-workplace variation (increased workload,  
265 access to training restricted, and reductions of non-wage benefits). However, they are joined by having  
266 to take unpaid leave, which is now the second-strongest effect, nearly quadrupling in size compared to  
267 the OLS result, but is only significant when considering control variables and as noted previously, due  
268 to the small number of instances, very imprecisely measured. Another important change occurs for  
269 wages frozen or cut, which roughly doubles in size.

270 Across OLS and fixed effects regressions nearly all of the effects of the crisis covered in the survey  
271 show a potential negative impact on work-related common mental distress. Only the reduction in  
272 contracted working hours was not significant in any of the analyses, which may be due to rarity in our  
273 sample. When controlling for unobserved workplace-invariant factors via fixed effects regression,  
274 changes are especially observed for requiring to take unpaid leave and freezing/cutting of wages,  
275 which become much more important than in the OLS regression. It appears that financial factors are  
276 more relevant within workplace than between workplaces. This is potentially due to differential wage  
277 distribution between workplaces.

278

279 Table IV – Effect workplace changes caused by the 2008-11 financial crisis on common mental  
 280 distress after introducing workplace fixed effect

Change due to crisis	Without controls	With controls
Workload increased	-1.808*** [0.171]	-1.787*** [0.173]
Work was reorganised	-0.543*** [0.200]	-0.551*** [0.198]
Moved to another job	-1.101*** [0.306]	-1.049*** [0.304]
Wages frozen or cut	-0.894*** [0.164]	-0.836*** [0.166]
Non-wage benefits reduced	-0.843*** [0.308]	-0.804** [0.312]
Contracted working hours reduced	0.117 [0.566]	0.096 [0.580]
Access to paid overtime restricted	-0.649*** [0.196]	-0.634*** [0.196]
Required to take unpaid leave	-1.440 [0.874]	-1.510* [0.868]
Access to training restricted	-0.923*** [0.214]	-0.899*** [0.214]
rho	0.135	0.134

281 Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard error reported in square brackets. The error term is clustered at workplace level. Manager  
 282 and worker representative results are not presented as no workplace fixed effect can be estimated given that the manager and worker  
 283 representative replies are fixed per workplace. The columns present the estimates with and without controls. The dependent variable is a  
 284 measure of common mental distress ranging from 0 to 30. Lower values of the dependent variable indicate worse common mental distress.  
 285 The controls are region (8 regions for England, Scotland and Wales), age from 16 onwards grouped in 9 categories, whether the person is  
 286 white or non-white, male or female, works in the private or public sector, and whether the employee submitted the survey online or via paper.  
 287 The number of employees observed is 4,802 and the number of workplaces is 393.

288 Finally, we employed two tests to investigate the potential for reverse causation of employees  
 289 influencing implemented changes at their workplaces. Table V presents fixed effect regression results  
 290 with workplaces split into low- and high-involvement workplaces based on the statement of the  
 291 worker representative (see columns of Table V). We first re-ran the fixed effects regression with all  
 292 employees in those two categories and again we find negative signs for nearly all crisis-induced  
 293 changes. In companies that are classified as "high involvement", reducing non-wage benefits and  
 294 being required to take unpaid leave correlate negatively with common mental distress. Whether or not  
 295 a workplace is classified as low- or high-involvement by the representative does not generally  
 296 moderate the relationship between perceived crisis-induced changes at the workplace and workplace  
 297 related common mental distress, but it may do so for specific types of changes.

298 Reichert and Tauchmann (2017) have suggested that employees in small firms are able to influence  
 299 how their workplace reacts to economic shocks. The results in Table V provide some support for that  
 300 idea, in high involvement small companies reorganised work has a small and statistically insignificant  
 301 coefficient. In high involvement large companies reorganised work has a statistically significant  
 302 negative signed coefficient. The coefficient for the case of low involvement large companies is even  
 303 larger and also statistically significant. However, the coefficient for the case of low involvement small  
 304 companies is qualitatively of similar size, but less precisely estimated.

305 The cut-off is the median firm size in WERS 2011, which is 244 employees. Within all four groups of  
 306 the combination of these two indicators of involvement the signs of all but three crisis-induced changes  
 307 remain negative. The coefficients with positive signs are (1) required to take unpaid leave in low  
 308 involvement large companies; (2) access restrictions to training in low involvement large companies;

309 and 3) contracted working hours having been reduced in high involvement large companies for all  
310 employees and for employees in small low involvement companies.

311 A number of coefficients are not significant anymore, which can be due to loss of precision with  
312 smaller sample sizes (especially in the low involvement group of companies). Nevertheless, if it were  
313 possible for employees in high-involvement small companies to influence their company's decisions  
314 more, then we would expect their regression coefficients to indicate weaker connections than in the  
315 other three cases. However, overall there is no pattern suggesting this, if at all only for two workplace  
316 changes does the coefficient pattern point in that direction (reorganisation of work and reduction of  
317 hours). Due to the non-randomized nature of our data, limited control variables and high number of  
318 comparisons this can only be a descriptive assessment, but to us it suggests that if workers influence  
319 was used in our sample to re-structure work places to their liking and demands, then this did not  
320 happen uniformly.

321 Overall, we find that in a survey of employee's who remained employed during the crisis in  
322 workplaces that were likely hit by the crisis that several of the crisis-induced changes correlated with  
323 worse/more common mental distress as predicted. Across OLS and fixed effects regression increased  
324 workload, followed by access restrictions to training and moving to another (internal) job, emerged as  
325 the strongest predictors. The OLS regressions further suggested that crisis-induced changes  
326 remembered by management and worker representatives were not strongly correlated with employees'  
327 common mental distress, which points to the perception of such changes by employees being an  
328 important factor.

329 Finally, there appears to be very little evidence that workplace culture, quality of management or  
330 quality of representation affect the results or that the results are driven by employees influencing how  
331 the workplace reacted to the crises.

332 Table V – Fixed effect regression results with controls exploring employee influence on manager  
 333 decisions

Change due to 2008 financial crisis	Low Involvement	High Involvement
All Employees		
Workload increased	-1.518*** [0.336]	-1.885*** [0.203]
Work was reorganised	-1.023** [0.420]	-0.406* [0.225]
Moved to another job	-1.440** [0.696]	-0.905*** [0.332]
Wages frozen or cut	-0.621** [0.296]	-0.869*** [0.198]
Non-wage benefits reduced	-1.160 [0.701]	-0.717** [0.347]
Contracted working hours reduced	-0.556 [1.497]	0.249 [0.635]
Access to paid overtime restricted	-0.773* [0.407]	-0.597*** [0.227]
Required to take unpaid leave	-1.267 [2.181]	-1.478* [0.866]
Access to training restricted	-0.585 [0.409]	-1.020*** [0.251]
rho	0.137	0.131
N (employees)	1,231	3,571
N (workplaces)	101	292
Employees in small companies		
Workload increased	-1.163** [0.452]	-1.866*** [0.322]
Work was reorganised	-1.012 [0.639]	-0.147 [0.332]
Moved to another job	-2.411** [1.061]	-1.627*** [0.473]
Wages frozen or cut	-0.501 [0.404]	-0.818*** [0.305]
Non-wage benefits reduced	-0.772 [0.842]	-0.865 [0.536]
Contracted working hours reduced	2.946* [1.677]	-0.435 [0.922]
Access to paid overtime restricted	-0.558 [0.530]	-0.358 [0.344]
Required to take unpaid leave	-1.566 [2.523]	-1.957 [1.338]
Access to training restricted	-1.193** [0.548]	-1.202*** [0.392]
rho	0.116	0.136
N (employees)	687	1,718
N (workplaces)	52	139
Employees in large companies		
Workload increased	-1.933*** [0.508]	-1.944*** [0.261]
Work was reorganised	-1.126* [0.564]	-0.693** [0.304]
Moved to another job	-0.521 [0.904]	-0.317 [0.440]
Wages frozen or cut	-0.775* [0.433]	-0.856*** [0.252]
Non-wage benefits reduced	-2.010** [0.977]	-0.564 [0.453]
Contracted working hours reduced	-4.017*** [1.212]	1.629*** [0.410]
Access to paid overtime restricted	-1.106* [0.631]	-0.830*** [0.304]
Required to take unpaid leave	0.245 [3.273]	-0.495 [0.832]
Access to training restricted	0.067 [0.624]	-0.827** [0.324]
rho	0.175	0.128
N (employees)	544	1,853
N (workplaces)	49	153

334 Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard error reported in square brackets. The error term is clustered at workplace level. The controls  
 335 are age from 16 onwards grouped in 9 categories, whether the person is white or non-white, male or female, works in the private or public  
 336 sector, and whether the employee submitted the survey online or via paper.



337

## 4.1. ROBUSTNESS CHECKS

338 We conduct some checks whether our results are driven by gender as both mental health behaviour and  
339 labour market patterns vary a lot with gender (Breuer, 2015; Cawley et al., 2015). Thus, we re-run the  
340 analysis reported in the right column of Table III by gender (an additional robustness analysis  
341 accounting for heterogeneity in the dependent variable is presented in the online appendix). Table VI  
342 presents the results split by gender, comparing these results to the right column of Table III point to  
343 some interesting associations. Since the previous analysis showed little difference between FE and  
344 OLS results (see discussion of Table III & Table IV), we again report OLS results here to report results  
345 on all three perspectives on crisis-induced changes

346 Increased workload remains the crisis-induced work change with the largest coefficient for both men  
347 and women. However, some of the statistically significant results in Table III are driven by one gender  
348 and not the other. Males drive the associations relating to (financial) work-benefits (frozen or cut  
349 wages, reduced non-wage benefits and restricted access to paid overtime). Women on the other side  
350 drive associations that could be summarized as “fear of unemployment” (reorganisation of work,  
351 moved to another job and access restrictions to training).

352 These were all employee self-reported crisis changes, considering the changes reported by managers  
353 and worker representatives all the previously statistically significant results are driven by females,  
354 except a manager-reported reduction in training expenses. Again the associations appear to be related  
355 to a concern about being employed (temporary freeze on recruitment, postponement of expansion  
356 plans, required to take unpaid leave, reduction in use of agency staff, increase in the use of agency  
357 staff, change in agency staff). The differences are potentially related to different work and employment  
358 patterns along gender lines/across gender groups (Goldin, 2014; Manning and Petrongolo, 2008). A  
359 potential underlying reason for this are classical gender roles with males being in charge of providing  
360 economic means of survival.

361

362 Table VI – OLS results for the change in common mental distress due to workplace changes caused by  
 363 the 2008-11 financial crisis by gender

Change due to crisis	Male	Female
<b>Employees</b>		
Workload increased	-1.697*** [0.249]	-1.989*** [0.220]
Work was reorganised	-0.294 [0.273]	-0.873*** [0.245]
Moved to another job	-0.687 [0.484]	-1.182*** [0.387]
Wages frozen or cut	-0.536** [0.246]	-0.309 [0.202]
Non-wage benefits reduced	-1.107*** [0.366]	-0.571 [0.444]
Contracted working hours reduced	0.439 [0.838]	0.093 [0.600]
Access to paid overtime restricted	-1.002*** [0.285]	-0.351 [0.258]
Required to take unpaid leave	-0.856 [0.933]	0.251 [0.766]
Access to training restricted	-0.198 [0.306]	-1.617*** [0.279]
<b>Managers</b>		
Compulsory redundancies	0.289 [0.292]	0.384 [0.268]
Voluntary redundancies	0.005 [0.281]	-0.279 [0.253]
Temporary freeze on recruitment	0.036 [0.308]	-0.492* [0.265]
Postponement of plans for expansion	-0.178 [0.278]	0.478* [0.249]
Wages frozen or cut	-0.126 [0.266]	0.037 [0.272]
Reduction in non-wage benefits	0.046 [0.354]	0.158 [0.349]
Reduction in basic hours	0.352 [0.455]	-0.234 [0.394]
Reduction in paid overtime	-0.308 [0.260]	-0.026 [0.249]
Required to take unpaid leave	-0.214 [0.567]	-1.217* [0.672]
Reduction in the use of agency staff	0.039 [0.274]	-0.712*** [0.257]
Increase in the use of agency staff	0.530 [0.376]	-0.949** [0.445]
Reduction in training expenditure	-0.561* [0.287]	-0.470* [0.239]
Other action	0.189 [0.273]	-0.444* [0.236]
<b>Worker Representatives</b>		
Redundancies	-0.070 [0.240]	0.002 [0.258]
Change agency staff	-0.043 [0.239]	-0.591** [0.259]
Wages frozen or cut	-0.332 [0.261]	-0.170 [0.273]
Introduction of performance pay	-0.295 [0.654]	-0.191 [0.521]
Change working time arrangements	-0.057 [0.282]	-0.443 [0.304]
Change organisation of work	0.112 [0.255]	-0.004 [0.267]
Other action	-0.035 [0.475]	0.561 [0.433]
N (employees)	2,192	2,610
N (workplaces)	366	370

364 Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard error reported in square brackets. The error term is clustered at workplace level. Each  
 365 section (employees, managers and worker representatives) represent two separate regression on employee level one for men and one for  
 366 females. The dependent variable is a measure of common mental distress ranging from 0 to 30. Lower values of the dependent variable  
 367 indicate worse common mental distress. The controls are region (8 regions for England, Scotland and Wales), age from 16 onwards grouped  
 368 in 9 categories, whether the person is white or non-white, works in the private or public sector, and whether the employee submitted the  
 369 survey online or via paper.

## 5. DISCUSSION

370

371 In this paper we study how the crisis affected work-related common mental distress of employees who  
372 were in continuous employment during the crisis. Many previous studies only explore the financial  
373 dimensions as a causal connector between the crisis and common mental distress (McInerney et al.,  
374 2013; Ólafsdóttir et al., 2015). Our study adds to this by exploring a large host of factors that could be  
375 triggered by the crisis and worsen common mental distress.

376 Indeed, no prior work has considered such a large number of changes within workplaces and their  
377 effects on common mental distress. We fill this gap by using detailed questions on how the crisis  
378 affected the workplace and how employees' work-related common mental distress was affected by  
379 this. Additionally, while most previous work relied on surveyed individuals reporting whether or not  
380 they were affected by the crisis (Deaton, 2012; Jones et al., 2016; McInerney et al., 2013; Ólafsdóttir  
381 et al., 2015), we leverage data from three perspectives on the impact of the 2008-11 financial crisis  
382 (employees, worker representatives, managers) to reduce the potential impact of justification bias.

383 We find that the 2008-11 financial crisis affected employee work-related common mental distress  
384 more strongly via an increase in workload, a factor that has been absent from the economics debate so  
385 far. On the other hand financial factors such as reduced wages only appear to be one of many factors  
386 connecting the crisis to reductions in common mental distress.

387 The results presented here are limited to the 2008-11 financial crisis. Though, Ruhm (2016) has shown  
388 that the health effect of crisis is similar to that of less severe economic downturns. It is therefore  
389 possible that the findings presented here are generalizable beyond the 2008-11 financial crisis.

390 A limitation of this study is that we only consider crisis-“survivors” who are continuously employed. It  
391 is likely that the common mental distress of those becoming unemployed due to the crisis was  
392 adversely affected (Breuer, 2015; Parmar et al., 2016). Nevertheless, previous research suggests that it  
393 is not only unemployment that affects mental health (Clark et al., 2010). Many of the effects of the  
394 crisis covered in the survey of employees can be seen as indicators of increased job insecurity and  
395 potential precariousness. Previous research has shown that both precariousness and unemployment are  
396 independent contributors to effects on mental health (Julià et al., 2017; Kim and von dem Knesebeck,  
397 2015). Precariousness is argued to be predictive of mental illness in the workforce (Han et al., 2017)  
398 and specifically contractual changes that increase the perceived precariousness of jobs have a negative  
399 impact on mental health (Moscone et al., 2016) and workplace related perceptions (Van Aerden et al.,  
400 2016).

401 We do not make any causal claim, because employees studied here are not randomly affected by the  
402 crisis. The potential of bias due to more resilient employees being continuously employed remains as  
403 well as the possibility that employees select into certain jobs conditional on their common mental  
404 distress. The ideal solution would be to have a measure of workplace culture that could be added to the

405 model or instrumental variables that determine how the workplace reacted to the crisis but does not  
406 affect the employee common mental distress, other than indirectly through the workplace reaction to  
407 the crisis. An alternative approach to tackle that some employees are more resilient than others would  
408 be to account for baseline levels of mental distress, but unfortunately WERS does not provide  
409 observations for the same individuals over time. A similar concern are buffer-mechanisms. Wealth for  
410 example is not observable for us and might buffer the effect between crisis-induced workplace changes  
411 and common mental distress with the wealthier employees being less affected by the crisis-induced  
412 workplace change than the less wealthy employees. However, in the absence of causal estimates in the  
413 literature and the unavailability of better data, our fixed effects approach offers insights into the  
414 relationships between specific crisis-induced changes in the workplace and common mental distress in  
415 the workplace currently not available in the literature.

416 Finally, the definition of mental health and illness in a general population is not straightforward  
417 (Böhnke and Croudace, 2016; Stewart-Brown et al., 2015). In our case the survey assessed as specific  
418 component, the amount of job-related mental distress an employee experiences. While the questions  
419 cover fairly typical adjectives used in other instruments as well (Stochl et al., 2016), they cover only  
420 negative descriptors, which means that an assessment of positive mental health was not possible  
421 (Böhnke and Croudace, 2016).

422 To conclude, managers and worker representatives might have perceived the economic literature so far  
423 in way that implied cutting non-financial benefits such as increasing workload as the least-worst  
424 option in reacting to a recession. This study raises some doubt whether this is the best course of action.  
425 Indeed managers should seek to balance reductions in necessary monetary and non-monetary  
426 reductions with respect to the mental distress of their staff. The future work on the effect of the  
427 financial crisis on mental health should invest more effort into exploring the causal chain between the  
428 financial crisis and their respective outcome to test the replicability of these results in other context. A  
429 better understanding of the mechanisms could then be translated into concrete policy  
430 recommendations.

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## APPENDIX A: INDIVIDUAL QUESTIONS OF THE COMMON MENTAL DISTRESS INDEX

The following offers a question-by-question sensitivity analysis of the responses to the individual questions of the mental distress index (Jones et al., 2016; Warr, 1990). These results are presented as an online appendix for two reasons, the level of the theoretical argument and the scaling of the dependent variables.

First, the index offers a more generalizable summary of the continued experience of common mental distress in the workplace since it does depend less on individuals' propensities to experience specific symptoms or their specific interpretations of an individual adjective. This interpretation is in line with the common use of such indices in epidemiology and individual differences research and especially such adjective lists have been shown to be largely exchangeable indicators for common mental distress (e.g., Böhnke and Croudace (2016); Jones et al. (2016); Stochl et al. (2016); Warr (1990)). The argument presented in the main paper connecting crisis-induced changes at the workplace and work-related common mental distress is on the level of this more abstract variable. But relationships between individual indicators and specific workplace related changes might be interesting for future research in the area.

Second, applying a fixed effects framework to the individual, ordinal question responses may lead to biases in the estimation of the relationships (Liddell & Kruschke, 2018). Averaging question responses, subtracting workplace averages from individual responses, and applying an OLS framework all assume that the dependent variable is interval-scaled. This is clearly not the case, but for comparability with the results of the main paper, this approach was retained.

Table A1 splits the mental distress variable into its six parts (tense, depressed, worried, gloomy, uneasy and misery). Overall, we examine nine crisis-induced workplace changes and their respective associations are quite homogenous in magnitude and precision across the six indicators of mental distress. For three of the crisis-induced workplace changes the coefficient is significant no matter what the outcome is: Increases in workload, reduction of non-work benefits, and restrictions to access training are all connected to statistically significant increases in common mental distress. Being required to take unpaid leave is not significant with large standard errors independent of the outcome variable.

For three further crisis-induced changes significant relationships are found for five out of six outcome variables. Reorganising work and moving to another job were not connected with feeling "tense" and cutting or freezing wages was not connected to "misery". The two crisis-induced changes that remain are a reduction in contracted working hours and a restriction in paid overtime. A reduction in contracted working hours is highly significant with a large and positive coefficient in the case of tense being the outcome, but in all other cases being insignificant with smaller coefficients. Access



1 restrictions to paid overtime showed consistently negative coefficients, but insignificant when tense  
 2 and worried are the outcomes.

3 Table A1 – Workplace fixed-effect regression results for the change in each question underlying the  
 4 common mental distress measure due to workplace changes caused by the 2008-11 financial crisis

	Tense	Depressed
Workload increased	-0.425*** [0.033]	-0.283*** [0.037]
Work was reorganised	-0.039 [0.039]	-0.082** [0.040]
Moved to another job	-0.102* [0.054]	-0.195*** [0.067]
Wages frozen or cut	-0.132*** [0.035]	-0.142*** [0.035]
Non-wage benefits reduced	-0.144** [0.059]	-0.113* [0.061]
Contracted working hours reduced	0.117 [0.098]	0.012 [0.127]
Access to paid overtime restricted	-0.072* [0.038]	-0.138*** [0.042]
Required to take unpaid leave	-0.261* [0.152]	-0.237 [0.171]
Access to training restricted	-0.180*** [0.039]	-0.108** [0.046]
	Worried	Gloomy
Workload increased	-0.328*** [0.036]	-0.236*** [0.037]
Work was reorganised	-0.091** [0.041]	-0.138*** [0.041]
Moved to another job	-0.168*** [0.060]	-0.162** [0.065]
Wages frozen or cut	-0.159*** [0.034]	-0.125*** [0.033]
Non-wage benefits reduced	-0.139** [0.058]	-0.147** [0.064]
Contracted working hours reduced	0.006 [0.100]	0.033 [0.121]
Access to paid overtime restricted	-0.069* [0.039]	-0.135*** [0.041]
Required to take unpaid leave	-0.171 [0.184]	-0.117 [0.168]
Access to training restricted	-0.142*** [0.042]	-0.176*** [0.046]
	Uneasy	Misery
Workload increased	-0.292*** [0.038]	-0.224*** [0.037]
Work was reorganised	-0.120*** [0.041]	-0.082** [0.040]
Moved to another job	-0.209*** [0.059]	-0.213*** [0.067]
Wages frozen or cut	-0.166*** [0.034]	-0.112*** [0.034]
Non-wage benefits reduced	-0.146** [0.064]	-0.116* [0.068]
Contracted working hours reduced	0.594 [0.111]	-0.013 [0.134]
Access to paid overtime restricted	-0.075* [0.040]	-0.145*** [0.042]
Required to take unpaid leave	-0.514*** [0.196]	-0.211 [0.160]
Access to training restricted	-0.166*** [0.044]	-0.126*** [0.045]

5 Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard error reported in square brackets. The error term is clustered at workplace level. The  
 6 controls are region (8 regions for England, Scotland and Wales), age from 16 onwards grouped in 9 categories, whether the person is white  
 7 or non-white, male or female, works in the private or public sector, and whether the employee submitted the survey online or via paper. The  
 8 number of employees observed is 4,802 and the number of workplaces is 393.  
 9

10 **References only appearing in the Appendix**

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