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Join the Union and be Safe; The Effects of Unionisation on Occupational Safety and Health in the European Union

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Abstract: This paper investigates the effect of unionisation on fatal and non-fatal work accidents after controlling for the country GDP, using a panel sample of 10 European Union countries, for the period 1982-2006. The study takes into account the time persistence in work injuries and the endogenous nature of the work injuries – union density relationship, by using GMM regression models. After controlling for endogeneity, both fatal and non-fatal work injuries decrease as union density increases. This finding has important implications for the design of OHS and industrial relations policies.

Keywords: Work accidents, Unemployment, GMM

JEL: J28, J81, C33

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Join the Union and be Safe; The Effects of Unionisation on Occupational Safety and Health in the European Union

Introduction

Health and safety at the workplace plays an important role in the well being of the employed population. Although work injuries exhibit downward trends the last decade, they still cause significant economic, social and emotional costs to the employees' involved and negative externalities to their families as well (European Agency for Health and Safety at Work, 2001).

Pouliakas and Theodossiou (2011) provide a detailed literature review of the OHS which reveals that labour unions play an important role in determining the framework of workplace health and safety policy initiatives. The literature indicates that labor unions use their political influence and engage actively through collective bargaining, representation in health and safety committees and the undertaking of relevant actions, in enhancing workplace safety (Donado, 2007). Hence, in industries with strong unionisation presence, work injuries appear to be lower in comparison to industries with weaker union presence (Donado, 2007). Furthermore, Freeman (1994) argues that unions contribute to the improvement of working conditions, obtain higher compensation benefits for employees who suffered work-related health problems, and in general, represent effectively the employees' interests regarding health and safety at the workplace (Donado, 2007; Fenn and Ashby, 2004; Hirsch *et al*., 1997; Morse *et al*., 2003). Siebert and Wei (1994) provide evidence that unionised workers experience lower fatal injury rates. A more recent study of Litwin (2000) found that the presence of unions in the British labour market contribute to the reduction of work injuries.

However, a number of studies provide evidence that increased unionisation is associated with higher workplace injuries (Donado, 2007; Fishback, 1986). In line with the above, Donado (2007), Fenn and Ashby (2004), Nichols *et al*. (2007) show that unionisation affects workplace injuries, but workplace injuries may also affect the degree of unionisation since high accidents rates may motivate workers to organise in unions in order to protect themselves from the hazardous working conditions. Indeed, the evidence indicate that workers who face increased hazards at work voice their concerns by participating in union activity, as a response to the hazardous job conditions (Hirsch and Berger, 2001; Robinson, 1990).

Yet, Donado (2007) failed to provide evidence of a simultaneous relationship between unionisation and work injuries. He attributes the observed increased work injury rates in unionised sectors to behavioral issues and he argues that the presence of a union in an establishment is accompanied by increased safety measures because individual workers tend to underestimate the true job hazards, and thus experience higher work accident rates, than when a union is involved. Donado (2007) utilised GMM regression to examine the endogenous nature of work injuries – unionisation. He used as identifying restrictions the past values and the past differenced values of union indicators on the assumption that union actions regarding occupational health and safety continue to influence the likelihood of work injuries at subsequent years.

Nichols *et al*. (2007) argued that unionisation can reduce work injuries in combination with the participation of union members health and safety committees at the establishment level. The above findings are in line with Reilly *et al.* (1991), who argues that lower injury rates are observed in plants where union representatives participate in the occupational safety and health committees compared to plans where unions are not represented in such committees.

In addition, Donado (2007), Fenn and Ashby (2004), Morse *et al*. (2003), Nichols *et al*. (2007) find that the report rate of work injuries is higher in workplaces with strong union presentation and this might bias upwards the effects of unionization on OHS. Fenn and

Ashby (2004) provide corroborating evidence indicating that the higher is the proportion of unionized workers in an establishment, the higher would be the risk of reported injuries or illnesses. They argue that highly unionised enterprises show high reporting of injuries at work, since they enjoy higher compensation due to the union representation.

The present study investigates the effect of unionisation on work-related injury rates using a panel of ten European Union countries during the period 1982-2006. The degree of unionisation is approximated by the union density index. In order to take into account the time persistence in work injuries and the endogenous nature of the work injuries – unionisation relationship, GMM regression techniques are utilised. Furthermore, since Boone and van Ours (2002), Davies *et al*. (2009), Catalano (1979), Sasaki (2010), Steele (1974), Ussif (2004) show that occupational accidents and injuries rates are affected by the macroeconomic conditions and the business cycle, a proxy for these conditions (real GDP per capita) is included in the regression. The study shows that after controlling for endogeneity and time persistence, both fatal and non-fatal work injuries tend to decrease as union density increases, indicating the protective role of unions on occupational safety and health.

The Dataset

The data used in this study is a panel of 10 European Union countries (Austria, Denmark, Finland, France, Ireland, Italy, Portugal, Spain, Sweden, UK) for the time period 1982-2006. Data on fatal and non-fatal work accidents and employee population are drawn from the International Labour Organization (ILO) database (LABORSTA). The variables to be explained are therefore[1]:

- *Total fatal injury rates per 100,000 employees*

[1] Data on fatal and non-fatal injuries disaggregated by industrial sector are also available at ILO database. Unfortunately, the increased missing values on the employee population per industry and union density, did not allow exploitation of this information.

- *Total non-fatal injury rates per 100,000 employees*

The independent variables of interest are as follows:

- *Union density*
- *GDP per capita (in PPP)*

The data on real GDP per capita are derived from the European Database 'Health for All' of the World Health Organization (WHO). Data on trade union density (the ratio of wage and salary earners that are trade union members divided by the total number of wage and salary earners) are drawn from the Annual Labour Force Statistics of the OECD database.

Finally, the instrumental variable used to control for the endogenous relationship between work injuries and union density, is the "days lost due to strikes and lockouts per 100,000 employees" and the information is drawn from the International Labour Organization (ILO) database (LABORSTA). The summary statistics of the variables included in the regressions are shown in Table 1.

Econometric Methodology

The methodological procedure followed is to estimate the following preliminary fixed effect model:

$$Fatal\ Work\ Accidents_{i,t} = a_i + b_1 \cdot GDP_{i,t} + b_2 \cdot Union\ Density_{i,t} + b_3 \cdot S_t + \varepsilon_{i,t} \tag{1}$$

$$Non-Fatal\ Work\ Accidents_{i,t} = a_i + b_1 \cdot GDP_{i,t} + b_2 \cdot Union\ Density_{i,t} + b_3 \cdot S_t + \varepsilon_{i,t}$$

(2)

The subscripts i and t denote the country and the year period respectively, a_i is the country-specific fixed-effects intercepts and S_t is the time trend variable[2]. The results for overall fatal and non-fatal work accidents are reported in Table 2 and 3 respectively (Column 1).

In the second stage two methodological shortcomings are addressed. First the dynamic nature of work-related injuries is taken into account. This is an implication of the fact that the experience of a work related health problem at present may be affected by work related health condition suffered in the past. For example, musculoskeletal disorders are found to be the most frequently experienced work-related health problem in the European Union countries. After the onset of a musculoskeletal disorder (for example, low back pain) due to working conditions there is a high probability of recurrence of this problem (De Beek *et al.*, 2000). Second, the endogenous nature of the relationship between trade union density and work injuries should be controlled for in order to derive unbiased estimates. Both the dynamic relationship and endogeneity issues can be accounted for by the use of GMM models. The Arellano and Bond (1991) first differenced GMM estimator estimates equations (1) and (2) after introducing lagged values of the dependent variable and first differencing the variables in order to eliminate unobserved heterogeneity. The first differenced equation uses as instruments the past values of union density. However, past union density should continue to affect the growth rate of work injuries at subsequent years through the union's actions regarding occupational health and safety policies and framework.

Arellano and Bover (1995) argue that the system GMM estimator is improved in terms of efficiency in comparison to the differenced GMM estimator, since the lagged variables in

[2] The models were also estimated with year dummies and the findings did not alter significantly.

levels maybe weak instruments for the differenced equation. In line with the above, the main model utilised in this study is the two-step system GMM estimator (the equations (1) and (2) respectively) to obtain the following system of two equations (one in differences, as in the differenced GMM estimator and one in levels) for fatal and non-fatal work injuries respectively (Δ denotes the difference operator)[3]:

$$\begin{bmatrix} Fatal\ Work\ Accidents_{i,t} \\ \Delta Fatal\ Work\ Accidents_{i,t} \end{bmatrix} = b_0 + b_1 \cdot \begin{bmatrix} Fatal\ Work\ Accidents_{i,t-1} \\ \Delta Fatal\ Work\ Accidents_{i,t-1} \end{bmatrix} + b_2 \cdot \begin{bmatrix} GDP_{i,t} \\ \Delta GDP_{i,t} \end{bmatrix} + b_3 \cdot \begin{bmatrix} Union\ Density_{i,t} \\ \Delta Union\ Density_{i,t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{i,t} \\ \Delta \varepsilon_{i,t} \end{bmatrix} \quad (3)$$

$$\begin{bmatrix} Non-Fatal\ Work\ Accidents_{i,t} \\ \Delta Non-Fatal\ Work\ Accidents_{i,t} \end{bmatrix} = b_0 + b_1 \cdot \begin{bmatrix} Non-Fatal\ Work\ Accidents_{i,t-1} \\ \Delta Non-Fatal\ Work\ Accidents_{i,t-1} \end{bmatrix} + b_2 \cdot \begin{bmatrix} GDP_{i,t} \\ \Delta GDP_{i,t} \end{bmatrix} + b_3 \cdot \begin{bmatrix} Union\ Density_{i,t} \\ \Delta Union\ Density_{i,t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{i,t} \\ \Delta \varepsilon_{i,t} \end{bmatrix} \quad (4)$$

The above systems of equations for fatal work injuries (3) and non-fatal work injuries respectively (4) respectively, are estimated using the two-step system GMM estimator. This estimator is considered to be more efficient than the differenced GMM estimator, since it uses as instruments the lagged differences of union density for the equation in levels and the lagged levels of union density for the equation in differences. The lagged values of $Union\ Density_{t-2}$ and so on, are assumed to be valid instruments for the first differenced equation. In order to improve the performance of the model, the variable "days lost due to

[3] The system of equations also includes control for the time trend variable. Alternative estimation models with year dummies were also utilised but the models presented indicated a better fit, due to the strong collinearity of the year dummies with the independent variables.

strikes and lockouts per 100,000 employees" is also included as an instrumental variable. This indicator of union activity should be is correlated with union density since it is found to consistently affect trade union density (Lesch, 204). However, there is no a priori reason to expect that strike activity is related to work-related injuries.

In addition, the Sargan test is also used in order to check for the validity of the over-identifying restrictions. The AR(1) and AR(2) tests are also presented since there should not be any evidence of second-order serial correlation while first-order serial correlation is expected in the model of first differences (Arellano and Bond, 1991).

Regression Results

Table 1 presents descriptive statistics for the variables of interest at country level. Fatal injury rates per 100,000 workers vary greatly across countries. Sweden exhibits the lowest rate with only 0.28 work related fatalities per 100,000 workers. Spain faces a high incidence of work-related fatalities (8.38 per 100,000 workers) and of non-fatal work injuries (5,026.84 per 100,000 workers). The lowest incidence is observed in the UK (632.91 non-fatal work injuries per 100,000 workers). Union density also varies across countries. Union membership is 10% for France, but 81% in Sweden.

Figures 1-3 show the mean fatal and non fatal work injury rates and union density rates for the countries included in the sample. A downward trend is observed for all three series. The mean rate of work-related fatalities exhibits a greater volatility throughout the period 1982-2005, and it has a similar pattern to the mean of non-fatal work injuries. Interestingly, both series exhibit a sharp increase in the middle to late 1980's and they drop afterwards. The mean union density rates are declining from 1982 up to 2005, with a sharp increase in the 1990-1995 period.

The results for the system GMM estimator for fatal and non-fatal work injuries are presented in Tables 2 and 3 respectively (Column 2). Table 2 presents the regression results for fatal work injury rates for 100,000 workers in the period 1982-2005. In the first column, the results from the fixed effects model are presented, and the second column presents the system-GMM results when endogeneity and time dependence is taken into account. The results of the Sargan test and the serial correlation tests (AR(1), AR(2)) are satisfactory. Sharp differences are observed between the results of the two estimation procedures. While only economic conditions seem to affect work-related fatalities in the fixed effects model, the relationship becomes insignificant in the system-GMM model. In contrast, union density appears to reduce work fatalities, when GMM technique is utilised. An increase in union density is associated with a lower rate of fatal work injuries, indicating that increasing union density helps unions to achieve better outcomes on occupational health and safety conditions.

The findings are similar when one considers the effect of union density upon non-fatal work injuries (Table 3). Increasing union density appears to reduce non-fatal work injury rates (at 10% level of significance). However, the fact that the coefficient is only marginally statistically significant may be an outcome of the limited number of observations included in the sample in this case. Thus, it appears that as in the case of fatal work related accidents, increased union density is associated with a lower number of non-fatal work injuries. Thus, union activity improves working conditions and increase workplace safety. Union strength, as reflected in high union membership, improves the ability of unions to negotiate and achieve improvement of occupational safety and health at the workplace. Unions also aim to increasing the risk premiums, training of workers and raising compensating wage differentials. Furthermore, the unions encourage workers to achieve greater health compensations in case of work-related injuries (Litwin, 2000).

The empirical evidence on the effects of unions on occupational health and safety is ambiguous. Some studies report a negative relationship between union activity and fatal or non-fatal workplace injuries (Siebert and Wei, 1994, Litwin, 2000) whereas other studies find a positive relationship (Donado, 2007; Fishback, 1986). This ambiguity may be an outcome of the endogeneity bias (Hirsch and Berger, 2001; Robinson, 1990). This paper shows that the role of endogeneity and state dependence is crucial for evaluating the effect of union density upon workplace injuries. If endogeneity is not taken into account a positive but not statistically significant effect of union density on occupational health and safety is shown but once endogeneity is controlled for the relationship becomes negative and statistically significant.

Contrary to the results obtained be the fixed effect model (column 1), the system-GMM model shows that non-fatal work injury rates move procyclically to economic conditions as approximated to country GDP. These findings suggest that during fattributed to the higher investment on occupational health and safety issues undertaken by employees at periods of economic booms. Barth *et al.* (2007) and Davies *et al*. (2009 unearth similar evidence and argue that during economic expansions work accidents tend to decrease. There is limited eempirical research on the effect of macroeconomic conditions on OHS focusing mainly on the non-fatal work accidents by country or by occupation (Barth *et al.*, 2007). The findings are ambiguous; indicating mainly that during economic recessions work injuries tend to decrease (Boone and van Ours, 2002; Ussif, 2004). These findings are sensitive to the choices of countries or occupational sectors. For instance Song *et al*. (2011) suggest that the above inconsistency of the empirical evidence is and outcome of the sensitivity of the models to the choice of the time period. The present study suggests that only non-fatal work injuries are affected by the macroeconomic conditions. These results are in line with the findings of Saloniemi and Oksanen (1998) who also failed to establish an empirical relationship between macroeconomic conditions and overall fatal work accidents. This is corroborated by the evidence offered by Davies *et al*. (2009) who is unable to establish a relationship between macroeconomic conditions anf serious workplace injuries.

Conclusions

This study attempts to provide further evidence of the effects unionisation, upon fatal and non fatal work accidents for ten European Union countries. The level of unionization is approximated by the union density rates. In doing so, this study utilizes system-GMM models in order to take into account the endogeneity on the work injuries-union density relationship and the dynamic character of work injuries. The findings of this paper suggest that both endogeneity and state dependence affect the relationship of interest. When both are controlled for, union density is conducive to reducing work place fatal and non-fatal injuries at the workplace.

Overall, the results imply that Union power seems to be an important determinant for the success of unions in occupational health and safety negotiations. Increased membership improves the ability of the unions to be effective in achieving improvements on occupational health and safety and hence the improvement of working conditions. Therefore, policy makers should help and facilitate the actions of unions towards the direction of improving workplace safety, the education of both workers and employees on health and safety regulations, and in general, the initiatives of reducing workplace injuries.

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Table 1. Descriptive Statistics

Variables \ *Country*	***Austria***		***Denmark***		***Finland***		***France***		***Ireland***	
	Mean	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***
Fatal Injury Rates per 100,000 employees	4.95	1.64	2.76	0.89	2.64	0.68	4.02	1.19	3.26	1.63
Non-Fatal Injury Rates per 100,000 employees			1910.03	350.69	3090.66	764.81				
Union Density (%)	43.11	6.79	75.81	2.45	74.36	4.08	10.40	2.63	49.69	9.99
GDP per Capita	20537.58	7101.47	21558.83	7240.06	18777.38	6393.45	19857.75	5661.74	18889.67	11197.02
Variables \ *Country*	***Italy***		***Portugal***		***Spain***		***Sweden***		***UK***	
	Mean	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***	***Mean***	***Standard Deviation***
Fatal Injury Rates per 100,000 employees	5.87	1.06	6.68	2.78	8.38	2.44	0.28	0.18	1.14	0.49
Non-Fatal Injury Rates per 100,000 employees	3356.84	643.63	4844.57	1315.57	5026.84	526.06	1274.43	617.06	632.91	94.33
Union Density (%)	38.35	3.83	27.15	8.78	14.06	2.87	80.63	2.11	36.70	7.18
GDP per Capita	19043.54	5973.48	12466.54	4883.09	14977.96	5767.34	20085.46	5641.46	18984.00	6639.99

* Information on fatal work injuries per 100,000 employees is available for the period 1982-2005. Information on non-fatal work injuries per 100,000 employees is available for the years 1985-2006.

Figure 1. Changes in Mean Fatal Work Injury Rates Over Time, 1982-2005.

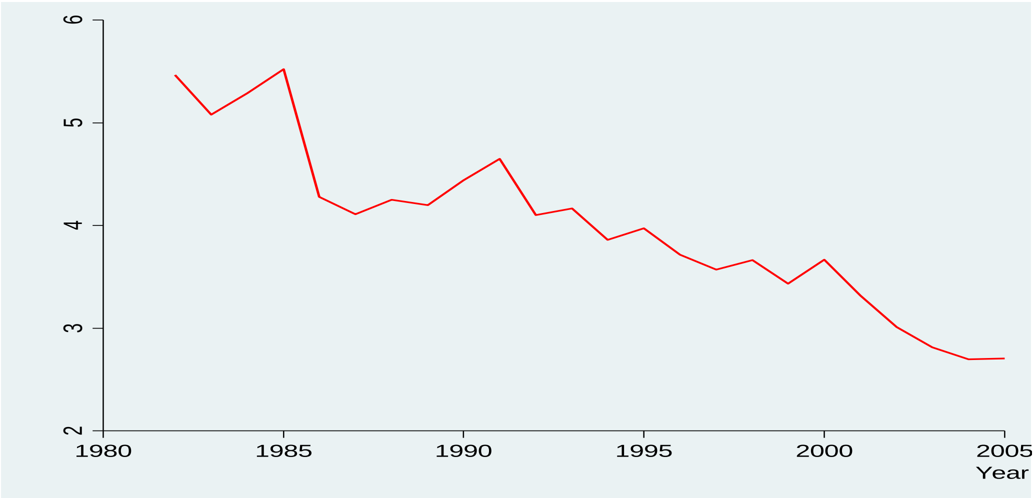

Figure 2. Changes in Mean Non-Fatal Work Injury Rates Over Time, 1985-2006.

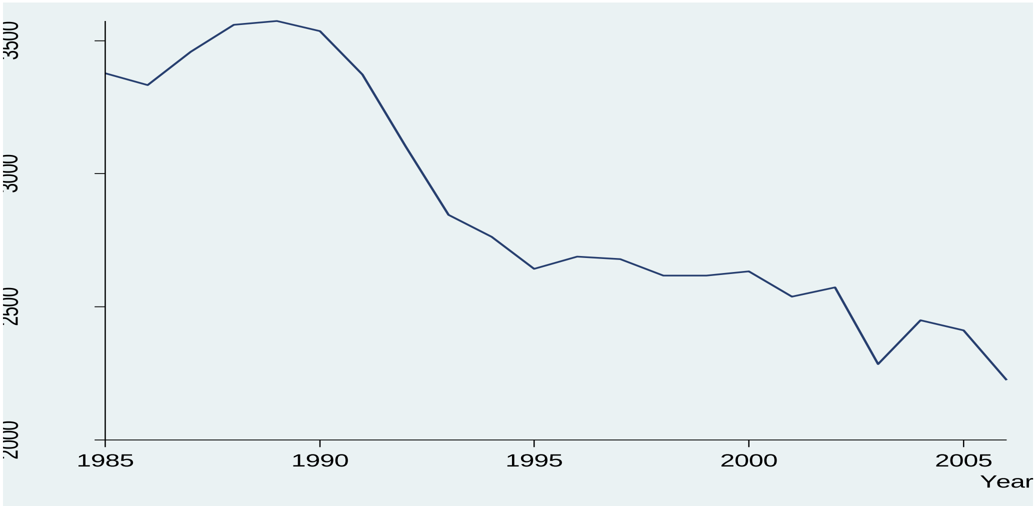

Figure 3. Changes in Mean Union Density Rates, 1982-2005.

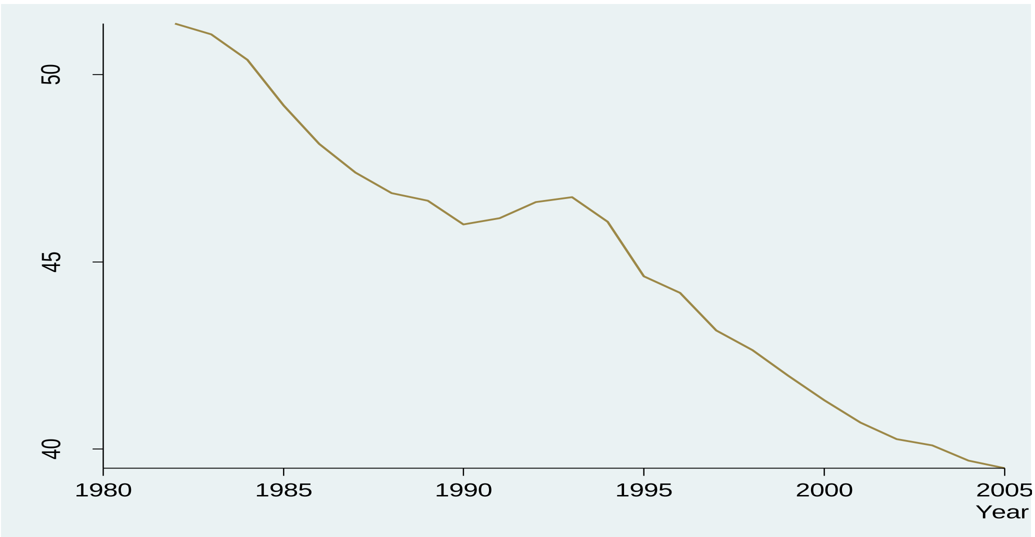

Table 2. The Effect of Unionization on Fatal Work Injuries, 1982-2005

Independent Variables* \ *Dependent Variable	***Fatal Injuries***	
	FE	***System GMM***
GDP	0.0002 * (2.78)	0.0001 (0.14)
Union Density	0.021 (0.67)	-0.344 * (-1.97)
Fatal Injuries$_{t-1}$		0.222 (0.61)
Trend	-0.247 * (-5.06)	-0.186 (-0.77)
Constant	3.109 ** (1.67)	20.296 * (1.97)
F test	26.00 (0.00)	
Wald chi2		60.47 (0.00)
AR(1)		0.927
AR(2)		0.900
Sargan test		0.416
Observations	240	230

* indicates statistical significance for p<0.05 and ** indicates significance for p<0.10.
Robust standard errors are calculated.
T-statistics are reported in parenthesis
Probabilities are reported for AR(1), AR(2) and Sargan test.

Table 3. The Effect of Unionisation on Non-Fatal Work Injuries, 1985-2006

Dependent Variable / ***Independent Variables***	***Non-Fatal Injuries***	
	FE	***System GMM***
GDP	-0.020 (-0.89)	-0.047 * (-2.63)
Union Density	0.001 (0.25)	-0.030 ** (-1.63)
Non Fatal Injuries$_{t-1}$		-0.365 (-0.55)
Trend	-0.006 (-1.75)	-0.008 (-1.61)
Constant	0.465 (1.37)	2.314 ** (1.86)
F test	7.25 (0.02)	
Wald chi2		27.30 (0.00)
AR(1)		0.435
AR(2)		0.291
Sargan test		0.115
Observations	154	147

* indicates statistical significance for p<0.05 and ** indicates significance for p<0.10.
Robust standard errors are calculated.
T-statistics are reported in parenthesis
Probabilities are reported for AR(1), AR(2) and Sargan test.
Non-fatal injuries index is divided by 10,000 and GDP is divided by 1,000,000 for the easer presentation of the findings.