

Statistical relationship between workplace well-being and productivity

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Abstract—The paper focuses on the relationship between workplace well-being and productivity in the European countries. The so called Oaxaca decomposition technique has been chosen to verify the hypothesis of positive relationship and to quantify how the job-satisfaction may increase the productivity in the different European regions. The developed market economies are considered according to the four main social models (Anglo-Saxon, Nordic, Mediterranean and continental countries), while three groups of transition economies are distinguished (Baltic, Middle and South-Eastern European countries). It has been found that workplace well-being have a relevant impact on productivity in the European economies, but the strength of this impact show a positive correlation with the development level. Also a supplementary calculation is presented indicating that the impact is relevant both in the developed market economies and in the less developed transition economies.

Keywords—Workplace well-being, productivity, Oaxaca decomposition

I. INTRODUCTION

THE employment may undergo a profound transformation in the 21st century. This opinion can be considered as a consensus of the academic sphere and by engineers, economists and other experts in the world of business. The transformation of the employment has both quantitative and qualitative aspects. The digitalization of the production, which is now considered to be the fourth industrial revolution (Industry 4.0), may rearrange the employment shares of different industries by decreasing of human jobs and by job shifts, similarly to the first three revolutions (see e.g. a recent analysis for OECD countries [1]). It will also change the tasks to be solved by employees; new skills and competencies will be needed, i.e. new jobs may be created in the future, while old ones may become obsolete. This latter one is the qualitative aspect of this process. It is also an important issue how the quality of existing workplaces affect productivity and outcome. This is certainly an important issue more or less independently of the given level of technological development,

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however, this area has been examined only for a couple of decades. The results of such researches show that the quality of workplaces, the well-being of employees will be an important factor of development and they show a positive relationship between workplace well-being and performance (see e.g. [2-12] and the references therein). This relationship can be examined by different approaches. The first typical approach is that of the experimental economics, when volunteers are asked to solve different tasks in a laboratory environment. Reference [13] considers these results less reliable arguing that the tasks are sometimes too stylized and the small group of volunteers may not be representative. Another approach is the application of different statistical methods relying on actual data. The present contribution belongs to the latter type of examinations. Data of the Eurostat has been used and the Oaxaca decomposition method has been chosen to quantify the relationship between workplace well-being and productivity. Also [13] emphasizes the fact that even if a statistically significant relationship is found it does not prove causality. In spite of this fact, authors think that the results of such an examination may be interesting for managers and for decision-makers in general. The chosen method has already been applied previously by the authors on this area. Only Hungarian data were used in [5], while [6] presented the results for European countries. The present paper extends and further develops the latter research by separating the effect of development level of the different examined countries.

In Section 2, the preliminaries, i.e. the relevant literature is reviewed. The applied methodology and the dataset of the examination is presented in Section 3. The main results of the research is shown in Section 4 including the comparison of results with and without eliminating the effect of development level. Section 5 concludes the paper.

II. PRELIMINARIES AND PROBLEM FORMULATION

The development level of a country is traditionally measured by economic indicators, typically by the GDP, which does not include several aspects contributing the well-being of people on the one hand and may have a positive feedback on the GDP in the long term. Therefore several recognized international institutions have already initiated to extend or to replace the traditional indicators, see among others e.g. the Better Life Initiative of OECD [14] or the UN Sustainable Development Goals [15]. We think that an analogous phenomenon can be observed on micro level as well. The

outcome of a work-place can be characterized by the productivity measured by the gross value added per hour or per labor cost, while this outcome could be higher if the employees' well-being is better because of the positive feedback. The workplace well-being has physical, career, social, organizational and other dimensions involving different measures: we mean workplace well-being in the broadest sense. If the hypothesis is true that the well-being positively affects productivity, this should be taken into account by the public policy as well, e.g. [16] and [17]. Several connected papers are known from the literature. Reference [18] developed a measure of perceived quality of working life. This composite indicator includes six components (general well-being, home-work interface, job and career satisfaction, control at work, working conditions and stress at work measured by psychometric scales). Several papers examined the factors that may contribute job satisfaction from the end of the 80's, see e.g. [19], [20-22]. The recently published book [23] includes several papers analyzing primarily the relationship between management control and workplace well-being, which might be the most important factor. Some other papers directly deal with the relationship of human performance and well-being: e.g. [2-3], [11] and [24] have found the positive role of well-being in the employees' performance. A regression model on British panel data is estimated by [3] expressing the level of performance as a function of several explanatory variables like job satisfaction, job-related affect among employees and some other workplace and workforce characteristics. Another panel model on Finnish data was applied by [2] to quantify the impacts of job-satisfaction, of capital stock per hours worked and of some other control variables on productivity in the manufacturing industry. Reference [24] is a statistical analysis (applying ANOVA) of a website feedback survey, while [10] examined the relationship between happiness and productivity based on laboratory experiments.

The main purpose of the present paper is to find statistical relationship between workplace well-being and productivity: according to the authors' hypothesis there is a positive relationship. The second purpose is an international comparison by the strength of this relationship. The application of the Oaxaca decomposition to this problem is one of the authors' new contributions. The analysis is based on the data of the European Union Statistics on Income and Living Conditions (EU-SILC) 2013 including the special ad hoc module of well-being survey data. The authors are not aware of statistical analysis of this latter dataset.

III. METHODOLOGICAL CONSIDERATIONS

First the applied method, i.e. the Oaxaca decomposition will be outlined. Second the dataset used in this investigation will be presented. Also the principles of determining the groups of the examined countries will be discussed.

A. The Oaxaca decomposition method

The Oaxaca decomposition procedure was originally

developed to analyze the so called gender gap, i.e. to explain what share of the wage difference of women and men can be explained by the discrimination of women ([25], see also a recent application in [26]). However, this method is applicable in general if the observed units can be divided characteristically into two groups having typically different values for a certain observed variable. If other observed variables are available that can be considered to be its explanatory variables, the Oaxaca decomposition method can determine the shares of the explained and non-explained part. In case of the wage discrimination, the two groups consist of male and female employees, respectively, where male employees have typically higher wages not explained by such explanatory variables like education level, position in the hierarchy, work experience, etc. In our case, the two characteristic groups consist of employees with higher and lower level of well-being and their productivity is explained by different explanatory variables. It was expected that the share of the non-explained part, i.e. the impact of well-being on productivity can be determined for each of the chosen groups of countries and in such a way the share of the well-being impact can be compared among the groups.

Denote by subscripts A and B the groups of high and low workplace wellbeing, respectively. The basic idea of the Oaxaca decomposition is to assess the regression for both groups separately as

$$Y_A = \beta_A X_A + \varepsilon_A \quad (1)$$

and

$$Y_B = \beta_B X_B + \varepsilon_B \quad (2)$$

where productivity is the endogenous variable Y and X is the set of explanatory variables. Since it is assumed that $E(\varepsilon_A) = 0$ and $E(\varepsilon_B) = 0$, one obtains from (1) and (2) that $E(\varepsilon_B) = 0$, one obtains from (1) and (2) that

$$E(Y_A) = \beta_A * E(X_A) \quad (3)$$

and

$$E(Y_B) = \beta_B * E(X_B). \quad (4)$$

Taking into consideration (3) and (4), equation

$$E(Y_A) - E(Y_B) = \beta_A * (E(X_A) - E(X_B)) + E(X_B) * (\beta_A - \beta_B) \quad (5)$$

obviously holds true. The left hand side of (5) expresses the total difference between the group means. The first term of the right hand side is the share of this difference that is explained by the exogenous (explanatory) variables. Consequently, the second term – the rest – can be considered as the share of the non-explained part, or, in other words, it can be explained only

by the group effect. If the share of this group effect is considerable, it means that the workplace well-being has a significant impact on productivity. However, we remark that there may be other explanatory variables that should contribute to the explained part, thus they should be taken into the regressions (1) and (2). Typically, the available information determines what one can take into account (data driven analysis). We think that the method is suitable for comparisons, if the same variables are available for each observation unit.

B. The input dataset

As mentioned above, the EU-SILC 2013 data published by the Eurostat have been used for the examination. The EU-SILC is a survey of households based on representative samples in each country. It contains microdata on income, poverty, social exclusion and living conditions from the EU member countries, from some EU candidates and also from EFTA countries. Although the EU-SILC is rather only a common framework than a common survey, it produces comparable data, since the survey is based on common guidelines, procedures, concepts and classifications. In general, the households are selected based on a stratified two stage sample design in every country. About 130,000 households and 270,000 persons aged 16 and more are interviewed in the EU countries for cross-sectional data, while about 100,000 households and 200,000 persons are interviewed for longitudinal data. The latter set of data are based on sample rotation; only cross-sectional data have been used for this research. It is worth mentioning that the anonymized microdata are available for scientific purposes (under specific conditions).

The standard primary dataset of the EU-SILC is collected each year containing characteristics of the household and of every household members aged 16 and more. The personal information includes basic demographic data, information on health, education, labor and income. The secondary dataset of the EU-SILC is related with the annually changing ad-hoc modules. The special topics of subjective well-being was addressed in 2013, therefore the data of 2013 were used in the present research.

The dataset of the ad hoc module includes several aspects of well-being. The respondents had to evaluate their opinions using numeric rating scales concerning their general feeling, relationships with others and trust in certain state institutions. Only 2 of the 22 questions related to work, namely the job satisfaction and the satisfaction with commuting time. The job satisfaction has been chosen as a proxy of workplace well-being (see e.g. [7] about the positive impact of employee satisfaction on meaningful business outcomes). The scale of this variable was 0-10. In order to use the Oaxaca decomposition, we divided the respondents into two groups in such a way that group A consisted of the very satisfied employees who had evaluated their feeling with 8 or higher. It is assumed in this way that they are the employees who enjoy workplace well-being. The endogenous variable, i.e. of the labor productivity is measured by the wage per hour worked;

this information was taken from the primary dataset. The explanatory variables are either categorical or ordinal as follows:

- *Age*: respondents aged 15 and more are divided into 7 groups (15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-)
- *Marital status*: 5 groups (Never married, Married, Separated, Widowed, Divorced)
- *Educational level*: 6 groups (Pre-primary, Primary, Lower secondary, Secondary, Post-secondary, Tertiary)
- *Employment status*: 4 groups (Self-employed with employees, Self-employed without employees, Employee, Family worker)
- *Managerial position*: 2 groups (Supervisory, Non-supervisory)
- *Occupation categories*: 10 groups (Armed forces, Managers, Professionals, Technicians and associate professionals, Clerical support workers, Services and Sales Workers, Skilled agricultural, forestry and fishery workers, Craft and related trades workers, Plant and machine operators and assemblers, Elementary occupations)
- *Gender of the respondent*
- *General health status*: 5 groups (Very good, Good, Fair, Bad, Very bad)
- *Overall life satisfaction* (0-10)
- *Satisfaction with personal relationships* (0-10)
- *Feeling downhearted or depressed* (1-5)
- *Number of persons working at the local unit*
- *Satisfaction with commuting time* (0-10)
- *Branch of the economy in which the respondent is employed* (according to ISIC/NACE sections with aggregate groups B-E and R-U)

Recently, [5] has presented the results of a study for Hungary, applying the same method but only for Hungarian data. This result showed that the job satisfaction itself explains about one third of higher productivity. The present paper aims to extend this investigation to most of the European countries in such a way that the decomposition method is applied to certain characteristic groups of European countries. The European developed market economies have been divided into four groups, namely the Anglo-Saxon, Nordic, Mediterranean and continental countries. This corresponds with the categorization of [27] and of many other papers dealing with comparative economics. These groups includes countries with similar social models, while there are apparent differences among them. Although the Nordic countries typically provide high level social transfers including high unemployment benefits, there are relatively less stringent rules of job protection. The continental countries and oddly the Mediterranean ones have stricter rules concerning the removal of employees: although in the Mediterranean countries the level of transfers is definitely lower. The trade unions are relatively weak in the Anglo-Saxon countries and consequently the protection of jobs is weaker, while the transfers are provided on a selective basis with guaranteed minimums. One of the aims of the present research is whether or not these different characteristics affect the calculated weight of well-being in the economic outcome and productivity. It is still an

open theoretical question to which models the different European transitional economies belong. The social and economic characteristics of these countries seem to be eclectic. For example, Hungary is close to the continental model regarding the relatively high share of income redistribution, the job protection is low similarly to the Nordic model but does not have an extensive and high level social security system. These transitional economies therefore are grouped rather according to geographical regions. Correspondingly, altogether seven groups of European countries are considered as follows. The groups of non-transitional economies are

- *Nordic* (Denmark, Finland, Iceland, Norway, Sweden)
- *Anglo-Saxon* (Ireland, United Kingdom)
- *Continental* (Austria, Belgium, France, Germany, Luxembourg, The Netherlands)
- *Mediterranean* (Cyprus, Greece, Italy, Malta, Portugal, Spain)

The transitional economies are grouped as

- *Baltic* (Estonia, Latvia, Lithuania)
- *Middle European* (Czech Republic, Hungary, Poland, Slovakia, Slovenia)
- *South-Eastern European* (Bulgaria, Croatia, Romania, Serbia)

Although Slovenia as a part of the earlier Yugoslavia should rather be included in the of South-Eastern European group, it is among the Middle European countries because of its relative high level of development.

As mentioned above the primary purpose of the present study is to verify the hypothesis that there is a positive relationship between the level of workplace well-being and labor productivity. If such a statistical relationship is found, the model can quantify the share of productivity gap, which a reasonable set of exogenous variables can explain and the share, which is explained by the workplace well-being only. The different groups of countries defined above will be compared from this point of view. Since the different groups have different institutional characteristics, the model results can show whether or not the different institutional environments matter from the viewpoint of the relationship between workplace well-being on productivity.

IV. MAIN RESULTS

Firstly, the statistical relationship between job satisfaction and productivity was statistically tested for data of all countries. Secondly, the categorical explanatory variables listed in Subsection 3.2 were considered, for which some descriptive statistics were calculated including the determination of their explanatory power. Thirdly, the Oaxaca-decomposition was implemented by the defined groups of European countries. Fourthly, it was examined if rather the development level of the country groups itself is reflected in the results of the Oaxaca decomposition, or the job satisfaction matters in deed in the difference of productivity.

A. Descriptive statistical analysis

The standard Wilks' Lambda/Pillai Trace and the Lawley-Hotelling Trace tests were applied in the preliminary statistical

analysis. All these tests affirmed the positive relationship between job satisfaction and productivity for the whole dataset, which justified the applicability of the Oaxaca-decomposition.

The next step was the testing of all possible explanatory variables. The relationships between each explanatory variable and the productivity were tested first using the above mentioned statistics and the distribution of the corresponding variable according to job satisfaction was examined by contingency tables. In all the contingency tables the job satisfaction is grouped as follows: 'Not satisfied' if evaluation is in the range 0-4, 'Moderately satisfied' in 5-7 and 'Very satisfied' in 8-10.

The explanatory power of age to productivity (based on Wilks' Lambda) is around 2%; there is a clear relationship between age and productivity, since the latter is measured by wage per hour, which typically increases during the career. Table 1 shows the distribution of job satisfaction by the chosen age categories. The shares of these groups are 10.2%, 39.4% and 50.4%, respectively. The most apparent changes of this distribution can be seen among elderly employees: people tend to be unsatisfied with their jobs if they still work after the usual retirement age.

Age	Not satisfied	Moderately satisfied	Very satisfied
15-24	11.3	36.6	52.1
25-34	9.7	40.2	50.1
35-44	9.7	40.4	49.9
45-54	10.3	39.6	50.0
55-64	10.7	38.1	51.1
65-74	10.5	30.2	59.3
75-	28.6	21.6	49.8

Table 1. The distribution of job satisfaction by age group in % mapping nonlinear data to a higher dimensional feature space. Source: own calculations based on Eurostat EU-SILC database

The *marital status* does not seem to have a strong impact on productivity, only widowed employees have significantly less average value; the explanatory power of this variable is around 0.5%. Correspondingly, the widowed have the highest share among those, who are not satisfied with their jobs, and have the lowest share in the category of 'Very satisfied' as Table 2 shows.

Marital status	Not satisfied	Moderately satisfied	Very satisfied
Never married	10.7	40.9	48.5
Married	9.4	39.0	51.6
Separated	13.9	40.7	45.4
Widowed	14.6	38.1	47.3
Divorced	12.0	36.3	51.7

Table 2. The distribution of job satisfaction by marital status in %. Source: own calculations based on Eurostat EU-SILC database

The *education level* has a strong impact on productivity, especially employees with tertiary education are significantly more productive than others, which is an obvious consequence that these employees have the highest average salaries in every country. The explanatory power of the variable is more than 5%. As Table 3 shows, employees with higher education level tend to be more satisfied with their jobs. On the other hand, the share of non-satisfied employees with the lowest education is relatively high, which is also an intuitive result.

Education level	Not satisfied	Moderately satisfied	Very satisfied
Pre-primary	24.8	46.4	28.8
Primary	14.8	44.6	40.6
Lower secondary	13.1	42.4	44.5
Secondary	10.8	39.9	49.3
Post-secondary	10.3	38.0	51.7
Tertiary	7.8	37.6	54.6

Table 3. The distribution of job satisfaction by education level in %. Source: own calculations based on Eurostat EU-SILC database

Regarding the *employment status*, employees are the most productive (their share is 96% among respondents, who have jobs). Table 4 shows that prefer to be self-employed, especially having also employees. This fact was supported also by the analysis for Hungarian data in [5].

Job status	Not satisfied	Moderately satisfied	Very satisfied
Self-empl. with employees	7.9	33.3	58.8
Self-empl. w/o employees	13.3	40.4	46.3
Employee	9.8	39.4	50.8
Family worker	19.8	44.5	35.7

Table 4. The distribution of job satisfaction by employment status in %. Source: own calculations based on Eurostat EU-SILC database

Two outcomes of *managerial position* are considered here. Tests show that it is an important factor, having about 4.5% explanatory power. The main cause is the significantly higher average wages of employees in supervisory positions (see Table 5).

Managerial position	Not satisfied	Moderately satisfied	Very satisfied
Supervisory	6.9	36.5	56.6
Non-supervisory	10.5	40.6	48.8

Table 5. The distribution of job satisfaction by managerial position in %. Source: own calculations based on Eurostat EU-SILC database

The *occupation category* was tested with outcomes listed in subsection 3.2. This variables had the strongest explanatory power of 8.5%. Since the productivity was measured by hourly wages, it is not surprising that managers have by far the highest average value. Professionals have the second highest value, while the non-profit sphere (clerical support, armed

forces) is around the overall average. Table 6 presents the corresponding distribution, which reflects basically the wage differences. It is somehow surprising that there are significant differences within the government sector, where the share of the non-satisfied is twice higher in clerical support activities than in the armed forces in spite of the similar average wages. Conspicuously, the general level of satisfaction is relatively low in agricultural and related activities, although this category includes skilled workers, and agriculture is one of the main focus of EU-supports.

Occupation category	Not satisfied	Moderately satisfied	Very satisfied
Armed forces	4.5	33.2	62.4
Managers	7.2	33.6	59.2
Professionals	6.3	35.0	58.7
Technicians and assoc.	9.0	37.5	53.5
Clerical support	10.1	42.2	47.8
Services and sales	11.4	41.0	47.7
Agric., forestry, fishery	16.6	45.2	38.2
Craft and rel. trades	11.7	41.7	46.7
Operators, assemblers	12.1	43.7	44.3
Elementary occup.	16.5	44.0	39.6

Table 6. The distribution of job satisfaction by occupation category in %. Source: own calculations based on Eurostat EU-SILC database

Our statistical test based on EU-SILC data shows that the *gender* variable has only a weak impact on productivity: this is somehow surprising since the productivity is measured here by wage per hour worked. The distribution shows a similar pattern for both sexes (see Table 7).

Gender	Not satisfied	Moderately satisfied	Very satisfied
Male	10.0	39.9	50.1
Female	10.3	38.9	50.8

Table 7. The distribution of job satisfaction by gender in %. Source: own calculations based on Eurostat EU-SILC database

The explanatory power of the *general health status* is also weak, it is lower than 1%. The distribution shown by Table 8 corresponds to the intuition: a better general health status implies a higher degree of job satisfaction.

General health status	Not satisfied	Moderately satisfied	Very satisfied
Very good	7.1	32.9	60.0
Good	8.9	41.2	49.9
Fair	16.3	44.1	39.6
Bad	28.2	40.2	31.6
Very bad	37.4	32.5	30.1

Table 8. The distribution of job satisfaction by general health status

in %. Source: own calculations based on Eurostat EU-SILC database

The next five variables, i.e. the *overall life satisfaction*, *satisfaction with personal relationships*, *feeling downhearted or depressed*, *number of persons working at the local unit*, *satisfaction with commuting time*, are not categorical characterized by contingency tables. Table 9 shows only the corresponding explanatory powers based on Wilk's Lambda. The outstanding value of number of persons in the local unit may imply that larger units/firms tend to be more effective. Also, the overall life satisfaction has a relatively strong explanatory power, it is significantly higher than that of satisfaction with personal relationships. This might indicate some inconsequence in the responses.

Variable	Explanatory power in %
Overall life satisfaction	2.1
Satisfaction with personal relationships	0.4
Feeling downhearted or depressed	0.4
Number of persons working at the local unit	3.8
Satisfaction with commuting time	0.3

Table 9. Explanatory powers of the non-categorical variables. Source: own calculations based on Eurostat EU-SILC database

The last variable is categorical again: the *branch of the economy in which the respondent is employed* has a strong impact on productivity with more than 3.5% explanatory power, since the productivity of different branches are obviously very different. Table 10 shows the distribution of job satisfaction by the respondent's branch.

Branch of the economy in which the respondent is employed	Not satisfied	Moderately satisfied	Very satisfied
Agriculture	17.1	44.6	38.3
Industry	10.7	41.5	47.8
Construction	11.7	41.1	47.2
Trade	11.0	42.4	46.6
Transportation	10.6	41.7	47.7
Accom. and Food Serv.	15.7	42.2	42.1
Info. and Comm.	8.5	39.4	52.1
Finance and Insurance	9.5	41.1	49.4
Non-material Services	10.5	39.4	50.1
Public Administration	7.6	36.6	55.8
Education	6.4	32.9	60.7
Health	8.4	35.1	56.5
Other Services	10.2	39.4	50.4

Table 10. The distribution of job satisfaction by the respondent's branch in %. Source: own calculations based on Eurostat EU-SILC database

The most satisfied employments work either in the government sector or in well paid industries like informatics or finance. It can be assumed that working in the government

sectors can be relatively attractive because of higher job security.

B. The results of the decomposition

Table 11 summarizes the results of the Oaxaca decomposition. The calculations were carried out for all countries and for the seven groups of countries as defined in Section 2. The results have several lessons.

Firstly, it is obvious that the job satisfaction, which was used in our examination as a proxy of workplace well-being, has a strong impact on productivity. According to the decomposition, this impact almost as high on average, than that of other characteristics. We remark that data of only European countries were used, but we assume that similar results could be experienced in other continents as well: this can be the focus of further studies. (The EU-SILC contains comparable data only for European countries.)

Secondly, it is a very interesting result that the share of the impact of job satisfaction is in a strong positive correlation with the economic development (the authors did not have any preliminary hypothesis about it). It is worth mentioning that the earlier cited examination for Hungary (see [5]), which belongs to the Middle European group, fits to this tendency with its 36.2% share. It suggests that this type of examination should be extended by country as well.

Thirdly, both the Anglo-Saxon and Nordic group are equally very high although these groups differ from many social and economic aspects. However, the labor market functions on strong market bases in both groups, which may explain the similar importance and impact of workplace well-being.

Fourthly, it is somehow surprising that the role of workplace well-being is rather low in the so-called transition economies, especially in the less developed ones. It might suggest that it is not so important to deal with this aspect to increase productivity. We however assume that measures to enhance workplace well-being is a good tool to raise productivity even in less developed countries, which is crucial for the catching-up process. The variability of results by country can be explained by the fact that the impact of job satisfaction is higher in developed country just because of the higher quality of life. Thus, a complementary analysis has been made intending to eliminate the effect of development level.

Region	Impact of job satisfaction	Impact of other characteristics
Anglo-Saxon	89.2%	10.8%
Nordic	82.0%	18.0%
Continental	62.9%	37.1%
Mediterranean	41.5%	58.5%
Middle European	40.4%	59.6%
Baltic	35.8%	64.2%
South-Eastern European	22.2%	77.8%
All countries	48.8%	51.2%

Table 11. The decomposition of difference in productivity by satisfaction and other characteristics of employees. Source: own

calculations based on Eurostat EU-SILC database

C. Eliminating the impact of development level

The basic idea of this complementary analysis was to specify a new explanatory variable in the regression equations that measures the overall economic development or at least that is country-group specific. However, this type of examination is reasonable only if the Oaxaca decomposition is calculated for all the countries and not for groups separately. In the first test, we simply added one new variable to the original dataset, namely the GDP/capita based on purchasing power parity. In the second one, a 0-1 dummy variable was assigned to each country. We remark that both solutions could not be applied at the same time because of collinearity.

First a regression was estimated for all the considered countries without considering the differences among the explanatory variables. Then, the above mentioned two regressions were estimated considering already the differences of countries as well. We estimated two different regression equations for each case: the first one estimates the parameters among persons, whose job satisfaction is low, and the second equation is for people with high job satisfaction. Table 12 shows the goodness of fit for three cases: the first one is the estimation for all the 32 countries without considering the differences in the development level in the model. The second one is a similar equation, in which only the GDP per capita was added to the set of the explaining variables. In the third case, the development differences was modelled by country specific dummy variables. One can see that the additional variables are very useful; they increase significantly the explanatory power of the regressions. The best fitting equations produce 37 and 34 percent R^2 , which matters pretty well, if one considers that micro-data were used. The difference in goodness of fit between the equations for less and more satisfied persons is around 3 percentage point. The discrepancy is not large, but the common sign of the differences shows that productivity could be less explained by the regression among people who are satisfied with their jobs. Probably this is caused by the larger variance of the independent variable in this group.

R² of the regressions	Job satisf. = 0	Job satisf. = 1
All countries	0.1827	0.1518
All countries using GDP per capita as control variable	0.3707	0.3419
All countries using region dummies as control variables	0.3411	0.3106

Table 12. Goodness of fit in the regressions used for the Oaxaca

decomposition. Source: own calculations based on Eurostat EU-SILC database

It is interesting itself to analyze the estimated coefficients in the different model estimations (see Appendix). Both treatment of country differences led to more or less similar results. Higher education level leads to higher productivity for both satisfied and non-satisfied employees, but the productivity gain is higher in case of the satisfied group. The age effect is positive for both groups, but the average increase in productivity by aging is higher for satisfied employees. Regarding the gender - wage rate nexus the models verified a significant difference in case of satisfied and non-satisfied group as well, but the gender wage difference seems to be higher when they are very satisfied with their job. Regarding the impact of subjective health status on productivity estimations showed that, if an employee does not feel himself/herself perfectly healthy, it tends to deteriorate the his/her job performance significantly and this impact is definitely higher in case of the satisfied group. Subjective rating for quality of personal issues (overall life satisfaction, personal relationships and feelings) are higher for those who are very satisfied. The impact of these issues on the performance is not so straightforward, in case of great satisfaction with personal relationships it can even led to a decrease in performance at the workplace. The employment status can also affect the performance: it seems that employed people are rather forced to be effective compared to the self-employed ones. The increasing size of the firm is estimated to have a positive impact on productivity; the impact is stronger in case of the satisfied employees. Regarding the impact by occupational categories: managers and professionals are proved to be the most productive employees, machine operators, agricultural and trade workers are in the most unfavorable situation for both groups. Regarding the effect of industry-type on productivity it is also worth mentioning that 23% of satisfied people are employed in public oriented branches (public administration, education, health), while this ratio is only about 17% for the unsatisfied group. People working in the finance, insurance, information and communication industries have the highest productivity gain compared to those working in the agriculture (which was the reference category in the regression equation). This difference is even higher for the satisfied employees. The impact of the development on productivity is definitely positive independently from the applied modelling methodology (dummy variables for country groups or GDP/capita as an additional explanatory variable). The impact of development tends to be stronger in the group of satisfied employees.

It was expected that, if the differences of countries were taken into account, the average impact of job satisfaction on productivity should be lower on average than the average of the original calculations (see the bottom line of Table 11), since a certain share of the non-explained part in the original model run will be explained by the additional variable or by the new dummy variables. Since the economic development

level can be assumed to be in strong positive relationship with wages, which is the proxy of productivity in our model, it can be expected the explained part will be relevantly higher. A smaller increase of the explained part can be expected in the second approach, since the dummy variables can only distinguish the different the country groups without comprising specific information that are in close relationship with the endogenous variable.

The first approach, i.e. the inclusion of the GDP/capita as a new explanatory variable, actually eliminates the differences in development level among country groups. The second approach eliminates differences, too, but these differences can be due to other factors as well. (We remark that one country was omitted by the regression estimating program in this second approach, because of collinearity, but it does not relevantly affect our estimations.) Table 13 summarizes the results of the complementary analysis. As it was expected, the inclusion of country-group specific dummy variables resulted in a significant decrease in the impact of job satisfaction, but this decrease was far more apparent in case of considering the GDP/capita in model as a new explanatory variable. However, the results show that workplace well-being does matter in the productivity, its relevance is around 10%.

All countries	Impact of job satisfaction	Impact of other characteristics
Without eliminating the development level	48.8%	51.2%
Elimination with country-group specific dummy variables	28.3%	71.7%
Elimination with GDP/capita on PPP as an additional variable	9.2%	90.8%

Table 13. Impact of job satisfaction on productivity with and without eliminating the differences among countries. Source: own calculations based on Eurostat EU-SILC database

V. CONCLUSION

The main focus of the present paper was to find statistical evidence to show that workplace well-being has a positive impact on productivity. This impact was quantified by the so called Oaxaca decomposition what share of productivity difference the workplace well-being itself may explain. Only European economies were examined for which comparable data were available from the Eurostat webpage: the calculations were based on EU-SILC data of 2013, when an ad hoc module was attached to the standard survey data on well-being. The results showed that impact of workplace well-being on productivity is really an important factor of productivity.

The calculations were carried out for relatively homogenous groups of countries. Results showed a close positive correlation between the impact of job satisfaction on productivity and of economic development. When the differences of the development level of countries had been eliminated in the calculations, the average impact relevantly decreased as expected. However, the role of job satisfaction is still around 10%, which shows that the enhancement of workplace well-being can be one of the tools to develop market economies among others also the less developed transition economies of Europe to raise the productivity therefore to support the catch-up process.

APPENDIX

Table 14 contains the regression coefficients without taking into account the differences in development level, with inclusion of GDP/per capita as the additional variable and with country-group specific dummy variables. All coefficients proved to be significant.

Explanatory variable	Without taking into differences		With GDP as an additional variable		With country-specific dummy variables	
	jobsat=1	jobsat=0	jobsat=1	jobsat=0	jobsat=1	jobsat=0
<i>Education level, ref. categ.: Pre primary</i>						
Primary	-1.767	-2.138	0.574	3.217	-0.490	0.394
Lower secondary	-0.421	-0.111	0.863	2.627	1.080	1.643
Secondary	-0.613	0.086	1.134	3.872	2.109	3.739
Post-secondary	1.231	0.858	1.760	4.440	2.838	4.495
Tertiary	2.590	3.382	4.061	7.393	4.507	6.677
Age	0.144	0.223	0.144	0.199	0.145	0.202
<i>Gender, ref. categ.: Male</i>						
Female	-2.777	-3.314	-2.116	-2.632	-2.003	-2.556
<i>General health, ref. categ.: Very good</i>						
Good	-0.819	-1.775	-0.566	-1.005	-0.599	-1.141
Fair	-1.453	-3.248	-1.477	-2.115	-1.378	-2.201
Bad	-1.051	-2.860	-1.111	-1.501	-0.975	-1.543
Very bad	-1.778	-2.550	-1.005	-1.706	-1.085	-1.507
Overall life satisfaction	0.074	-0.015	0.037	0.001	0.053	0.015
Satisfaction with personal relationships	-0.015	-0.054	-0.015	-0.035	-0.004	-0.018
Feeling downhearted or depressed	-0.224	0.104	0.215	0.369	0.174	0.419
<i>Status in empl., ref. categ.: Self employed w. employees</i>						
Self-employed w/o employees	3.723	1.578	2.507	0.461	2.823	1.070
Employee	6.586	5.182	4.922	4.497	5.704	5.265
Family worker	4.204	6.267	2.238	2.360	2.716	2.391
<i>Number of persons working at the local unit</i>						
	0.225	0.263	0.165	0.255	0.224	0.292
<i>Occupation categ., ref. categ.: Armed force</i>						
Managers	6.869	9.887	3.308	5.498	5.522	7.383
Professionals	3.982	5.143	1.428	2.011	3.422	3.561
Technicians and Associate Professionals	1.547	3.408	-1.571	-0.738	0.261	0.659
Clerical Support Workers	-0.185	1.874	-2.813	-1.959	-1.435	-1.038
Services and Sales Workers	-1.499	1.199	-3.103	-2.111	-1.612	-0.924
Agricultural, Forestry and Fishery Workers	-1.739	1.026	-3.498	-3.753	-1.611	-2.101
Craft and Related Trades Workers	-2.928	-1.195	-3.475	-3.266	-1.792	-1.875
Plant and Machine Operators and Assemblers	-3.616	-1.945	-4.312	-3.732	-2.734	-2.557
Elementary Occupations	-2.569	0.156	-3.355	-2.287	-1.966	-1.572
<i>Branch of the respondent, ref. categ.: Agriculture</i>						
Industry	4.009	4.468	2.689	2.794	2.909	2.748
Construction	2.548	4.093	1.510	1.956	1.815	2.009
Trade	2.672	3.025	1.566	1.248	1.648	1.240
Transportation	3.251	4.389	1.774	2.517	1.946	2.464
Accommodation and Food Services	2.033	1.381	0.534	-0.666	0.422	-1.038
Information and Communication	5.674	6.233	3.242	3.222	3.342	3.108
Finance and Insurance	8.332	8.966	6.102	6.248	6.496	6.195
Non-material Services	3.552	5.839	1.487	2.765	1.609	2.804
Public Administration	3.689	3.056	1.986	1.038	1.993	0.599
Education	1.944	2.153	0.298	-0.155	0.194	-0.559
Health	3.887	4.295	1.119	0.544	1.144	0.240
Other Services	3.384	3.548	1.174	0.656	1.176	0.318
<i>Satisfaction with commuting time</i>						
	-0.006	-0.072	-0.011	-0.045	-0.003	-0.025
<i>GDP/capita PPP</i>						
			0.001	0.001		
Dummy-Nordic					5.492	4.662
Dummy-South East Europe					-3.491	-3.491
Dummy-Baltic					-12.394	-14.656
Dummy-Middle European					-11.686	-13.493
Dummy-Mediterranean					-13.531	-16.356

Table 14. Estimated coefficients in the 3x2 regressions for all countries

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