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Tax sharing under the Common Consolidated Corporate Tax Base: Measurement of the profit generating factors in the agriculture sector

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Abstract: The allocation formula for the distribution of the Common Consolidated Corporate Tax Base (CCCTB) should be based on three macroeconomics factors which are considered to have the largest impact on profitability. The paper researches the ability of the allocation formula factors to explain variability in profit/loss generation of single enterprises from the perspective of the Czech Republic with the special focus on the explanation power of the allocation formula on profit/loss generation of companies operating in the agriculture sector (NACE A). The analysis is based on the comparison of the coefficients of determination as an indicator of the explained variability of the proposed simple as well as the multiple regression models. The paper concludes that proportion of explained profitability by the formula factors as are defined by the Draft Directive on a Common Consolidated Corporate Tax Base can differ by more than 30% with regard to the sector of economic activity classified by the NACE, whereas in the individual subsectors of the agriculture the difference may amount to 40%.

Keywords: agriculture, CCCTB, Corporate Income Tax, formula apportionment, NACE Classification

The Common Consolidated Corporate Tax Base (CCCTB) as a tool for the harmonization of direct taxation, namely for the harmonization of the corporate income tax, draws its origin from 2001, when the European Council, the European Parliament and the Economic and Social Commission initiated the debate on the Single Internal Market without tax obstacles and when the strategy for providing companies with a Consolidated Corporate Tax Base for the EU-wide activities was issued (Trandafir 2011).

The Working Group (WG) for the CCCTB of the European Commission, settled in 2004, suggested more than sixty proposals for the definition of the consolidated tax base and its mechanism till the final publishing of the CCCTB Draft Directive on 16 March 2011.

Therefore, for the first time in the history, the businesses in the Central and Eastern European Countries should have the opportunity to increase their competitiveness on the global market through the possibility of applying the unified rules for the tax base construction. Moreover, through the CCCTB system, the businesses fulfilling the required conditions might have access to the group taxation schemes, which are not provided by their national taxation systems. The CCCTB system will introduce autonomous rules for computing the tax base of companies, but it shall not influence the national rules on financial accounting of the EU Member States. The European Commission also emphasized that the harmonization of the corporate tax system based on the CCCTB will not introduce the harmonization of tax rates

According to the CCCTB Draft Directive, the system will be addressed to a group of companies operating on the territory of the EU with a high degree of economic dependence which also fulfil the criterion of ownership with a threshold set at > 75% capital, control, where > 50% of the voting rights are required and the > 75% rights giving the entitlement to profit. Initially, the European Commission suggested the

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voluntary scheme for the CCCTB where every group of companies should be able to decide about its participation in the system. This was rejected by the voting of the European Parliament on 19. 4. 2012, based on which the CCCTB should became mandatory after a transition period. The CCCTB would be firstly applicable for a cross-border operating group of companies and after the first five years, it would be employed by all companies with the exception of small and medium size enterprises (these could opt in if they wish) (Loyens & Loeff 2012). The part of the CCCTB system also represents the mechanism for the sharing of the group tax base. After several discussions, the European Commission decided for the allocation formula with three equally weighted factors.

The main aim of this paper is to evaluate whether the proposed allocation formula factors can be considered as the main indicators of profitability and whether their inclusion in the allocation formula is justifiable.

The paper researches the ability of the allocation formula factors to explain variability in the profit/loss generation of enterprises from the perspective of the Central and Eastern European countries (i.e. the countries which underwent the economic transition). The empirical analysis is based on the company data from the Czech Republic with a special focus on the explanation power of the allocation formula on profit/loss generation of the companies operating in the agriculture sector, where the results are compared with different sectors of economic activity classified by the NACE classification of the European industrial activity[1]. This approach follows the methodology of Hines (2008), which states that for the estimation of the extent in which formula apportionment factors are able to explain the profitability of a company, it is better to consider the data of companies located in a single country and thus to achieve a better comparability and quality of the obtained results.

The paper is aimed at the agricultural sector since the agriculture area represents more than half of the territory of the Czech Republic, while its contribution to the Gross Domestic Product (GDP) amounts approximately to 2%. The specific problems of agricultural enterprises has also been researched by Nerudová and David (2008) or David and Nerudová (2008).

The fact that the income from agriculture is inter alia influenced by the extent of the land area owned by the respective enterprise may have a considerable effect on the distribution of the CCCTB under the tax sharing mechanisms, where the volume of the tangible fixed assets constitutes one of three distributive factors. Moreover, the immobility of the tangible fixed assets factor, mainly represented by the land in the agricultural sector, may play a significant role against the possible profit shifting the avoidance of which is considered as one of the main objectives of the implementation of the CCCTB system in the European Union.

Further, the paper addresses the assessment of the proposed special definition of the formula factors and their allocation for certain type of economic sectors as proposed by the Arts. 98–101 of the CCCTB Draft Directive.

THEORETICAL OVERVIEW

The theoretical literature on the CCCTB system can be categorized to the papers trying to quantify the impact of the introduction of the CCCTB system on the volume of the tax revenues of EU Member States (Fuest et al. 2007; Devereux and Loretz 2007, 2008; Bettendorf et al. 2009, Cline et al. 2010; Van der Horst 2007). The analysis of the impact of the CCCTB system implementation in the conditions of the Czech Republic has been researched by Nerudová et al. (2015).

As another group, there can be considered papers evaluating the main pros and cons of the provisions in the proposed CCCTB system (McLure 2007; Oestreicher and Spengel 2007; Mintz 2007; Barry 2008 or Gördör 2011). Finally, there are also papers considering the comparison with papers focusing on the evaluation of the corporate tax system of the United States, where the formula apportionment for the distribution of the federal corporate income tax among the individual states was introduced already in 1930 (Shackelford and Slemrod 1998; Mintz and Smart 2004; Wiener 2005 or Devine et al. 2007).

At present, some researchers are focusing on the evaluation of the allocation formula for the distribution of the common consolidate corporate tax base as is designed by Art 86 of the CCCTB Draft Directive (Runkel and Schejelderup 2007; Hines 2008; McLure 2008; Roggeman et al. 2011; Cobham and Loretz 2014).

[1]Statistical Classification of Economic Activities in the European Community, Rev. 2 (2008). Available at http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2

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The proposed formula apportionment on the CCCTB (stated by Art 86 of the CCCTB Draft Directive) is based on three macroeconomic factors: labour, sales and tangible fixed assets. The sales factor reflects the demand side, while the labour and the property factor reflect the supply side (Petutschnig 2010). According to Fuest (2008), the basic idea underlying the sharing mechanism for the tax base is that companies should pay taxes in the proportion to their economic presence in a country, which is measured by the presence of employees, assets and sales.

Fuest (2008) also argued, that the differences in tax rates will give rise to other distortion caused by the formula factors. For example, in the situation where every EU Member State can apply for its own tax rate, the incorporation of payroll costs in the allocation formula will affect employment between the EU Member States. This was proved by Martini et al. (2014), who consider a principal agent model of the LEN-type[2] with agents in two different jurisdiction and the allocation formula with the payroll as the only formula factor. They concluded that the employment is shifted to the low tax jurisdiction and the extension of the shifting activities intensifies with the rising tax rate differential. Further, the negative impact of differences in the tax rates was analysed by Büttner et al. (2011); they showed that the scope of the tax rates differences has an impact on the tax base consolidation of a group of companies. Their results suggest that an increase in the variation of tax rates within a group of companies for the purpose of the calculation of the CCCTB by one standard deviation lowers the rate of growth of the number of the consolidated affiliates almost by 20%.

Eichfelder et al. (2014) analysed how the German multi-jurisdictional entities react to the local tax rates changes in a payroll apportionment formula. The German payroll apportionment formula is used for the distribution of the business tax base of multi-jurisdictional entities, where the tax base is apportioned to the municipalities according to the establishment's payroll share with the maximum limit up to 50 000 EUR. They proved that the companies shift away the payroll from the local establishment to the opposite establishment if local tax rate rises. An increase in local tax rate has a negative impact on the payroll share of the local establishment as well as on its sales and investment share.

The sales factor in the allocation formula for the CCCTB comprises the value added tax-free revenues from sales of goods and services after the sales discounts and warranty claims. The sales will be attributed to the EU Member State based on the destination principle, i.e. to that state where the dispatch or transport of the goods ends or where the services are carried out. The destination principle is argued to be more preferable because it is less mobile than the location of assets and employees.

The composition of the payroll factor is made as a combination of the total amount of the labour compensation, which includes the cost of salaries, wages, bonuses and all other employee compensation; and the number of employees, whose definition shall be determined by the national law of the EU Member State where the employment is exercised. The assets factor will include only the tangible fixed assets, i.e. the property, permanent plants and equipment, at their tax written down value, and it will be attributed to the entity which uses the assets. Leased assets will be also included in the assets factor either of the lessor or the lessee, whereas all intangible and financial assets will be excluded.

The composition of the allocation formula from three factors (payrolls, assets and sales) is viewed as a reasonable approximation of the share of the company output in the state total (sales factor) and the production activity in the state total (assets and payroll factors) whereas the profit is a function of both supply and demand.

Since the CCCTB Draft Directive does not provide one harmonized definition of "employee", the EU Member States can choose between the narrow definition of "employee", i.e. a full-time permanent worker in one Member State, or to choose rather its boarder definition which includes the part-time contracts, the leased workforce of certain self-employed contractors in the other Member States. Eberhartinger and Petutschnig (2014) applied the game theory approach to analyse which kind of the definition of "employee" will be more beneficial for the respective Member State. Their paper shows that in the situation of the existing tax rate differences, the only rational strategy of the respective Member State is to define "employee" broadly, which allows to maximize the volume of the allocated share of the taxable income.

[2]An acronym for the linear agent's compensation function and the linear function, the exponential agent's utility function and the normally distributed noise terms.

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Roggeman et al. (2012) empirically investigated the design of the EU apportionment formula factors as the a main profit generating factors based on firm-level data from the Amadeus database for the European manufacturing and service sector in the year 2008[3]. Their results indicate that the best performing formula is the three factor formula including sales, tangible assets and labour costs, which are able to significantly explain 28% of the variation in profit between the companies. Moreover, they conclude that the demand factor – sales - is the dominant factor in explaining the profit and costs of employees are the most accurate labour factor. Their results are in line with the study of Henszey and Koot (1983) who investigate the historical Pennsylvanian equally-weighted three factor formula. They conclude that the formula actually reflects how the business income of multinationals groups is generated. These results are contrary to the more recent study of Hrena and Silhan (1986), which show that the payroll factor distorts the allocation of income and that the property and sales formula should be preferred. Hines (2008) suggested that an equally weighted three factor formula (sales, assets and labour) may be a reasonable predictor of market capitalization. He also concluded that the labour cost factors does a very poor job in predicting of income, which may not be surprising given to the fact that labour expenses are deductible in calculating of the taxable income.

DATA AND METHODOLOGY

As was already mentioned above, the paper follows the methodological approach of Hines (2008), who concludes that for the estimation of the extent on which the formula apportionment factors are able to explain the profitability of a company, it is better to consider the data of companies located in a single country and thus to achieve better comparability and quality of the obtained results.

The research is mainly focused on the evaluation of the explanatory power of the allocation formula factors with regard to the sector of economic activity classified by the NACE codes with a special focus on the agriculture sector. Further, the aim of the paper is to justify the legitimacy of the proposed special definition of factors in the formula for specific types of industries as are designed by Art 98–101 of the CCCTB Draft Directive. The paper verifies whether the allocation formula with three equally-weighted factors (labour, assets and sales factors) defined by the Art. 86 of the CCCTB Draft Directive is able to significantly explain the variability in the profitability of companies operating in these types of industry sectors. Moreover, the paper tries to highlight that the proportion of explained variability in profitability (based on three equally-weighted formula factors) can differ with respect to the industry sector (or subsectors in case of the agriculture) in which the particular company operates.

The structure of the allocation formula for sharing the CCCTB is stated in Art. 86 of the CCCTB Draft Directive as in the Equation 1, where the share of a member of group of company on the common consolidated tax base is calculated based on its proportion in the total volume of sales, assets and payroll costs in combination with the number of employees.

The firm-level data of active independent (i.e. unconsolidated) companies registered in the Czech Republic with the published value of profit/loss for taxable year 2012 from the Amadeus database[4] were used for the research. The data which refers to the taxable year 2012 were used. The gained data set before a further adjustment consisted of 111 295 independent enterprises. The following data were collected: tangible fixed assets (TFA), operating turnover (OPT), number of employees (NoE), payroll costs (CoE) and profit/loss before taxes (PL). As a proxy for the sales formula factor where served the operating turnover, which is defined as the total output of economic activity carried out over a certain period. It is usually measured by the total revenues on the sales of goods, products and services under the ordinary business activity reduced by the warranty claims and rebates. All the companies with missing information about the sector of economic activity classified by the NACE codes or with the missing value

$$ShareX = \left(\frac{1}{3} \frac{Sales^{X}}{Sales^{group}} + \frac{1}{3} \left(\frac{1}{2} \frac{Payroll^{X}}{Payroll^{group}} + \frac{1}{2} \frac{No\_of\_employees^{X}}{No\_of\_empolyees^{group}} \right) + \frac{1}{3} \frac{Assets^{X}}{Assets^{group}} \right) * Con'd\_Tax\_Base \quad (1)$$

[3]Manufacturing companies: the NACE codes 15–36 and services: the NACE Codes 50–74 and 92.

[4]Amadeus update number 234, the date of update 13.03.2014.

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Table 1. The structure of the sample based on the NACE sectors. The total volume of observations was 65 376

NACE sector	Description	Details (first two digits)	Number of observation	% proportion
A	AGRICULTURE, FORESTRY AND FISHING	01–03	2 316	3.54
B	MINING AND QUARRYING	05–09	88	0.13
C	MANUFACTURING	10–33	10 471	16.02
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	35	448	0.69
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	36–39	661	1.01
F	CONSTRUCTION	41–43	7 007	10.72
G	WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES	45–47	17 968	27.48
H	TRANSPORTATION AND STORAGE	49–53	2 216	3.39
I	ACCOMMODATION AND FOOD SERVICE ACTIVITIES	55–56	2 803	4.29
J	INFORMATION AND COMMUNICATION	58–63	2 268	3.47
K	FINANCIAL AND INSURANCE ACTIVITIES	64–66	100	0.15
L	REAL ESTATE ACTIVITIES	68	5 720	8.75
M	PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	69–75	7 944	12.15
N	ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	77–82	1 827	2.00
O	PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY	84	7	0.01
P	EDUCATION	85	692	1.06
Q	HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	86–88	1 747	2.67
R	ARTS, ENTERTAINMENT AND RECREATION	90–93	564	0.86
S	OTHER SERVICE ACTIVITIES	94–96	529	0.81
T	ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS; U0NDIFFERENTIATED GOODS AND SERVICES-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE	97–98	0	0.00
U	ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES	99	0	0.00

of any variable as well as with the negative values of tangible fixed assets and labour compensation and all extreme values below the 1st percentile and above the 99th percentile were excluded from the sample. The sample covers variables for 65 376 companies. Table 1 presents the structure of the analysed sample with regard to the number of available observations for a single NACE sector.

From the Table 1, it is visible that there are no observation for the NACE sector T and U and there are only 7 observation for the NACE sectors O; with regard to the low volume or missing observations these NACE sectors were excluded from the further research. With regard to the particular objective of the paper, the data for the NACE sector A (Agriculture, forestry and fishing) were further divided into subsectors based on first two digits specification, the number of observations in each subsector is specified in the following Table 2.

The Table 3 presents descriptive statistics of all variables in 2012. The observed variables are correlated in a positive and significant way at 5 % significance level. For details, see correlation matrix in *Appendix 1.*

Table 2. The structure of the NACE sector A

A – AGRICULTURE, FORESTRY AND FISHING	Number of observation	% proportion
A-01 – Crop and animal production, hunting and related service activities	2 060	0.89
A-02 – Forestry and logging	237	0.10
A-03 – Fishing and aquaculture	19	0.01
Total amount of observations	2 316	1.00

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Table 3. Descriptive statistics, all variables in thousands EUR, except for the number of employees, active companies in the Czech Republic with the known value of profit/loss before tax for 2012

Name of variable	Abbreviation	Mean value	Standard Deviation	Min. value	Max. value
Sales	OPT	1 579.74	4 402.00	0.00	63 844.42
Profit/loss before taxes	PL	53.69	225.44	–526.90	3 015.65
Tangible fixed assets	TFA	417.25	1 373.47	0.00	19 351.05
Number of employees	NoE	18	41	3	375
Cost of employees	CoE	226.56	569.05	1.27	7 282.04

The Table 4 shows descriptive statistics of all variables for the companies operating in the agriculture sector. The variables are positively and statistically significantly correlated at the significance level of 5%. The correlation matrix for more details is stated in *Appendix 2.*

The methodology of the research is based on the evaluation of the adjusted coefficients of the determination of various regression models analysed by the Ordinary Least Squares method (OLS). A simple regression model with one dependent and one independent variable and also a multiple regression model with more than one independent variable were applied in the research. The parameters of the proposed regression models were determined by the unrestricted regression as well as by the restricted regression where the equal weight of parameters is considered. The positive linear links between the dependent and the independent variables in the proposed regression models were considered.

The proposed regression models were as follows:

$$PL_n = \beta_0 + \beta_1 CoE_n + ... \quad (2)$$

$$PL_n = \beta_0 + \beta_1 CoE_n + \beta_2 NoE_n .... \quad (3)$$

$$PL_n = \beta_0 + \beta_1 CoE_n + \beta_2 NoE_n + \beta_3 TFA_n \quad (4)$$

$$PL_n = \beta_0 + \beta_1 CoE_n + \beta_2 NoE_n + \beta_3 TFA_n + \beta_4 OPT_n \quad (5)$$

where PL_n considers the profit/loss before taxes as the dependent variable which is explained with a different number of independent variables and their combinations, i.e. the payroll costs (CoE), the volume of tangible fixed assets (TFA) and the operating turnover (OPT) or number of employees (NoE)

As was already mentioned above, both unrestricted and restricted regression, where the equal weight of independent variables is considered, were performed during the research.

RESULTS AND DISCUSSION

The main aim of the paper was to analyse the explanatory power of the proposed formula factors on the generation of profit/loss with regard to the sector of economic activity based on the NACE classification and to justify the needs for a special definition of the formula factors for the special type of industries as are defined in the CCCTB Draft Directive. Further, the paper is focusing on the analysis of the explanatory power of the proposed formula factor on the generation of profit/loss in the agriculture sectors, which may be characterized by the low immobility of the performed business, since it is mainly based on the extent of the land area for animal breeding or crop cultivation. However, the low mobility of the tangible fixed assets factor may have a significant effect on the distributed share of the tax base under the CCCTB tax sharing mechanism.

The analysis was based on the research of variety of regression models with one or more independent

Table 4. Descriptive statistics for the companies operating in the agriculture sector, all variables in thousands EUR, except for the number of employees, active companies in the Czech Republic with the known value of profit/loss before taxes for 2012

Name of variable	Abbreviation	Mean value	Standard Deviation	Min. value	Max. value
Sales	OPT	2 213.43	4 092.73	0.00	57 857.26
Profit/loss before taxes	PL	133.32	285.27	–495.72	2 973.81
Tangible fixed assets	TFA	1 578.56	2 446.12	0.00	18 237.26
Number of employees	NoE	32	43	3	375
Cost of employees	CoE	350.69	477.39	1.35	4 894.00

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variables. The parameters of the proposed regression models were estimated via the Ordinary Least Squares method (OLS). We assumed positive linear links between the independent variables and the dependent variable. As a dependent variable (response variable) the profit/loss before taxes (PL) was considered and as the independent variables those which are involved in the allocation formula for distribution of the CCCTB, i.e. the volume of tangible fixed assets (TFA), the payroll cost (CoE), the number of employees (NoE), the volume of sales, respectively the operating turnover (OPT).

The variety of regression models with a different number of independent variables were proposed with the aim to prove whether any other combination of the formula factors would not be able to explain a higher proportion of variability in the generation of profit/loss. The model with two independent variables (i.e. with CoE and OPT) was also applied during the research. This model in fact reflects the structure of the Canadian allocation formula for the distribution of the tax base of the multi-jurisdiction enterprises operating on the territory of more than one Canadian province.

Further, the regression model with three independent variables (i.e. CoE, OPT and TFA) provides the evidence of the explanatory power of the Massachusetts formula, i.e. the formula which is commonly used for the distribution of the federal corporate income tax base in the United States since 1930.

The comparison of the explanatory power of the analysed regression models was based on the values of the coefficient of determination – the obtained rate indicates what proportion of variability in percentage are chosen independent variables able to explain. Since the values of the unadjusted coefficients of determination might be distorted by a different number of independent variables, the analysis is based on the indicator of the adjusted coefficient of determination, which is able to eliminate this distortion.

All values of the adjusted coefficients of determination were analysed by the statistical significance test for the coefficient of determination with the critical value for *F*-distribution. The obtained results are presented in Table 5 and Table 6. All proposed regression models were also tested by the *F*-test, which tests the statistical significance of the regression model and shows if the variables in the model are properly chosen. The results of *F*-test test are also presented in the below Tables 5 and 6. The unlisted *F* in the tables indicates that the proposed model is statistically significant at the 1% significance level. The FN in the tables indicates that the model in not statistically significant at the 10% significance level. Further, the F5 in the tables expresses that the model is statistically significant at the 5% significance level. The highlighted figure for each NACE sector in tables suggests the model with the highest proportion of variability in generating of profit/loss.

Table 5 shows the results of the explanation power of the proposed apportionment factors on the profit/loss generation for the unrestricted regression models, while the Table 6 provides the results of analysis for the restricted regression models, where the equal-weight of parameters was considered. The first part of Table 5 shows the results for the regression models with the individual independent variable. In the second part, there are the results of the arranged models in which the individual variables are combined. The lower part of the Table 5 shows the results of the regression with three, respectively four independent variables. The results reported for the restricted regression in the Table 6 are similar with the exception that the regression models with one variable are not eligible for the constrained regression.

It is obvious from the Tables 5 and 6 that the volume of the explained variability by both unrestricted and restricted regression models differs in each sectors of economic activity defined by the NACE sectors. It is also necessary to mention that as the relevant results, there are considered only those with the statistically significant value of the coefficient of determination at any of envisaged significance level.

Based on the results for the unrestricted regression models, it can be observed that the proportion of the explained variability for the whole sample is almost 35% in the model with four independent variables as the formula factors, i.e. by the operating turnover, the tangible fixed assets, the number of employees and the payroll costs, which are actually these variables which are incorporated in the allocation formula for the CCCTB system.

The same result was obtained also for the subsample of companies operating in 13 out of 18 considered NACE sectors. Based on a deeper analysis, we can conclude that the values of the adjusted coefficient of determination of the subsamples classified by the NACE codes can differ almost by 27% in comparison with the result for the sample containing all data. Moreover, throughout the individual NACE sectors the difference in the proportion in explained variability can reach up to 34%. A low volume, in the actual

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amount of 13.27%, of the explained but statistically significant variability was obtained for the NACE sector I – accommodation and food services activities, in the case of the model with four independent variables. This can be explained by the fact that provision of accommodation and food services is very often operated in the rented spaces and therefore the volume of the tangible fixed asset does not play such an important role. If we shift this assumption to the cross-border level, the most common cross-border operating units are the fast-food chains. Even if their performance in different countries is often based on the franchising system, (which considers a legal and financial autonomy, on the other hand, it assumes that the franchiser provide the franchisee with all facilities, brand and technology), the most common way how to spread this type of business in another country is to set a subsidiary there.

With regard to the particular objective of the paper to analyse the explanatory power of the proposed formula factors in the agriculture sector (the NACE sector A), it can be observed that the highest proportion of variability is explained by the regression model employing four independent variables

Table 5. Analysis of the explanation power of the proposed apportionment factors on the profit/loss generation based on the adjusted coefficients of determination, dependent variable Profit/loss before taxes

	All NACES	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Number of observation	65 376	2 316	88	10 471	448	661	7 007	17 968	2 216	2 803
Independent variable(s)										
CoE	0.2700***	0.3180***	0.2273***	0.3376***	0.2517***	0.3264***	0.3101***	0.2170***	0.2804***	0.0434***
NoE	0.1771***	0.2339***	0.0698**	0.2333***	0.1504***	0.2418***	0.2293***	0.0977***	0.2379***	0.0247***
TFA	0.1452***	0.3343***	0.3201***	0.2575***	0.1293***	0.1881***	0.1409***	0.0888***	0.2156***	0.0397***
OPT	0.2911***	0.2830***	0.2662***	0.3946***	0.1938***	0.3325***	0.3678***	0.2570***	0.2974***	0.0886***
TFA NoE	0.2160***	0.3422***	0.3121***	0.2988***	0.2062***	0.2939***	0.2454***	0.1184***	0.2620***	0.0453***
OPT NoE	0.3043***	0.3098***	0.2988***	0.3959***	0.2472***	0.3745***	0.3677***	0.2574***	0.3055***	0.1288***
CoE TFA	0.2888***	0.3599***	0.3277***	0.3581***	0.2930***	0.3574***	0.3122***	0.2176***	0.2900***	0.0529***
CoE OPT	0.3318***	0.3409***	0.2577***	0.4100***	0.2973***	0.3975***	0.3711***	0.2812***	0.3195***	0.1084***
OPT TFA	0.3140***	0.3830***	0.3240***	0.3997***	0.2766***	0.3902***	0.3688***	0.2580***	0.3230***	0.0912***
NoE OPT TFA	0.3191***	0.3836***	0.3309***	0.4000***	0.2978***	0.4066***	0.3687***	0.2580***	0.3323***	0.1314***
CoE OPT TFA	0.3410***	0.3842***	**0.3842*** **	0.4116***	0.3382***	0.4228***	0.3713***	0.2819***	0.3340***	0.1175***
OPT TFA NoE CoE	**0.3489*** **	**0.3872*** **	0.3617**	**0.4246*** **	**0.3437*** **	**0.4264*** **	**0.3736*** **	**0.3033*** **	**0.3400*** **	**0.1327*** **

	J	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**S**
Number of observation	2 268	100	5 720	7 944	1 827	692	1 747	564	529
Independent variable(s)									
CoE	0.2579***	0.0829***	0.0550***	0.2733***	0.2396***	0.0683***	0.1975***	0.0376***	0.0508***
NoE	0.2280***	0.0496**[F5]	0.0269***[F5]	0.2534***	0.1196***	0.0164***	0.1570***	0.0375***	0.0413***
TFA	0.1288***	0.0616**	0.0558***	0.1012***	0.1433***	-0.0008[FN]	0.2248***	0.0042[F5]	0.0363***
OPT	0.3385***	0.0973***	0.1631***	0.3552***	0.2749***	0.1245***	0.3663***	0.3663***	0.0754***
TFA NoE	0.2513***	0.0982***	0.0687***	0.2646***	0.2183***	0.1500***	0.2475***	0.2598***	0.0514***
OPT NoE	0.3568***	0.0955***	0.1719***	0.3850***	0.2954***	0.1309***	0.3713***	0.2590***	0.0740***
CoE TFA	0.2881***	**0.1208*** **	0.0937***	0.2896***	0.2801***	0.0689***	0.2679***	0.0359***	0.0565***
CoE OPT	0.3586***	0.1057***	0.1659***	0.3780***	0.3162***	0.1238***	0.3693***	0.2596***	0.0739***
OPT TFA	0.3721***	0.0988***	0.1752***	0.3724***	0.3003***	0.1260***	0.4036***	0.2722***	0.0820***
NoE OPT TFA	0.3774***	0.1027**	0.1849***	0.3912***	0.3196***	0.1313***	**0.4253*** **	0.2773***	0.0804***
CoE OPT TFA	**0.3818*** **	0.1163***	0.1774***	0.3878***	**0.3326*** **	0.1257***	0.4203***	0.2709***	0.0837***
OPT TFA NoE CoE	0.3817***	0.1070**	**0.1855*** **	**0.3925*** **	0.3323***	**0.1564*** **	0.4251***	**0.2856*** **	**0.0841*** **

***,**,* indicates significance level of the adjusted coefficients of determination at the 1, 5 and 10% level respectively. FN indicates that the proposed model is not significant at the 10% significant level base on F-test. F5 indicates that the proposed model is significant at the 5% significance level. The unlisted F implies that a proposed regression model is statistical significant at the 1% significance level

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as the formula factors, which are indeed the ones which are incorporated in the CCCTB allocation formula. The proportion of the explained variability (38.72%) is even higher by 3.83% in comparison with the explained proportion of variability for all considered companies. This fact may indicate a greater effect of the tangible fixed assets factor on the proportion of the explained variability in case of the agriculture sector. However, this assumption is not supported by the results of the more detailed analysis performed for the individual subsectors of agriculture. For details see *Appendix 3*. The result for the unrestricted regression models shows, that the proportion of the explained variability for the case where the tangible fixed assets is considered as the sole allocation factor can differ up to 24.41%. These results may be justifiable given the fact, that the tangible fixed assets cannot be considered as the sole profit generating factor without employing any other factor, for example number of employees, where in the combination of these two factors for the agriculture subsector 03-Fishing and Aquaculture the statistically significantly explained variability amounts to 70.87%.

Table 6. Analysis of the explanation power of the froposed apportionment factors on the profit/loss generation based on the adjusted coefficients of determination, dependent variable Profit/loss before taxes

	All NACES	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Number of observation	65 369	2 316	88	10 471	448	661	7 007	17 968	2 216	2 803
Independent variable(s)										
CoE										
NoE										
TFA										
OPT										
TFA NoE	0.1503***	0.3355***	0.3199***	0.2628***	0.1310***	0.1944***	0.1487***	0.0920***	0.2209***	0.0403***
OPT NoE	0.2920***	0.2844***	0.2640***	0.3950***	0.1946***	0.3347***	0.3678***	0.2571***	0.2981***	**0.0869*** **
CoE TFA	0.2236***	0.3494***	**0.3353*** **	0.3252***	0.1704***	0.2676***	0.2464***	0.1565***	0.2669***	0.0460***
CoE OPT	0.3077***	0.2994***	0.2658**	0.4045***	0.2116***	0.3582***	**0.3708*** **	**0.2640*** **	0.3080***	0.0809***
OPT TFA	0.3136***	0.3671***	0.3163***	0.3983***	0.2710***	0.3899***	0.3647***	0.2576***	0.3258***	0.0786***
NoE OPT TFA	0.3141***	0.3672***	0.3148***	0.3985***	0.2716***	0.3910***	0.3647***	0.2576***	0.3259***	0.0782***
CoE OPT TFA	0.3252***	0.3700***	0.3137***	**0.4053*** **	0.2840***	0.4048***	0.3671***	0.2634***	**0.3295*** **	0.0768***
OPT TFA NoE CoE	**0.3254*** **	**0.3700*** **	0.3123***	0.4052***	**0.2845*** **	**0.4055*** **	0.3670***	0.2633***	0.3294***	**0.0763*** **

	J	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**S**
Number of observation	2 268	100	5 720	7 944	1 827	692	1 747	564	529
Independent variable(s)									
CoE									
NoE									
TFA									
OPT									
TFA NoE	0.1386***	0.0621**	0.0562***	0.1118***	0.1562***	-0.0001^{FN}	0.2295***	0.0045^{FN}	0.0425***
OPT NoE	0.3396***	0.0974***	**0.1622*** **	0.3567***	0.2778***	0.1235***	0.3647***	**0.2599*** **	0.0773***
CoE TFA	0.2767***	0.0730***	0.0651***	0.2572***	0.2475***	0.0409***	0.2663***^{F5}	0.0075**^{F5}	0.0586***
CoE OPT	0.3560***	0.1006***	0.1532***	0.3731***	0.2998***	**0.1237*** **	0.3457***	0.2555***	0.0756***
OPT TFA	0.3672***	0.1075***	0.1171***	0.3721***	0.3001***	0.1134***	**0.4016*** **	0.1540***	**0.0840*** **
NoE OPT TFA	0.3679***	0.1076***	0.1172***	0.3732***	0.3025***	0.1125***	0.3995***	0.1540***	0.0839***
CoE OPT TFA	0.3777***	0.1107***	0.1221***	0.3852***	0.3193***	0.1143***	0.3788***	0.1533***	0.0811***
OPT TFA NoE CoE	**0.3778*** **	**0.1108*** **	0.1221***	**0.3857*** **	**0.3206*** **	0.1132***	0.3767***	0.1532***	0.0810***

***,**,* indicates significance level of the adjusted coefficients of determination at the 1, 5 and 10% level respectively. FN indicates that the proposed model is not significant at the 10% significant level base on F-test. F5 indicates that the proposed model is significant at the 5% significance level. The unlisted F implies that a proposed regression model is statistical significant at the 1% significance level

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Further, in three NACE sectors (B, J, N) is the highest proportion of the variability explained by the regression model with three variables, i.e. the payroll costs, the operating turnover and the volume of tangible fixed assets, which represent these variables which are included into the US Massachusetts allocation formula. It was assumed that these results will be obtained for the subsamples of companies in more than three NACE sectors, since based on the analysis of the number of employees, it seems that these information provided in the Amadeus database for Czech companies are recorded with regard to the size of company.

None of considered regression models explained the highest proportion of variability by two independent variables which are incorporated in the Canadian allocation formula based on the results for the unrestricted regression.

The results implied for the subsample of companies operating in the NACE sector – K, i.e. Financial and Insurance Activities, are statistically significant but the proportion of the explained variability by the allocation formula factors reach up to 10.70%. Based on this result, we can conclude that the formula factors as are designed in the Art. 86 of the CCCTB Draft Directiv, are able to explain the significant proportion of variability in the generation of profit/loss, however, the portion of the explained variability for the companies operating in this sector of economic activity is very low and, therefore, the different approach for the definition of formula factors is justifiable. With regard to the special provision of the CCCTB Draft Directive for the Oil and Gas extractors and producers (stated in Art. 100) it is necessary to mention that these provisions govern only the allocation rules of the sales formula factor, therefore, the formula factors variables are able to explain the satisfactory proportion of profitability, as is also obvious from research in the paper.

Further, the proportion of the explained variability is statistically significant but very low in the actual amount of 15.64% for NACE sector P – Education; which includes education at any level of for any profession. Based on the results we suggest considering the special definition of formula factors also for this sector. Low volumes, however, the highest at level of 18.55%, resp. 0.08%, of the explained variability for all proposed regression models are also obtained for the NACE sector L and S (L – Real Estate Activities, S – Other Services, which are defined as the activities of membership organisations, the repair of computers and personal and household goods and a variety of personal service activities not covered elsewhere in the classification). It is quite questionable, whether for these kind of activities, the tangible fixed assets factor is important, since the revenues from these activities mainly rely on the quality of the provided services and, therefore, on the quality of employees who are costly.

The Table 6 provides the results of the analysis of the explanatory power of the formula factors on generating profit/loss with regard to the NACE sector in which the company operates based on the restricted regression model. The restricted regression models assume that the weight of parameters is equal, therefore, the results of the analysis of the explanation power on the profitability of equally-weighted factors are more relevant for the restricted regression.

The results show that in the sample of the analysed companies in all NACE sectors, there is the highest proportion of profitability explained by the regression models with four independent variables which are incorporated in the allocation formula for the CCCTB system, but the proportion of the explained variability is by 2.35% lower in comparison with the unrestricted regression model. The same result was reached in the case of the subsamples of companies operating in the NACE sector D, E, J, K, M, and N, as well as in the agriculture sector indicated by the NACE code A. With regard to the results of the detailed analysis of the agriculture subsectors based on the restricted regression models, it may be concluded that the proportion of the explained variability by those formula factors which are incorporated in the CCCTB allocation formula is lower by 21.89% for 02-Forestry and Logging subsector and by 5.69% higher for 03-Fishing and Aquaculture subsector in comparison with the proportion of explained variability for the whole agricultural sector (37.00%). For details, see *Appendix 4*.The highest proportion of variability for 01-Crop and Animal production, Hunting and Related Service activities is explained by the restricted regression model employing two independent variables, i.e. the volume of the operating turnover and the volume of the tangible fixed assets, while for the 03 agriculture subsector, the highest proportion variability is explained by the restricted regression model with the costs of employees and the operating turnover factor. Based on the restricted regression analysis the assumption of the importance of the tangible fixed assets factor cannot be confirmed.

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Further, regarding the analysis of the explanatory power of the allocation formula factors in different sectors of economy based on the restricted regression models, the results for the Accommodation and Food Service (NACE sector I) activities are based on the restricted regression statistically significant, but the proportion of the explained variability is very low (i.e. 7.63%). Therefore, the results suggest that a special definition of allocation factors should be considered also for those economic sectors. The results for the restricted regression show that there are now 3 different NACE sectors (C, G and H) in comparison with the results obtained for the unrestricted regression, where the highest proportion of variability in profitability is explained by the variables which are incorporated in the U.S. Massachusetts formula. Also the previous suggestion for the consideration of a special definition of formula factors for the Education Activity sector (NACE sector P) became more relevant, since the proportion of the explained variability evaluated according the value of adjusted coefficient of determination is even lower in comparison with the results for the unrestricted regression (i.e. 11.32%).

The results of the research presented in the paper are partially in the line with the results published by Roggan et al. (2012), who states that the formula proposed by the CCCTB Draft Directive seems to be the best performing formula and it is able to explain almost 28% of the variability of generating of profit/loss. The higher proportion of the explained variability in the profit/loss generation in the paper for companies operating in all sectors of economic activity is probably result of the fact that following the Hines (2008) methodology, we employed the data of one region – the Czech Republic.

Contrary to the results of Roggeman et al. (2012), researching only companies operating in the manufacturing and service sector, our paper covers companies operating under all NACE sectors. Moreover, the results in the paper of our research do not confirm the conclusion of their study that the formula should contain just a single labour compensation factor without its combination with number of employees. The obtained results indicate that the model with four independent variables, i.e. the number of employees (NoE), the payroll costs (CoE), the volume of sales (OPT) and the tangible fixed assets (TFA), is able to explain the highest proportion of variability in the profit generation in 13 out of 18 considered NACE sectors based on the results for the unrestricted regression models and in 7 NACE sectors based on the results for the restricted regression models. Contrary, the model with three independent variables (CoE, OPT and TFA) is able to explain the highest proportion of variability in the profit generation for companies operating only in 3 out of 18 NACE sectors for both of the unrestricted and restricted regression models.

Further, in the light of the results of study of Anand and Sansing (2000), who concluded that the choice of the structure of the allocation formula will be mainly influenced by the dominating industry sector in a particular country, our paper concludes that the most appropriate allocation formula for the Czech Republic indicated by the results for the predominating industry sector, G – Wholesale and Retail Trade activities, would not be the allocation formula as is designed by the CCCTB Draft Directive, but indeed the Canadian allocation formula employing two allocation formula factors, i.e. the volume of sales and the labour compensation.

CONCLUSION

The paper was aimed on the research of the explanatory power of the proposed formula factors on the generation of profit/loss with regard to the sector of economic activity classified by the NACE classification and on the justification of the needs for a special definition of the formula factors for certain type of industries as are defined in the CCCTB Draft Directive. Further, the special objective of the paper was to analyse the explanatory power of the allocation formula factors in the agriculture sector and its subsectors with the hypothesis that the low mobility of the tangible fixed assets factors may play a significant role for the distribution of the tax base under the CCCTB tax sharing mechanisms. However, this assumption was not confirmed by the paper.

The research was based on estimating of a wide variety of regression models based on the Ordinary Least Squares method; based on the comparison of the volumes of adjusted coefficients of determination and on the evaluation of their statistical significance. According to the results, we can conclude that the proposed formula factors are able to explain almost 35% variability in the profitability of sample of companies operating in all NACE sectors in the territory of the Czech Republic. Further, in the case of the subsample of companies operating in a single type of the NACE sectors, this explanatory ability is

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higher almost by 8% (for example for manufacturing and construction activities). On the other hand, the explained proportion of variability for the subsample of companies operating in other services sector (S) is by 34% lower for the unrestricted regression model and by 32% lower for the restricted regression model.

For companies operating in 13 out of 18 NACE sectors, the highest proportion of variability in profit is explained by the unrestricted regression model with four independent variables, which are identical with those incorporated in the allocation formula for the distribution of the CCCTB. Among them, the same results were obtained for the agriculture sector and its subsector 02-Forestry and Logging. The results for the restricted regression model indicate the same result for 7 out of 18 NACE sectors.

In 3 of the total 18 NACE sectors, the highest rate of variability in the profit/loss generation is explained by the unrestricted regression model with three independent variables comprised in the US Massachusetts allocation formula. The same results were obtained for the agriculture subsector 01-Crop and Animal Production, Hunting and Related Service Activities.

The research did not confirm the conclusion of Roggeman et al. (2012), based on which the payroll factors should contain only the payroll costs without its combination with the number of employees. According to the results of our research, the formula with three-equally weighted factors (OPT, TFA and CoE) is able to explain the highest share of variability for companies operating in 3 NACE sectors out of the total 18 NACE sectors for both of the restricted as well as the unrestricted regression models.

The results for the restricted regression model with three independent variables (OPT, TFA and NoE) show that in comparison with other models, this combination of the formula factors is not able to explain the highest share of variability in the generation of profit/loss of companies operating in neither of the considered NACE sectors. The results of the restricted regression models indicate that for 3 out of 18 NACE sectors, the profit is best explained by these two variables (OPT, CoE) which are incorporated in the Canadian allocation formula.

The results indicate that the formula factors as stated in the Art. 86 of the CCCTB Draft Directive are able to significantly explain just 10.70%, resp. 11.08%, of profit of the companies operating in Financial and Insurance activities. These results provide the justification for a special definition of the formula factors for a special type of industries, e.g. for the financial and insurance company services, as are stated by the Art. 98–99 of the CCCTB Draft Directive. The results of the research also suggest a special definition of the formula factors for companies operating in education, the real estate activities or in the accommodation and food service activities, where the share of the statistically significantly explained variability based on the unrestricted regression model reach up to 15.64%, resp. 18.55% and 13.27%. In accordance with the previously mentioned, the results for the restricted regression models show that the share of the explained variability is even lower.

Based on the results obtained for the predominating industry sector it the Czech Republic – G (wholesale and retail trade), we conclude that the formula factors, as incorporated in the allocation formula for the CCCTB system, are able to explain the highest portion of variability in the profit/loss generating activities based on the results for the unrestricted regression model, while the results for the restricted regression model indicate that the greater share of variability is explained by the two-equally weighted factors formula, where the payroll factor comprises the demand side and the volume of sales constitutes a proxy for the supply side.

Appendix 1

Table 7. Correlation matrix for the whole sample of companies

Correlation matrix, n = 65 376; 5% both sides critical value 0.0077					
PL	OPT	NoE	CoE	TFA	
1.0000	0.5395	0.4209	0.5196	0.3811	PL
	1.0000	0.6113	0.6938	0.4565	OPT
		1.0000	0.8873	0.4997	NoE
			1.0000	0.5056	CoE
				1.0000	TFA

Appendix 2

Table 8. Correlation matrix for the sample of companies operating in the agriculture sector

Correlation matrix, n = 2316; 5% both sides critical value 0.0407					
PL	OPT	NoE	CoE	TFA	
1.0000	0.5323	0.4839	0.5642	0.5784	PL
	1.0000	0.6835	0.7722	0.6200	OPT
		1.0000	0.9224	0.7297	NoE
			1.0000	0.8138	CoE
				1.0000	TFA

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Appendix 3

Table 9. Analysis of the explanation power of the apportionment factors of the profit/loss generation in the agriculture sector based on the adjusted coefficients of determination, dependent variable Profit/loss before taxes

	All NACES	A	A-01	A-02	A-03
Number of observations	65 376	2 316	2 060	237	19
Independent variable(s)					
CoE	0.2700***	0.3180***	0.3154***	0.2307***	0.6586***
NoE	0.1771***	0.2339***	0.2359***	0.1343***	0.6970***
TFA	0.1452***	0.3343***	0.3456***	0.1015***	0.1456FN
OPT	0.2911***	0.2830***	0.3520***	0.1070***	0.5845***
TFA NoE	0.2160***	0.3422***	0.3483***	0.1815***	**0.7087*** **
OPT NoE	0.3043***	0.3098***	0.3607***	0.1411***	0.5845***
CoE TFA	0.2888***	0.3599***	0.3606***	0.2581***	0.6499***
CoE OPT	0.3318***	0.3409***	0.3694***	0.2318***	0.6374***
OPT TFA	0.3140***	0.3830***	0.4050***	0.1722***	0.5639***
NoE OPT TFA	0.3191***	0.3836***	**0.4057*** **	0.1886***	0.6897***
CoE OPT TFA	0.3410***	0.3842***	**0.4057*** **	0.2466***	0.6444***
OPT TFA NoE CoE	**0.3489*** **	**0.3872*** **	0.4056***	**0.2725*** **	0.6761***

***,**,* indicates significance level of the adjusted coefficients of determination at the 1, 5 and 10% level respectively. FN indicates that the proposed model is not significant at the 10% significant level base on *F*-test. F5 indicates that the proposed model is significant at the 5% significance level. The unlisted F implies that a proposed regression model is statistical significant at the 1% significance level.

Appendix 4

Table 10. Analysis of the explanation power of the proposed apportionment factors of the profit/loss generation in the agriculture sector based on the adjusted coefficients of determination, dependent variable Profit/loss before taxes

	All NACES	A	A-01	A-02	A-03
Number of observations	65 376	2 316	2 060	237	19
Independent variable(s)					
CoE					
NoE					
TFA					
OPT					
TFA NoE	0.1503***	0.3355***	0.3463***	0.1057***	0.1522*
OPT NoE	0.2920***	0.2844***	0.3529***	0.1076***	0.5884***
CoE TFA	0.2236***	0.3494***	0.3560***	0.1454***	0.2305**
CoE OPT	0.3077***	0.2994***	0.3612***	0.1147***	**0.6068*** **
OPT TFA	0.3136***	0.3671***	**0.4034*** **	0.1445***	0.3808***
NoE OPT TFA	0.3141***	0.3672***	0.4033***	0.1449***	0.3847***
CoE OPT TFA	0.3252***	**0.3700*** **	0.4026***	0.1507***	0.4234***
OPT TFA NoE CoE	**0.3254*** **	**0.3700*** **	0.4024***	**0.1511*** **	0.4269***

Explanation see Table 9

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