

Nicodeme, Gaetan; Caiumi, Antonella; Majewski, Ina

**Working Paper**

## What Happened to CIT Collection? Solving the Rates-Revenues Puzzle

CESifo Working Paper, No. 7412

**Provided in Cooperation with:**

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Nicodeme, Gaetan; Caiumi, Antonella; Majewski, Ina (2018) : What Happened to CIT Collection? Solving the Rates-Revenues Puzzle, CESifo Working Paper, No. 7412, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/198772>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## What Happened to CIT Collec- tion? Solving the Rates- Revenues Puzzle

*Gaetan Nicodeme, Antonella Caiumi, Ina Majewski*

## **Impressum:**

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email [office@cesifo.de](mailto:office@cesifo.de)

Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl

[www.cesifo-group.org/wp](http://www.cesifo-group.org/wp)

An electronic version of the paper may be downloaded

- from the SSRN website: [www.SSRN.com](http://www.SSRN.com)
- from the RePEc website: [www.RePEc.org](http://www.RePEc.org)
- from the CESifo website: [www.CESifo-group.org/wp](http://www.CESifo-group.org/wp)

# What Happened to CIT Collection? Solving the Rates-Revenues Puzzle

## Abstract

Despite sharp reductions in corporate income tax (CIT) rates worldwide, CIT revenues have not fallen dramatically in the last two decades. This paper investigates the recent developments in CIT in the European Union, by taking a closer look at the potential driving forces behind this puzzle. Using a unique dataset of national sectoral accounts, we decompose the CIT revenue to GDP ratio for the EU and find that while the decrease in the statutory rates has driven down tax collection, the effect was more than offset by a broadening of the taxable base and a slight increase in the size of the corporate sector. However, this result holds for the period 1995-2015 but not for the last decade where base broadening has not been able to match further cuts in rates.

JEL-Codes: E620, H250, O520.

Keywords: corporate tax, implicit tax rate, tax reforms, incorporation, European Union.

*Gaetan Nicodeme*  
*European Commission*  
*Bruxelles / Belgium*  
*gaetan.nicodeme@ec.europa.eu*

*Antonella Caiumi*  
*European Commission*  
*Bruxelles / Belgium*  
*acaiumi@istat.it*

*Ina Majewski*  
*European Commission*  
*Bruxelles / Belgium*  
*ina-majewski@gmx.net*

October 2018

We are thankful to Valeska Gronert, Daiki Kishishita, Luis Peragon, Agnieszka Skonieczna, Brian Sloan, Clare Southworth, the members of the working group "Structures of the Taxation Systems" and the participants to the 2018 IIPF Congress in Tampere (Finland) for their useful comments and suggestions. This research was conducted while Ina Majewski was working at the European Commission. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and should not be attributed to the European Commission. Possible errors and omissions are those of the authors and theirs only.

# 1. Introduction

Corporate income tax rates have declined over the last two decades in Europe and worldwide. In the EU28, the (simple) average statutory tax rate has declined from 35.2% in 1997 to 21.9% in 2017 and additional rate cuts have been announced in several Member States. However, tax revenues from corporations have not gone down. In 1995, the EU28 average was 2.25% of GDP and 20 years later this average was 2.58%.<sup>2</sup> This situation – sometimes referred to as the tax-rate-tax-revenue puzzle or the Corporate Income Tax (CIT) paradox – has been the topic of previous academic investigations, not least because of the policy relevance of identifying what has prevented revenues from falling.

One way of investigating the underlying drivers behind this development is to break down the CIT to GDP ratio into its various components. For instance, one might distinguish between factors influencing the implicit tax rate on business profits from others affecting the size of corporate profits in the economy. Based on a number of stylized facts on the EU and G7 countries Devereux et al. (2002) indeed argue that tax rate cuts have been accompanied by tax base broadening, which according to them would then explain the path of tax collection. Recently, Brautigam et al. (2017) identify interest deduction limitation rules and more restrictive loss provisions as the main drivers of tax base broadening in the EU-15 Member States since 2007, whereas in contrast Kawano and Slemrod (2016) find only limited evidence for such a tendency across OECD countries between 1980 and 2004. Other studies, in particular Sorensen (2007) and de Mooij and Nicodeme (2008a), have shown that besides tax base broadening this puzzle could be partly attributable to increases in the size of the corporate sector in the economy.

In practice, it is complex to link developments in the overall implicit tax rate on business income to statutory tax rates and other tax base changes. In particular, the problem of measuring the CIT taxable base is a key but complex issue in such analysis. At national level, actual corporate tax returns can be used to overcome this problem. Relying on such fiscal data, Auerbach (2007) reveals that the use of losses partially explains the rise in the implicit tax rate on corporations in the U.S. between 1983 and 2003. For Belgium, Valenduc (2011) finds no evidence of the importance of the size of the corporate sector but his analysis reveals that the introduction of the allowance for corporate equity (ACE) in 2006 has led to a strong decrease in the implicit tax rate on corporations but also to a surge in gross profitability.

This paper aims at explaining the recent evolution of corporate tax collections in the European Union over the years 1995 to 2015. Tax return data are not publicly available and their scope would differ across countries. Instead, we resort to a unique dataset of national accounts provided by the European System of National and Regional Accounts (ESA 2010). The high comparability of such data across countries constitutes its great advantage.

---

<sup>2</sup> Own computations using Eurostat data. For the rates, the GDP-weighted average EU28 rate fell from 42.9% to 27.5% between 1995 and 2015. For CIT to GDP data, CIT collection fluctuates with business cycle. For the period 1995-2015, the minimum and maximum averages have been 2.20% in 2009 and 3.22% in 2007, respectively (based on data from July 2017, subject to revisions). See Annex (1).

Nevertheless, national accounts data on profits of corporations should be regarded as a rough approximation of actual taxable corporate profits. To improve this approximation, we relate corporate tax revenues to the net operating surplus incremented by financial income flows. Moreover, by omitting net dividends from this adjusted CIT base we fully account for the broadly applied tax exemption of received dividends as notably foreseen by the EU Parent-Subsidiary directive.

Our analysis is based on the decomposition initially proposed by Sorensen (2007) who distinguishes the implicit tax rate on corporation, the size of the corporate sector in the economy and the profitability of economic activities. Our paper attempts to obtain approximates of the tax base more closely by using national account statistics. Such an additional decomposition constitutes an improvement to Sorensen's approach that relies on the gross operating surplus of companies as approximation of the corporate tax base. In addition, to capture other factors that might have prevented CIT revenues from falling, we conduct an alternative decomposition of the CIT revenue to GDP ratio based on value-added. Overall, our results confirm that the implicit tax rate has been the major driving force behind the development of the CIT to GDP ratio. In particular, there is evidence of corporate tax base broadening before the financial crisis. While the period after the crisis (post 2010) provides evidence that tax rates cuts have not been matched by further broadening of the taxable base.

The paper is organized as follows: Section 2 provides an overview of developments in CIT collection in the European Union between 1995 and 2015. Section 3 describes the decomposition of the CIT to GDP ratio and the evolution of each component. Section 4 presents a full differentiation of the CIT to GDP ratio and offers an assessment of each factor's contribution to the development of the ratio. Finally, Section 5 concludes.

## **2. Developments in CIT collection in the European Union 1995 – 2015**

As mentioned above, the statutory corporate income tax rates (STR) have fallen substantially worldwide since at least the early 1980s.<sup>3</sup> Yet, the pace of reduction has varied over time. While the years prior to the crisis in 2008 showed significant reductions, the race to the bottom in CIT slowed down afterwards (but did not stop).<sup>4</sup>

---

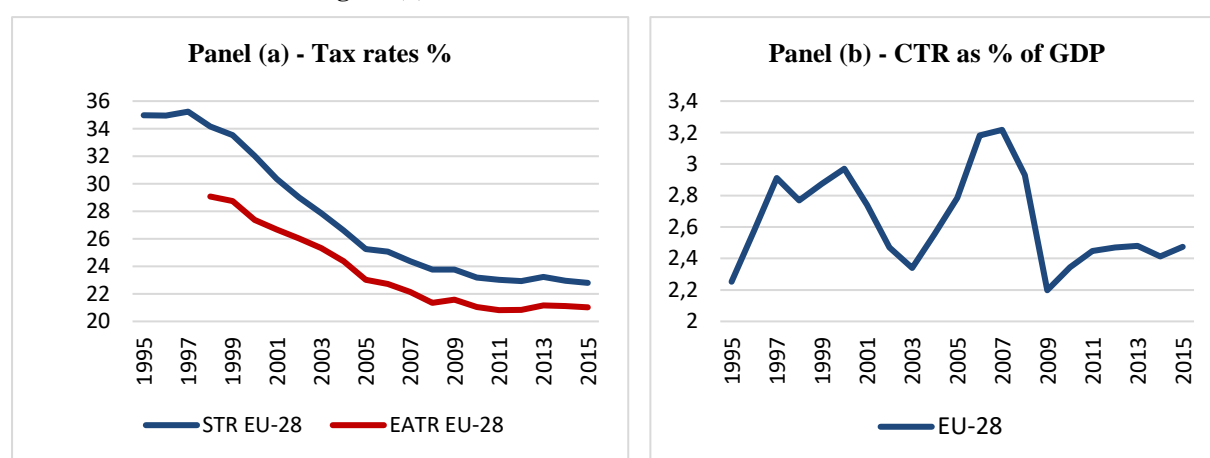
<sup>3</sup> A vast empirical literature investigates the idea of tax competition between countries for mobile capital as an explanation for this development. A recent survey by Leibrecht and Hochgatterer (2012) attributes these falling rates of corporate taxes in OECD countries to the pace of globalization, and the resulting tax competition. Overesch and Rincke (2011) provide an analysis of the declining rate of corporate taxes in Europe. They conclude that, in the absence of tax competition, the mean statutory tax rate of Western European countries in 2006 would have been about 12.5 percentage points above its actual level.

<sup>4</sup> It is noteworthy, that such CIT development was not only driven by tax competition. For instance, many of the new Member States that acceded the EU in 2004 lowered their direct taxes, partly to compensate for increases in VAT.

However, not only the STR but also the taxable base determine the tax liability of a company. Therefore, a complementary way to analyse such tax cuts is to consider effective average tax rates (EATR), which take into account both the tax rate and several elements of the tax base and are thus thought to capture the effective development in CIT more adequately than solely the STR. One example of such an EATR is the measure proposed by Devereux and Griffith (1998) who applies some of the basic tax rules to the pre-tax return of a hypothetical investment (ZEW 2016). Interestingly, the EATR exhibits a less sharp decline compared to the STR as it only decreases from about 29 % in 1998 (first available year) to about 21% in 2015.

Despite the reductions of the tax rates and acknowledging some volatility with the business cycle, the EU28 average CIT revenues to GDP ratio seem to be relatively stable over time. The ratio has been increasing between 1995 and 2000, before declining between 2000 and 2003 and increasing again just before the financial crisis of 2008. During the economic and financial crisis corporate tax revenues have fallen in line with economic activities. Accordingly, tax revenues are recovering along the economy afterwards but it is important to highlight here the likely role of losses carried forward from earlier years. Overall, however, the stability of the ratio suggests that the corporate tax base must have grown sufficiently to compensate for the drop in the STR.

**Figure (1) – The CIT Rates-Revenues Puzzle - EU-28**



*Source: Own calculations based on data from ESA2010 and European Commission (2017)*

### 3. Decomposing the CIT to GDP ratio

To highlight potential patterns in corporate income tax developments, we factorize the ratio of CIT revenues to GDP. The decomposition suggested by Sorensen (2007) allows analysing whether an increase in the ratio of CIT revenues to GDP is driven by a rise in one or more of three factors: the effective tax burden of the corporate sector, measured here by the ratio between total taxes paid by corporations to the gross operating surplus of the corporate sector (CTR/GOS<sub>C</sub>); the share in total profits accruing to the corporate sector,

measured as the ratio of the gross operating surplus of corporations to the gross operating surplus of the economy ( $GOS_C/GOS_E$ ); or the profit share of total GDP, measured as the gross operating surplus of the economy to GDP ( $GOS_E/GDP$ ).

$$(1) \quad \frac{CTR}{GDP} = \frac{CTR}{GOS_C} \times \frac{GOS_C}{GOS_E} \times \frac{GOS_E}{GDP}$$

In Sorensen (2007) decomposition, the corporate tax revenue to the gross operating surplus of the corporate sector ratio is a rough macro-level measure of the total pre-tax earnings of the corporate sector.<sup>5</sup> However, the national account concept of operating surplus gross of interest and depreciation is a much broader measure than the actual business income tax base. Therefore, it is interesting to refine the analysis and use the net operating surplus incremented by the flows in financial incomes from the European System of National and Regional Accounts (ESA 2010) to approximate the 'true' CIT base instead of the GOS.<sup>6</sup> This procedure is consistent with the methodology used in the computation of the implicit tax rate (ITR) on capital income (see Schmidt-Faber, 2004). Specifically, under the ESA2010 statistical classification, the CIT base is defined as the net operating surplus of non-financial and financial corporations enhanced by net receipt of interest, dividends and rent from land and natural resources, as in financial accounts profits (FAP), not included in national accounts.<sup>7</sup> Furthermore, we also account for the widespread tax exemption of received dividends, notably thanks to the EU parent-subsidiary directive,<sup>8</sup> and for the fact that paid dividends are not tax deductible. A positive or negative net receipt of dividends artificially inflates or deflates the taxable corporate base. Hence, we subtract net receipts of dividends from our measure of net operating surplus enhanced by financial profit as defined above and obtain a measure of the CIT base, hereafter denoted as "Base". Our decomposition exercise becomes:

$$(2) \quad \frac{CTR}{GDP} = \frac{CTR}{Base} \times \frac{Base}{GOS_C} \times \frac{GOS_C}{GOS_E} \times \frac{GOS_E}{GDP}$$

Alternatively, the decomposition of the CIT revenue-to-GDP ratio can be rearranged to specifically explore the role of the size of the corporate sector on CIT revenues. For instance, issues related to the distribution of income within the corporate sector or the incidence of corporate taxes<sup>9</sup> could be of interest. To analyse these aspects, we relate the

---

<sup>5</sup> See Nicodeme (2001).

<sup>6</sup> National accounts provide a consistent framework to compare income and tax revenue data across Member States. However, business income according to national accounts should only be regarded as a rough approximation of taxable corporate profits. For instance, consumption of fixed capital cannot always be considered a good proxy for tax-deductible depreciation.

<sup>7</sup> See European Commission (2017), p 261.

<sup>8</sup> Council Directive (EU) 2015/121 of 27 January 2015 amending Directive 2011/96/EU on the common system of taxation applicable in the case of parent companies and subsidiaries of different Member States.

<sup>9</sup> Recent empirical evidence (Randolph 2006, Hassett and Mathur 2006) shows that a significant part of the corporation income tax is passed on to the labour force in the form of lower wages. By using a sample of



GOS of the corporate sector to the corporate value added ( $VA_c$ ), to obtain a ratio that represents the profit rate of corporations. Then, the corporate value added is used in the final term of the decomposition to depict the share of the corporate sector in GDP.

$$(3) \quad \frac{CTR}{GDP} = \frac{CTR}{Base} \times \frac{Base}{GOS_c} \times \frac{GOS_c}{VA_c} \times \frac{VA_c}{GDP}$$

The following table (1) summarizes the elements of the decomposition and provides some insights with regard to their economic interpretation as well as their potential drivers.<sup>10</sup>

Table (1) – Factors determining the CIT to GDP ratio

Ratio	Definition	Potential Determinants
$\frac{CTR}{Base}$	Implicit corporate tax rate (backward-looking measure of the effective tax burden on the corporate sector)	<ul style="list-style-type: none"> <li>• Statutory tax rates</li> <li>• Definition of the taxable base</li> <li>• Carried-over losses and loss compensation</li> <li>• Tax expenditures (e.g. patent boxes)</li> <li>• Time lags in tax payments</li> <li>• Tax deferral</li> <li>• Tax avoidance or profit shifting</li> </ul>
$\frac{Base}{GOS_c}$	Distance between Base and the Gross Operating Surplus	<ul style="list-style-type: none"> <li>• Consumption of fixed capital</li> <li>• Flows of financial incomes</li> </ul>
$\frac{GOS_c}{GOS_e}$	Share of the corporate sector in the Gross Operating Profit	<ul style="list-style-type: none"> <li>• Incorporation decisions</li> <li>• Foreign direct investment (FDI) driven by tax differentials</li> <li>• Tax avoidance that leads to lower economic activities</li> </ul>
$\frac{GOS_e}{GDP}$	Profitability of the economy	<ul style="list-style-type: none"> <li>• Technological progress</li> <li>• Distribution of income between production factors</li> </ul>
$\frac{GOS_c}{VA_c}$	Profit rate of corporations	<ul style="list-style-type: none"> <li>• Bargaining power of trade unions</li> <li>• Incidence of the corporate income tax on wages</li> </ul>
$\frac{VA_c}{GDP}$	Corporate value added in the economy	<ul style="list-style-type: none"> <li>• Technological progress</li> <li>• Tax avoidance that leads to lower economic activities</li> <li>• Reallocation of economic activities between the corporate and non-corporate sector</li> </ul>

European firms, Arulampalam *et al.* (2012) find that a USD 1 increase in the tax bill tends to reduce real wages by around USD 50 cents. Using a 20-year panel of German municipalities Fuest, Peichl and Siegold (2018) also find that workers bear about half of the corporate taxes. In addition, they point to significant distributive effects as low-skilled, young and female employees bear a larger share of the tax burden.

<sup>10</sup> Annex (2) in the appendix provides additional variables definitions. See also Annex (3) for our extrapolation of missing data to compute EU28 aggregate for illustrative purposes.

Notice that fiscal factors affecting the taxable base – including mandatory adjustments made to financial accounting profits, loss compensation, tax treatment of losses, tax expenditures (e.g. tax credits and patent boxes), time lags in tax payments, tax deferral, tax avoidance or profit shifting – drive only the numerator of our measure for the implicit tax rate, which is tax revenues. In contrast, the denominator, Base, as recorded in national accounts is assumed to represent the theoretical tax base for CIT which is conceptually close to earnings before taxes.

The distance between the Base and the GOS is mainly affected by net flows of financial incomes as the consumption of fixed capital computed in national accounts is unrelated to tax depreciation allowances. Factors affecting the magnitude of domestically generated value added by corporations not allocated to employees – such as incorporation decisions, FDI, or tax avoidance leading to lower economic activities – drive the share of the corporate sector as well as the corporate value-added in the economy. Finally, changes in the distribution of income between production factors will somewhat impact the profitability rate in the economy and the profit rate of corporations.

In the following, we discuss the evolution of the various components of equations (2) and (3) of the decompositions above. First, the CIT revenue as percentage of the corporate tax base, which can be defined as an implicit tax rate (ITR), shows a volatile trajectory with an average at about 22% (see Figure 2 – panel a). Its evolution has some resemblance to the one of the CIT to GDP ratio. The ITR of business income displays a strong increase between 1995 and 2000, a decline in the period 2001 to 2003 when the fastest reduction in STRs takes place, an increase again in years 2005 and 2006 despite continuing cuts in STR, and again a steep decline in the aftermath of the financial crisis. After a slight recover thereafter, the ITR more or less stabilises at a level close to that of 1995. The increase in the ITR in the years 2005-2006 is interesting. Among possible explanations for the increase, one could suspect the adoption of base broadening policies to lessen the impact of tax rates cut. Another possibility is higher capital gains, as while CIT revenues include tax payments on capital gains, the CIT tax base defined by ESA2010 national accounts does not include extraordinary income or capital gains. Note also that as profitability was on the rise at that time (see Figure 2 – panel d), the effective tax burden on corporate income could also increase due to the nonlinearity of some corporate tax systems such as reduced rates for SMEs. In contrast, in the years following the crisis, the slow recovery in the ITR might be due to the presence of a policy mix targeted to boost the economic recovery, while retaining tax revenues,<sup>11</sup> and the impact of the usage of accumulated losses from earlier periods.

Similarly, the development of the CIT base shows some cyclicity around roughly 50% of the gross operating surplus. The gap decreases from 1995 to 1998, widens in the period 1998–2001, falls again before the financial crisis and widens again after 2008. Overall,

---

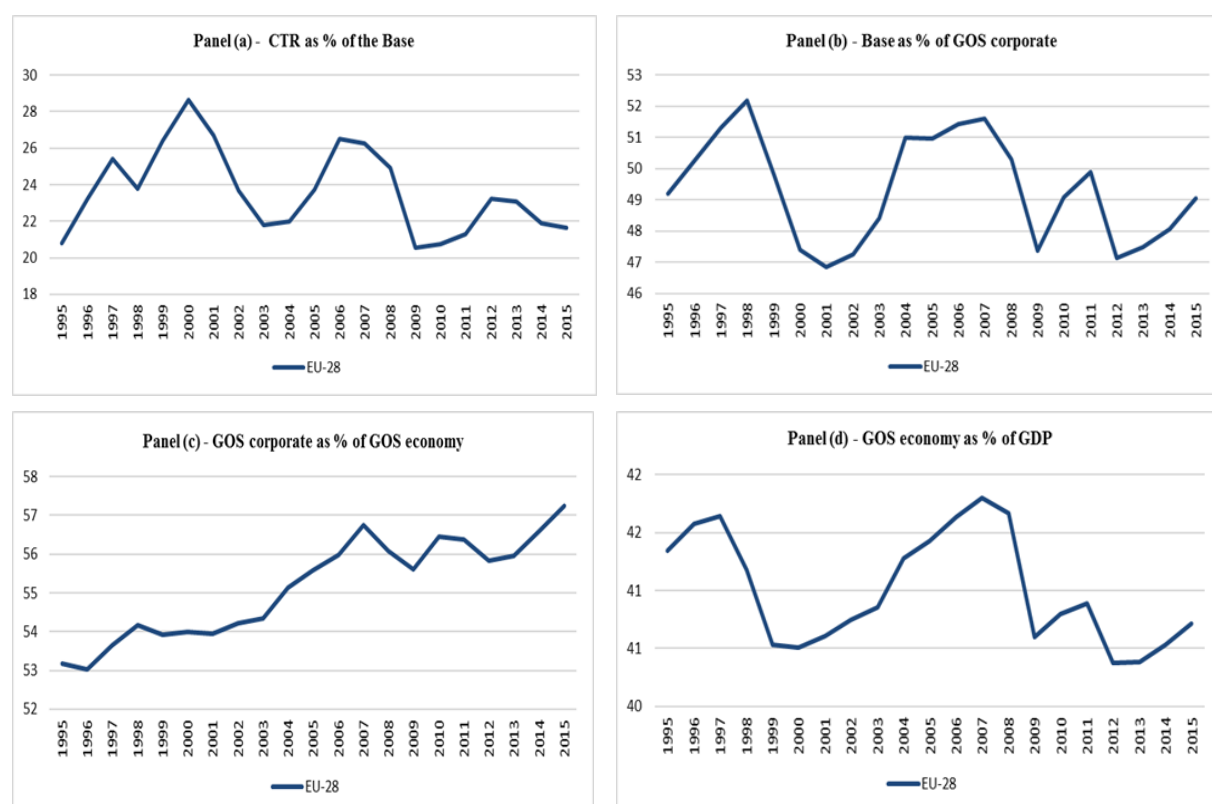
<sup>11</sup> Note moreover that the tax revenue data might be driven to some extent by cash accounting. Even though in national accounts flows are in principle accrual based, this is not achievable in tax revenues data, which effectively result in a mix between cash and accrual accounting. Thus a base-broadening measure that come into force in a given tax year may show in the data only with time lags, since tax payments for the tax year  $t$  are spread over later years. This issue should not affect the overall long-term trend, but may contribute to some erratic movements in the shorter term. To account for this circumstance we repeated our calculations with a three years moving average for each variable. The results qualitatively remain the same.

the gap between the Base and GOS is the result of the consumption of fixed capital and of financial charges.

The share of the corporate sector in terms of GOS show an upward and constant trend over the period, with a stronger run up between 2003 and 2007. Overall, the share of the corporate sector increases by about 4 percentage points, likely as a result of a growing number or size of domestic corporate firms<sup>12</sup> and inward foreign direct investments.<sup>13</sup>

The total profit rate in the economy decreases by about 0.6 percentage points between 1995 and 2015. However, again this conceals significant deviations. The profitability increases by about 1.1 percentage points before the financial crisis and it falls sharply afterwards.

**Figure (2): Decomposition of CIT revenues on GDP - EU-28**



*Source: Own calculations based on data from ESA2010 and European Commission (2017)*

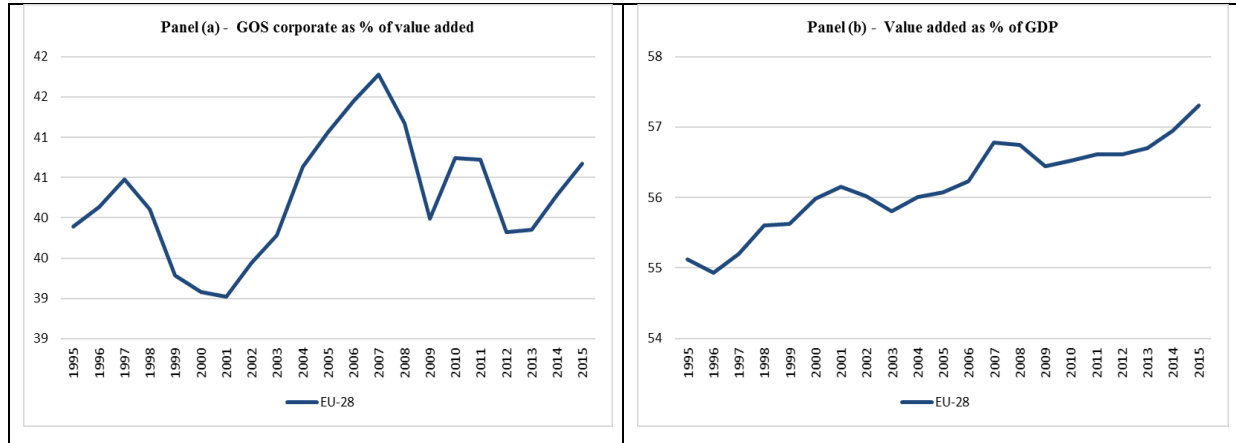
We now turn to the alternative decomposition of CIT revenues over GDP, and observe that the share of profits over value-added within the corporate sector also reveals a mixed pattern over the years. After a decline in the period 1997 to 2001, the profit rate exhibits a significant rise till 2007. After the financial crisis, it follows a volatile pathway. It is worth noticing that the run up of the profit share before the crisis might be an additional

<sup>12</sup> Notice, besides a genuine growth, an increasing number of domestic corporations may also be due to tax incentives for sole entrepreneur, partnerships or the self-employed to incorporate. For instance, while CIT rates decreased significantly in the period under consideration personal income tax rates remained quite stable (European Commission, 2017). This in turn could imply a decrease in personal income tax revenues in favour of increasing or at least stable CIT revenues (see de Mooij and Nicodeme, 2008b).

<sup>13</sup> See for instance Ederveen and de Mooij (2003) and Feld and Heckemeyer (2011).

explanation for the boost in the share of the corporate sector in the economy occurring over the same period.

**Figure (3): Decomposition of CIT revenues on GDP - value added alternative - EU-28**



*Source: Own calculations based on data from ESA2010 and European Commission (2017)*

Similarly to the share of the corporate sector in the gross operating profit of the economy, its share in value added exhibits a stable upward trend over the whole period and increases overall by about 2 percentage points.

To sum this descriptive analysis up, the first period between 1995 and 2000 shows an increase in the tax to GDP ratio. During this period, the implicit tax rate (defined as the ratio of the tax collected to the taxable base) sharply increases. We note also a slight increase in the size of the corporate sector. This seems to be enough to counteract the decline in the statutory tax rate and in the profitability in the economy. The next period between 2000 and 2003 shows a decline in the CIT collection relative to GDP. This corresponds to a sharper decline in both the statutory rate and the implicit tax rate. Interestingly, this seems again enough to counteract the increase in the share of the corporate sector and also in the profitability of the economy. The next period of interest runs between 2003 and 2007 with a very sharp increase in the GDP-weighted average tax collection from around 2.3% to about 3.2%. It corresponds to a steady increase in the share of the corporate sector, in the profitability of the economy and in the ITR, despite relatively stable tax rates. Between 2007 and 2009, the opposite scenario is the case with a decrease in the share of the sector, the profitability and the implicit rate. Finally, during 2010 and 2015, there is less variation in the elements of the formula.

We see that the implicit tax rate plays a prime role in the developments. However, the implicit tax rate formulation does not allow a separate identification of the effects of the statutory tax and the taxable base changes. To gain insight in this regards as well as to assess the contribution of each factor to the CIT to GDP ratio, in the next section we compute the full differential of the tax revenue share.

## 4. Contribution of factors to the CIT to GDP ratio

### 4.1. Full differentiation of the CIT to GDP ratio.

To disentangle the role of statutory tax rate changes vis-à-vis the other components of the corporate tax-to-GDP ratio on the evolution of the ratio, we firstly differentiate the change, denoted by  $\Delta$ , in the CIT revenue-to-GDP ratio into two components: the variation due to the statutory rate and the associated change in the taxable base-to-GDP ratio as follows

$$(4) \quad \Delta \left( \frac{CTR}{GDP} \right) = \Delta \tau * \left( \frac{CTR}{\tau GDP} \right)_t + \tau_{t+1} * \Delta \left( \frac{CTR}{\tau GDP} \right)$$

where  $\tau$  denotes the CIT rate,  $\left( \frac{CTR}{\tau} \right)$  corresponds to the actual CIT base on which the statutory rate applies, and the subscript reflects whether a variable refers to the situation before (t) or after (t+1) the reform. The first term in (4) shows the ex-ante change in the tax revenue caused by a change in the CIT statutory rate. With no behavioral response to the tax change (i.e.  $\Delta(CTR/\tau GDP) = 0$ ), the ex-post revenue effect would be equivalent to the direct ex-ante effect and revenues would simply change proportionately to the change in the rate. If however the corporate tax base responds to the change in the CIT rate, the second term of the right hand side of (4) measures the revenue impact associated with behavioral responses, the so-called indirect effect. It also captures the impact of any base broadening provisions accompanying the tax rate cut.

The overall effect of a reduction of the corporate tax rate on the taxable base can also be measured in terms of the tax elasticity. By factoring the percentage variation of the taxable base-to-GDP ratio and the tax rate  $\tau_1$ , we obtain the revenue impact of the base broadening associated to a reduction in the corporate tax rate by 1 percentage point ( $\Delta\tau = -1$ ). Thus, the ex-post revenue impact of a tax rate change is equal to

$$(5) \quad \Delta \left( \frac{CTR}{GDP} \right) = \Delta \tau * \left( \frac{CTR}{\tau GDP} \right)_t \left[ 1 + \frac{\tau_{t+1}}{\Delta \tau} \frac{\Delta \left( \frac{CTR}{\tau GDP} \right)}{\left( \frac{CTR}{\tau GDP} \right)_t} \right]$$

where the second term between square brackets corresponds to the tax elasticity of the corporate tax base to GDP with respect to the CIT rate, also denoted as  $\varepsilon_{\tau}^{\frac{CTR}{\tau}/GDP}$ .

If base broadening provisions do not completely offset the CIT rate cut, firms may take advantage of the overall reduction in the tax burden and the corporate tax base may increase due to reduced incentives for tax avoidance and tax deferral, increased incentives for

incorporations or relocation decisions of real economic activities by multinationals, increased profitability and so on. It is therefore useful to separate the ratio of the corporate tax base over GDP ( $\frac{CTR}{\tau GDP}$ ) into its components. Analogous to equation (2), this ratio can be decomposed into the fraction of corporate income that is taxed ( $\frac{CTR}{\tau Base}$ ) times the distance between corporate income and gross operating surplus ( $\frac{Base}{GOS_C}$ ), the share of corporate profit in the economy ( $\frac{GOS_C}{GOS_E}$ ), and the profitability for the overall economy ( $\frac{GOS_E}{GDP}$ ). By fully differentiating the second term in equation (4), we obtain the following expression for the ex-post revenue-to-GDP change:

$$(6) \quad \Delta \left( \frac{CTR}{GDP} \right) = \Delta \tau * \left( \frac{CTR}{\tau GDP} \right)_t + \tau_{t+1} \left( \frac{Base}{GDP} \right)_t \Delta \left( \frac{CTR}{\tau Base} \right) + \left( \frac{CTR}{Base} \right)_{t+1} \left( \frac{GOS_C}{GDP} \right)_t \Delta \left( \frac{Base}{GOS_C} \right) + \left( \frac{CTR}{GOS_C} \right)_{t+1} \left( \frac{GOS_E}{GDP} \right)_t \Delta \left( \frac{GOS_C}{GOS_E} \right) + \left( \frac{CTR}{GOS_E} \right)_{t+1} \Delta \left( \frac{GOS_E}{GDP} \right)$$

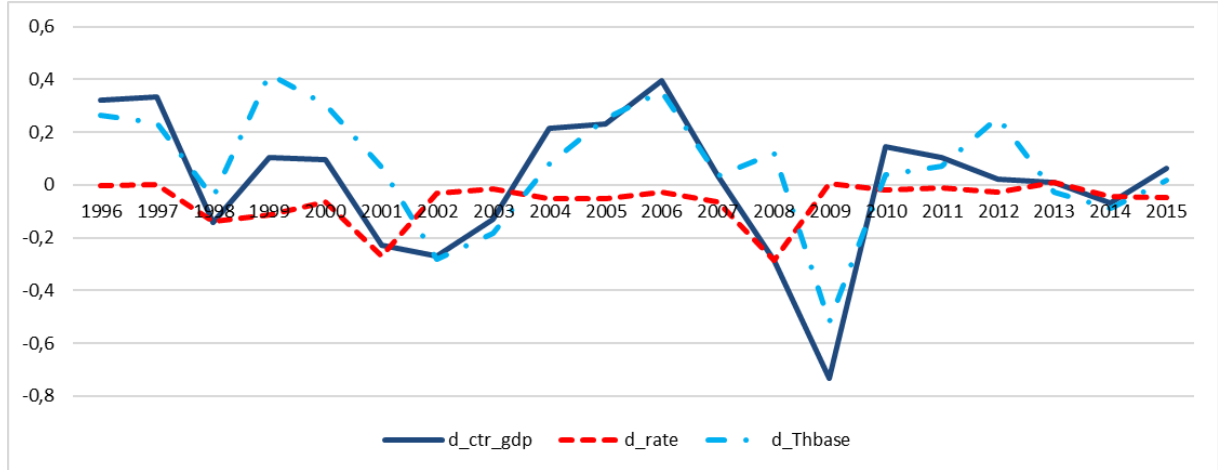
The four terms in addition to the direct ex-ante effect capture different types of impacts. The second term is the most prominent for the purpose of our analysis as it captures changes in the share of corporate income that is taxed. It can be directly related to base broadening policies. Changes in tax avoidance and tax deferral efforts by firms may affect the results.

The third term accounts for changes in the composition of the corporate income between financial and non-financial income as well as changes in the consumption of fixed capital. As the latter is unrelated to tax depreciation deductions and to the extent that firms in the financial sector react to changes in taxation more than in manufacturing (Lawless *et al.* 2014), this term captures relocation decisions of the financial income component.

The fourth term of equation (6) captures the effect of changes of the size of the corporate sector relative to the economy, such as income shifting from the personal to the corporate tax base and/or relocation decisions of real economic activities by multinationals for instance to exploit tax rate differentials among countries. Lastly, the final term of equation (5) captures changes in the overall profitability in the economy.

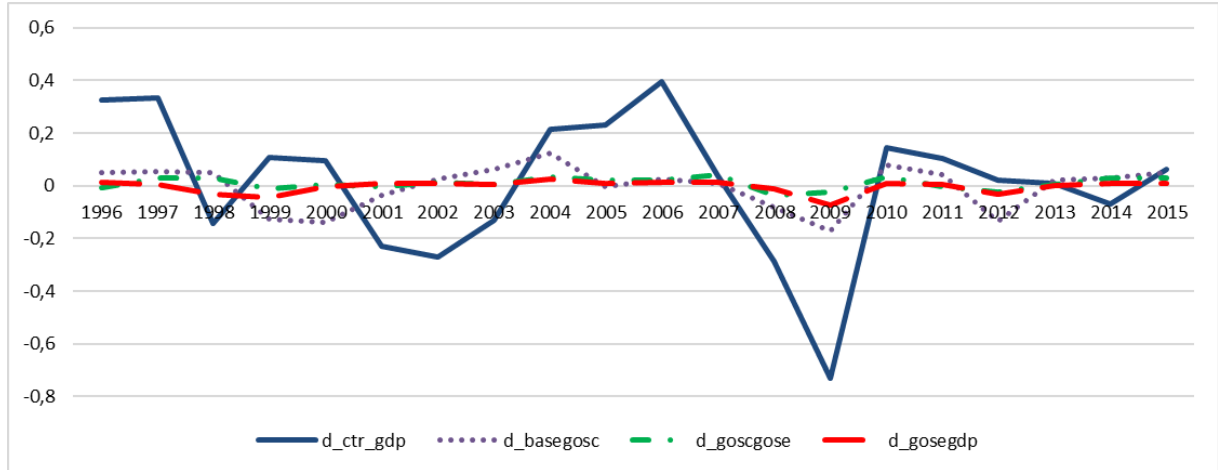
Figures (4) and (5) show the patterns of the yearly change of CIT collection-to-GDP ratio and its five underlying components for the EU28. The graphs reveal that the five components have evolved in different ways. Both the tax rate and the tax base differentials shape the development in the CIT-to-GDP ratio. However, changes in the tax base are broader in size and somewhat counterbalance tax rate changes, such as in the years 1998-1999, 2004-2006 and 2012. All the other components – the gap between Base and GOS, the share of the corporate sector in the economy, and the rate of total profit in the economy – feature a fairly stable development.

**Figure (4): Yearly changes in CIT-to-GDP and components - EU28**



Source: Own calculations based on data from ESA2010 and European Commission (2017)

**Figure (5): Yearly changes in CIT-to-GDP and components – EU28**



Source: Own calculations based on data from ESA2010 and European Commission (2017)

#### 4.2. Exploring the role of the size of the corporate sector: value-added alternative

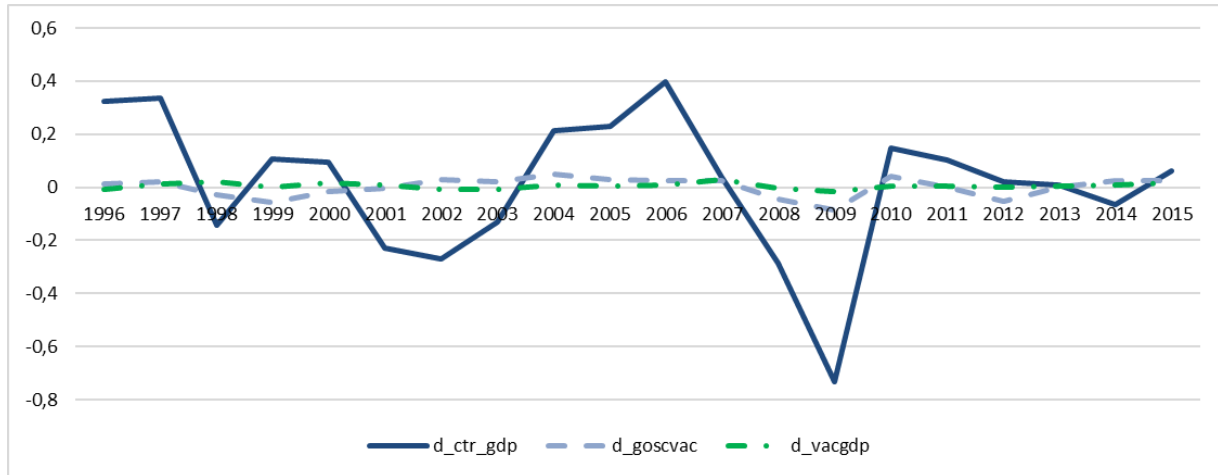
By applying the value-added decomposition from equation (2), the full differential of a change in revenues stemming from a CIT rate cut is equal to:

$$(7) \quad \Delta \left( \frac{CTR}{GDP} \right) = \Delta \tau * \left( \frac{CTR}{\tau GDP} \right)_t + \tau_{t+1} \left( \frac{Base}{GDP} \right)_t \Delta \left( \frac{CTR}{\tau Base} \right) + \left( \frac{CTR}{Base} \right)_{t+1} \left( \frac{GOSC}{GDP} \right)_t \Delta \left( \frac{Base}{GOSC} \right) + \left( \frac{CTR}{GOSC} \right)_{t+1} \left( \frac{VAC}{GDP} \right)_t \Delta \left( \frac{GOSC}{VAC} \right) + \left( \frac{CTR}{VAC} \right)_{t+1} \Delta \left( \frac{VAC}{GDP} \right)$$

The first three terms are the same as in equation (6). The fourth term now captures changes in the profit rate of corporations, whereas the final term captures tax-induced reallocation of economic activities that affect both the size of the corporate sector and GDP.

Figure (6) shows the patterns of the yearly changes of CIT collection-to-GDP ratio and the last two components of the value-added alternative decomposition for the EU28: the profit rate of corporate firms and the share of the value added of the corporate sector over GDP. Once again, both components reveal a rather stable pattern.

**Figure (6): Yearly changes in CIT-to-GDP and its components – value-added - EU28.**



*Source: Own calculations based on data from ESA2010 and European Commission (2017)*

Given the diverse patterns, it is difficult to draw clear-cut conclusions on the potential drivers of the CIT-to-GDP ratio. To this aim, we compute the full differentiation of the CIT-to-GDP ratio in the long run. Table (2) summarizes the results for both decompositions. The change in the CIT-to-GDP ratio between 1995 and 2015 in the EU28 is equal to 0.222 percentage points. The decomposition allows us ranking the potential drivers in the CIT-to-GDP ratio. First, the taxable base reveals a positive effect, increasing the CIT to GDP ratio by 0.899 pp. over the period. It more than compensates the negative effect of the rates cuts, which have contributed to decreasing the ratio by 0.810 pp. Interestingly, this widening of the base is not driven by changes in depreciation or changes in financial flows (as the ratio of base to gross-operating surplus exerts almost no effect) but most likely by changes in tax expenditures, avoidance and carry-over losses.

The increase in the size of the corporate sector accounts for an increase in CIT collection of 0.178 pp. of GDP. In contrast, the changes in profitability and in the ratio of the taxable base to the GOS of companies have only marginal effects.



**Table (2) - Full differential of the CIT revenue-to-GDP ratio over the period 1995-2015**

<b>Decomposition (eq. 6)</b>		<b>Value added alternative (eq. 7)</b>	
CIT to GDP	0.222	CIT to GDP	0.222
Tax Rate	-0.810	Tax Rate	-0.810
Taxable base	0.899	Taxable base	0.899
Base-to-GOS <sub>c</sub>	-0.007	Base-to-GOS <sub>c</sub>	-0.007
Size corporate sector (GOS)	0.178	Profit rate of corporations	0.046
Profitability	-0.038	Size corporate sector (VA)	0.094

*Source: Own calculations based on data from ESA2010 and European Commission (2017).*

#### 4.3. Evolution by periods

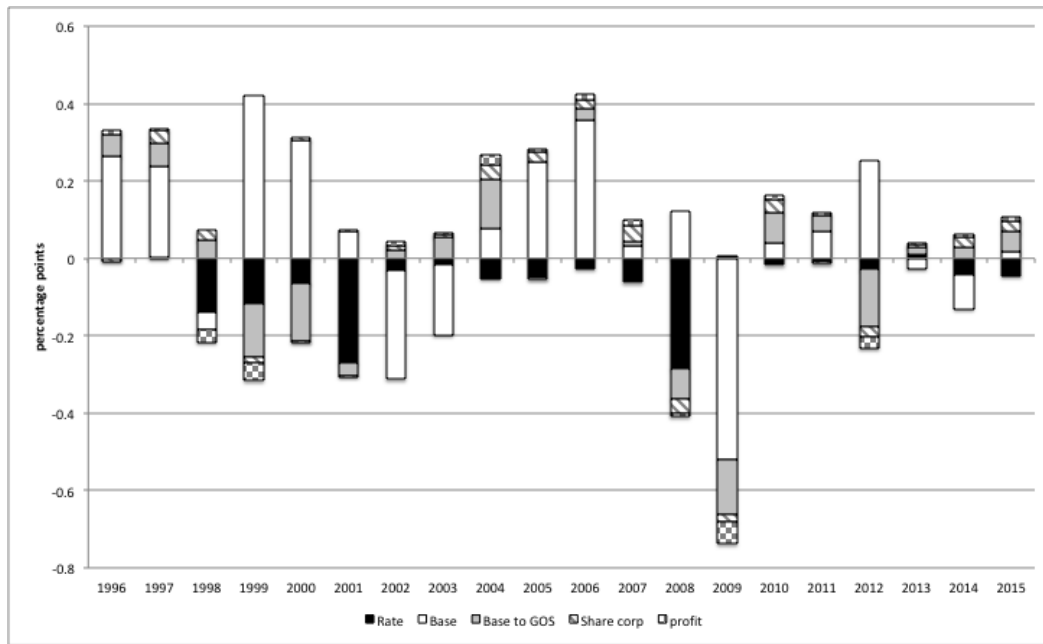
Given the erratic pattern of the CIT to GDP ratio, it seems worthwhile to decompose the contribution of the various factors in two sub-periods. This is done in table (3). Several elements are striking. First, the continuous decrease in the CIT rates exerts a negative impact on the CIT to GDP ratio in both sub-periods. Second, we see that even though over the entire period, the increase in the corporate tax base has fully offset the effect of the decrease in the rates, this phenomenon appears to be mainly an element of the past. It may be that the scope for continuous base broadening has dried out. The ratio of the base to GOS of corporations has had a negligible impact since 2005. Finally, the size of the corporate sector exerts a small but constant positive influence on the changes in corporate tax collection. Figure (7) shows the yearly decomposition.

**Table (3) - Full differential of the CIT revenue-to-GDP ratio over various periods**

	<b>1995-2015</b>	<b>1995-2005</b>	<b>2005-2015</b>
CIT to GDP	0.222	0.532	-0.311
Tax Rate	-0.810	-0.530	-0.453
Taxable base	0.899	0.845	0.207
Base-to-GOS <sub>c</sub>	-0.007	0.092	-0.095
Size corporate sector	0.178	0.120	0.073
Profitability	-0.038	0.005	-0.043

*Source: Own calculations based on data from ESA2010 and European Commission (2017).*

**Figure (7): Yearly contributions to the changes in the EU28 CIT-to-GDP.**



*Source: Own calculations based on data from ESA2010 and European Commission (2017).*

## 5. Conclusions and Policy Implications

Statutory corporate tax rates in Europe have been falling ever since the early 1980s. Despite the reductions of the tax rates and acknowledging some volatility with the business cycle, the average EU28 CIT revenues to GDP ratio seem to be relatively stable over the last two decades. Between 1995 and 2015, the corporate tax collected to GDP in the EU28 has increased by 0.222 percentage points, from 2.252% to 2.473%. Using unique dataset of national sectoral accounts, we revisit the decomposition of the CIT to GDP ratio provided by Sorensen (2007) to assess the effects of the underlying variables. Our results suggest that the decrease in rates has contributed to a negative evolution of the CIT to GDP ratio by about -0.8 percentage points. This decrease in tax rates has however been more than offset by an increase in the corporate tax bases, which has positively affected the ratio by about +0.9 percentage points. Finally, the increase in the size of the corporate sector in the economy has positively contributed to sustain corporate tax collection by about 0.2% of GDP. Yet, this phenomenon could be an element of the past. Over the last decade, the taxable base has hardly offset the effects of the rates decreases. Henceforth it remains to be seen whether there remains some scope for further base broadening.

## References

- Arulampalam, W., M.P. Devereux and G. Maffini (2012), "The direct incidence of corporate income tax on wages", *European Economic Review*, 56: 1038-1054.
- Auerbach, A. (2007), "Why Have Corporate Tax Revenues Declined? Another Look", *CESifo Economic Studies*, 53(2): 153-171.
- Brautigam R., C. Spengel and K. Stutzenberger (2017), "The Development of Corporate Tax Structures in the European Union from 1998 to 2015 – Qualitative and Quantitative Analysis", *ZEW Discussion Paper* 17-034.
- De Mooij, R. and G. Nicodeme (2008a), "Corporate tax policy and incorporation in the EU", *International Tax and Public Finance*, 15: 478-498.
- De Mooij, R. and G. Nicodeme (2008b), "How Corporate Tax Competition Reduces Personal Tax Revenue", *ifo DICE Report*, 6(1): 27-31.
- Devereux, M. and R. Griffith (1998), "The Taxation of Discrete Investment Choices", *IFS Working Paper*, W98/16.
- Devereux, M., R. Griffith and A. Klemm (2002), "Corporate income tax: Reforms and tax competition", *Economic Policy*, 17(35): 449-495.
- Ederveen, S. and R. de Mooij (2003), "To which tax rate does investment respond? A synthesis of empirical research on taxation and foreign direct investment", *Tax policy*, Bank of Italy, pp. 327-354.
- European Commission (2017), *Taxation Trends in the European Union*, Taxation and Customs Union, Brussels.
- Feld, L. and J. Heckemeyer (2011), "FDI and Taxation: A Meta-Study", *Journal of Economic Surveys*, 25 (2): 233-272.
- Fuest, C., Peichl, A. and S. Siegloch (2018), "Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany", *American Economic Review*, 108(2): 393-418
- Hassett, K. and A. Mathur (2006), "Taxes and wages", *American Enterprise Institute Working Paper* 128.
- Heckemeyer, J.H. and M. Overesch (2017), "Multinationals' profit response to tax differentials: Effect size and shifting channels", *Canadian Journal of Economics*, 50(4): 965-994.
- Kawano, L. and J. Slemrod (2016), "How Do Corporate Tax Bases Change When Corporate Tax Rates Change? With Implications for the Tax Rate Elasticity of Corporate Tax Revenues", *International Tax and Public Finance*, 23(3): 401-433.
- Lawless, M., D. McCoy, Morgenroth E. and C. O'Toole (2015), "Corporate Tax and Location Choice for Multinational Firms", *MPRA Paper* No. 64769, <http://mpra.ub.uni-muenchen.de/64769/>
- Leibrecht, M. and C. Hochgatterer (2012), "Tax Competition as a Cause of Falling Corporate Income Tax Rates: A Survey of Empirical Literature", *Journal of Economic Surveys*, 26(4): 616-648.
- Nicodeme, G. (2001), "Computing effective corporate tax rates: comparisons and results", *Economic Paper* 153, European Commission.

- Randolph, W.G. (2006), "International burdens of the corporate income tax", *Congressional Budget Office Working Paper* 9.
- Rinke J. and M. Overesch (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.
- Shea, J. (1997), "Instrument relevance in multivariate linear models: A simple measure", *Review of Economics and Statistics*, 49: 348-352.
- Schmidt-Faber C. (2004), "An Implicit Tax Rate for Non-financial Corporations: Definition and Comparison with other Tax Indicators", *Taxation Papers* 5.
- Sorensen, P.B. (2007), "Can Capital Income Taxes Survive? And should they?", *CESifo Economic Studies*, 53(2): 172-228.
- Stock, J. H. and M. Yogo (2005), "Testing for weak instruments in linear IV regression", In *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, D. W. K. Andrews and J. H. Stock (eds.), 80-108, Cambridge University Press.
- Valenduc, C. (2011), "Imposition des revenus du travail, du capital et de la consommation: évolutions récentes", *Bulletin de Documentation du Ministère des Finances*, 71(3).
- ZEW (2016), *Effective tax rates in an enlarged European Union – 2015 report*, European Commission

**Annex (1): EU28 CIT to GDP ratio and GDP-weighted average CIT rate**

year	CIT rate	CIT/GDP
1995	42.9	2.25
1996	42.9	2.58
1997	43.0	2.91
1998	40.9	2.77
1999	39.2	2.87
2000	38.4	2.97
2001	34.9	2.74
2002	34.5	2.47
2003	34.3	2.34
2004	33.5	2.55
2005	32.8	2.78
2006	32.5	3.18
2007	31.9	3.22
2008	29.0	2.93
2009	29.1	2.20
2010	28.9	2.34
2011	28.7	2.45
2012	28.4	2.47
2013	28.5	2.48
2014	28.0	2.41
2015	27.5	2.47
Average	33.8	2.64
Minimum	27.5	2.20
Maximum	43.0	3.22

Source: Own computations based on Eurostat national account data  
(with extrapolation for Croatia, see Annex 3). EU28 CIT rate is GDP-Weighted.

## Annex (2) – Variables definition and source – July 2017.

Variables	Definition	Source
Corporate Statutory tax rates (STR)	Nominal statutory corporate tax rates, including local taxes and surcharges, applicable to large companies	Taxation Trends Report (European Commission)
Corporate tax revenues (CTR)	Taxes on the income or profits of corporations, including holding gains (In billions EUR).	Eurostat, main national accounts tax aggregates (gov_10a_taxag)
Gross Operating Surplus of Corporations (GOSc)	Surplus (or the deficit) accruing from production activities before account has been taken of the interest, rents or charges payable on financial or tangible non-produced assets which the production unit has borrowed or rented; and of the interest, rents or charges receivable on financial assets or tangible non-produced assets owned by the production unit. The gross operating surplus of corporations can be compiled as Gross value added (B.1g) - Compensation of employees (D.1) - Other taxes on production (D.29) + Other subsidies on production (D.39). Gross operating surplus means operating surplus without deducting consumption of fixed capital. Corporations include the non-financial sector (S11) and the financial sector (S12). (In billions EUR).	European Commission AMECO database (UOGC)
Gross Operating Surplus of the Economy (GOSe)	The gross operating surplus of the total economy is the sum of the gross operating- surpluses of the various industries or the various institutional sectors. (In billions EUR).	European Commission AMECO database (UOGD)
Nominal GDP (GDP)	Gross domestic product at current market prices for the total economy. (In billions EUR).	European Commission AMECO database (UVGD)
Real GDP growth	Proportional change in the Gross Domestic Product at constant 2010 prices (in national currency)	European Commission AMECO database (OVGD)
Gross Value Added of Corporations (VAc)	Value added is the net result of output valued at basic prices less intermediate consumption valued at purchasers' prices. In case of UGVAC intermediate consumption does not include FISIM, which means that FISIM is included in gross value added. Gross value added means value added before deducting consumption of fixed capital. Corporations include the non-financial sector (S11) and the financial sector (S12). (In billions EUR).	European Commission AMECO database (UGVAC)
Gross Value Added of the Economy (VAc)	Value added is the value of output less the value of intermediate consumption. It measures the value generated by any unit engaged in a production activity. The variable UVGE does not include FISIM (Financial Intermediation Services Indirectly Measured). Basic prices do not include taxes less subsidies on products. Gross value added means value added without deducting consumption of fixed capital. (In billions EUR)	European Commission AMECO database (UVGE)
Corporate Tax Base (BASE)	Net operating surplus of the non-financial and financial corporations (B.2n_S11-12) + net interest received by financial and non-financial corporations (D.41_S11-12rec - D.41_S11-12pay) + net rents on land paid by non-financial and financial corporations (D.45_S11-12rec - D.45_S11-	Taxation Trends Report (methodological annex) and Eurostat (Non-financial transactions nasa_10_nf_tr).

	<p>12rec) + net insurance property income attributed to policyholders received by non-financial and financial corporations (D.44_S11-12rec - D.44_S11-12pay). (In billion EUR).</p> <p>We exclude from the base net dividends received by non-financial and financial corporations (D.42_S11-12rec - D.42_S11-12pay) + dividends received by the general government (D.42_S13rec) + dividends received by the rest of the world (D.42_S2rec) + dividends received by households, self-employed and non-profit institutions (D.42_S14-15rec).</p>	
--	--	--

*Note: The variables have been extracted in July 2017.*

### **Annex (3) – Extrapolation of missing data.**

Several indicators display missing data for a limited number of countries and years. In order to present the general EU28 developments, we had to extrapolate these data to obtain a EU28 figure. This annex explains the extrapolation procedure.

1. Corporate tax revenues are unavailable for Croatia for the years 1995 to 2001. We take the sum of the corporate tax revenues for the EU27 other Member States and look at the percentage change of this total between each year. We then take the first available information for Croatia, which is for year 2002 and proceed backwards to find the value of 2001, applying the average EU27 growth of CIT revenues between 2001 and 2002. We proceed then further to extrapolate values for 2000, 1999, etc.
2. The Gross Operating Surplus of Corporations is not available for Ireland (1995-1998). Croatia (1995-2001 and 2015). Luxembourg (2013-2015), and Malta (1995-1999. 2011-2015). We take the sum of the corporate tax revenues for the EU27 other Member States and look at the percentage change of this total between each year. We take the sum of the Gross Operating Surplus of Corporations for the EU24 other Member States and look at the percentage change of this total between each year. We then apply this rate forward or backward to extrapolate missing data.
3. We apply the same procedure to retrieve the Gross value-Added at basic price of corporations, which is missing for the same countries and years.
4. The Corporate Tax Base is missing for Ireland (1995-1998). Spain (1995-1998). Croatia (1995-2001 and 2015). Lithuania (1995-2003) and Romania (2015). For those countries, we apply the same procedure as above based on the growth rate for the sum of all other Member States. More critically, the Corporate Tax Base is missing for all years for Luxembourg and for Malta (notably. interest. rents. dividends. and property income attributed to insurance policy holders received and paid by corporations are not available for those two countries). For Luxembourg and Malta, we proceed in the following way: for each year, we take the ratio of the corporate tax base to the gross operating surplus of corporations for the countries for which these items are available. We then multiply this ratio by the gross operating surplus of Luxembourg and Malta to respectively obtain the extrapolated value of the corporate tax base of Luxembourg and Malta.
5. The Gross Operating Surplus of the Economy, the Gross value added at current basic prices excluding FISIM for the total economy and the Gross domestic product at current prices are available for all Member States and years.