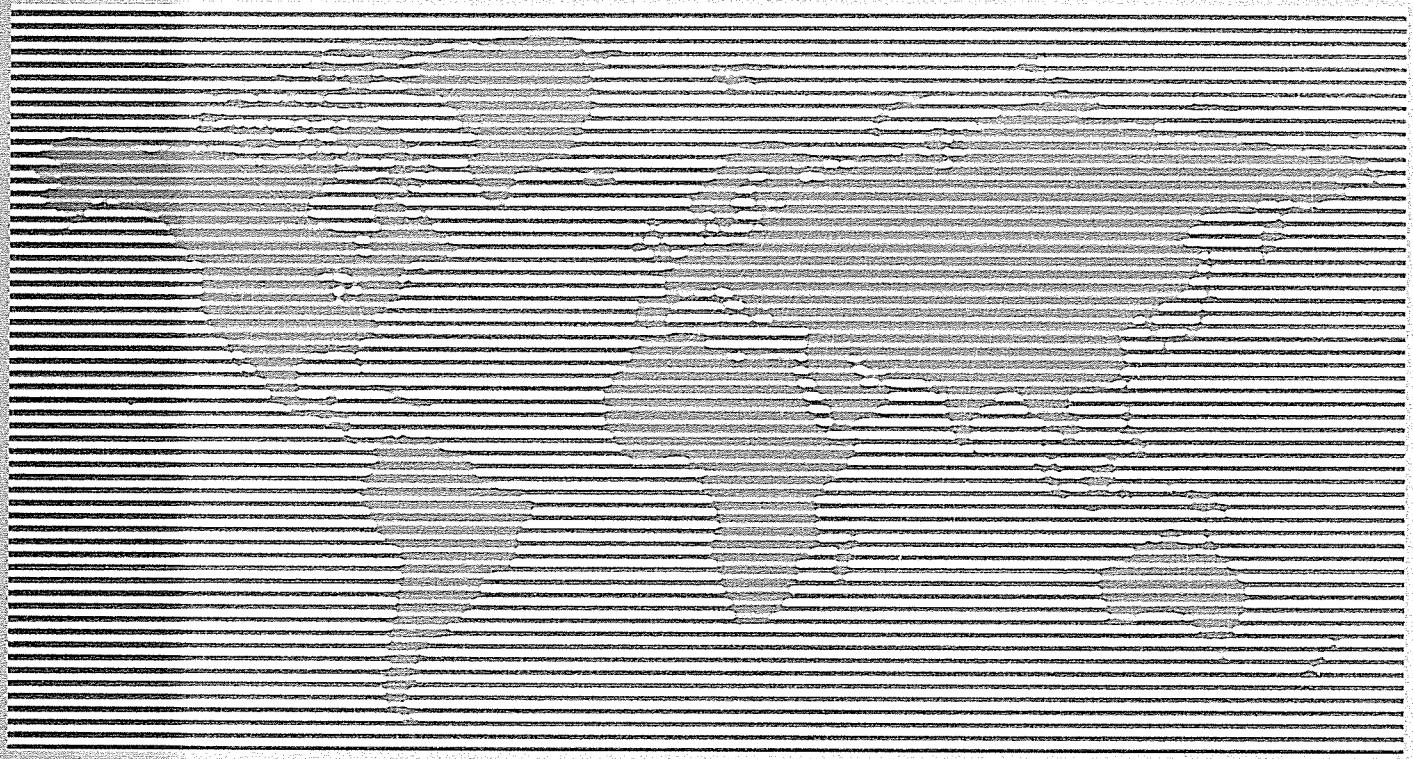
JIMS, Volume 17, Number 3, 2017

ISSN: 1930-6105

JIMS

JOURNAL OF INTERNATIONAL MANAGEMENT STUDIES®



EDITOR-IN-CHIEF

David D. Stinson, MEd
Director, Equity of Access and Learning Resources, Trinity Western University

A Publication of the

International Academy of Business and Economics™

Promoting Global Competitiveness™

IABE.ORG

DETERMINANTS OF OVERTIME WORK (A STUDY ON DATA FROM AN ALUMINUM MANUFACTURING FACILITY)

Tekin Akgeyik, Istanbul University, Istanbul, Turkey
dx.doi.org/10.18374/JIMS-17-3.4

ABSTRACT
The objective of the current study is to estimate the determinants of overtime work using a dataset from an aluminum manufacturing facility, Istanbul, Turkey. The results of hierarchical regression analysis revealed that production volume and production unit (work factors) and annual paid leave, sickness absence and other paid leaves (employee factors) were positive determinants of overtime work. Moreover annual paid leave was found to be a negative predictor of overtime in a sub-sample of the production units. Finally, the findings of the correlation analysis for the full sample pointed out that overtime was positively and significantly correlated with production volume, operational team, annual paid leave, sickness absence and other paid leaves.

Keywords: *overtime, annual paid leave, absence, employee, Turkey.*

ACKNOWLEDGEMENT: This study was supported by Istanbul University Research Fund.

1. INTRODUCTION

International Labor Organization (ILO) defines overtime as working hours exceeding the normal statutory hours (Seo, 2015). Overtime is an alternative instrument for increasing production through higher usage of human resources (Jirjahn, 2008). However, excessive overtime may adversely impact an employee's physiological and psychological health. Therefore, international organizations (such as ILO, EU) and national regulations impose limits on overtime hours.

Despite restrictive legislation, in some countries such as Mexico, Korea, Chile, and the U.S. overtime hours remain higher than the average of OECD (OECD, 2017). According to the BLS (2016), in the U.S. the average annual overtime work per manufacturing worker has risen from 44.7 in 2008 to 51.6 hours in 2016, an increase of 15.4%. However, the figures reveal a somewhat different picture in some other countries over the same period. For example, in Canada the average annual overtime has reduced from 22.8 hours to 19.9 hours, with a reduction of 13% (Statcan, 2016). Also in the EU-28, the average annual overtime hours per full-time employee decreased by 10.7% (Eurostat, 2017). Similarly, in Turkey the average weekly overtime hours per full-time worker has fallen by 16.7% (TSI, 2017).

Many studies have been intended to find out the organizational determinants of overtime. For example, Bauer and Zimmermann (1999) showed that output growth was a significant factor in determining overtime. Using a sample of manufacturing firms from Germany, Jirjahn (2008) suggested that the managerial environment, production technology, work's organization, workforce's structure and industrial relations were significant contributing factors of overtime. Another study among Japanese office workers by Uchida, Kaneko and Kawa (2014) claimed that position, taking paid holiday, job demand, stopping work, and fear of the boss were significantly related to both long and excessive overtime work.

A research on data from New York State hospitals by Berney, Needleman and Kovner (2005) reported a significant difference in overtime hours between unionized and nonunionized hospitals. Berney and Needleman (2005) found that overtime increased significantly more rapidly in non-teaching hospitals compared to teaching hospitals. In another study, Berney (2005) observed a significant difference between governmental and non-government hospitals in the use of overtime.

Beltempo et al. (2016) has concluded that overtime was affected by non-modifiable factors such as unit occupancy, season and the number of patients. Kalwij and Gregory (2005) revealed that the occupation

and industry structure of employment, wages, standard hours and unionization predicted about half of the variance in overtime for male employees, and most of the change for female employees.

On the other hand, some researchers have conducted the empirical studies investigating the relationship of absence with overtime. The findings are mixed. For example, Ehrenberg (1971) illustrated a positive link between absenteeism and the use of overtime hours. Likewise, Preston (1995) suggested that there was a significant correlation between overtime and higher levels of absence. However, Brown (1995) asserted that absence was negatively associated with overtime working. Similarly, Kenyon and Dawkins (1989) revealed a negative correlation between overtime and absenteeism (Colley, 2006). Inconsistent with these results, the study by Hopkins (1990) found no significant association between the amount of overtime and absenteeism.

Moreover, the association of individual and social characteristics with overtime has been analyzed by some studies. In a research among 1612 Dutch full-time employees, Beckers et. al (2008) claimed that voluntary overtime group demonstrated significantly higher levels of income and education than involuntary overtime workers. Uchida, Kaneko and Kawa (2014) found gender, body mass index and meal times to be significantly related to excessive overtime work. Moreover Zapf (2015) has indicated a significant negative correlation between female employees and paid overtime. The same relationship was observed by the author between part-time employees and unpaid overtime. Finally, Kang, Matusik and Barclay (2017) concluded that Eastern cultural values including seniority, righteousness, relationship and benevolence were the key variables in working overtime in Asian firms.

The objective of the current study is to estimate the determinants of overtime work using a dataset from an aluminum manufacturing facility, Istanbul, Turkey. More specifically, the paper aims to answer some questions: (1) Are there statistically significant differences in the means of overtime hours between the production units? (2) Is there a correlation between the variables? (3) To what extent do the independent variables (production volume, annual paid leave, sickness absence and other paid leaves) determine the dependent variable (overtime work)?

The rest of the paper is divided into three sections: Section two describes the research methodology used. Section three presents the data analysis, findings and discussion. The last section provides a summary of the results and conclusions.

2. METHOD

2.1. Sample and Data

The study used monthly team-level data on overtime, production volume, annual paid leave, sickness absence and other paid leaves (i.e. maternity, marriage and funeral leave) for 5 years, covering January, 2012 to December, 2016. Data were obtained from the production department and the human resources department of the company.

The sample consisted of 10 operational teams in 4 production units: preparation (including the teams of molding and casting), processing (including the teams of extrusion, anodizing and powder coating), finishing (including the teams of machining, wood effect coating and thermal break) and distribution (including the teams of packaging and shipping). 29 team-months with zero overtime hours were removed from the sample, thus reducing the number of sample to 571 team-months.

2.2. Variables

Overtime was the dependent variable. The independent variables were production volume, annual paid leave, sickness absence and other paid leaves. While variable "production volume" was measured by tons, the other variables were measured by the number of hours.

2.3. Data Analysis

The analyses were conducted on the full sample as well as separately for the sub-samples of the production units. The variables were summarized with mean and standard deviation. The significant differences

between the units were evaluated by the Kruskal Wallis Test. The possible interactions between the variables were measured by the Spearman's correlation analysis. Lastly, the study investigated the determinants of overtime work by using the hierarchical regression analysis.

3. RESULTS

3.1. Descriptive Statistics

An overview of the descriptive statistics for the full sample, and for the sub-samples of the production units is shown in Table 1. The mean team size for the full sample was 24.3 employees, with varying between 11.6 and 42.0 employees across the production units.

Other variables in Table 1 are expressed in per worker terms. The overall mean values were 56.8 hours, 17.8 tons, 6.8 hours, 3.0 hours and 0.2 hours for overtime, production volume, annual paid leave, sickness absence and other paid leaves, respectively.

The Kruskal-Wallis test revealed significant differences between the production units regarding the variables. The distribution unit had significantly higher overtime hours per worker ($M = 73.2$, $p < .001$), production volume per worker ($M = 37.8$, $p < .001$) and annual paid leave hours per worker ($M = 8.7$, $p < .001$), as compared to the other production units. Moreover, the processing unit differed meaningfully from the other production units in the mean of sickness absence per worker ($M = 4.2$, $p < .001$). A similar significant difference was seen in other paid leave hours per worker. It was observed significantly lower in the preparation unit than the other units ($M = 0.1$, $p < .01$).

TABLE 1: THE DESCRIPTIVE STATISTICS

	Full Sample	Production Units			
		Preparation	Processing	Finishing	Distribution
	(N = 571)	(n = 100)	(n = 179)	(n = 179)	(n = 113)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Team Size	24,3 (0,2)	51,6 (0,1)	11,6 (0,0)	42,0 (0,8)	32,4 (15,7)
Per-Worker					
Overtime (hr)	56.8 (19.5)	28.6 (3.7)	61.9 (10.4)	63.3 (9.6)	73.2 (12.9)***
Production Vol. (tons)	17.8 (12.9)	4.1 (1.2)	18.3 (1.9)	11.1 (1.0)	37.8 (3.6)***
Annual Paid Leave (hr)	6.8 (3.6)	3.6 (1.4)	7.3 (3.2)	7.4 (3.8)	8.7 (3.8)***
Sickness Absence (hr)	3.0 (1.5)	0.9 (0.6)	4.2 (0.9)***	3.5 (1.0)	3.3 (1.0)
Other Paid Leaves (hr)	0.2 (0.2)	0.1 (0.1)**	0.3 (0.1)	0.3 (0.3)	0.3 (0.1)

*p < .05. **p < .01. ***p < .001.

3.2. Correlation Analysis of Variables

Table 2 shows the correlations between the variables for the full sample. Overtime was found to be strongly related to production volume (r = .67; p < .001), while there was a less strong correlation between overtime and sickness absence (r = .53; p < .001). Moreover, the findings indicated a moderate correlation between overtime and annual paid leave (r = .47; p < .001). By contrast, overtime had a weakly correlated with other paid leaves (r = .37; p < .001).

TABLE 2: THE CORRELATION ANALYSIS FOR THE FULL SAMPLE

Variables	*1*	*2*	*3*	*4*	*5*
1. Overtime	-				
2. Production Volume	*,67***	-			
3. Annual Paid Leave	*,53***	*,43***	-		
4. Sickness Absence	*,47***	*,44***	*,40***	-	
5. Other Paid Leaves	*,37***	*,34**	*,38***	*,30***	-

*p<.05, **p<.01

The study also computed separate correlations between overtime and the independent variables for each sub-sample (as given in Table 3). The correlation of overtime with production volume was positive and significant for the processing unit (r = .46) and the finishing unit (r = .51) but not the preparing and the distribution.

TABLE 3: THE CORRELATION ANALYSIS FOR THE SUB-SAMPLES

Dependent Variable	***Independent Variables***			
Overtime by Production Unit	Production Volume	Annual Paid Leave	Sickness Absence	Other Paid Leaves
Preparation	*.16*	*.23**	*.02*	*.10*
Processing	*.46***	*-.16**	*.15**	*-.04*
Finishing	*.51***	*-.19***	*.11*	*.17**
Distribution	*.15*	*.65***	*.49***	*.40***

*p<.05, **p<.01

Theoretically there should be a positive relationship between overtime and annual leave, with higher levels of annual leave being correlated with higher levels of overtime. But surprisingly annual paid leave was found negatively related to overtime for the processing (r = -.16) and the finishing (r = -.19). A possible explanation could be that the workers in these units could not get annual leave due to excessive overtime.

For both the preparation unit and the finishing unit, overtime was not significantly associated with sickness absence. It was related to sick absence significantly but moderately for the distribution unit (r = .49, p < .001) and was also correlated significantly though very weakly for the processing unit (r = .15, p < .05). Finally the relationship between overtime and other paid leaves was moderately significant for the distribution (r = .40, p<.001) but very weakly for the finishing (r = .17, p < .05) and not significant for the other sub-samples.

3.3. Determinants of Overtime Work

For analyzing the determinants of overtime work, separate hierarchical regressions were conducted for the full sample and the sub-samples. The independent variables were entered in two steps. In Model 1 work factors (production volume and production unit) were involved. Model 2 consisted of the variables in Model 1, plus employee factors (i.e. annual paid leave, sickness absence and other paid leaves). Table 4 shows the results of regression analysis for the full sample, using overtime hours as the dependent variable.

Overall, Model 1 was significant, accounting for 45.6% (F = 237.625, p < .001) of the total variance in overtime. Both predictors in the Model contributed significantly to the prediction of overtime, with production volume having the strongest association with overtime (β = .719, p < .001), indicating that higher amount of production was associated with increased overtime hours. The negative beta coefficient for the variable "production unit" implied that the finishing unit and the distribution unit were more likely to do overtime that the other units.

The entry of employee factors slightly increased the explained variance by 8.1%. All predictors in Model 2 were significant predictors of changes in overtime, with sickness absence having the strongest association with overtime (β = .229, p < .001). The beta value for employee factors indicated that the higher levels of annual paid leave, sickness absence and other paid leaves were more likely to result in more overtime hours. Production volume (p < .001) and production unit (p < .001) remained significant predictors in Model 2.

TABLE 4: THE HIERARCHICAL REGRESSION ANALYSIS FOR THE FULL SAMPLE

Independent Variables	Dependent Variable: Overtime Hours (N = 571)					
	Model 1			Model 2		
	B	SE	β	B	SE	β
Constant	1452.109	124.231		969,271	125,048	
Work factors						
(1) Production Volume	1.991	.087	,719***	1.370	.097	,519***
(2) Production Unit	-136.522	20.970	-,215***	-84.070	20,216	-,132***
Employee factors						
(3) Annual Paid Leave				,899	,179	,157***
(4) Sickness Absence				2.481	,369	,229***
(5) Other Paid Leaves				6.917	3.496	,061*
R^2 for Model		45.6%			53.6%	
R^2 Change		45.6%			8.1%	
F		237.625***			130.660***	

Note: Production Unit was coded Preparation = 1, Processing = 2, Finishing = 3, and Distribution = 4.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5 represents the outcome of the analysis for the sub-samples, using overtime hours worked by the production units as the dependent variable. In comparison to the full sample, the analysis of preparation unit indicated different results. Overall, both models were significant and explain more than 50% of the variation in overtime however only the operational team variable was significant in both models.

The outcome of the regression for the sample of the processing unit highlighted the interactive relationships between the predictor variables. Overall, both models were significant. Only three variables (production volume, operational team and annual paid leave) were significant determinants of overtime. Contrary to the theory, the negative coefficient for the variable "annual paid leave" indicated that a decrease in annual paid leave caused an increase in overtime.

The findings of the hierarchical regression for the sample of the finishing unit were similar to that of the sample of the processing unit. Overall, the both models were highly significant as the probability values were less than .001. The R values for the models were 0.339 and 0.399, respectively. In Model 1, both variables were strongly predictors of overtime (with β .58 and .26, respectively). In Model 2, the variables "production volume" and "operational team" remained significant. The negative beta coefficient for annual paid leave demonstrated that a unit change in that variable led to a 0.14 change in overtime in the opposite direction.

TABLE 5: THE HIERARCHICAL REGRESSION ANALYSIS FOR THE SUB-SAMPLES

	Independent Variables		Preparation (n = 100)		Processing (n = 179)		Finishing (n = 179)		Distribution (n = 113)	
			Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	Constant	B	1.735,24	1.872,95	2.710,50	4052,11	-312,79	-372,63	3.4613,75	3.1909,69
Work Factors	Production Volume	B	.299	.17	1.28	1,20	3.35	3.29	1,92	1.93
		β	.06	.03	.48***	.45***	.59***	.58***	.29***	.29***
	Operational Team	B	-.713,3	-751,15	-180.87	-375,61	87.98	104.34	-3.638,04	-3378.13
		β	-.72***	-.76***	-.10	-.20*	.22**	.26***	-.78***	-.73***
Employee Factors	Annual Paid Leave	B		-.60		-.73		-.44		.56
		β		-.10		-.18**		-.14*		.10
	Sickness Absence	B		-.37		-.38		-.28		1.02
		β		-.03		-.05		-.07		.09
	Other Paid Leaves	B		-3.53		-8.36		.91		-11.16
		β		-.06		-.10		.03		-.09
	R^2 for Model		%50.2	%51.5	%30.3	%34.2	33.9%	39.9	62.1%	64.1%
	R^2 Change		%50.2	%1.3	%30.3	%3.9	33.9%	2%	62.1%	2.1%
	F		48.947***	19.983***	38.273***	18.013***	45.185***	19.417***	90.067***	38.272***
	*p < .05. **p < .01 ***p < .001.		Operational team was coded molding = 1 and casting = 2		Operational team was coded extrusion = 1, anodizing = 2 and powder coating = 3		Operational team was coded machining = 1, wood effect coating = 2 and thermal break = 3		Operational team was coded Packaging = 1 and Shipment = 2	

Finally, an analysis of the distribution unit yielded disparate results compared to the other analyses. Although overall the analysis was strongly significant and accounted for a relatively large proportion of the variance (more than 62%), only the variables "production volume" and "operational team" were significant predictors of overtime in Model 1 and 2 ($p < .001$). The negative sign associated with the variable "operational team" indicates that shipment team had lower overtime hours compared to the packaging team.

4. DISCUSSION AND CONCLUSIONS

Overtime is a strategic *planning* tool that enables a company to have additional workforce without new hires. Empirical studies examining the predictors and the effects of overtime have attracted a considerable attention recently. The present paper mainly aims to study the determinants of overtime in a sample of an aluminum manufacturing facility. It is possible to derive some general conclusions from the results.

Overall, the findings of the hierarchical regression analysis for the full sample revealed that production volume and production unit (work factors) and annual paid leave, sickness absence and other paid leaves (employee factors) were the determinants of overtime work.

This result agrees with the study of Bauer and Zimmerman (1999), in which output growth was seen as a predictor of overtime. It also is consistent with the findings of Uchida, Kaneko and Kawa (2014), which showed that taking paid leave was a determinant of overtime. Again, this result is in line with the findings of Ehrenberg (1971), which found a link between absenteeism and overtime hours. However, this finding differs from the study of Brown (1995), showing that absence was negatively associated with overtime.

On other hand, the results of the hierarchical regression analysis for the sub-samples indicated that production volume was a significant determinant of overtime for all production units except the preparation unit. In terms of employee factors, only annual paid leave was a negative significant predictor for overtime in the sub-samples of the processing and the finishing. This result is in line to the study by Fakih (2014), in which an additional week of paid vacation was related to a fall in overtime.

Moreover, the findings of the correlation analysis for the full sample pointed out that overtime was significantly and positively related to production volume, production unit, annual paid leave, sickness absence and other paid leaves. This finding is accord with the study by Preston (1995), claiming that there was a significant relation between overtime and higher levels of absence. However, the results are inconsistent with the study of Kenyon and Dawkins (1989), which reported that overtime was negatively and significantly related to absence (Colley, 2006). The finding is also in contrast to the study of Hopkins (1990), in which overtime worked was found to be not associated with absenteeism.

The correlation analysis of the sub-samples indicated that there was a positive and significant association between overtime and production volume for only the processing unit and the finishing unit. In contrast, the relationship between overtime and annual paid leave was statistically significant for all the sub-samples.

A surprising result was that overtime was shown to be significantly and negatively related to annual paid leave for the processing unit and the finishing unit (-16% and -19%, respectively), implying that in these units, higher hours of overtimes resulted in a decrease in the use of annual paid leave.

In addition, the results of the Kruskal Wallis Test illustrated statistically significant differences between the production units regarding overtime hours per worker, production volume per worker, annual paid leave hours per worker, sickness absence hours per worker and other paid leaves hours per worker.

In conclusion, this study hopes to contribute to the literature by investigating the determinants of overtime. Future studies should investigate other factors, including other withdrawal behaviors such as tardiness, turnover, longer break times and working more slowly, and job losses such as firings, temporary layoffs, and permanent displacement, which may influence the use of overtime.

REFERENCES:

Bauer, Thomas, and Zimmermann, Klaus F., "Overtime Work and Overtime Compensation in Germany", Scottish Journal of Political Economy, Volume 46, Number 4, Pages 419–436, 1999.

Beckers, Debby G.J., Linden, Dimitri van der, Smulders, Peter G.W., Kompier, Michiel A.J., Taris, Toon W. and Geurts, Sabine A.E., "Voluntary or Involuntary? Control over Overtime and Rewards for Overtime in Relation to Fatigue and Work Satisfaction", Work & Stress, Volume 22, Number 1, Pages 33–50, 2008.

Beltempo, Marc, Lacroix, Guy, Cabot, Michele, and Piedboeuf, Bruno, "Factors and Costs Associated With the Use of Registered Nurse Overtime in the Neonatal Intensive Care Unit", Pediatrics and Neonatal Nursing, Volume 4, Number 1, Pages 17–23, 2016.

Berney, Barbara and Needleman, Jack, "Trends in Nurse Overtime, 1995-2002", Policy, Politics, & Nursing Practice, Volume 6, Number 3, Pages 183–190, 2005.

Berney, Barbara, Needleman, Jack and Kovner, Christine, "Factors Influencing the Use of Registered Nurse Overtime in Hospitals, 1995-2000", Journal of Nursing Scholarship, Volume 37, Number 1, Pages 165–172, 2005.

Berney, Barbara, Use, Trends, and Impacts Of Nurse Overtime In New York Hospitals, 1995-2000, Boston University, Ph. D Thesis, Boston, 2003.

BLS, "Manufacturing Average Weekly Overtime Hours of Production and Nonsupervisory Employees: 2008-2016", U.S. Bureau of Labor Statistics, www.bls.gov, 2017.

Brown, Sarah, The Absence Decision: A Theoretical and Empirical Analysis, PH. D Thesis, Loughborough

University, Leicestershire, 1995.

Colley, Linda, "Who's There? Analysis of Absence Trends in the Public Sector", Proceedings of the 13th International Employment Relations Association Conference, 13th International Employment Relations Association Conference, Aalborg, Denmark, 26-29 June 2005.

Ehrenberg, Ronald G., "Absenteeism and the Overtime Decision", American Economic Review, Volume 60, Number 3, Pages 352–357, 1971.

Eurostat, "Hours Worked per Week of Full-Time Employment: 2008-2016", http://ec.europa.eu, 2017.

Fakih, Ali, "Vacation Leave, Work Hours, and Wages: New Evidence from Linked Employer–Employee Data", Labour, Volume 28, Number 4, Pages 376–398, 2014.

Hopkins, Thomas D., The Relationship between Absenteeism and the Amount of Overtime Worked in Various Job Classifications in a Metal Fabrication Plant, PH. D Thesis, Western Michigan University, Michigan, 1990.

Jirjahn, Uwe, "On the Determinants of Shift Work and Overtime Work: Evidence from German Establishment Data", British Journal of Industrial Relations, Volume 46, Number 1, Pages 133–168, 2008.

Kalwij, Adriaan S. and Gregory, Mary, "A Panel Data Analysis of the Effects of Wages, Standard Hours and Unionization on Paid Overtime Work in Britain", Journal of the Royal Statistical Society: Series A, Volume 168, Number 1, Pages 207–231, 2005.

Kang, Jae Hyeung and Matusik, James G. and Barclay, Lizabeth A., "Affective and Normative Motives to Work Overtime in Asian Organizations: Four Cultural Orientations from Confucian Ethics", Journal of Business Ethics, Volume 140, Number 1, Pages 115–130, 2017.

OECD, "Dataset: Average Annual Hours Actually Worked Per Worker", www.oecd.org, 2017.

Preston, Alison, "What Causes Absenteeism? Understanding the Economic and Psychological Theories and Evidence", Managing Absenteeism: Analysing and Preventing Labour Absence, Department of Industrial Relations (eds. by Riedel and Preston), Industrial Relations Research Series Number 18, Canberra, 1995.

Seo, Ji-Won, Excessive Overtime, Workers and Productivity: Evidence and Implications for Better Work, ILO Discussion Paper Series: No. 2, Geneva, 2011.

Statcan, "Labour Force Survey Estimates (LFS), Employees Working Overtime (weekly) by North American Industry Classification Table 282-0083", Statistics Canada, www.statcan.gc.ca, 2017.

TSI, "Employed Persons by Actual Hours Worked", Turkish Statistics Institute, www.tsi.gov.tr, 2017.

Uchida, Mitsuo, Kaneko, Minoru and Kawa, Shigeyuki, "Effects of Personality on Overtime Work: A Cross-Sectional Pilot Study among Japanese White-Collar Workers", BMC Research Notes, Volume 7, Number 180, Pages 1–9, 2014

Zapf, Ines, Individual and Workplace-Specific Determinants of Paid and Unpaid Overtime Work in Germany, IAB Discussion Paper (15/2015), Nuremberg, 2015.

AUTHOR PROFILE:

Dr. Tekin Akgeyik earned his Ph.D. at Istanbul University in 1997. Currently, he is a full professor of human resource management at Faculty of Economics, Istanbul University, Istanbul, Turkey (akgeyik@istanbul.edu.tr).