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# Corporate Taxation in the European Union: The Role of Intangibles in the Formulary Apportionment

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**Abstract**: This paper seeks to contribute to the current debate on EU-wide corporate taxation, steered by the impending Proposal by the European Commission on a new framework for the taxation of income of businesses in Europe. The objective of this paper is to verify whether the inclusion of intangible assets enhances the ability of the current proposals for Formulary Apportionment to explain variability in profitability. The research question addressed is "What is the explanatory power of the Formulary Apportionment, for factors such as tangible assets, intangible assets, labour and sales by destination, to describe the variability in the profitability of companies active within the EU internal market?". The paper employs regression analysis of cross-sectional microeconomic data to analyse the explanatory power of the Formulary Apportionment. The research reveals that the inclusion of intangible assets fails to enhance the explanatory power and that factoring in intangible assets does not appear to have a statistically significant effect in the model. The best-performing model, without the inclusion of intangible assets, explained 22.6 % of the variability in the profitability of companies active within the EU internal market.

**Keywords**: formulary apportionment, common consolidated corporate tax base, BEFIT, intangible assets

**JEL Classification:** H25, K34, C21

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## Introduction

This paper focuses on Formulary Apportionment (FA) to be used within the European Union (EU). We respond to the publication: Communication from the European Commission[2] (EC), which indicates a proposal for Business in Europe: Framework for Income Taxation (BEFIT Proposal). It is intended that it will be introduced in 2023 and will replace the pending Proposal for a Council Directive on a Common Consolidated Corporate

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[2] COM (2021) 251 final, 18. 05. 2021.

Tax Base[3] (CCCTB Proposal). As indicated, the BEFIT Proposal will be based on the key features of the CCCTB Proposal, such as a single corporate tax rulebook and FA.

The core concept of FA is that the consolidated profits of multinational companies (MNCs) should be distributed across the EU Member States, through a quantitative allocation mechanism. Traditionally, countries with subnational FA systems have relied on a combination of factors, based on sources, such as tangible assets, labour and third-party sales (Matheson *et al.*, 2021). Intangibles and financial assets are generally excluded from the FA methodology due to their mobile nature and the risk of circumvention of the system (Roggeman *et al.*, 2012; Mintz, 2008).

In a progressively digitalized and globalized economy, the importance of intangible assets in generating economic value is substantial. Particularly in industries such as information technology, the role of intangible assets as a crucial production input is undeniable (Kenney et al., 2021; Kenney and Zysman, 2020; Parker et al., 2016; Corrado, et al., 2009). Existing literature consistently acknowledges that intangible assets are an important value-creating factor and represent an important and growing component of the total capital stock (Corrado et al., 2009). Marrocu et al. (2012) and Martins and Taborda (2022) claimed that intangibles enhance the competitive advantage and performance of companies. Moreover, digitalization enabled the spread of new business models, in particular platform-based business models that, even though they employ just a tiny fraction of the traditional value-creating assets, significantly disturb and dominate traditional industries (e.g.: Ivanov et al., 2022; Kenney, et al., 2021; Kenney and Zysman, 2016; Parker, et al., 2016). Despite the growing economic significance of platform business models, the existing international tax framework has not adequately captured their unique characteristics (Olbert and Spengel, 2019; Auerbach et al., 2017; Devereux and Vella, 2017). Considering the importance of intangible assets in global value chains, the EC has addressed the stated conundrum and indicated the inclusion of intangible assets in the BEFIT FA. Martins and Taborda (2022) theoretically debated the recognition of intangible assets and concluded that they should, in principle, be included in the FA. Nevertheless, to the best of our knowledge, there is no empirical analysis that examines the statistical significance of intangible assets in the process of value creation.

Based on the hypothesized significance of intangible assets in value creation and the absence of an empirical basis, the main aim of this paper is to carry out an empirical analysis of the explanatory power of the FA methodology to explain the variability in the profitability of companies that are active within the EU internal market. To fulfil the stated objective, regression analysis of cross-sectional microeconomic data was used. Based on the empirical results, we seek to devise a suitable FA, thus making further contribution to the discussion of whether intangible assets are a factor that is relevant and should be included in the upcoming BEFIT FA from the perspective of explained variability in profitability. The following research question is addressed "What is the explanatory power of the FA, for factors such as tangible assets, intangible assets, labour and sales by destination, to describe the variability in the profitability of companies active within the EU internal market?".

[3] COM (2016) 683 final, 25. 10. 2016.

The structure of this paper is as follows: Section 2: literature review; Section 3: description of the methodology applied; Section 4: presentation of the results; Section 5: discussion of the results along with a list of the contributions and practical implications; Section 6: presentation of the conclusions and acknowledgement of limitations.

## Literature Review

The method of FA is a method using a formula, an "apportionment mechanism", to distribute the consolidated corporate tax base of an MNC across the tax jurisdictions where the MNC performs an economic activity. The consolidated corporate tax base is distributed according to various selected variables, factors, that reflect the value creation of the MNC, hence explaining the variability in profitability (Mayer, 2009). Currently, this method is mainly used in federal economies, for example, in the United States of America (USA), Canada, Germany and Switzerland.

The first attempt by the EC to implement FA within the EU internal market was the CCCTB Proposal, based on a single set of rules to calculate the taxable profits of an MNC within the EU. Subsequently, these taxable profits would be shared between the EU Member States through the FA mechanism (CCCTB FA). The CCCTB Proposal has not yet been approved by the Council of the EU. Moreover, the EC has indicated that the pending CCCTB Proposal will be withdrawn and replaced by a new framework for the taxation of income of businesses in Europe (BEFIT). As indicated, BEFIT will be based on the key features of the CCCTB Proposal that preceded it. Firstly, we anchor the theoretical framework before any subsequent empirical analysis. Table 1 shows a comparison of different forms of FA used in various federal economies and that within the pending, but expected to be withdrawn, CCCTB Proposal.

**Table 1. Comparison of different forms of FA**

| | FA | Industry Specific FA | Theoretical classification |
|---|---|---|---|
| The USA | Tangible fixed assets, Sales by destination, Cost of employees. | Yes | Supply - Demand |
| Canada | Cost of employees, Sales by destination. | Yes | Supply - Demand |
| Switzerland | Separate accounting results, Capital/cost of employees or sales by destination. | Yes | Supply |
| Germany | Cost of employees. | No | Supply |
| CCCTB Proposal | Tangible fixed assets, Sales by destination, Cost of employees, Number of employees. | No | Supply - Demand |

*Source: Own elaboration based on Mayer (2009).*

*Evaluation of the FA Methodology in the literature*

The scholarly literature extensively examines the effectiveness and appropriateness of the FA and related Proposals tabled by the EC in comparison to the currently used Separate Accounting (SA). This section provides a summary of studies emphasizing the advantages of FA, studies emphasizing its limitations, studies presenting concerns regarding both systems, and studies offering an overall evaluation of CCCTB Proposals.

Polezharova and Krasnobaeva (2020), McGaughey and Raimondos (2019), and Lehoux et al. (2019) argued that the implementation of the FA within the EU is long overdue. Polezharova and Krasnobaeva (2020) considered the implementation of the FA within the EU to be highly desirable, particularly for taxing digital activities or services that operate remotely. Due to the existence of an inadequate definition of national taxable income concerning MNCs and digital business models, McGaughey and Raimondos (2019) clearly supported the FA adoption. Lehoux et al. (2019) substantiated the benefits of FA in ensuring a fair distribution of the taxation base, particularly within technology and capital-intensive industries.

On the other hand, the feasibility of implementing the FA within the EU was a subject of concern raised by several authors. Schreiber and Fuhrich (2009), and Gordon and Wilson (1986) presented arguments supporting the maintenance of the current SA system, citing various drawbacks associated with the implementation of the FA. According to the authors, the FA may potentially result in inefficiently low tax rates and a shift towards direct taxation of property, and the imposition of high corporate tax rates under the FA has the potential to negatively impact domestic workers and potentially reduce wages at foreign affiliates.

Scholars examined the feasibility and appeal of the FA compared to the SA, yet a consensus has not been reached among researchers. Several studies reached the conclusion that both methodologies have their respective limitations. Moreover, Eggert and Haufler (2006) highlighted the practical challenges and difficulties that would arise from transitioning to the FA. Petkova and Weichenrieder (2020), Quentin (2017), Cottani (2016), Herzig et al. (2010), Eggert and Haufler (2006), and Conrad (2006) proposed a combined approach that integrates elements from both systems.

The EC's proposals, primarily the CCCTB Proposals, were evaluated by de Wilde (2020), Khan Niazi (2017), Cerioni (2016), Fuest (2008), Eichner and Runkel (2008), Devereux and Fuest (2010), and Russo (2005). Fuest (2008) recommended the necessity for additional economic evidence demonstrating the advantages of implementing the FA. Eichner and Runkel (2008) reported a positive welfare increase resulting from the implementation of FA within the EU. Khan Niazi (2017) claimed that the CCCTB Proposal demonstrates pragmatism and holds the potential for significant advancements. However, Devereux and Fuest (2010) identified profit shifting to low-tax countries outside the EU as the primary drawback of the CCCTB project. De Wilde (2020) proposed restructuring of the CCCTB Proposal to adopt a unitary taxation model that would tax the global economic profits of MNCs based on a destination-oriented FA approach.

*The FA's explanatory power of the variability in profitability of MNCs*

As stated earlier, the core concept of the FA is a formula that attributes income to the place where the value was created. Hence, the FA includes various factors which are hypothesized to create value; and the apportionment formula is expected to explain the variability in profitability. Considering the theoretical conclusions of Martins and Taborda (2022), the suggested composition of the BEFIT FA, and the implications of the current digitalized context, in addition to the traditional factors used to describe value creation, we studied the effect of the extension of the CCCTB FA with the factor of intangible assets. It is hypothesized that these four are the essential profit-generating factors.

The choice of factors in the FA significantly affects its ability to explain the variability in the profitability of MNCs. Several authors have examined the CCCTB FA, including Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman et al. (2012), and Hines (2008) who used microeconomic data to estimate the percentage of explained variability in profitability through regression analysis. The CCCTB FA was found to explain between 26.32 % and 35 % of the variability in profitability. Additionally, though Hundsdoerfer and Wagner (2020) found large income misallocations and systematic distortions caused by the CCCTB FA, it was still considered the best-performing formula compared to alternative compositions of the FA. Finally, Roggeman et al. (2012) found that the inclusion of intangible assets did not enhance the explanatory power of the FA. Table 2 summarizes the main findings reached by scholars.

**Table 2. Literature review**

| Study | Data | Results |
|---|---|---|
| Krchnivá and Nerudová (2018) | Amadeus database, Year: 2013, Companies with a link to the CR[4]. | The CCCTB FA explains 26.32 % of the variability in profitability. |
| Krchnivá and Nerudová (2015) | Amadeus database, Year: 2012. | The CCCTB FA explains to a statistically significant extent the variability in profitability in all 18 of the NACE sectors considered.<br>The proportion of explained variability differs by up to 34 % with respect to the sector of economic activity. |
| Krchnivá (2015) | Amadeus database, Year: 2012, Companies registered in the CR. | The CCCTB FA is able to explain almost 35 % of the variability in profitability. |
| Roggeman *et al.* (2012) | Amadeus database, Year: 2008, European manufacturing and service sector. | The best performing formula[5] statistically significantly explains 28 % of the variability in profitability.<br>Intangible assets do not significantly increase the explanatory power. |
| Hines (2008) | Amadeus database, Year: 2004. | The CCCTB FA explains less than 22 % of the variability in profitability. |

*Source: Own elaboration.*

[4] The Czech Republic.

[5] FA including the factors of tangible fixed assets, cost of employees and sales by destination.

## Methods

To analyse the ability of the FA to explain variability in profitability, regression analysis was used. The estimation method used was a traditional Ordinary Least Squares regression (OLS), which should prevent future issues of interpretation and allow the widespread use of the data by other professionals. Models were computed to cover all the theoretical concepts used within the FA. The paper follows the approach used by Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012), and Hines (2008). The rationale for the selection of the chosen research methods was also based on papers published by Solilová and Nerudová (2018), Nerudová and Solilová (2016 and 2015) and Devereux and Loretz (2008).

Cross-sectional microeconomic data for the year 2018, information relating to profit before tax, operating revenue turnover, cost of employees, number of employees, tangible fixed assets and intangible fixed assets was obtained from the Orbis database, a global company database, produced by Bureau van Dijk. The data was exported from the database, software version 129.00. The empirical analysis was performed using IBM SPSS Statistics software. The factors, sales by destination, labour and tangible assets are defined in accordance with the CCCTB Proposal.

Firstly, "labour factor", according to articles 32 and 33 of the CCCTB Proposal, is calculated from the total amount of the payroll and the number of employees. To reflect the differences in wage levels across the EU Member States and allow for a fairer distribution of the consolidated tax base, the labour factor is divided into two components, payroll and the number of employees. Considering the profit shifting and tax base erosion strategies pursued by MNCs, Matheson *et al.* (2021) stated that payroll usually involves third-party transactions that increase robustness to manipulation of the labour factor. On the other hand, the authors argued that headcount is independent of wage levels but may be easier to manipulate for tax reporting purposes since nominal positions can be created without any significant associated labour costs (*ibid*.). As did Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012), and Hines (2008), we calculate the number and cost of employees, as a proxy variable, extracted from balance sheets.

Secondly, the "sales by destination" factor, according to article 37 of the CCCTB Proposal, equals to the proceeds of all sales of goods and supplies of services after discounts and returns, excluding value-added tax, and other taxes and duties. In the following empirical analysis, we, as did Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012), Hines (2008), consider operating revenue turnover to be a proxy for the factor of sales by destination.

Thirdly, the factor "tangible assets", according to article 34 of the CCCTB Proposal, is defined as the average value of all tangible fixed assets owned, rented or leased by the MNC. Matheson *et al.* (2021) claimed that even though the value of tangible assets is straightforward to calculate, it is, however, vulnerable to manipulation, particularly in accounting systems that give some leeway on the amount of depreciation. As did Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012), and Hines (2008), we calculate fixed tangible assets, as a proxy variable, extracted from balance sheets.

In addition, based on the theoretical conclusions of Martins and Taborda (2022) and the suggested inclusion of intangible assets in the BEFIT FA, the CCCTB FA was extended with an additional factor, "intangible assets". Intangibles were originally excluded from the CCCTB FA due to their mobile nature and the risk of circumvention of the system. For example, Roggeman *et al.* (2012) and Mintz (2008), when addressing the question of the inclusion of intangible assets, financial assets and assets that are leased by the company, concluded that, given the mobility of such factors, it is appropriate to omit them from the FA. In the same vein, the main concern regarding the inclusion of intangibles in the FA, according to Martins and Taborda (2022), is related to the fact that the location of the intellectual property can easily be manipulated and may not necessarily accurately represent the location of value creation. Matheson *et al.* (2021) agreed that the possibility of manipulation of intangible assets has excluded them from consideration as a factor suitable for use within the FA. The authors further claimed that as intangible assets are highly mobile, they are often employed by MNCs in their tax avoidance activities (*ibid*.).

Nevertheless, according to Martins and Taborda (2022), ignoring intangible assets in the FA could weaken the relationship between the FA and the growing relevance of intangibles in modern economies. The literature agrees that intangible assets are an important factor in the creation of value and represent an important and growing component of total capital stock (Corrado *et al*., 2009). Further, Martins and Taborda (2022) assume that intangible assets are the main source of competitiveness.

As stated earlier in the text, we build on the theoretical conclusions reached by Martins and Taborda (2022) who concluded that intangible assets should, in principle, be included in the FA (*ibid*.). The authors further considered that there are four categories of intangible assets and concluded that only intangible assets developed internally by group members that meet the accounting recognition criteria and intangible assets acquired from third (independent) parties should be reflected in the FA (*ibid*.). Due to database limitations, in the empirical analysis, we uniformly employ tangible fixed assets, as did Roggeman *et al.* (2012). The proxy variable for intangible assets is extracted from the balance sheets, as was the proxy variable for tangible assets.

The observed companies were identified in line with the selection criteria outlined in the CCCTB Proposal. The search strategy consisted of the following steps. Firstly, active companies operating in the EU internal market were selected. In addition, only companies with a known pre-tax profit for 2018, the most up-to-date data available in the Orbis database, were selected. Moreover, similarly to Roggeman *et al.* (2012), we did not apply the consolidated balance statements as they do not link the profit of an entity with the factors used in the FA. It is hypothesized that the unconsolidated statements of a company that belongs to a consolidated group could be distorted by profit shifting.

Contrary to the article 2(c) of the CCCTB Proposal, we did not apply the qualifying threshold of 750 million EUR total consolidated revenue, for an MNC to fall within the scope. We do not aim to investigate the implications of the CCCTB Proposal, as they have already been addressed by a large volume of literature[6] and the CCCTB Proposal is expected to be withdrawn. The aim of this paper is to empirically test the ability of the

[6] For example, by Nerudová and Solilová (2015), Solilová and Nerudová (2018).

FA to explain the variability in profitability of companies active within the EU internal market.

The obtained data set contained missing or incorrect values, hence, in the next step, companies whose data contained incomplete, incorrect, or irrelevant information were removed from the data set. Only companies with information on all the factors required for the FA were selected. In contrary to, for instance Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), and Hines (2008), we did not exclude companies with a negative profit before tax. The above-mentioned authors examined the implications of the CCCTB FA for profit distribution. They built upon the theoretical hypothesis that corporate income tax is dependent on having a financial surplus that can subsequently be distributed via the FA. In this paper, as did Roggeman *et al.* (2012), we retained companies with a negative profit before tax within the data set to enhance the financial interpretation of the empirical analysis. This sequential process of cleaning the data set resulted in data on a total number of 7,122 companies, containing complete information on the dependent and independent variables.[7]

Following further examination of the data, information sets that had the potential to skew the results, along with outliers were removed from the total data set to ensure consistent results. Similar to Roggeman *et al*. (2012), extreme values below the 1st and above the 99th percentiles were dropped. As a result, we were left with data for a total of 6,732 companies available for use in the empirical analysis.

Based on the previously described theoretical framework, the dependent variable in the regression analysis was profit before tax ($pbt$) and the explanatory variables (regressors) are the traditional factors used in the FA, that is, operating revenue turnover (*ort*), cost of employees (*coe*), number of employees (*noe*), tangible fixed assets (*tfa*) and intangible fixed assets (*ifa*). To obtain the best possible estimates, the classical assumptions for a simple linear regression should be met. The formal model specification is shown below:

$$pbt_i^{FA} = \beta_0 + \beta_1 ort_i + \beta_2 coe_i + \beta_3 noe_i + \beta_4 tfa_i + \beta_5 ifa_i + \epsilon_i \quad (1)$$

The variables used are defined as follows (all related to company *i)*

*pbt*; profit before tax
*ort;* operating revenue turnover
*coe;* cost of employees
*noe;* number of employees
*tfa;* tangible fixed assets
*ifa;* intangible fixed assets
ε; error
*i;* is the company number.

[7] Descriptive statistics in Appendix A.

## Results

In this paper, we examine the explanatory power of the FA to explain the variability in profitability using the example of a sample of companies active within the EU internal market. We expect all the individual factors to make a positive and significant contribution to the generation of profit and we assume we will be constrained due to multicollinearity.[8]

As stated earlier, in this paper, we analyse the extent to which the factors in the FA represent profit-generating activities. We use regression techniques to analyse the relationship between the profit before tax (*pbt*) and the other factors used in the FA (*ort, coe, noe, tfa* and *ifa*). Firstly, the explanatory power of the FA under consideration was analysed, based on an examination of the adjusted coefficients of determination (adjusted $R^2$) of the proposed multivariate regression models.

**Table 3. Regression analysis**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| cons | 668.620*** | 446.456*** | 500.481*** | 466.614*** | 416.252*** | 464.706*** |
| | (83.717) | (84.396) | (84.634) | (84.908) | (84.844) | (84,924) |
| ort | 0.448*** | 0.328*** | 0.336*** | 0.324*** | 0.318*** | 0.323*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| coe | | 0.185*** | 0.264*** | 0.263*** | 0.177*** | 0.260*** |
| | | (0.007) | (0.010) | (0.010) | (0.007) | (0.010) |
| noe | | | -0.107*** | -0.118*** | | -0.118*** |
| | | | (0.430) | (0.434) | | (0.434) |
| tfa | | | | 0.050*** | 0.038*** | 0.050*** |
| | | | | (0.005) | (0.005) | (0.005) |
| ifa | | | | | | 0.013 |
| | | | | | | (0.010) |
| $R^2$ | 0.200 | 0.220 | 0.225 | 0.227 | 0.221 | 0.227 |
| adj. $R^2$ | 0.200 | 0.220 | 0.224 | 0.226 | 0.221 | 0.226 |
| Obs. N | 6,732 | 6,732 | 6,732 | 6,732 | 6,732 | 6,732 |

*Standard errors in parentheses. The significance levels are indicated by stars: $* p < 0.05$, $** p < 0.01$, $*** p < 0.001$; two-tailed tests.*
*Source: Authors' own calculations.*

[8] Correlation analysis in Appendix B.

Table 3 reveals the results of the regression analysis. We report standardized regression coefficients for the independent regressors and unstandardized coefficients for the constants, standard errors, number of observations and the $R^2$ values as well as the adjusted $R^2$ values[9]. The histogram of standardized regression residuals and the partial regression plots are shown in Appendix C.

As to the models' design, model (2) coincides with the FA used in Canada, model (4) with the CCCTB FA, model (5) corresponds to the Massachusetts FA and model (6) corresponds to our theoretical FA with the addition of intangible assets, as per the hypothesis that they are a relevant factor in value creation. The partial results indicated that the demand factor, sales by destination, is the dominant factor in the explanation of the generation of profit, hence model (1) was added. Similarly, model (3) was computed to exhibit the combination of sales by destination and labour factor.

Based on our empirical results, the best performing models, (4) and (6), provide an explanation for an equal degree of variability in profitability, 22.6 %. However, in model (6), intangible assets are statistically insignificant, and their inclusion does not enhance the explanatory power of the FA. Based on the partial results, the best performing FA is the CCCTB FA, nonetheless, as a cross-check on the best performing models, (4) and (6), we used the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan–Quinn Information Criterion (HQIC) as metrics to compare the fit of different regression models (see Table 4). AIC, SIC and HQIC are used for model selection as they measure how well the models fit the given data.

**Table 4. Information criteria**

| | (4) | (6) |
|---|---|---|
| *Akaike information criterion* | 136 662.6 | 136 663.4 |
| *Schwarz information criterion* | 136 696.7 | 136 704.3 |
| *Hannan–Quinn information criterion* | 136 674.4 | 136 677.5 |

*Source: Authors' own calculations.*

Lower values of information criteria indicate a better fit, hence models that have lower values of information criteria are those that are predicted to better "fit" the observed data. Based on the results, lower values for the information criteria were reported by model (4), this confirms that the CCCTB FA performs well when applied to the studied data set.

Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015) and Roggeman *et al.* (2012) further considered that restricted regression models[10] were better able to reflect the structure of the CCCTB FA where all the factors are equally weighted. Therefore, to additionally verify that the CCCTB FA was the best-performing FA, we added the restriction that the independent variables would be equally weighted in regression models (4) and (6) and performed a restricted regression analysis. The results revealed that the restricted model (4) explains 18.0 % of the variability in profitability and the restricted model (6) explained

[9] In addition, all the adj. $R^2$ obtained were tested for statistical significance. They were all statistically significant at the 1 per cent significance level, unless otherwise stated.
[10] Independent variables are restricted to be equal (restricted regressions).

17.3 %. Hence, the results of the restricted regression confirmed that the CCCTB FA is suitable.

To summarize, based on the results, the best-fit model, i.e., the FA that is best able to explain variability in profitability, is model (4), which corresponds to the CCCTB FA. The results suggest that intangible assets only play a rather minor role in the profit generation process and are not a value creation factor that has a statistically significant effect. The cost of employees produces a higher variance in profit than the number of employees, moreover, the number of employees has an inverse relationship with profit before tax. This has considerable relevance, especially within Central and Eastern European countries with relatively lower wages.

**Robustness analysis**

To verify the robustness of our results, the more extreme values, those below the 5$^{th}$ and above the 95$^{th}$ percentiles, were also omitted (as was done by Roggeman *et al.*, 2012). This resulted in the elimination of data from additional 1,309 companies, resulting in a final tally of 5,423 companies. We employed the Stepwise regression method as a step-by-step iterative construction of a regression model that involved the selection of independent variables to be used in the final model. The application of the Stepwise method, whose underlying goal is to find the best-fit model, produced an output of models (7) to (11) (see Table 6).

**Table 5. Robustness analysis**

| | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|
| cons | 364.974*** | 235.957*** | 213.026*** | 233.527*** | 238.504*** |
| | (30.784) | (31.999) | (32.312) | (32.539) | (32.629) |
| ort | 0.510*** | 0.405*** | 0.396*** | 0.396*** | 0.398*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| coe | | 0.180*** | 0.166*** | 0.242*** | 0.248*** |
| | | (0.006) | (0.006) | (0.010) | (0.010) |
| noe | | | | -0.099*** | -0.100*** |
| | | | | (0.439) | (0.439) |
| tfa | | | 0.058*** | 0.072*** | 0.073*** |
| | | | (0.006) | (0.006) | (0.006) |
| ifa | | | | | -0.023* |
| | | | | | (0.025) |
| $R^2$ | 0.260 | 0.281 | 0.284 | 0.287 | 0.288 |
| adj. $R^2$ | 0.260 | 0.281 | 0.284 | 0.287 | 0.287 |
| Obs. N | 5,423 | 5,423 | 5,423 | 5,423 | 5,423 |

*Standard errors in parentheses. The significance levels are indicated by stars: $*\ p < 0.05$, $**\ p < 0.01$, $***\ p < 0.001$; two-tailed tests.*
*Source: Authors' own calculations*.

The overall results of the robustness check revealed that, by a narrow margin, intangible assets were found to have a significant effect within the model, $p = 0.050$. Therefore, the best-fit model, according to the Stepwise regression, is model (11), which corresponds to our theoretical FA that includes intangible assets. However, the inclusion of intangible assets in the model does not significantly enhance the explanatory power of the FA. If we compare the adjusted $R^2$, we see that model (10), which corresponds to the CCCTB FA, and model (11) are equally effective in providing an explanation for the variability in profitability, i.e., 28.7 %. Moreover, within the model, the relationship between intangible assets and profit before tax was found to be an inverse correlation, even though it was expected to be positive. Table 5 shows the results of the robustness analysis. As a cross-check of the best-performing models, (10) and (11), we additionally report the AIC, SIC and HQIC (see Table 6).

**Table 6. Information criteria**

| | (10) | (11) |
|---|---|---|
| *Akaike information criterion* | 96 950.38 | 96 948.53 |
| *Schwarz information criterion* | 96 983.37 | 96 988.12 |
| *Hannan–Quinn information criterion* | 96 961.90 | 96 962.35 |

From the above results, we can see that model (10), which corresponds to the CCCTB FA, (without intangible assets), reports lower values for the additional metrics, thus it can be considered a better "fit" for the studied data. Furthermore, restricted regression models were also considered. Based on the results, the restricted regression version of model (10) explains 22.3 % of the variability in profitability and the restricted regression version of model (11) explains 20.4 % of the variability in profitability. With these results taken together, the robustness analysis confirmed the empirical results that the CCCTB FA is the most suitable formula, as it is able to explain the highest percentage of variability in profitability, moreover, all the factors included in the model are statistically significant. In addition, the robustness analysis confirmed that the factor of sales by destination is the dominant factor that explains the generation of profits and that the cost of employees better explains the variance in profit than the number of employees. Further, the inverse relationship between the number of employees and profitability was confirmed.

## Discussion

Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman et al. (2012) and Hines (2008), coincidentally, have applied the same methodological approach using cross-sectional microeconomic data obtained from the Amadeus database in the recent past. Most of the studies listed were triggered by the CCCTB Proposal, published in 2011, and the ensuing debate over a suitable composition of the FA. The degree to which the variability in profitability is explained by the various studies ranges from 22 % to 35 %. Coincidently, all of the mentioned studies, including ours, found that the most suitable FA was the CCCTB Proposal, the only exception being a study by Roggeman *et al.* (2012).

Our results, similar to those of Roggeman *et al.* (2012), showed that the inclusion of intangible assets does not enhance the performance of the FA and that intangible assets

have a statistically insignificant effect in the model. These results contradict the hypothesised importance of intangible assets in value creation. In this regard, it is important to distinguish between a statistical rejection and an economic context. It is imperative to initiate a discussion whether the statistical rejection arises from the unavailability of data or other potential limitations inherent in the analyses. Roggeman *et al.* (2012) elaborated that the current accounting methods used under the International Financial Reporting Standards (IFRS) require most intangibles to be expensed and, as a consequence, capitalized intangibles do not reflect how valuable intangible assets are to many companies. Dancaková *et al.* (2022) argued that due to the persistent conservatism of the IFRS, the actual value of intangible assets cannot be fully recognized and disclosed in financial statements. Taking into consideration that various definitions of intangible assets are employed in the field of taxation, accountancy, and transfer pricing of MNCs, it is hypothesised that intangible assets are undervalued in financial statements. Drawing upon the escalating corporate investments in intangible assets and the consequential issue of their suitable accounting treatment, the recent study conducted by Penman (2023) delved into novel approaches to address the accounting challenges associated with intangible assets.

The stated weaknesses of the current accountability of intangible assets, hypothetically, generate bias in the empirical results related to the significance of intangible assets as a factor of value creation. Alternatively, the result of the empirical analysis could also be interpreted as confirming the understatement of intangible assets in the financial statements of companies and outlining the need to adjust the rules of their reporting. As a consequence, we are of the opinion, as are Martins and Taborda (2022) and/or Corrado et al. (2009) that intangible assets are principally value-creation assets which have an increasing importance and their inclusion in the BEFIT FA should be considered by the policymakers. Moreover, we believe that omitting intangible assets would mean neglecting to consider a significant portion of total assets and one of the main sources of competitiveness of MNCs. In conclusion, given the escalating economic importance of platform business models and the continuous influx of corporate investments in intangible assets, it becomes imperative to adapt the current international tax framework to accommodate these dynamic shifts. Consequently, substantial adjustments need to be made to the international corporate tax framework to ensure its adequacy and alignment with the evolving business landscape. The incorporation of intangible assets within the BEFIT FA should be viewed as a component of the broader solution to address the existing conundrum. While it contributes to tackling the issue, it is important to recognize that it does not offer a comprehensive resolution in isolation, but rather represents one element within the larger framework of measures required to effectively address the challenges associated with intangible assets.

This paper contributes to the debate on EU-wide corporate taxation, currently enlivened by the impending BEFIT Proposal, and the related question of whether intangible assets should be included in its scope. The paper provides a general analysis of all sizes and types of companies which are active within the EU internal market to identify the factors of value creation and provide a springboard for further research in this field. In our analysis, we employed data for individual companies for 2018, thus our results reflect, to some extent, changes in the economy since the original CCCTB Proposal of 2011 and follow on from studies such as Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012) or Hines (2008). We believe that the usefulness of our paper lies in the revival of the discussion of the application of FA within the EU and our results

should be seen as a first attempt to provide a general empirical base for the upcoming discussion on BEFIT Proposal.

## Conclusion

The main aim of this paper was to carry out an empirical analysis of the explanatory power of the FA to explain the variability in profitability of companies active within the EU internal market. It includes an additional factor, intangible assets, to further explain the variability in profitability, and thus contributes to the debate around the impending BEFIT Proposal. We employed microeconomic data, for 2018, obtained from the Orbis database. Our final data set consisted of 6,732 companies active within the EU internal market. The empirical analysis of the explanatory power of the FA was, similar to Krchnivá and Nerudová (2018 and 2015), Krchnivá (2015), Roggeman *et al.* (2012) and Hines (2008), based on a comparison of the adj. $R^2$ from the regression models.

Our results revealed that the FA including the factor of intangible assets explains 22.6 % of the variability in profitability. However, the inclusion of intangible assets did not enhance the explanatory power of the FA. Moreover, the intangible assets were identified as statistically insignificant in the computed model. Based on the empirical results, it was concluded that the most suitable FA that provides a statistically significant explanation for the variability in profitability is the CCCTB FA, without the inclusion of intangible assets. An approach by Roggeman et al. (2012) was employed and augmented by the usage of the Stepwise regression to verify the robustness of the obtained results.

We must acknowledge that this paper has certain limitations. Firstly, we did not reflect the division of intangible assets as described by Martins and Taborda (2022). In this paper, we uniformly applied a proxy for intangible assets, as reported in the financial statements of the companies – the fixed intangible assets. This potentially could have influenced the results obtained and the statistical significance of the impact revealed. The aggregation of intangible assets arises from two primary factors: the limited availability of data in the Orbis database and the acknowledged weaknesses within existing accounting standards, particularly when it comes to the treatment of intangible assets. Furthermore, the specific nature of intangible assets further compounds the challenge. A significant constraint in this study was the inadequate reporting of intangible assets in the financial statements of companies, which hindered the ability to analyse different types of intangible assets individually. Consequently, these intangible assets were incorporated in an "aggregated form". It is worth noting that the reporting of intangible assets, such as digital data, lacks a standardized framework up to the present day, which restricts deeper empirical analyses focusing on distinct groups of intangibles. Moreover, we extracted the most up-to-date data from the Orbis database, dating from 2018, hence the considerable changes caused by the COVID-19 pandemic that, since 2020, has influenced the economies of the EU Member States, are not reflected in the data set used. We fully acknowledge that incorporating the consequences of the Covid-19 pandemic would be an intriguing aspect to consider in future research. Thus, our findings suggest that future research might wish to follow these directions: i) an empirical analysis that investigates subgroups of intangible assets that might be included in the FA, as per the theoretical explanation of Martins and Taborda (2022), and ii) the possibility of having a specification for the FA that applies to specific economic sectors.

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**Appendix A. Descriptive statistics**

| | Min. | Max. | Mean | Std. Deviation |
|---|---|---|---|---|
| *pbt* | -15,281.70 | 105,036.25 | 2,045.14 | 7,038.01 |
| *ort* | 30.65 | 1,167,062.01 | 35,702.74 | 81,705.82 |
| *coe* | 11.36 | 188,255.73 | 6,151.47 | 13,570.20 |
| *noe* | 1.00 | 3,939.00 | 126.64 | 287.60 |
| *tfa* | 0.00 | 203,901.09 | 4,874.70 | 15,699.51 |
| *ifa* | 0.00 | 130,591.81 | 1503.73 | 8,038.87 |

*Note: The data is in thousands of EUR, with the exception of the number of employees.*
*Source: Authors' own calculations*.

**Appendix B. Correlation analysis (Pearson correlation coefficients)**

| *Pearson correlation* | *pbt* | *ort* | *coe* | *noe* | *tfa* | *ifa* |
|---|---|---|---|---|---|---|
| *pbt* | 1 | | | | | |
| *ort* | 0.448* | 1 | | | | |
| *coe* | 0.397* | 0.647* | 1 | | | |
| *noe* | 0.288* | 0.555* | 0.789* | 1 | | |
| *tfa* | 0.222* | 0.377* | 0.359* | 0.377* | 1 | |
| *ifa* | 0.160* | 0.272* | 0.320* | 0.264* | 0.159* | 1 |

*The significance levels are indicated by stars: $* p < 0.05$.*
*Source: Authors' own calculations*.

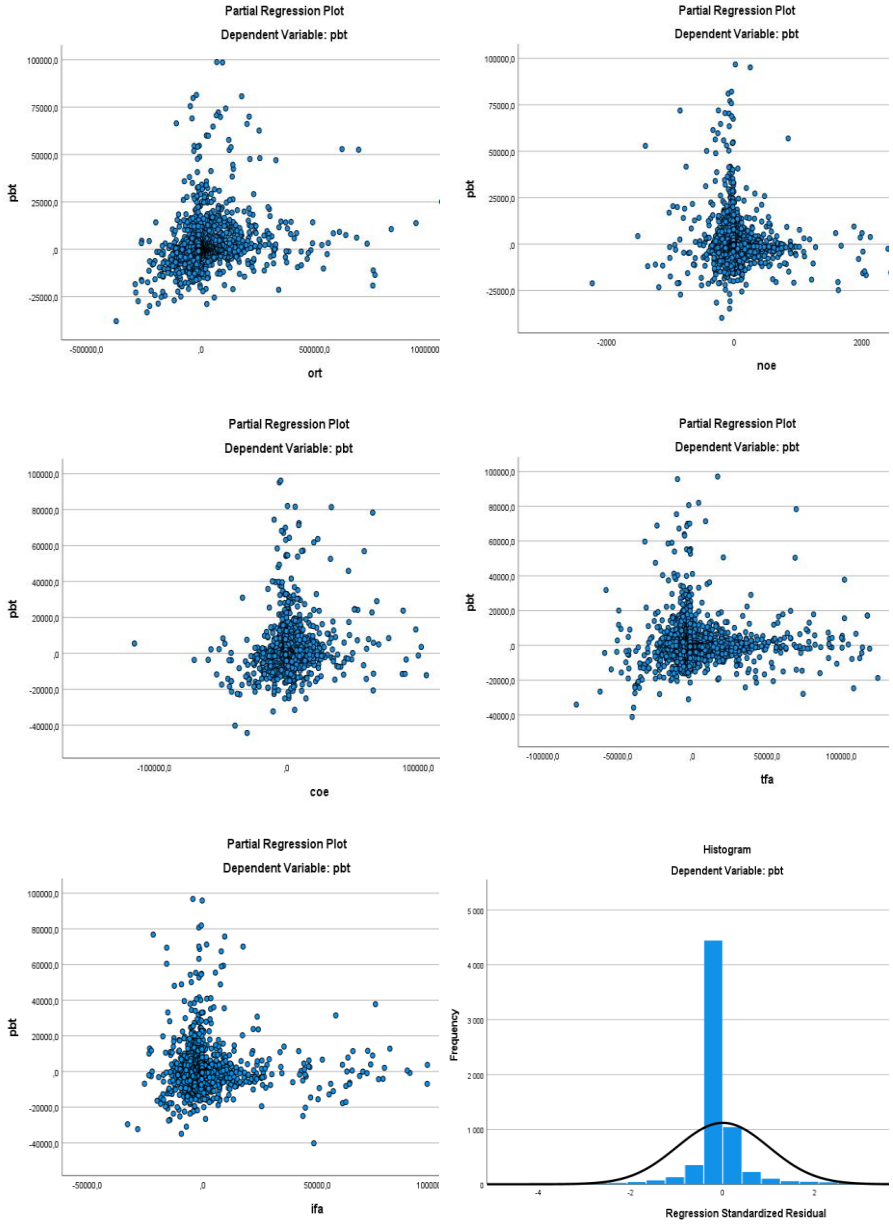
As expected, all the variables correlate both positively and significantly, however, none of the coefficients of correlation is above the suggested threshold (Gujarati, 2003) of $r = 0.800$. The highest partial correlation, $r = 0.789$ was, as expected, found between the number of employees and the cost of employees. Furthermore, the second highest correlation was identified between the cost of employees and operating revenue turnover, $r = 0.647$. To ensure the interpretation of the results does not contain any bias, following the regression analysis, we also analysed the variance inflation factor (VIF) for each regression model to measure multicollinearity in the set of multiple regression variables.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *ort* | 1 | 1.719 | 1.734 | 1.801 | 1.793 | 1.812 |
| *coe* | | 1.719 | 3.186 | 3.188 | 1.766 | 3.249 |
| *noe* | | | 2.677 | 2.737 | | 2.737 |
| *tfa* | | | | 1.225 | 1.198 | 1.226 |
| *ifa* | | | | | | 1.124 |

*Source: Authors' own calculations*.

The higher the value of VIF, the higher the correlation between a particular variable and the rest of the regressors. According to Tabachnick and Fidell (2012), if the VIF value is higher than 10, it is considered to have a high correlation with other independent variables and the issue of multicollinearity is present. However, the acceptance range is subject to requirements and constraints. The VIF ranges between 1.124 and 3.249 and thus, is below the recommended threshold. We conclude that the results suggest no multicollinearity constraints.

**Appendix C. Partial regressions plots, Histogram of standardized regression residuals**




*Source: Authors' own calculations.*