sciendo Economics and Business Review https://www.ebr.edu.pl Vol. 9 (3), 2023: 124–152 https://doi.org/10.18559/ebr.2023.3.798

Formulary apportionment in the European Union—future research agenda

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Abstract

The aim of the paper is to identify the relevant prior research focused on the Formulary Apportionment methodology in the European Union, to explore the current literature and develop directions for future research. Reflecting upon the announced European Commission's Proposal for new framework for business taxation and the foreseeable upswing of academic discussion focused on the formulary apportionment methodology this paper represents the first systematic literature review on this topic. The study identifies eight main thematic clusters, provides an interpretative framework and suggests valuable future research directions within each thematic cluster as well as general future research agenda.

Keywords

- formulary apportionment
- Common Consolidated Corporate Tax Base
- BEFIT
- systematic literature review

JEL codes: H25, H71, K34

Article received 26 February 2023, accepted 1 June 2023.

This Paper was supported by the Internal Grant Agency at Faculty of Business and Economics, Mendel University, Brno within a Doctoral project [IGA-PEF-DP-23-019].

Suggested citation: Mlčúchová, M. (2023). Formulary apportionment in the European Union—future research agenda. *Economics and Business Review*, *9*(3), 124–152. https://doi.org/10.18559/ebr.2023.3.798

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Introduction

This paper reflects the impending proposal for a new framework for corporate taxation in the European Union (EU) (BEFIT Proposal)[2] which will be based on the key features of the Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB proposal)[3] such as a single corporate tax rulebook and the Formulary Apportionment (FA). Given the impending BEFIT Proposal and the anticipated increase in scholarly and political discourse on the FA methodology it may be the appropriate time to summarize the existing research, confirm some insights and develop directions for future research.

This study conducts a systematic literature review to gather and synthesize the existing research on this topic. The main aim is to identify pertinent prior research examine the current literature with a focus on FA methodology and related aspects of the previously proposed but likely to be withdrawn CCCTB proposal. In addition, the study aims to provide guidance for future research and addresses the following research question: "What are the implications for further research suggested by findings of the systematic literature review?."

The review reveals eight thematic clusters and highlights the key findings. While some topics such as the effects on tax revenue and the factors of the FA methodology were extensively researched others such as the FAs' explanatory power of the variability in profitability of Multinational Companies' (MNC) or new forms of profit shifting resulting from FA implementation received relatively little attention. Based on the review significant and promising areas for future research were identified.

The remainder of this paper is organized as follows. Section 1 clarifies key definitions and conceptual matters. Section 2 describes the methodology applied and sampling process. Section 3 continues by discussing the results of the literature review including the theoretical foundations and temporal evolution of the literature. Section 4 suggests future research avenues. Section 5 presents conclusions, contributions, and main limitations of the study.

[2] Indicated in COM (2021) 251 final, 18.05.2021. Communication from the Commission to the European Parliament and the Council. Business Taxation for the 21st Century.

[3] COM (2016) 683 final, 25.10.2016. Proposal for a Council directive on a Common Consolidated Corporate Tax Base (CCCTB).

1. Theoretical framework

The Separate Accounting (SA) and the FA are the two major principles for corporate taxation. The SA with the arm's length principle requires MNCs to calculate a separate tax base in each tax jurisdiction as if each entity within the group were independent (Weiner, 2006). Whereas the FA is used at the sub-national level in the United States (US), Canada, Germany, or Switzerland the SA is currently applied in the EU.

Under the currently applied SA methodology MNCs utilise technical disparities among tax systems of the EU Member States to pursue aggressive tax planning, misuse of transfer pricing and the use of different methods of loss compensation to minimize their tax obligations which in turn means losses in tax revenues of national budgets and distortion of the internal market. Furthermore, there is a widespread perception that MNCs and purely domestic companies bear significantly different tax burdens. Additionally, the present global taxation system is widely regarded as incompatible with the globalized and digitized economy. Given the stated points it is justifiable to engage in a discussion concerning alternative approaches to the SA methodology in the EU such as the FA approach.

The theory underlying FA methodology, despite being vague, can be considered under the concept introduced by Musgrave (1972), i.e. source taxation. The theoretical concept of the FA is based on the idea of allocating profits of MNC among different tax jurisdictions where the MNC performs economic activity. The consolidated corporate tax base is distributed according to selected variables, factors reflecting the value creation of companies hence explaining the variability in profitability (McLure, 1981). Traditionally countries with sub-national FA systems have relied on a combination of (proxies for) production factors such as tangible assets, labour and third-party sales. Table 1 compares different forms of FA used in federal economies and the FA proposed by the European Commission. Table 1 lists FA's factors applied, information whether an industry specific formula is employed and theoretical classification reflecting both supply as well as demand sides of economy are reflected by the employed allocation factors.

The FA's application within the EU was first discussed together with other alternatives to the SA methodology by the European Commission in the Communication *Towards an internal market without tax obstacles*.[4] Consequently in 2011 the European Commission presented the early CCCTB proposal[5] which was re-launched in 2016 in a two-stage approach on Common

[4] COM (2001) 582 final, 23.10.2001.
[5] COM (2011) 121 final, 16.03.2011.

Table 1. Comparison of different formula configurations

Jurisdiction	Standard FA	Industry specific FA	Theoretical classification
Germany	– cost of employees.	no	supply
Switzerland	– separate accounting results – capital/cost of employees* or sales by destination**	yes	supply
Canada	– cost of employees – sales by destination	yes	supply–demand
The US (Massachusetts)	– tangible fixed assets – sales by destination – cost of employees	yes	supply–demand
CCCTB Proposal	– tangible fixed assets – sales by destination – cost of employees – number of employees	no	supply–demand
BEFIT Proposal	– tangible fixed assets – sales by destination – cost of employees – number of employees – intangible fixed assets	yes	supply–demand

* For manufacturing. ** For commerce.

Source: based on (Mayer, 2009).

Corporate Tax Base (CCTB proposal)[6] and Common Consolidated Corporate Tax Base (CCCTB proposal).[7] The configuration of the apportionment formula is outlined in Table 1. Whilst the CCTB proposal sets a single set of rules for the calculation of the corporate tax base some provisions such as a cross-border loss relief were destined to apply only when the full CCCTB proposal comes into force. However, complexities surrounding the definition of the consolidated tax base prompted the EU to shift focus away from immediate consolidation and prioritize the establishment of a common tax base as an initial step. The FA methodology was a constant and inseparable part of the overall CCCTB project.[8] Put on hold the CCCTB project was subsequently revived in 2021 in Communication on *Business taxation for the 21st century* which proclaimed a forthcoming BEFIT Proposal to be tabled in 2023. As stated earlier the BEFIT Proposal, coincidently with the CCCTB proposal, will be based on a single corporate tax rulebook and FA methodology.

[6] COM (2016) 0685 final, 25.10.2016.

[7] COM (2016) 683 final, 25.10.2016.

[8] The overall initiative at the EU level to implement the FA methodology under multiple CC(C)TB Proposals is further referred as the CCCTB project.

2. Methodology

This study aims to provide a systematic summary of the existing literature on the FA methodology and related features of the CCCTB proposal as well as to identify pertinent themes and opportunities for future research. To accomplish this a systematic approach to the literature review was adopted following mainly studies published in the *International Journal of Management Reviews*[9] as a leading global review journal in organization and management studies and *Technological Forecasting & Social Change*[10] focused on methodology and practice of technological forecasting.

The review process consisted of several steps necessary to obtain a list of articles. Two commonly used internet-based academic databases Web of Science (WoS) and Scopus which includes the leading taxation journals such as National Tax Journal or International Tax and Public Finance were perused. The search strategy consisted of general inclusion criteria and search boundaries within each of the employed database. As general inclusion criteria the following search string was applied: "formula*" AND "apportionment*" OR "common consolidated corporate tax base". Furthermore, no time restrictions

Table 2. Search boundaries

WoS	
Search in	Title, Abstract, Author Keywords, and Keywords Plus
Boolean operator	AND between the terms
Document type	"Article"
Citation topic	"Economic Theory", "Economics"
Exclusion criteria	Proceeding papers; Web of Science Categories: Environmental Studies, Geography
Scopus	
Search in	Title, Abstract, Author Keywords
Boolean operator	AND between the terms
Document type	"Article"
Source type	"Journal"
Subject area	"Economic, Econometrics and Finance", "Business, Management and accounting", "Social Science"

Source: own work.

[9] For instance (Schaltegger et al., 2021; Ceipek et al., 2019).
[10] For instance (Ancillai et al., 2023).

were set and the filter 'Language = English' was applied. Titles, abstracts and keywords were scanned to confirm that the study fits with the review scope. Table 2 summarizes the search boundaries subsequently applied within each database.

As a result of the applied search strategy (summarised in Table 2) 152 articles in the WoS database and 155 articles in the Scopus database were identified. Nevertheless, the obtained sample contained irrelevant studies, incorrect entries and duplicates. The data cleaning consisted of the following steps. First, removal of duplicates and incorrect entries. Besides, removal of articles based on titles and abstracts to verify whether the search results fit the content scope of the review. In this stage a total number of 114 articles was removed from the sample hence 148 studies were included in the full text review. Despite a rigorous review of titles and abstracts the full text analysis, the third step, revealed that many articles did not have the desired focus and thus 31 studies were removed. Table 3 shows the sequential steps of cleaning the sample of literature.

Table 3. Database search process and results

	WoS	Scopus	Total
Initial download of literature	152	155	307
Removal of duplicates and incorrect entries	–17	–99	–114
Removal of articles based on review of titles and abstracts	–24	–21	–45
Articles subjected to full text review	111	37	148
Exclusion based on full text review	–24	–13	–37
Inclusion of articles based on backward reference search			1
Total of articles included in the systematic review	87	24	111

Source: own work.

In total 111 research papers were identified as thoroughly and explicitly addressing the topic of the FA methodology and related features of the CCCTB proposal.

3. Results

In this section the theoretical foundations and temporal evolution of the literature is discussed. Based on the full text review main streams of literature were identified and corresponding thematic clusters were proposed (see Table 4).

Table 4. Thematic clusters and respective studies[11]

Cluster	Studies
Evaluation of the FA methodology and the CCCTB proposals	Polezharova and Krasnobaeva (2020), de Wilde (2020), Petkova and Weichenrieder (2020), McGaughey and Raimondos (2019), Lehoux et al. (2019), Khan Niazi (2017), Quentin (2017), Cerioni (2016), Riedel (2011), Herzig et al. (2010), Devereux and Fuest (2010), Schreiber and Fuhrich (2009), Eichner and Runkel (2008), Fuest (2008), Bogerd (2007), Conrad (2006), Eggert and Haufler (2006), Russo (2005), Gordon and Wilson (1986)
Composition and factors of the FA methodology	Martins and Taborda (2022), Hundsdoerfer and Wagner (2020), Krchnivá and Nerudová (2018), Llopis (2017), Eberhartinger and Petutschnig (2017), Swenson (2015), Merriman (2015), Roggeman et al. (2012, 2013), Fernandez (2012), Pirvu et al. (2011), Altshuler and Grubert (2010), Eichner and Runkel (2009), Edmiston and Granado (2006), Fox et al. (2005), Hellerstein and McLure (2004), Edmiston (2002), Goolsbee and Maydew (2000), McLure (1981, 2000), Anand and Sansing (2000), Shackelford and Slemrod (1998)
The FA's explanatory Power of the variability in profitability of MNCs	Hundsdoerfer and Wagner (2020), Krchnivá and Nerudová (2018), Nerudová and Krchnivá (2016), Roggeman et al. (2012)
Ability to eliminate profit shifting and tax base erosion	Cobham et al. (2021), Bloch and Demange (2021), de Mooij et al. (2021), Nerudová et al. (2020), Greil et al. (2019), Faccio and Fitzgerald (2018), Eichfelder et al. (2018), Kiesewetter et al. (2018), Cerioni (2015, 2016), Ortmann and Sureth-Sloane (2016), Martini et al. (2016), Sadiq (2015), Becker and Runkel (2013), Buettner et al. (2011), Altshuler and Grubert (2010), Gupta et al. (2009), Jarass and Obermair (2008), Riedel and Runkel (2007), Eggert and Haufler (2006), Fox et al. (2005), Kind et al. (2005), Sørensen (2004), Nielsen et al. (2003), Wetzler (1995), Munnell (1992)
Impact on tax revenues	Cobham et al. (2021), Nerudová et al. (2021), de Mooij et al. (2021), Nerudová and Solilová (2015, 2017, 2018, 2019), Mardan and Stimmelmayr (2018), Solilová et al. (2016), Hodzic (2015), Domonkos et al. (2013), Oestreicher and Koch (2011), Pirvu et al. (2011), Altshuler and Grubert (2010), Bettendorf, Devereux et al. (2010), Gupta et al. (2009), Devereux and Loretz (2008), Eichner and Runkel (2008), Pethig and Wagener (2007), Fuest et al. (2007), Edmiston and Granado (2006), Shackelford and Slemrod (1998)
Impact on tax competition and tax rates	Perotto (2021), Liesegang and Runkel (2019), Arel-Bundock and Parinandi (2018), Mardan and Stimmelmayr (2018), Gordon (2014), Roggeman et al. (2014), Sosnowski (2014), Wrede (2013, 2014), Fernandez (2012), Eichner and Runkel (2008, 2009, 2011, 2012), Riedel (2010), Becker and Fuest (2010), Kudrle (2009), Pethig and Wagener (2007), Pinto (2007), Eggert and Haufler (2006), Kind et al. (2005)

[11] Some studies cover multiple topics and hence, are listed in several clusters.

Table 4 continued

Cluster	Studies
Welfare effects	Runkel and Schjelderup (2011), Bettendorf, Devereux et al. (2010, Bettendorf, van der Horst et al. (2010), Eichner and Runkel (2008), Kind et al. (2005), Sørensen (2004), Nielsen et al. (2003), Edmiston (2002), Anand and Sansing (2000)
Miscellaneous	d'Andria et al. (2018), Cerioni (2018), Spinosa and Chand (2018), Gutmann and de la Bletiere (2017), Lacova and Hunady (2018), de Groot (2017), Gresik (2016), Matsumoto (2016), Garbarino (2014), Borg (2013), Becker and Runkel (2013), van de Streek (2012), Martini et al. (2012), Riedel (2010), Almendral (2010), Mitroyanni and Putzolu (2009)

Source: own work.

3.1. Evaluation of the FA methodology and CCCTB proposals

A significant body of literature addressed the question of whether FA is an attractive and feasible methodology compared to SA methodology as well as the theoretical arguments for and against its introduction. Studies within this stream of literature present varying findings and no unified conclusion has been offered. This section summarizes studies highlighting the benefits of the FA, studies highlighting its flaws, studies arguing that both systems are problematic and studies providing a general evaluation of the CCCTB proposal.

Several scholars argue that the implementation of the FA within the EU is long overdue. This position is supported by Polezharova and Krasnobaeva (2020), McGaughey and Raimondos (2019), and Lehoux et al. (2019). Polezharova and Krasnobaeva (2020) emphasized that a simple and transparent taxation mechanism based on the FA is highly desirable particularly for taxing e-commerce profits of MNCs. Similarly, McGaughey and Raimondos (2019) strongly supported the adoption of FA especially in the context of problematic definitions of national taxable income for MNCs and digital business models. Lehoux et al. (2019) confirmed the advantages of FA for fair distribution of the taxation base especially in technology and capital-intensive industries. In addition, Spinosa and Chand (2018) proposed a shared taxing rights mechanism for taxing specified digital activities or services that operate remotely.

Several authors have raised concerns over the feasibility of implementing FA within the EU. Riedel (2011), Schreiber and Fuhrich (2009), and Gordon and Wilson (1986) have argued that the current SA system should be maintained due to various drawbacks of the FA methodology. Gordon and Wilson (1986) noted that the FA may lead to inefficiently low tax rates and a shift to direct taxation of property. Riedel (2011) has highlighted that high corporate tax rates under the FA may harm domestic workers and diminish wages at for-

eign affiliates. Schreiber and Fuhrich (2009) have suggested that the SA has an advantage over FA as it does not pressure EU Member States to harmonize their anti-avoidance tax rules concerning non-EU countries.

Numerous studies have addressed the feasibility and attractiveness of the FA compared to the SA with no unified conclusion. Some studies support the FA, including those by Polezharova and Krasnobaeva (2020), McGaughey and Raimondos (2019), and Lehoux et al. (2019). Others including Riedel (2011), Schreiber and Fuhrich (2009) and Gordon and Wilson (1986), suggest maintaining the status quo. Several studies conclude that both systems have flaws and suggest a combined approach including those by Petkova and Weichenrieder (2020), Quentin (2017), Cottani (2016), Herzig et al. (2010), Eggert and Haufler (2006) and Conrad (2006). Eggert and Haufler (2006) emphasized practical difficulties associated with a switch to FA in the EU. Herzig et al. (2010) suggested supplementing SA with aspects of unitary taxation where necessary. Petkova and Weichenrieder (2020) discussed a hybrid model combining features of both systems. Finally, Conrad (2006) showed that the attribution method is arbitrary if the tax systems across jurisdictions are identical and neutral.

De Wilde (2020), Khan Niazi (2017), Cerioni (2016), Fuest (2008), Eichner and Runkel (2008), Devereux and Fuest (2010), and Russo (2005) evaluated the European Commission's proposals to implement the FA system in the internal market primarily under the CCCTB proposals. Russo (2005) provided an overview of FA, summarized currently used FA in federal economies, discussed the definition of the group and tax base, and proposed an alternative method, the profit split method. Fuest (2008) suggested that more economic evidence of benefits from FA implementation is needed while Eichner and Runkel (2008) reported an increase in welfare from FA implementation in the EU. Khan Niazi (2017) stated that the CCCTB proposal is pragmatic and may result in tangible progress while Devereux and Fuest (2010) concluded that the main drawback of the CCCTB project is profit shifting to low tax countries outside the EU. De Wilde (2020) recommended remodelling the CCCTB proposal into a unitary taxation model[12] for taxing the global profits of MNCs using a destination-based FA.[13]

3.2. Composition and factors of the FA methodology

The distribution of the consolidated corporate tax base under FA is determined by chosen factors that reflect value creation which can impact the tax

[12] The unitary tax model is an approach to taxing global profits that consolidates the profits of MNCs across multiple jurisdictions.

[13] Destination-based FA is method how to tax MNCs based on where the goods and services are consumed rather than where they are produced or where the MNC is headquartered.

base distribution and potential profit shifting. Production factors based on tangible assets, labour and third-party sales have traditionally been used in sub-national FA systems while intangibles and financial assets have been excluded due to mobility and transfer pricing concerns. The design and choice of FA factors have been examined by various authors with different objectives and results. This section summarizes the main findings of this literature.

The composition of FA has been widely discussed by various authors. Pirvu et al. (2011) examined the impact of FA on tax revenues while Fernandez (2012) emphasized the importance of the FA design for practical application and conflict resolution. Altshuler and Grubert (2010) pointed out the potential asymmetry between the determinants of taxable income and the factors that enter the FA. Roggeman et al. (2013) studied the design of the FA and concluded that including more factors with equal weights would create an efficient FA and reduce MNCs' incentive for profit shifting. Krchnivá and Nerudová (2018) explored whether FA should be distinguished based on different economic sectors. Meanwhile McLure (1981)[14] argued that the FA methodology transforms corporate income tax into a direct tax on the factors applied in the FA and Goolsbee and Maydew (2000) found that using payroll in FA partially turns the corporate income tax into a payroll tax.

The labour factor has been investigated by Eberhartinger and Petutschnig (2017) who suggested that using the payroll factor based on the number of employees can help analyse the effects of employee costs on tax allocation. The importance of wages for tax allocation has been explored by Fox et al. (2005), Hellerstein and McLure (2004), Anand and Sansing (2000), Shackelford and Slemrod (1998), and McLure (1981). Goolsbee and Maydew (2000) studied the inclusion of payroll in the FA and found that it affects state-level employment. Merriman (2015) replicated their results but noted that the econometric evidence is weak.

The allocation of taxable income in the context of the FA factors has been discussed by various authors with a particular focus on the sales factor. Swenson (2015) found that a single sales factor FA had no significant effect on aggregate employment but that locally based companies could benefit from the FA application. Llopis (2017) also considered a single sales factor FA and an alternative based on assets and labour concluding that the former was more efficient at combating profit shifting by MNCs. Other authors have suggested that increasing the weight of the sales factor could have positive effects on the utilization of productive factors (Edmiston & Granado, 2006; Fox et al.,

[14] McLure (1981) claimed that by using factors as a basis for income allocation the tax burden shifts from being solely focused on the income itself to also encompassing the underlying factors, such as assets, the labour and the sales generated by the taxpayer. This transformation alters the nature of the tax system broadens its reach beyond income and potentially impacts the overall economic dynamics and behaviour of taxpayers.

2005) and mitigate fiscal externalities caused by tax competition (Eichner & Runkel, 2008). Hundsdoerfer and Wagner (2020) agreed that increasing the weight of the sales factor could improve FA performance to some extent but that significant profit deviations would remain.

Several authors have explored alternatives to traditionally applied factors in the increasingly digitalized and globalized economy. McLure (2000) addressed the application of FA to the digitalized economy and the inclusion of new types of value-creating assets. Roggeman et al. (2012) empirically tested the inclusion of intangible assets in FA while Martins and Taborda (2022) argued for the recognition of certain categories of intangible assets. Hellerstein and McLure (2004) suggested the inclusion of value added as a conceptually attractive approach but one that is subject to transfer pricing issues. The authors emphasize the considerable contribution of intangible assets to the creation of economic value and suggest their incorporation in the FA.

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

In accordance with pertinent theory (Hundsdoerfer & Wagner, 2020; Krchnivá & Nerudová, 2018; Nerudová & Krchnivá, 2016; Roggeman et al., 2012) it is highly desirable for the allocation formula to effectively capture and mirror the profit generation process of companies. Nevertheless Weiner (2006) contended that explanatory power alone does not encompass all desired attributes.[15] 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 Hundsdoerfer and Wagner (2020), Krchnivá and Nerudová (2018), Nerudová and Krchnivá (2016), and Roggeman et al. (2012) who used microeconomic data to estimate the percentage of explained variability in profitability through regression analysis. The CCCTB FA was found as the best performing formula explaining between 26.32% and 35% of the variability in profitability. While 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. Additionally, Roggeman et al. (2012) found that the inclusion of intangible assets did not enhance the explanatory power of FA.

[15] Weiner (2006) asserted that the preferred formula should not be solely based on performance superiority, but rather prioritize characteristics of simplicity, comprehensibility, feasibility, and acceptability to individual states.

3.4. Ability to eliminate profit shifting and tax base erosion

There is a large body of literature examining MNCs' profit shifting activities under both SA and FA systems. Some view the FA methodology as a potential solution to this problem while others argue that FA could create new distortions and provide further tax avoidance opportunities potentially even strengthening MNCs' profit shifting activities.

Nerudová et al. (2020), Jarass and Obermair (2008), and Fox et al. (2005) examined profit shifting of EU MNCs under SA. Nerudová et al. (2020) identified primary profit shifting channels and quantified tax revenue losses. Fox et al. (2005) affirmed that SA generally leads to substantial tax distortions and tax planning opportunities. Jarass and Obermair (2008) detailed the decline in competitiveness of small and medium-sized enterprises that pay the full domestic tax rate.

Scholars have expressed a positive outlook towards the ability of the FA system to address profit shifting by MNCs. Faccio and Fitzgerald (2018), Sadiq (2015), Eggert and Haufler (2006), and Munnell (1992) are among the authors who support the FA methodology. According to Faccio and Fitzgerald (2018), FA has the potential to reduce the allocation of profits to low-tax jurisdictions where MNCs have minimal economic activities. Munnell (1992) similarly suggested that FA can effectively curb international profit shifting. Sadiq (2015) proposed the implementation of industry-specific unitary taxation based on FA as a solution to profit shifting, particularly for MNCs in the financial sector.

Cobham et al. (2021), de Mooij et al. (2021), Eichfelder et al. (2018), Kiesewetter et al. (2018), Martini et al. (2016), Buettner et al. (2011), Sørensen (2004) and Nielsen et al. (2003) have argued that while the implementation of FA may limit profit shifting under SA it may also create new opportunities for tax avoidance that must be addressed. Cobham et al. (2021) specifically discussed the application of FA at the EU level stating that it could overlook the extent of profit shifting out of the EU which was also addressed by previous studies such as Kudrle (2009), Shackelford and Slemrod (1998), Wetzler (1995) and Musgrave (1972) in the context of US MNCs. Buettner et al. (2011) noted that profit shifting incentives remain important under FA as it is only abolished within the corporate group if all group affiliates of an MNC are consolidated.

Martini et al. (2016) demonstrated that FA provides opportunities for profit shifting a view shared by Kiesewetter et al. (2018) who argued that FA may lead to a shift from manipulating reported profits to influencing the apportionment key. Eichfelder et al. (2018) supported this by suggesting that MNCs may alter the allocation of production factors and manipulate the FA factor using tax avoidance strategies. Sørensen (2004) agreed that while FA has the potential to create new distortions if existing tax rate differences are maintained. Furthermore, de Mooij et al. (2021) concluded that this is fore-

seeable based on the experience of federal states currently utilizing the FA system. Lastly, Nielsen et al. (2003) found that switching from SA to FA may strengthen profit shifting activities by MNCs in a model where transfer prices are used to manipulate the behaviour of a subsidiary.

The literature generally agrees that neither system fully prevents profit shifting and the effectiveness of each system depends on the MNCs' response to changes in corporate tax rates. This view is supported by studies such as Bloch and Demange (2021), Greil et al. (2019), Ortmann and Sureth-Sloane (2016), Cerioni (2015, 2016), Becker and Runkel (2013), Altshuler and Grubert (2010), Gupta et al. (2009), Riedel and Runkel (2007) and Kind et al. (2005).

Kind et al. (2005) argued that SA and FA differ in their ability to prevent profit shifting and maintain national tax autonomy. Riedel and Runkel (2007) found that while FA could initially reduce profit shifting from the EU to non-FA tax havens in the long run it could lead to negative externalities under the water's edge. However, the negative externality is less harmful than profit shifting under SA and may offset other externalities under FA. Altshuler and Grubert (2010) demonstrated that SA and FA distort behaviour in different ways and FA has no clear advantage over SA. Becker and Runkel (2013) concluded that both tax regimes distort the international allocation of ownership taking into consideration the behavioural changes of MNCs triggered by the shift from SA to FA. Ortmann and Sureth-Sloane (2016) analysed the conditions under which the FA or SA is advantageous for MNCs, focusing on loss-offsets. They found that the FA is preferred for increasing loss/profit streams while the SA is beneficial for decreasing profit/loss streams.

Bloch and Demange (2021) and Greil et al. (2019) have identified significant challenges associated with taxing the profits of MNCs in the digital economy and particularly digital platforms. Bloch and Demange (2021) found that digital platforms can shift profits from high-tax to low-tax jurisdictions by exploiting network externalities under SA and manipulating the apportionment key under FA even in the absence of transfer pricing. Greil et al. (2019) concluded that recent reforms aimed at curbing profit-shifting activities have led to increased legal uncertainty and while the FA has potential to mitigate this problem its integration into the existing transfer pricing framework raises complex delineation issues.

3.5. Impact on tax revenues

The literature has extensively examined the impact of the FA methodology on corporate income tax revenues. The impact of the integrated FA methodology on tax revenues for EU Member States has been a topic of interest for many authors in the context of the CCCTB proposal. Results obtained from

various researchers vary and a clear conclusion has not yet been reached. The evaluation of revenue studies presents inherent complexities due to their reliance on publicly available data. Therefore, understanding the specific formula and dataset examined is crucial for accurate assessment. To address this concern a comprehensive summary of the methodology and data of empirical studies has been provided in the Appendix for reference and further insight.

De Mooij et al. (2021) stated that large economies generally experience an increase in corporate income tax revenues under FA with developing countries gaining mostly if employment is heavily weighted in the FA. Pethig and Wagener (2007) claimed that high tax countries are likely to gain tax revenues under FA while low tax countries are likely to lose revenues. Bettendorf et al. (2010) simulated the impact with a Computable General Equilibrium (CGE) model and concluded that higher tax revenues could be achieved by the implementation of the CCCTB proposal but only if accompanied by corporate tax rate harmonization. Mardan and Stimmelmayr (2018) found that a shift from SA to FA unambiguously decreases tax revenues in the short run while in the medium-term tax revenues are still lower under FA if the probability of incurring losses or the costs of profit shifting are sufficiently low.

Various scholars including Cobham et al. (2021) and Fuest et al. (2007) have examined the potential for loss offsetting in the CCCTB proposal. Fuest et al. (2007) found that loss offsetting would cause a 20% reduction in the EU corporate tax base with larger countries gaining at the expense of smaller low-tax countries. Similarly, Cobham et al. (2021) found that implementing the CCCTB proposal with loss consolidation would lead to substantial tax revenue costs equal to about one fifth of the corporate tax base with profit shifting EU countries such as Luxembourg, Ireland and the Netherlands experiencing significant revenue losses.

Nerudová and Solilová (2019) and Oestreicher and Koch (2011) have examined the potential impact of both mandatory and voluntary implementation scenarios of the CCCTB proposal. Nerudová and Solilová (2019) found that exclusively mandatory implementation for large MNCs would lead to a 4.2% reduction in the total tax base due to cross-border loss offsetting during the consolidation regime. Conversely Oestreicher and Koch (2011) argued that the revenue effect of the CCCTB hinges on the nominal tax rate of each EU Member State resulting in a decline of 4.56% under a compulsory and 4.65% under a voluntary CCCTB.

Within this stream some authors have focused on the implications on tax revenues of individual EU Member States. Pirvu et al. (2011) found that implementation of the CCCTB in Romania would lead to a 0.04% reduction in the corporate tax base. Domonkos et al. (2013) employed a similar methodology to analyse the impact of the CCCTB proposal in Slovakia finding that it would result in a 31.9% decrease in tax revenues in 2009 and a 14.6% drop in 2010. Hodzic (2015) discussed the pros and cons of implementing the CCCTB

in Croatia while Nerudová and Solilová (2015) and Solilová et al. (2016) conducted a detailed analysis of different implementation scenarios and their impact on the tax revenues of the Czech Republic. They found that if the CCCTB were implemented obligatorily, the Czech Republic would gain an additional 3.39% of corporate tax revenue compared to the current system but if cross-border loss offsetting were allowed the Czech Republic would lose 0.78% of current corporate tax revenues. Nerudová and Solilová (2015) noted that the size of the country may affect the impact on the share of the tax base with the Czech Republic recording a 1.22% increase in tax revenues if the CCCTB proposal were introduced in all EU Member States. The authors also found a slight increase in tax revenues in Slovakia, Slovenia and Spain but a decrease in Germany, Estonia, Hungary, and Poland. Nerudová and Solilová (2018) claimed that mandatory implementation of the CCCTB system in the Eurozone would negatively affect the tax base in the Czech Republic while Nerudová and Solilová (2017) analysed the impact of the implementation steps on the amount of tax base allocated in Slovakia and concluded that while the first step would decrease the total corporate tax base by 0.27%, the overall corporate tax base in Slovakia would increase after the second implementation step by 3.02%. Devereux and Loretz (2008) performed a comprehensive analysis indicating that the corporate tax revenues of EU Member States would be reduced by approximately 2.5% on average with Hungary, the Czech Republic and Slovakia potentially gaining additional tax revenues and the largest decrease in tax bases facing Germany. However, depending on the exact design of the FA countries such as Hungary and Slovakia could see an increase in tax revenues of around 50% mainly at the expense of Denmark, Finland, Germany, Italy and Luxembourg. Finally, Nerudová et al. (2021) focused on the economic environment in the EU after Brexit and concluded that the overall tax base under the CCCTB in the post-Brexit period would decline by 5.34%. Some authors such as Bettendorf et al. (2010) have argued that an increase in tax revenues cannot be achieved if the FA is not accompanied by corporate tax rate harmonization. Thus, this paper focuses on the impact of the FA on tax competition, tax rates and related fiscal externalities.

3.6. Impact on tax competition and tax rates

This section analyses the impact of the FA methodology and partly the CCCTB proposal on tax competition[16] and the possibility of affecting corpo-

[16] Tax competition as defined in the literature refers to the phenomenon where jurisdictions engage in strategic measures to attract or retain economic activity by implementing policies that offer more favourable tax conditions compared to other jurisdictions.

rate income tax rates. Gordon (2014) conducted an analysis of corporate tax competition with regard to the CCCTB proposal and found that it would immobilize the tax base, eliminate competitive expansion and raise taxes. Furthermore, the author argued that the individual interests of EU Member States conflict with direct tax harmonization and that the CCCTB proposal is unlikely to adhere to the objectives of the EU internal market which lacks a legal basis under EU law. Kudrle (2009) argued that the global adoption of the FA could reduce the appeal of tax competition. Liesegang and Runkel (2019) found that tax revenue equalization under the FA may better mitigate detrimental tax competition. Additionally, Mardan and Stimmelmayr (2018) demonstrated that higher weighting of input shares in the FA may mitigate tax competition. However, Eggert and Haufler (2006) argued that countries are likely to offer overly generous tax breaks to MNCs. Finally, Wrede (2014) analysed asymmetric tax competition under the FA and concluded that a larger country tends to impose a higher tax rate than a smaller country.

Eichner and Runkel (2011) argued that tax rates are too low under both FA and SA systems and that changes in one country's tax rate affect other countries through changes in the interest rate. Riedel (2010) also identified inefficiencies in corporate tax rates under FA. However, Kind et al. (2005) found that reducing trade barriers under SA leads to lower equilibrium corporate taxes but higher taxes under FA. Pinto (2007) developed a framework in which regional governments strategically determine corporate tax structures under FA and concluded that tax rates increase under FA. Finally, Eichner and Runkel (2008) have shown that a transition from SA to FA using a sales-only formula would raise average tax rates by 2%.

Sosnowski (2014) and Perotto (2021) examined the CCCTB proposal's impact on tax competition. Sosnowski (2014) suggested that the CCCTB proposal could enhance transparency in tax regimes while maintaining tax competition. However, Bettendorf et al. (2010) argued that harmonizing tax rates could hamper economic growth. Perotto (2021) asserted that the CCCTB proposal could reduce incentives for profit shifting thus affecting tax competition.

MNCs engage in profit shifting through transfer pricing and debt-equity structures to reduce tax liabilities which leads to fiscal externalities and tax competition between governments. Fernandez (2012), Becker and Fuest (2010), Riedel (2010), Eichner and Runkel (2008, 2009) have investigated the fiscal externalities of corporate tax policies under both FA and SA. Becker and Fuest (2010) found that tax enforcement levels may be too high under SA due to negative externalities while under FA tax enforcement may be too low due to positive externalities. Riedel (2010) reported a sizable positive externality. Eichner and Runkel (2008) suggested that FA with a sales factor can mitigate or eliminate fiscal externalities. Eichner and Runkel (2009) analysed the taxation of MNCs under SA versus FA in the presence of labour market imperfections concluding that unemployment externalities exist under FA but not under SA.

3.7. Welfare effects

Several studies have examined the welfare implications[17] of transitioning from SA to FA. The effect of this shift was addressed by Runkel and Schjelderup (2011), Bettendorf, Devereux et al. (2010), Bettendorf, van der Horst et al. (2010), Eichner and Runkel (2008), Kind et al. (2005), Sørensen (2004), Nielsen et al. (2003), Edmiston (2002) and Anand and Sansing (2000). Bettendorf, Devereux et al. (2010) used a CGE model to assess the welfare effects of consolidation with FA and concluded that it does not yield substantial welfare gains in the EU. Similarly, Nielsen et al. (2003) and Sørensen (2004) found that the welfare effects of the transition from SA to FA are ambiguous. However, Eichner and Runkel (2008) showed that the transition to a sales-only FA results in an increase of welfare. Finally, Anand and Sansing (2000) argued that coordinated use of the same FA maximizes aggregate social welfare but that at least one state can increase its welfare by deviating from this coordinated solution.

3.8. Miscellaneous

A 'Miscellaneous' section was established to reflect additional supplementary findings. Studies by Gresik (2016), Becker and Runkel (2013), Martini et al. (2012) and Riedel (2011) focused on the behavioural response of MNCs to FA implementation within the EU internal market. Barrios et al. (2020) used a CORTAX model to investigate the macroeconomic impacts of the CCCTB proposal which aims to reduce compliance costs and increase economic efficiency. Van de Streek (2012) addressed the consolidation concept as a crucial feature of the CCCTB project while Mitroyanni and Putzolu (2009) discussed the business reorganization linked to the loss-offset of companies. The cross-border loss relief conundrum was similarly addressed by Almendral (2010). Borg (2013) and Cerioni (2015) discussed how losses are treated under the CCCTB proposal. Gutmann and de la Bletiere (2017) gave an overview of the main provisions of the CCCTB proposal containing a cross-border element. D'Andria et al. (2018) reflected on the bonus allowance for R&D in the CCCTB proposal. Garbarino (2014) addressed the major tax design issues with respect to foreign branches and controlled companies. Spinosa and Chand (2018) focused on taxing digitalized business models, Matsumoto (2016) analysed the effect

[17] Even though the stated studies define the welfare effects differently (see the list of reference for further insights) this paper utilizes a simplified understanding of the concept as typically referring to the impact of a policy, intervention, or change on the overall well-being or welfare of individuals or society.

of corporate income taxation with FA on public-input provision, Lacova and Hunady (2018) analysed the effect of the CCCTB proposal on the innovation performance of EU Member States and entrepreneurial innovation activity, de Groot (2017) discussed the participation exemption, the switch-over provision and the controlled foreign company rules in the CCCTB proposals, and Cerioni (2018) discussed complementing the harmonization of the tax base with a uniform minimal tax rate applied at the EU level.

4. Future research agenda

In line with the research question posed the possible future research avenues based on the conducted literature review are outlined. Throughout this paper it is stated that the extant research efforts are rather fragmented as outlined in Table 4 with highly heterogeneous and even opposing results. In general the future research around the FA methodology and potentially the related features of the impending BEFIT proposal should reflect the considerable changes caused by the COVID-19 pandemic, Russia's invasion of Ukraine which has, lead to price volatility, supply shortages, security issues, economic uncertainty and the realities of the digitized context and global developments. Discussing the main findings and contributions within each cluster opportunities for future research were identified in particularly important and promising areas. The identified future research agenda for selected thematic clusters is stated in Table 5.

Table 5. Future research agenda for each thematic cluster

Cluster	Future research agenda
Evaluation of the FA methodology and the CCCTB proposals	The evaluation of the FA methodology and the related features of the BEFIT Proposal should consider the increasingly digitalised and globalised context together with the considerable changes caused by the epidemiological and geopolitical realities of nowadays As asserted by Weiner (2006) the preferred formula should not be solely based on performance superiority but rather prioritize characteristics of simplicity, comprehensibility, feasibility and acceptability to individual states. Reassessing all potential formula configurations considering the stated criteria is essential

Table 5 continued

Cluster	Future research agenda
Composition and factors of the FA methodology	Reevaluating the proposition of equal weight allocation to factors in FA through an empirical examination of microeconomic data FA distinguished from the perspective of different economic sectors defined by the NACE codes with special focus on economic sectors with a relatively higher importance of intangible assets as value creating factors Research focused on alternative factors with special attention paid to the intangible assets and value added Both empirical and theoretical analysis of the amendment of the CCCTB FA suggested by the European Parliament in 2018*, i.e. extension of the FA with a fourth factor based on digital data, collected and exploited Emphasis placed on the examination of accounting standards concerning digital data, alongside the identification and analysis of potential inadequacies associated with the current state of art. Given the escalating economic significance of platform business models and the ongoing influx of corporate investments in intangible assets it becomes essential to adapt the existing international tax framework to effectively accommodate these dynamic transformations. In this regard it is crucial to thoroughly examine the inclusion of intangible assets as an integral aspect of the proposed FA considering it as a constituent of a comprehensive resolution strategy to tackle the multifaceted challenges inherent in the digitalized context
The FA's explanatory power of the variability in profitability of MNCs	The impending BEFIT FA's explanatory power of the variability in profitability of MNCs together with possible inclusion of alternative value creating factors Empirical analysis of the explanatory power of the CCCTB FA including factor digital data, as proposed by the European Parliament in 2018
Ability to eliminate profit shifting and tax base erosion	Addressing the new possible forms of profit shifting precisely manipulating / influencing the apportionment key and potential of strengthening of the profit shifting of MNCs under the FA Evaluation of each FA factor according to their robustness to profit shifting / manipulation activities of MNCs As the considered implementation of the FA methodology within the EU internal market overlooks the profit shifting of EU MNCs outside of EU jurisdictions the possible extension of FA to countries outside the EU jurisdiction and the tax revenue implications can be further analysed in both empirical and theoretical way
Impact on tax revenues	Strengthening of the research on the tax revenue implications on the EU Member States in the post Brexit period as researched by Nerudová et al. (2021) Empirical analyses of the tax revenue implications of the BEFIT FA on the EU Member States

Table 5 continued

Cluster	Future research agenda
Impact on tax competition and tax rates	Better understanding of the fiscal spill-over effects between EU Member States that choose a national subsidy or a national special depreciation and the subsequent effects on its partner countries (Petkova & Weichenrieder, 2020)
Miscellaneous	Further research both empirical and theoretical is needed to design optimal FA to distribute the profit of MNCs based on digital platforms Additionally, the impact on trade with third countries and the international competitiveness of the EU Member States, EU MNCs and EU domestic companies

* European Parliament legislative resolution of 15 March 2018 on the proposal for a Council directive on a Common Consolidated Corporate Tax Base (CCCTB).

Source: own work.

Conclusions

This paper presents a systematic literature review on the FA methodology and the related features of the CCCTB proposal considering the upcoming BEFIT proposal. The review identified eight thematic clusters (see Table 4) based on 111 research papers (see Tables 2 and 3) and separately discussed each cluster. The paper provided opportunities for future research in selected thematic clusters and a general future research direction (see Table 5).

To date no systematic literature review has been conducted on the FA methodology and the CCCTB project. Despite the valuable insights gained from existing studies there is still a fragmented understanding of the topic. This study clusters current knowledge and identifies areas for future research contributing to ongoing and upcoming academic discussions particularly with regards to the anticipated BEFIT proposal.

However, it should be noted that the review is limited to English-language peer-reviewed articles retrieved from selected search terms and databases but excluding potentially valuable insights from non-English publications, books, book chapters and/or conference proceedings.

Appendix

Study	Data sample / methodology
Nerudová et al. (2021)	Micro-data, database: Amadeus and Bankscope.
de Mooij et al. (2021)	(1) company-level data, database: Orbis, EU MNCs; (2) country-level data, affiliates of US MNCs worldwide; database: Bureau of Economic Analysis; (3) country-by-country reports by US MNCs with revenue greater than USD 850 million, database: Internal Revenue Service
Cobham et al. (2021)	Micro-data, database: Orbis, years: 2007–2015, total: 34,266 individual companies, which consolidate in up to 19,223 groups
Nerudová and Solilová (2019)	A semi-dynamic model, database: Amadeus and Bankscope, year: 2014
Nerudová and Solilová (2018)	Micro-data, database: Amadeus and Bankscope, 2,424 parent companies with 3,860 CZ subsidiaries
Nerudová and Solilová (2017)	Micro-data, database: Amadeus and Bankscope, Two groups of companies: i) SK subsidiaries of the EU parent companies (52,689 tax residents in the SK), ii) EU subsidiaries with parent companies in the SK (728 entities); year: 2015
Solilová et al. (2016)	Micro-data, database: Amadeus and Bankscope, 1,597 CZ parent companies with 2,476 subsidiaries in the CZ and other EU Member States and, 827 other EU parent companies with 1,384 subsidiaries in the CZ
Nerudová and Solilová (2015)	Micro-data, database: Amadeus, i) Parent company in CZ and subsidiaries in EU, ii) Parent company in EU and subsidiaries in EU
Domonkos et al. (2013)	Micro-data, 11 MNCs operating in the SK (8 of prevalently industrial nature, 3 service oriented), years: 2009–2010
Oestreicher and Koch (2011)	Micro-data, database: Amadeus, 11,350 EU MNCs (with 66,110 companies), years: 1994–2003
Pirvu et al. (2011)	Micro-data, 9 MNCs and all their subsidiaries active in RO (37 subsidiaries), years: 2006–2009
Devereux and Loretz (2008)	Micro-data, database: Orbis, companies registered in one of the 25 pre-2007 EU Member States
Fuest et al. (2007)	Combined dataset, DE company-level foreign direct investment data and balance sheet information on the parent companies, years: 1996–2001

Source: Own work.

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