Offshoring in the European Union: a Study of the Evolution of the Tax Burden

Elisabeth Bustos-Contell[1], Salvador Climent-Serrano[2], Gregorio Labatut-Serer[1]

ABSTRACT

One of the most serious effects of offshoring is tax avoidance, which harms the economies of the affected regions. In an attempt to eradicate tax avoidance, the EU seeks to establish tax harmonization across its Member States. Based on data for 2006–2014, this study analyzes the historical evolution and current trends of a convergence or divergence of the tax burden for 15 EU Member States. The effective tax rate was used to assess the tax burden. This study used a novel approach to analyze the tax burden and conducted a cluster analysis to examine changes in the effective tax rates between 2006 and 2014. The results imply that when the economy prospers, effective tax rates tend to converge. In contrast, during periods of economic downturns, effective tax rates diverge. This divergence occurs because of differences in Member States' tax policies that reflect the various strategies that are adopted by different Member States to combat economic crises. Therefore, the tax harmonization criteria that were established by the EU are relegated to the background and offshoring is encouraged.

KEY WORDS: Offshoring, Tax Convergence, Effective Tax Rate, Tax Burden

JEL Classification: H26; H7

[1] Department of Accounting, University of Valencia, Spain;
[2] Department of Financial and Actuarial Economics. Faculty of Economics. University of Valencia, Spain

Introduction

Since Kaplan's (1975) study regarding effective corporate tax rates, scholars' interest in the tax burden has increased because of different tax policies that have been adopted in successive macroeconomic environments, both locally and globally. The tax burden is such a popular topic, that certain scholars have written reviews on tax research (Hanlon & Heitzman, 2010).

Correspondence concerning this article should be addressed to: **Salvador Climent-Serrano,** Department of Financial and Actuarial Economics. Faculty of Economics. University of Valencia. Campus Els Tarongers s/n, 46022 Valencia, Spain. Email Salvador.climent@uv.es

Different research streams focus on different aspects of the tax burden. Scholars have studied the tax burden from a macroeconomic perspective (Loretz, 2007) and a microeconomic perspective using data from company accounts (Chen, Chen, Cheng, & Shevlin, 2010; Crabbe & Vandenbussche, 2009). Other scholars compared the effects of applying different tax policies in different regions.

Scholars have studied the effective tax burden in different countries within a particular region: Devereux, Lockwood, and Redoano (2008), Dyreng, Hanlon, Maydew, and Thornock (2017) in the US, Kim, Li, and Zhang (2011), Overesch and Rincke (2011) in Europe, Richardson and Lanis (2007) in Australia, Suzuki (2014) in Asia. Other studies have compared countries

across different continents. For example, Chennells and Griffith (1997) and Jacobs and Spengel (2000) compared European versus non-European countries and ambitious research projects by Abbas and Klemm (2013) and Chen and Mintz (2011) examined 50 and 83 countries, respectively.

It is important to discuss the different measures that can be used to assess the tax burden. The statutory tax rate (STR) is the tax rate that a country applies to companies that are located within that country's borders. In Europe, the STR ranges from 12.5% in Ireland to 34% in Belgium. The effective tax rate (ETR) represents the tax rate that companies actually (or effectively) pay after accounting for applicable deductions and tax breaks within the country's tax system.

Numerous attempts have been made to achieve tax harmonization within the EU. However, despite these attempts, corporate tax rates have never been fully harmonized. Buijink, Janssen, and Schols (2002) and Marques and Pinho (2014) report significant differences in the tax burden across the primary European countries.

Countries establish tax rates and conversely, companies traditionally seek methods to reduce their tax bills (Holtzblatt, Geekie, & Tschakert, 2016; Lisowsky, 2010). This desire to pay less tax has led companies to offshore their operations to countries with more favorable tax rates (Dyreng & Markle, 2016; Graham, Hanlon, & Shevlin, 2011). Certain multinationals use transfer pricing to channel profits to one of their other companies that is located in a country that has low tax rates.

Council Directive (EU) 2016/1164 of 12 July 2016 was recently approved to mitigate the problem of tax avoidance in the EU. This directive formalizes rules against tax avoidance practices that directly affect the functioning of the internal market[1]. The Council Directive is based on the Base Erosion and Profit Shifting (BEPS) Project report that was published by the Organisation for Economic Co-operation and Development (OECD, 2017). This report offers recommendations to ensure countries work more closely together to eliminate controversial legal loopholes that enable tax avoidance.

This new Council Directive seeks to minimize offshoring and ensure that companies comply with their tax obligations in the country where they oper-

ate, thereby fulfilling their social duty, rather than simply moving their taxable income to countries with lower tax rates. The EU's goal is to achieve full harmonization to prevent the implementation of aggressive tax policies that lead to tax avoidance by tax-paying companies.

In accordance with the goal of Council Directive (EU) 2016/1164 of 12 July 2016, the European Commission recently heavily fined Apple for taking advantage of low tax rates in Ireland. In doing so, the European Commission sent a warning to other large firms that tax engineering would not stop them having to pay the taxes they owe.

Notably, the aforementioned Council Directive was approved only last year. Therefore, the issues that are addressed in this study are highly topical, which justifies its relevance. This study used empirical data to investigate whether the primary EU Member States (including the United Kingdom) differ significantly in terms of their tax burden. Accordingly, the effective tax rate (ETR) of 15 EU countries was analyzed. The ETR was used because it is the most widely used indicator to measure a country's tax burden (Armstrong, Blouin, & Larcker, 2012; Fairfield & Jorratt De Luis, 2016; Kaplan, 1975). Our primary goal was to study how these differences evolved over time to determine whether there is a tendency towards convergence that would lead to tax harmonization and subsequently, the absence of undesirable offshoring to countries with lower tax rates.

This study contributes to extant literature in several ways. First, this study offers a current analysis of the historical evolution and current trends regarding a convergence or divergence of the tax burden across Europe that results from tax policies that have been applied by EU Member States. Second, the number of countries included in the analysis (15) is considerably larger than the number of countries that have been analyzed in prior studies that compared tax systems across European countries. Therefore, this study provides a substantially broader perspective of the current situation. Third and most importantly, the study's primary contribution to extant literature is the application of cluster analysis, a novel technique for studying the tax burden. Cluster analysis is a method that is commonly used in other fields, such as medicine and the geosciences, and allows us to group countries based on

the similarity of their ETRs; therefore, it should reveal how tax harmonization has evolved over time.

The ETR was chosen as an indicator of the tax burden in each country for this study's empirical analysis based on a rigorous literature review. From a methodological perspective, we selected the sample to avoid biases and justify the procedure that we used. For example, outliers were removed because they might have distorted the mean. In addition, non-representative data were removed from the data set.

The primary result is that during periods of economic prosperity, there is a tendency towards a common tax policy. Accordingly, the tax burden tends to converge. In contrast, during periods of economic downturn, an absence of convergence can be observed and each country applies its own tax policy. This situation results in divergence in the tax burden.

The paper is organized as follows. Section 2 presents the theoretical framework, reviews extant literature and states the hypothesis. Section 3 describes the method, sample characteristics, and variables that are used in the empirical study. Section 4 presents and discusses the results of the analysis. Finally, Section 5 discusses the conclusions of the study.

Literature review and hypotheses

The fundamental goal of studies that compare tax burdens in different regions is to determine whether tax burdens differ, which may affect decisions regarding company location and therefore, may affect the conditions necessary for a free market. Notable studies include those conducted by Chennells and Griffith (1997), Chen et al. (2010), Chen and Mintz (2011), Dyreng and Markle (2016), Dyreng et al. (2017), Hanlon and Heitzman (2010), Kim et al. (2011), Soriano (2005). In most of the aforementioned articles, the authors reach valuable conclusions regarding the homogeneity or heterogeneity of tax burdens and particularly, their causes and effects. Nevertheless, none of these studies focuses on observing the evolution and trends of tax burdens, for either individual regions or the entire area that was included in the studies.

For example, Chennells and Griffith (1997) compared the STR and ETR in four non-European countries (Australia, Canada, Japan, and the US) and six European countries (France, Germany, Ireland, Italy, Spain, and the UK) between 1985 and 1994.

The authors determined that the countries with the greatest spread between the two rates were Germany, Italy, and Spain.

Jacobs and Spengel (2000) compared the ETRs of companies located in France, Germany, the Netherlands, the UK, and the US over 10 years. These scholars used an innovative measure of a specific ETR that was calculated as a percentage of profit and indicated how much profitability each company lost because of taxes. These scholars determined that tax burdens varied across different sectors within the same country and across different countries within the same sector. They reported that the UK had the lowest tax burden, followed by the US and the Netherlands. France and Germany had the highest ETRs.

Overesch and Rincke (2011) studied the ETRs of 32 European countries between 1983 and 2006 and reported that tax competition led to a reduction in tax rates. Fernández, Martínez, and Álvarez (2008) focused on Europe and studied data for publicly traded companies from 19 EU countries between 1995 and 2005. These scholars tested how reductions in the STR since 1995 affected the ETR. The analysis demonstrated that these reductions in the STR did not reduce the tax burden. The companies were subject to approximately the same ETRs in 2005 as in 1995. However, after 1995, there was a drop in the ETR, although it remains unconfirmed whether this was an isolated reduction or a new trend. The scholars leave this question open to future studies, which provides a starting point for this study.

Offshoring for tax reasons is an issue that greatly concerns governments. In response to this problem, numerous scholars have studied variations in the tax burdens of different countries and attempted to identify significant differences that may lead to offshoring (Buijink et al. 2002; Lisowsky, 2010).

Lisowsky (2010) and Devereux et al. (2008) argue that the introduction of the Common Consolidated Corporate Tax Base (CCCTB) in Europe could cause substantial changes in locational investment decisions and a shift in the economic substance of low-tax countries. Holtzblatt et al. (2016) reached a similar conclusion after examining international strategies of tax minimization and financial reporting and efforts by governments to combat tax avoidance through offshoring.

Lanis and Richardson (2012) report that a significant relationship exists among offshoring, tax aggressiveness, and the composition of boards of directors. Accordingly, a link exists between important corporate governance characteristics and the tax burden.

Dyreng and Markle (2016) studied the extent that financial constraints affected tax-motivated income shifting by US multinationals between 1998 and 2011. The authors report that financially constrained multinationals shift 20% less income from the US to foreign countries than unconstrained multinationals.

Another notable study, Buijink et al. (2002), analyzed tax policies of 15 EU Member States between 1990 and 1996. The author sought to identify substantial differences in tax burdens (in terms of the ETR) that might influence company location decisions by offering competitive advantages that distort free competition. The authors determined that tax incentives differed significantly among countries and caused greater variations in ETRs than in STRs.

Buijink et al.'s (2002) study offers a starting point for this study because of its similarities in terms of geographical coverage and sample characteristics. Although certain aspects of their study differ from the current study, both studies sought to observe differences in tax burdens. Based on the literature review and the scope of the present study, the two following hypotheses are proposed:

Proposition for the first hypothesis: Tax rates are identical across the 15 EU countries that are analyzed in this study. Therefore,

Null hypothesis H_0: ETRs and STRs are the same among the 15 EU countries that are analyzed in this study.

Alternative hypothesis H_1: ETRs and STRs differ among the 15 EU countries that are analyzed in this study.

Proposition for the second hypothesis: From 2006 to 2014, the process of tax harmonization in the EU implied that tax rates converged over time. Therefore,

Null hypothesis H_0: Tax rates converged during 2006–2014.

Alternative hypothesis H_1: Tax rates diverged during 2006–2014.

Sample and research design

Sample
Our sample includes data from 2006 to 2014. The data were gathered from the Orbis database, which belongs to Bureau van Dijk Electronic Publishing. The sample includes firms located in all EU Member States, with the exception of the 13 countries that acceded to the EU after 2003: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, Romania, and Croatia.

These countries were excluded to avoid distorting the results because of economic disparities. Therefore, the first selection criterion was to limit the sample to companies that are located in the 15 countries and have a relatively uniform economic environment. These 15 countries include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the UK.

Financial services companies, which have a very specific nature, were removed from the sample because they were in similar studies (Buijink et al. 2002; Crabbe & Vandenbussche, 2009; Lisowsky 2010; Soriano, 2003). The next filter was publicly traded companies that presented consolidated accounts because offshoring for tax reasons is easier for large companies. In addition, we removed companies that provided incomplete data or lacked the necessary data to calculate the variables for any year between 2006 and 2014.

This process yielded a sample of 777 companies with complete data and resulted in a total of 6,993 observations between 2006 and 2014. However, similar to prior studies (Buijink et al. 2002; Gupta & Newberry, 1997; Plesko, 2003), companies with inconsistent information or outliers were removed to avoid distorting the results of the statistical tests. Therefore, the final sample included 6,249 observations. Table 1 provides the number of companies and observations in the sample by EU Member State.

Tax preference measures
In the study that acted as the precursor to tax research, Kaplan (1975) highlighted the effective tax rate (ETR) as a measure of the tax burden and stressed the usefulness of ETR as an analysis tool. Since that study, numerous scholars have used this measure to conduct empirical studies. Notable examples include Armstrong et al. (2012), Fairfield and Jorratt De Luis (2016), Fullerton (1984), Gupta and Newberry (1997), Lisowsky (2010), Wang (1991), Zimmerman (1983).

Table 1. Changes in the sample after the data cleansing process

Country	After applying filters		Data cleansing process	
	Companies in the sample	Observations in the initial data set (after filters)	Observations removed	Observations in the final data set
Germany	178	1,652	248	1,354
Austria	28	252	13	239
Belgium	23	207	16	191
Denmark	35	315	21	294
Spain	27	243	23	220
Finland	43	387	49	338
France	93	837	54	783
Greece	25	225	57	168
Netherlands	29	261	26	235
Ireland	20	180	8	172
Italy	20	180	34	146
Luxembourg	8	72	4	68
Portugal	3	27	1	26
UK	169	1,521	131	1,390
Sweden	76	684	59	625
Total	777	6,993	744	6,249

There are numerous types of ETR and each one depends on the nature of the taxes that are used to calculate it (Fullerton, 1984). Despite the broad range of ETRs, according to Giannini and Maggiulli (2002, p. 2), "The existence of different indicators is not, per se, a shortcoming of this kind of analysis, but simply reflects the fact that each indicator measures different things." These authors argue that there is no universally valid ETR because the researchers' choice of ETR depends on the approach of the study and, more importantly, how that approach is applied.

This study employed the effective average tax rate (EATR), which is defined by Fullerton (1984) as the average tax rate imposed upon the assets or past operations of the company. Conversely, Buijink et al. (2002) defined the EATR as an indicator that measures taxes paid by a company in a fiscal year divided by financial accounting income.

The EATR was utilized for this study because it is the most suitable indicator when the goal is to examine the tax burden to compare companies, regions, or tax systems; measure variations over time; or analyze the effects of changes in tax regulations. Swank and Steinmo (2002) and Evers, Miller, & Spengel (2015) used the EATR in their studies. The specific EATR used in this study is the corporate EATR, which considers only corporate income tax. The goal was to isolate accrued corporate tax from other taxes (Suzuki, 2014).

The tax preference measure that was used in this study combined the effective average tax rate (EATR) and the corporate tax, which yielded the average effective corporate income tax accrued. Based on accounting data, the ETR used in this study was calculated as the corporate income tax paid divided by the pre-tax accounting profit. This combination of ETRs aligns with Omer, Molloy, and Ziebart (1991) recommendation to use more than one ETR measure in empirical studies. In this study, as in numerous prior studies (Chen et al. 2016; Dyreng & Lindsey, 2009; Gupta & Newberry, 1997; Hanlon & Heitzman, 2010; Markle & Shackelford, 2012; Phillips, 2003; Robinson & Sansing, 2008), the ETR was compared against the STR.

Table 2. One-factor ANOVA for STR and ETR

	STR					ETR				
	Sum of squares	d.f.	Mean square	F	Sig.	Sum of squares	d.f.	Mean square	F	Sig.
Within group	13.01	14	0.93	1,426.78	0.00	5.43	14	0.398	40.82	0.00
Between group	4.06	6234	0.001			59.27	6,234	0.01		
Total	17.07	6248				64.70	6,248			

Research design

To determine whether significant differences exist between the means of the tax burdens in the countries that were analyzed in this study, we performed ANOVA and a robust test of differences between the means of the STRs and the ETRs for each country. Any significant differences that were revealed by the analysis were then examined in greater detail to analyze these differences and their evolution over time. Therefore, it was possible to assess the tax harmonization policy of the EU.

A cluster analysis was performed. Cluster analysis is a multivariate statistical method that is used to group objects based on their similarity and is defined as the distance between objects (Loster, 2013). The distance is calculated based on the distance matrix, which is constructed using the squared Euclidean distance, as per the following formula.

$$d(x_i, x_j) = \sum_{c=1}^{p} (x_{ic} - x_{jc})^2$$

where i and j are the explanatory variables (*STR* and *ETR,* respectively) that are used to calculate the differences between countries. Therefore, the squared Euclidean distance measures the differences among the 15 countries in terms of these two variables.

The objects for this study were the 15 EU Member States; the cluster analysis grouped the countries for each year between 2006 and 2014. The goal was to study how tax harmonization evolved over time. The explanatory variables (STR and ETR) were used to group the countries and both indicators were considered in the empirical analysis. The sum of the squared Euclidean distance for each country was analyzed for each year to observe how the squared Euclidean distances evolved quantitatively over time. Finally, two tests were performed to check the results of the cluster analysis: an analysis of the standard deviations for each year and the sum of the differences between means in terms of the absolute values of the ETR.

The analysis was conducted in SPSS, which forms clusters of objects according to the squared Euclidean distances among those objects. Cluster analysis is commonly used to study groupings in other disciplines, such as geoscience (Asante & Kreamer, 2015) and medicine (Sonğur & Top, 2016). However, the use of cluster analysis is a novel approach to analyze ETR. Although Regis, Cuestas, and Chen (2015) and Chen, Cuestas, and Regis (2016) conducted their studies using cluster analysis, they used a different technique and examined only the STR.

Results

Results of the ANOVA

Table 2 provides the results of the ANOVA that was conducted in SPSS. Based on the data in Table 2, the null hypothesis is rejected. Therefore, significant differences exist in the mean values for STR and ETR among the EU15 countries. This result is consistent with the results that were reported by Buijink et al. (2002), which analyzed the evolution of differences and tax harmonization between 1990 and 1996.

Robust test of differences between means

The robust test of differences between means indicates that the differences between means are significant for almost all pairs of countries for STR and ETR. Tables 3 and 4 present the results of the robust test of differences of means between pairs of countries for the STR and ETR across all years included in the sample.

The first null hypothesis, which proposed that the tax rates for all 15 countries are equal, is rejected. This

Table 3. Difference between means of the STR in each country

Nominal	Germany	Austria	Belgium	Denmark	Spain	Finland	France	Greece	Netherlands	Ireland	Italy	Luxembourg	Portugal	UK	Sweden
Germany	0	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.005	0.001	0.001
Austria	0.072***	0.000	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003	0.003	0.004	0.005	0.002	0.002
Belgium	-0.018***	-0.090***	0.000	0.002	0.003	0.002	0.002	0.003	0.002	0.003	0.003	0.004	0.005	0.002	0.002
Denmark	0.069***	-0.003	0.087***	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.002	0.002
Spain	0.013***	-0.059***	0.031***	-0.056***	0.000	0.002	0.002	0.003	0.002	0.003	0.003	0.004	0.005	0.002	0.002
Finland	0.071***	-0.0004	0.090***	0.002	0.058***	0.000	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.002	0.002
France	-0.030***	-0.102***	-0.012***	-0.099***	-0.043***	-0.101***	0.000	0.002	0.002	0.002	0.002	0.003	0.005	0.001	0.001
Greece	0.077***	0.005*	0.095***	0.008***	0.064***	0.005**	0.107***	0.000	0.003	0.003	0.003	0.004	0.005	0.002	0.002
Netherlands	0.064***	-0.007***	0.082***	-0.004***	0.051***	-0.007***	0.094***	-0.012***	0.000	0.003	0.003	0.004	0.005	0.002	0.002
Ireland	0.197***	0.125***	0.215***	0.128***	0.184***	0.125***	0.227***	0.120***	0.132***	0.000	0.003	0.004	0.005	0.002	0.002
Italy	-0.007***	-0.078***	0.011***	-0.076***	-0.020***	-0.078***	0.023***	-0.083***	-0.071***	-0.203***	0.000	0.004	0.005	0.002	0.002
Luxembourg	0.031***	-0.041***	0.049***	-0.038***	0.018***	-0.040***	0.061***	-0.046***	-0.034***	-0.166***	0.037***	0.000	0.006	0.003	0.003
Portugal	0.034***	-0.037***	0.053***	-0.034***	0.022***	-0.037***	0.064***	-0.042***	-0.030***	-0.162***	0.041***	0.004	0.000	0,005	0,005
UK	0.055***	-0.017***	0.073***	-0.013***	0.042***	-0.016***	0.085***	-0.022***	-0.009***	-0.142***	0.062***	0.024***	0.020***	0.000	0.001
Sweden	0.063***	-0.009***	0.081***	-0.006***	0.050***	-0.008***	0.093***	-0.014***	-0.001	-0.134***	0.070***	0.032***	0.029***	0.008	0

Notes: Upper right portion of table: Standard errors. Bottom left portion of table: Difference between means with significance levels of 1%, 5%, and 10% denoted by *, **, and ***, respectively

Table 4. Differences between means of the ETR in each country

	Germany	Austria	Belgium	Denmark	Spain	Finland	France	Greece	Netherlands	Ireland	Italy	Luxembourg	Portugal	UK	Sweden
Germany	0.000	0.007	0.008	0.006	0.007	0.006	0.004	0.008	0.007	0.008	0.008	0.012	0.019	0.004	0.005
Austria	0.053***	0.000	0.009	0.008	0.009	0.008	0.007	0.010	0.009	0.010	0.010	0.013	0.020	0.007	0.007
Belgium	0.056***	0.003	0.000	0.009	0.010	0.009	0.008	0.010	0.009	0.010	0.011	0.014	0.020	0.008	0.008
Denmark	0.026***	-0.026***	-0.030***	0.000	0.009	0.008	0.007	0.009	0.009	0.009	0.009	0.010	0.013	0.020	0.006	0.007
Spain	0.0480***	-0.005	-0.008	0.022**	0.000	0.008	0.007	0.010	0.009	0.010	0.010	0.014	0.020	0.007	0.008
Finland	0.0558***	0.003	-0.002	0.029***	0.008	0.000	0.006	0.009	0.008	0.009	0.010	0.013	0.020	0.006	0.007
France	-0.017***	-0.070***	-0.073***	-0.044***	-0.065***	-0.073***	0.000	0.008	0.007	0.008	0.009	0.012	0.019	0.004	0.005
Greece	0.033***	-0.019**	-0.023**	0.007	-0.015	-0.023**	0.051***	0.000	0.010	0.011	0.011	0.014	0.021	0.008	0.008
Netherlands	0.069***	0.017*	0.013	0.043***	0.021**	0.014	0.087***	0.036***	0.000	0.010	0.010	0.013	0.020	0.007	0.007
Ireland	0.096***	0.043***	0.040***	0.070***	0.048***	0.040***	0.114***	0.063***	0.027***	0000	0.011	0.014	0.021	0.008	0,008
Italy	-0.053***	-0.106***	-0.109***	-0.079***	-0.101***	-0.109***	-0.036***	-0.086***	-0.123***	-0.149***	0.000	0.014	0.021	0.008	0,009
Luxembourg	0.027**	-0.026*	-0.029**	0.001	-0.021	-0.029	0.044***	-0.006	-0.042***	-0.069***	0.080***	0.000	0.022	0.012	0,012
Portugal	0.055***	0.003	-0.006	0.029	0.007	-0.000	0.073***	0.022	-0.014	-0.0408**	0.109***	0.028	0.000	0,019	0,005
UK	0.033***	-0.019**	-0.022***	0.007	-0.014**	-0.022***	0.051***	0.000	-0.036***	-0.063***	0.087***	0.007	0.022	0.000	0,005
Sweden	0.031***	-0.022***	-0.025***	0.005	-0.017**	-0.025***	0.048***	-0.002	-0.038***	-0.065***	0.084***	0.004	-0.003	0,003	0,000

Notes: Upper right portion of table: Standard errors. Bottom left portion of table: Difference between means with significance levels of 1%, 5%, and 10% denoted by *, **, and ***, respectively
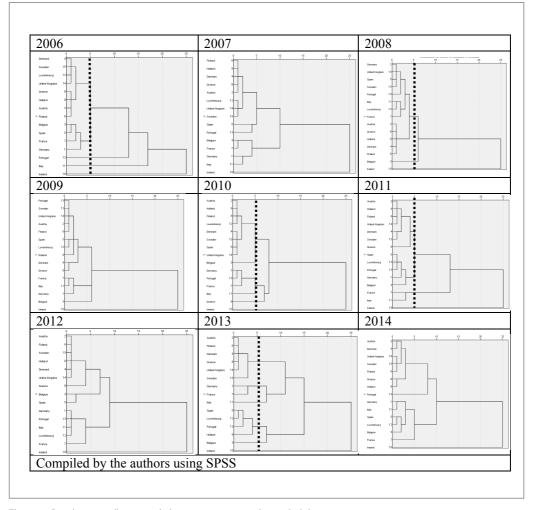
Figure 1. Dendrograms illustrating links among groups with rescaled distances

rejection leads to the acceptance of the alternative hypothesis, which proposed that the tax rates differ among the EU15 countries.

Cluster analysis

After identifying the significant differences in the tax rates across countries, we conducted a cluster analysis to test the second hypothesis and analyze how tax rates evolved between 2006 and 2014. The goal was to confirm whether the goal of tax harmonization in the EU has been achieved. The explanatory variables were the STR and the ETR for each country for each year that was included in the study.

Dendrograms were used in the cluster analysis. Dendrograms are defined as classification trees. Dendrograms are used to graphically represent the summary of the grouping process that results from a cluster analysis. Similar objects (in this study, countries) are connected via links. The positions of these links in the dendrograms are determined by the distances
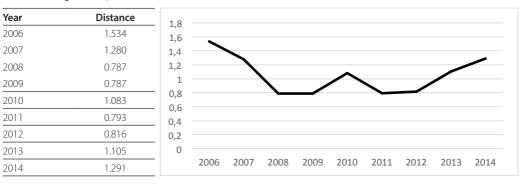
Table 5 and Figure 2. Squared Euclidean distance

Year	Distance
2006	1.534
2007	1.280
2008	0.787
2009	0.787
2010	1.083
2011	0.793
2012	0.816
2013	1.105
2014	1.291

among the objects. Figure 1 provides the dendrograms that resulted from the cluster analysis.

According to Figure 1, from 2006 to 2008, the number of clusters and the distances decreased. This result implies that the tax rates, both STR and ETR, evolved towards convergence. In 2006, with the rescaled distance of five points, five clusters resulted from the analysis. The first cluster included Denmark, Sweden, Luxembourg, the UK, Greece, the Netherlands, Austria, and Finland. The second cluster included Belgium, Spain, France, and Germany. The remaining three clusters included only one country each: Portugal, Italy, and Ireland. Therefore, these three countries diverged the most from the other EU15 countries. In 2008, using the same rescaled distance, three clusters resulted from the analysis. The first cluster included all the countries, with the exception of Belgium and Ireland, which made up the second and third clusters, respectively. However, for the next three years (2009 to 2011), the trend changed and the number of clusters increased to six in 2010. In addition, the distance of the five rescaled points increased, which implies a greater variation in the tax rates during this period. However, in 2011, once again, the distances decreased and the number of groups decreased to four. Finally, from 2012 to 2014, the number of groups increased to six.

To quantify the information that is illustrated by the dendrograms, the sum of the squared Euclidean distances among all the countries was calculated for each year of the study. Table 5 and Figure 2 present the corresponding results.

The distances are calculated as the sum of the squared Euclidean distances among all the EU15 countries.

The sum of the squared Euclidean distances for each year confirms what is observed in the dendrograms. The divergence between the tax rates, for both the STR and the ETR, decreased between 2006 and 2008 (from 1.534 to 0.787), then increased until 2010 (1.083), decreased again in 2011 (0.793), and increased again until 2014 (1.291).

Although the divergence in tax rates decreased from 1.534 to 1.291 between 2006 and 2014, the difference between the tax rates in 2014 was nearly identical to the difference in 2007 (1.280). Therefore, this analysis demonstrates that over the seven-year period, despite fluctuations in the differences in tax rates, the final difference was ultimately the same as at it was near the beginning of the study period.

To complete the empirical analysis, we checked the results of the cluster analysis using two tests: an analysis of the standard deviations for each year and the sum of the differences between means in terms of the absolute values of the ETR. Figure 3 provides the standard deviations of the mean ETR for each year. Figure 4 provides the sum of the differences between means across countries in absolute values.
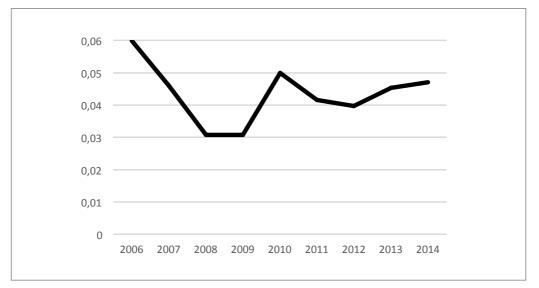
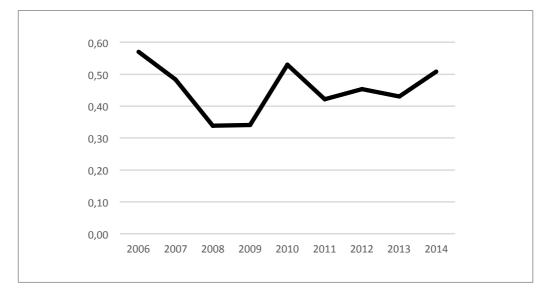**Figure 3.** Standard deviation ETR

Figure 4. Sum of the differences between the means of the absolute values of the ETR

Both tests confirm the results that were obtained by the cluster analysis and the analysis of squared Euclidean distances. The evolution of the tax burden in the EU15 countries between 2006 and 2014 may appear erratic; however, a comparison of the tax burden and the economic cycle indicates that the two phenomena are closely related. The results demonstrate that during periods of economic growth, the tax burden approaches harmonization. In contrast, during periods of recession, the gap in tax rates increases. Consequently, the second

null hypothesis is rejected and the alternative hypothesis is accepted. Notably, during periods of economic prosperity, tax rates converge and during periods of recession, tax rates diverge.

Conclusions

Countries have expressed a concern regarding the need to address tax avoidance, which has led to the recent publication of the BEPS report. This study responds to the EU's desire to harmonize the tax burden across all Member States. The goal of this study was to provide evidence of whether the tax policies that were adopted between 2006 and 2014 led tax rates to converge or diverge. If tax rates diverge, companies would be inclined to pay taxes in countries with lower tax rates. This empirical study compared the STR and ETR that were imposed upon 6,249 companies located in 15 EU countries with similar economic conditions.

A robust analysis of the differences between the means indicated that differences in STR among the countries that were included in the sample were significant. Similarly, the mean ETR differed significantly among the countries in this study's sample. These results are consistent with prior studies (Abbas & Klemm, 2013; Marques & Pinho, 2014).

Next, a cluster analysis was conducted to analyze how the tax burden evolved over the study period. Therefore, it was possible to observe whether the trend was towards harmonization or whether harmonization did not occur. The application of cluster analysis constitutes a novel approach in the study of tax burdens. Although other authors have used this technique (Chen et al., 2016; Regis et al., 2015;), they conducted their analysis from a different perspective and focused only on STR.

The results demonstrate that during the study period, the tax burden in the EU15 countries converged and diverged at different times. Interestingly, when the economy prospered, the tax burden tended to converge. Conversely, during periods of economic crisis, whether related to financial or sovereign debt problems, the differences between tax burdens of the countries were significant.

These results imply that during periods of economic prosperity, EU countries apply tax policies that approach harmonization. However, during periods of economic turmoil, each country sets its own STR and ETR according to its unique strategy to cope with the downturn. These actions indicated that the tax unification criteria that was established by the EU is ignored and companies are inclined to engage in offshoring.

References

Abbas, S., Klemm, A. (2013). A partial race to the bottom: Corporate tax developments in emerging and developing economies. *International Tax and Public Finance*, *20*(4), 596–617.

Armstrong, C. S., Blouin, J. L., & Larcker, D. F. (2012). The incentives for tax planning. *Journal of Accounting and Economics*, *53*(1), 391-411.

Asante, J., Kreamer, D. (2015). A new approach to identify recharge areas in the lower Virgin River basin and surrounding basins by multivariate statistics. *Mathematical Geosciences*, *47*(7), 819-842.

Buijink, W., Janssen, B., & Schols, Y. (2002). Evidence of the effect of domicile on corporate average effective tax rates in the European Union. *Journal of International Accounting, Auditing & Taxation*, *11*, 115-130.

Chen, S., Chen, X., Cheng, Q., & Shevlin, T. (2010). Are family firms more tax aggressive than non-family firms? *Journal of Financial Economics*, *95*(1), 41-61.

Chen, D., Mintz, J. (2011, February 1). New estimates of effective corporate tax rates on business investment. Cato Institute Tax & Budget Bulletin No. 64. Available at http://ssrn.com/abstract=2231640

Chen, Y., Cuestas, J. C., & Regis, P. (2016). Convergence in corporate statutory tax rates in the Asian and Pacific economies. *International Journal of Finance & Economics, 21*(3), 266-278.

Chennells, L., Griffith, R. (1997). Taxing profits in a changing world. London: The Institute for Fiscal Studies. Retrieved from https://www.ifs.org.uk/comms/taxprofits.pdf

Crabbe, K., Vandenbussche, H. (2009). Are your firm's taxes set in Warsaw? Spatial tax competition in Europe. (Discussion Paper No. 7159). Centre for Economic Policy Research. Available at http://cepr.org/pubs/dps/DP7159.asp

Devereux, M., Lockwood, B., & Redoano, M. (2008). Do countries compete over corporate tax rates? *Journal of Public Economics 92*(5-6), 1210–1235.

Dyreng, S. D., Hanlon, M., Maydew, E. L., & Thornock, J. R. (2017). Changes in corporate effective tax rates over the past 25 years. *Journal of Financial Economics, 124(*3), 441-463.

Dyreng, S. D., Markle, K. (2016). The effect of financial constraints on tax-motivated income shifting by U.S. multinationals. *The Accounting Review*, *91*(6), 1601-1627.

Dyreng, S. D., Lindsey, B. P. (2009). Using financial accounting data to examine the effect of foreign operations located in tax havens and other countries on U.S. multinational firms' tax rates. *Journal of Accounting Research, 47*(5), 1283-1316.

Evers, L., Miller, H., & Spengel, C. (2015). Intellectual property box regimes: Effective tax rates and tax policy considerations. *International Tax and Public Finance*, *22*(3), 502-530.

Fairfield, T. & Jorratt De Luis, M. (2016). Top income shares, business profits, and effective tax rates in contemporary Chile. *Review of Income and Wealth*, 62(S1), S120-S144.

Fernández, E., Martínez, A., & Álvarez, S. (2008). La Presión Fiscal por Impuesto sobre Sociedades en la Unión Europea [The corporate tax burden in the EU] . *Estudios Financieros. Revista de Contabilidad y Tributación [Financial studies. Accounting and taxation magazine], 307*, 163-184.

Fullerton, D. (1984). Which effective tax rate? *National Tax Journal*, *37*(1), 23-41.

Giannini, S., Maggiulli, C. (2002). The effective tax rates in the EU Commission study on corporate taxation: Methodological aspects, main results and policy implications (Working Paper No. 666). CESifo Munich Group. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=301502

Graham, J. R., Hanlon, M., & Shevlin, T. (2011). Real effects of accounting rules: Evidence from multinational Firms investment location and profit repatriation decisions. *Journal of Accounting Research*, *49*(1), 137–185.

Gupta, S., Newberry, K. (1997). Determinants of the variability in corporate effective tax rates: Evidence from longitudinal data. *Journal of Accounting and Public Policy*, *16*(1), 1-34.

Hanlon, M., Heitzman, S. (2010). A review of tax research. *Journal of Accounting and Economics*, *50*(2-3), 127-178.

Holtzblatt, M. A., Geekie, J., & Tschakert, N. (2016). Should U.S. and global regulators take a bigger tax bite out of technology companies? A case on Apple's international tax minimization and reporting strategies. *Issues in Accounting Education*, *31*(1), 133-148.

Jacobs, O. H., Spengel, C. (2000). Measurement and development of the effective tax burden of companies. An overview and international comparison. *Intertax*, *28*(10), 334-351.

Kaplan, R. L. (1975). Effective corporate tax rates. *Journal of Corporate Taxation*, *2,* 187-198.

Kim, J. B., Li, Y., & Zhang, L. (2011). Corporate tax avoidance and stock price crash risk: Firm-level analysis. *Journal of Financial Economics*, *100*(3), 639-662.

Lanis, R., Richardson, G. (2012). Corporate social responsibility and tax aggressiveness: An empirical analysis. *Journal of Accounting and Public Policy*, *31*(1), 86-108.

Lisowsky, P. (2010). Seeking shelter: Empirically modeling tax shelters using financial statement information. *Accounting Review*, *85*(5), 1693-1720.

Loretz, S. (2007). Determinants of bilateral effective tax rates: Empirical evidence from OECD countries. *Fiscal Studies*, *28*(2), 227-249.

Loster, T. (2013, September). Evaluating of the results of clustering in practical economic tasks. Paper presented at 7th International Days of Statistics and Economics, Prague.

Markle, K. S., Shackelford, D. A. (2012). Cross-country comparisons of corporate income taxes. *National Tax Journal, 65*(3), 493-527.

Marques, M., Pinho, C. (2014). Tax-treaty effects on foreign investment: Evidence from European multinationals. *Finanzarchiv*, *70*(4), 527-555.

OECD (2017). Limiting Base Erosion Involving Interest Deductions and Other Financial Payments, Action 4 - 2016 Update: Inclusive Framework on BEPS, OECD/G20 Base Erosion and Profit Shifting Project. Paris: OECD Publishing. Available at http://www.oecd-ilibrary.org/taxation/oecd-g20-base-erosion-and-profit-shifting-project_23132612

Omer, T. C., Molloy, K. H., & Ziebart, D. A. (1991). Measurement of effective corporate tax rates using financial statement information. *Journal of American Taxation Association*, *13*, 57-72.

Overesch, M. & Rincke, J. (2011). What drives corporate tax rates down? A reassessment of globalization, tax competition, and dynamic adjustment to shocks. *The Scandinavian Journal of Economics, 113*(3), 579–602.

Phillips, J. D. (2003). Corporate tax-planning effectiveness: The role of compensation-based incentives. *The Accounting Review, 78*(3), 847–874.

Plesko, G. A. (2003). An evaluation of alternative measures of corporate tax rates. *Journal of Accounting and Economics*, *35*(2), 201-226.

Regis, P. J., Cuestas, J., & Chen, Y. (2015). Corporate tax in Europe: Towards convergence? *Economics Letters*, *134*, 9-12.

Richardson, G., Lanis, R. (2007). Determinants of the variability in corporate effective tax rates and tax reform: Evidence from Australia. *Journal of Accounting and Public Policy*, *26*(6), 689-704.

Robinson, L. A., Sansing, R. (2008). The effect of "invisible" tax preferences on investment and tax preference measures. *Journal of Accounting and Economics, 46*, 389–404.

Sonǧur, C., Top, M. (2016). Regional clustering of medical imaging technologies. *Computers in Human Behavior*, *61*, 333-343.

Soriano, D. R. (2003). The Spanish restaurant sector: Evaluating the perceptions of quality. *Service Industries Journal*, *23*(2), 183-194.

Soriano, D. R. (2005). The new role of the corporate and functional strategies in the tourism sector: Spanish small and medium-sized hotels. *Service Industries Journal*, *25*(4), 601-613.

Suzuki, M. (2014). Corporate effective tax rates in Asian countries. *Japan and the World Economy*, *29*, 1-17.

Swank, D., Steinmo, S. (2002). The new political economy of taxation in advanced capitalist democracies. *American Journal of Political Science*, *46*(3), 642-655.

Wang, S. (1991). The relation between firm size and effective tax rates: a test of firms' political success. *The Accounting Review*, *66*(1), 158-169.

Zimmerman, J. L. (1983). Taxes and firm size. *Journal of Accounting and Economics*, *5*(1), 119-149.