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Corporate Taxation, Tax Evasion, and Tax Design

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I dedicate this work to my best childhood friend, Vaseto A. Karamanov, who left us too early and is sorely missed.

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Preface

In a letter to Jean-Baptiste Leroy in 1789, Benjamin Franklin observed that "...in this world nothing can be said to be certain, except death and taxes!" Individuals and businesses, however, certainly employ skilful ways to evade taxes until they are caught, if they ever are. Inevitably, the evolution of taxation systems and their accompanying legal frameworks result in adjustments to evasion/avoidance patterns and mechanisms, which are of interest to economists, social psychologists, and public administrations alike.

The objective of this thesis is to study the effects of the widespread shift towards indirect taxation in the European Union (EU) on firms' tax compliance behaviour. This shift is generally characterised by rising consumption taxes, in particular the value-added tax (VAT) and falling corporate tax rates (CIT). While the policy of radical lowering of the corporate tax burden will likely lead to more honest profit disclosure, my research suggests that firms' evasion practices can migrate to other tax bases, such as social security, where plentiful savings from evasion schemes can be realised. When payroll taxes are significantly above the CIT rates, incentives emerge for companies to under-report wages, since under-stating labour costs is cheaper than paying full contributions. Chapter 1 of this dissertation, titled "The Effect of Low Corporate Tax Rate on Payroll Tax Evasion," explores the phenomenon of wage under-reporting in the context of Bulgaria, which has one of the lowest CIT rates in the EU and yet, due to negative demographic trends and low revenue collection capacity, maintains high payroll contributions.

An interesting trend observed in Central and Eastern Europe, and to a smaller degree in the 'Old' Member States, is that despite dramatic cuts in rates, corporate tax receipts exhibit an upward tendency. The extent to which firms anticipate tax cuts and shift taxable income to years with lower CIT rates becomes an important empirical question in view of its relevance to the deadweight loss of the CIT. Whether accomplished through accounting manipulation or a reduction of outright evasion, intertemporal income shifting can be one possible explanation for the stability of CIT revenue. Evidence of income shifting as well as discussion of tax incentives and the timing of CIT cuts is presented in Chapter 2, "Intertemporal Income Shifting in Expectation of Lower Corporate Tax Rates: The Tax Reforms in Central and Eastern Europe," using firm-level panel data for Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia.

In addition to the greater reliance on indirect taxation, another equally important shift is the global move towards a cashless economy and its implications for tax enforcement. Chapter 3, "The Impact of Cash and Card Transactions on VAT Collection Efficiency," investigates whether the visibility of card payments contributes to better tax compliance in the case of VAT. While no evidence is found that card transactions improve VAT performance in a country-level panel of 26 EU countries, cash payments are shown to be negatively correlated with the VAT-to-consumption ratio.

Considerable revenue dependence on indirect taxation coupled with a rising level of VAT fraud necessitate a reform in VAT's design, and in particular, its method of collection, as pro-

posed recently by the European Commission. The last chapter of the thesis, entitled "Real-time Collection of the Value-added Tax: Some Business and Legal Implications," analyses the feasibility of a real-time split-payment mechanism (VAT withholding) for electronic transactions, which would eliminate the system of fractionated payments, but would also preclude VAT from passing through private bank accounts. Any technological reform in that direction, however, raises important issues on data privacy and protection, which can be positioned within the broader debate on property rights in an economy steadfastly advancing towards payment digitisation. An even more crucial question is whether tax systems should evolve towards involuntary compliance, given the unprecedented amount of information tax administrations can potentially access.

Předmluva

V dopise Jean-Baptistu Leroyovi v roce 1789, Benjamin Franklin, poznamenal, že "...v tomto světě není nic, co by bylo jisté, kromě smrti a daní!" Nicméně občané a podniky přicházejí se šikovnými způsoby, jak se vyhnout placení daní až do té doby, dokud nejsou chyceni, pokud tedy vůbec někdy chyceni jsou. Vývoj daňových systémů a jejich doprovodných právních rámců nevyhnutelně vede k úpravám způsobů vyhýbání se daním a mechanismů, které jsou zajímavé pro ekonomy, sociální psychology, i pro veřejnou správu.

Cílem této práce je studium účinků přesunu směrem k nepřímému zdanění, obecně rozšířeného v Evropské unii (EU), na dodržování daňových předpisů firmami. Tento posun se obecně vyznačuje rostoucími spotřebními daněmi, zejména pak daně z přidané hodnoty (DPH), a poklesem daně z příjmu právnických osob (DPPO). Přestože politika radikálního snížení korporátní daňové zátěže pravděpodobně povede k pravdivějšímu reportování zisků, můj výzkum naznačuje, že se firemní praktiky na vyhýbání se daním přesunou do jiných daňových kategorií, jako je například daň ze sociálního zabezpečení, kde je možné generovat velké úspory pomocí daňových úniků. Pokud jsou daně z mezd výrazně vyšší než korporátní daně, vzniká motivace pro firmy, aby přiznávali uměle nízké mzdy, jelikož podhodnocení nákladů práce je levnější než placení plných příspěvků. Kapitola 1 této dizertační práce s názvem "Vliv nízké korporátní daňové sazby na úniky na dani ze mzdy", zkoumá fenomén podhodnocování mezd v Bulharsku, které má jednu z nejnižších sazeb DPPO v EU, a přesto, díky negativnímu demografickému vývoji a nízké kapacitě vybírat daně, udržuje vysoké srážky z mezd.

Zajímavý trend, který je možné pozorovat ve střední a východní Evropě a v menším měřítku i ve "starých" členských státech EU, je, že i přes dramatické snižování sazeb, příjmy z korporátních daní vykazují vzestupnou tendenci. Do jaké míry firmy předvídají snižování daňových sazeb a pak přesouvají zdanitelný příjem do let s nižší DPPO se stává důležitou empirickou otázkou vzhledem k jejímu významu pro ztrátu mrtvé váhy z korporátní daně. At' již je ho dosaženo pomocí účetních manipulací nebo přímo snížením daňových úniků, intertemporální přesouvání příjmů může být jedním z možných vysvětlení pro stabilitu příjmů z DPPO. Data ohledně intertemporálního přesouvání příjmů spolu s diskuzí o daňových pobídkách a načasování snižování DPPO jsou uvedena v kapitole 2 s názvem "Intertemporální přesouvání příjmů v důsledku očekávaných nižších korporátních daňových sazeb: Daňové reformy ve střední a východní Evropě". Kapitola používá panelová data na úrovni firem z Bulharska, České republiky, Mad'arska, Polska, Rumunska a Slovenska.

Další neméně důležitý posun, kromě většího spoléhání se na nepřímé daně, je globální posun směrem k bezhotovostní ekonomice a jeho důsledky pro vymáhání daní. Kapitola 3 s názvem "Dopad peněžních a karetních transakcí na účinnost výběru DPH," zkoumá, zda viditelnost plateb kartou přispívá k lepšímu plnění daňových povinností v případě DPH. Zatímco se nepodařilo prokázat, že by karetní transakce zvyšovaly výběr DPH na panelu s 26 zemi EU, platby v hotovosti mají prokazatelně negativní korelaci s poměrem DPH a spotřeby.

Značná závislost příjmů na nepřímých daních spolu s rostoucí četností podvodů na DPH si

vyžaduje reformu v designu DPH, a zejména pak způsobu jejího výběru, tak jak nedávno navrhla Evropská komise. Poslední kapitola této dizertační práce s názvem "Výběr daně z přidané hodnoty v reálném čase: Některé obchodní a právní důsledky,"analyzuje proveditelnost mechanismu split-plateb v reálném čase (zadržování DPH) pro elektronické platby, což by eliminovalo systém dělených plateb, ale také znemožnilo, aby DPH procházelo soukromými bankovními účty. Každá technologická reforma v tomto směru však vyvolává důležité otázky týkající se ochrany soukromých údajů, které mohou být analyzovány v kontextu širší debaty o vlastnických právech v ekonomice vytrvale postupující směrem k platební digitalizaci. Ještě důležitější otázkou je, zda by se daňové systémy měly vyvíjet směrem k nedobrovolnému plnění, vzhledem k nebývalému množství informací, ke kterým potenciálně mohou daňové úřady získat přístup.

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Besides enhancing my appreciation of the elegance of the English language, Robin-Eliece Mercury, in her capacity as a teacher and friend, instilled in me a sense of self-discipline and internal strength, for which I am truly thankful.

My deepest gratitude goes to my parents for their unceasing and unconditional moral support throughout the development of this dissertation and in every other respect. I would like to also thank my significant other, Justin, for his incredible patience, consideration and encouragement.

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Chapter 1

The Effect of Low Corporate Tax Rate on Payroll Tax Evasion

It is a commonly held view that the widespread policy of cutting the corporate income tax has a positive effect on taxable income through decreasing firms' incentive to hide profits. A neglected side of this policy, however, is its potential to trigger more evasion in other tax bases, such as the social security base, especially if the corporate income tax rate is low compared to the payroll rate. I develop a model in which employers and employees cooperate in declaring lower wages to the tax authorities in order to evade payroll contributions. Since wages and payroll taxes are a deductible expense for firms, a lower reported wage translates into higher corporate profits on paper and hence, shifting of tax liability out of social security into the corporate tax base. Using firm-level panel data for Bulgaria, where the problem of contribution evasion is prevalent, the estimates indicate that a 1% increase in the net-of-tax-share of the corporate tax rate reduces reported wages in the economy by .21%, but leads to higher taxable incomes. An identical increase in the payroll net-of-tax-share results in a .28% rise in wages. The separate tax bases respond strongly to changes in the corporate tax rate, with the overall impact on the combined tax base of wages and taxable incomes being negative.

Keywords: Corporate tax, Payroll tax, Evasion, Wage under-reporting, Bulgaria
JEL Classification: H25; H26; H55; J3

1.1 Introduction

The evasion of social security contributions has been a long-standing problem in the countries of Latin America and Central and Eastern Europe (CEE). Crude estimates for some Latin American countries in the early 1990s indicate that 50% to 60% of the contribution liability remained uncollected, with Brazil heading the list, while between 20% and 30% of total contribution income in CEE was evaded in the mid-1990s, as estimated by the International Labour Office (Gillion et al., 2000).

I wish to thank Libor Dušek, Peter Katuščák, Viktor Steiner, Peter Egger, Clemens Fuest, Jan Kmenta and the seminar participants at Potsdam University, Ruhr University of Bochum, CESifo Venice Summer Institute and the University of Copenhagen for useful comments. Any remaining errors are mine.

In 2002, for example, according to a number of surveys, approximately 34% of all employed in Bulgaria under-stated their true wages and 25% worked without an official labour contract (CSD, 2004). Based on a survey in Hungary, Tonin (2011) documents that 56% of the interviewed households claimed that employers declare the minimum wage and pay the rest in cash in the form of "envelope wages." In Estonia undeclared labour income amounted to 8-9% of GDP in 2001 (Kriz et al., 2007). Although pervasive in CEE and Latin America, payroll tax evasion is by no means limited to these regions. In fact, as Gillion et al. (2000) point out, this type of evasion poses a challenge even in the OECD countries, albeit on a smaller scale.

In China, where the problem is substantial, Zhu and Nyland (2004) find that barely 18% of private firms met their mandated obligations fully in 2000. In a 2001 study of 2,200 randomly audited companies in Shanghai, 71% were found to pay less than the prescribed social security contributions, with big firms tending to evade more contributions relative to smaller firms (Nyland et al., 2006).

Not only does payroll tax evasion undermine the credibility and legitimacy of the social security system, but it also distorts labour markets by creating unfair competition and necessitating higher tax rates to generate required revenue. Unlike tax evasion that affects the general functioning of government, contribution evasion directly impacts current pensioners' benefits and compliant contributors under the defined benefit (DB) scheme. It reduces aggregate savings and output and may result in the introduction of a minimum pension paid from general revenue in defined contribution (DC) systems with low personal savings (Manchester, 1999; Gillion et al., 2000). When achieved through the under-reporting of wage earnings, contribution evasion tends to flatten the benefits structure, erodes the personal income tax (PIT) base and, depending on strategy, spreads out to other tax bases as well.

There are various ways for an employer to evade the payment of contributions. The principal strategies include failing to register an employee or registering him as a contractor/temporary worker, not remitting contributions to the authorities, underpaying withheld contributions, or under-reporting wage payments (McGillivray, 2001; Bailey and Turner, 2001). Theoretically, the issue of wage under-reporting has been tackled by Gideon Yaniv in a series of papers in the context of PIT (Yaniv 1988, 1992). Yaniv (1988) studies the advantages of withholding versus self-declaration for personal income taxation. In particular, he explores the possibilities of tax evasion in a withholding system, in which the employer remits employees' withheld PIT taxes to the authorities. In many countries employers are responsible for filing a tax return on behalf of employees in the absence of other personal income but the labour income. All of the above schemes, therefore, can be executed with or without employees' collusion.

Studying evasion is especially difficult due to its illegality and hence, lack of consistent data. Nevertheless, various theoretical and empirical studies, predominantly on personal income tax evasion, have emerged, primarily after 1972, when Allingham and Sandmo (1972) positioned evasion in a specific theoretical framework. Contribution evasion, however, remains largely unexplored in the economic literature, even though there is a significant discussion of the reasons, consequences and possible strategies for fighting payroll tax evasion (Gillion et al., 2000;

McGillivray, 2001; Bailey and Turner, 2001; Manchester, 1999).

This chapter examines the effect of the widespread policy of cutting the corporate income tax (CIT) rate on contribution evasion in Bulgaria accomplished through massive under-reporting of labour income. From 1997 to 2002, the CIT rate decreased by 7 percentage point on average in CEE (European Commission, 2011). Bulgaria was not an exception to this trend. Specifically, the statutory CIT rate declined from 42.4% to 23.5% for big companies and from 33.4% to 23.5% for smaller businesses. Social security rates, however, exhibited only a slight downward trend, moving from 44% in 1997 to 42.7% in 2002. Yet, the reduction in direct taxes in Bulgaria did not translate into a narrower compliance gap, a fact largely attributed to the excessive burden of compulsory contributions (Pashev, 2005). The decreased corporate burden made it more advantageous to shift evasion towards the payroll tax base, where larger savings could be realised.

The most common way of evading contributions was the under-statement of workers' real earnings, which triggered evasion in the PIT base too (CSD, 2004). Since firms under-stated wages, they necessarily ended up with higher corporate profits, as labour costs are a deductible expense. Thus, a trade-off emerged between overpaying CIT and paying full contributions. Given that the CIT rate was significantly lower than the payroll rate, firms would rather not report their full costs by under-stating wages, than pay their full payroll tax liability.

I develop a theoretical framework in which employers and employees cooperate in under-reporting actual wages for tax purposes. As a consequence, employers decrease their payroll tax payments, while employees receive higher net wages. The declaration of lower wage payments than incurred in reality increases the firm's taxable income (TI) and hence, profit tax liability. The employer, therefore, can decide to decrease TI through the manipulation of sales or other schemes in order to bring profit down to its actual level, or to overpay corporate income tax, fully or partially. With CIT rates falling, overpaying tax on profits is not an irrational strategy when payroll tax evasion is ongoing, as it can divert tax authorities' attention from investigating previously reported profit and especially the wage pattern of the firm. I then derive the relationships between the magnitude of fraud, the payroll and the CIT rates.

To find out whether there is indeed shifting of tax liability out of social security into the corporate tax base, I use firm-level panel data for Bulgaria from 1997 to 2002. I study the effect of the payroll and the CIT rate, and the difference between the two on reported wages and taxable incomes by firms. The presence of income shifting would manifest as a positive effect of the corporate tax rate on reported wages and a negative effect of the payroll rate on taxable income. The effect of the tax wedge on wages should be negative, as an increase in the tax wedge makes income shifting out of the payroll base more profitable and hence, drives reported wages down. Even if only a fraction of firms decide to overpay corporate income tax as a result of their evasion activities in the social security base, the tax wedge should have a positive influence on reported taxable incomes in the corporate base. The two-rate CIT code until 2002, the annual cuts in the CIT, and the fact that different categories of labour are subject to different payroll contribution rates within and across years are exploited as sources of variation in the tax rates.

The results show that a 1% increase in the CIT net-of-tax-share reduces wages in the economy by .21%, but raises taxable incomes. Conversely, a 1% rise in the payroll net-of-tax-share results in .28% higher reported wages. Despite the opposing effects of the corporate tax rate on the separate tax bases of wages and taxable income, the impact of CIT on the combined base of wages and taxable income is found to be negative, due to the prevailing negative response of wages and limited change in TI.

The chapter is structured as follows: Section 2 presents the theoretical framework of analysis; Section 3 provides an overview of the Bulgarian social security system and the major reforms over the period of interest as well as sketches the main features of the CIT law, while Sections 4 and 5 discuss the data, the empirical specification, and test the main hypotheses generated by the model; Section 6 evaluates the impact of the tax reforms on the full tax base, and Section 7 concludes.

1.2 The Model

In the model that follows the firm under-reports its wage bill while having the consent of its employees, and shares the benefits of evasion with them. The firm simultaneously decides whether to overpay corporate profits, only part of the increase in profit, or none of it.

Let the true profit of the firm be $\pi^{real} = Y(L^*) - w^R L^* - w^R L^* t_s$, where w^R is the gross wage paid to the employee in the absence of fraud, L^* is the number of workers, already optimally chosen by the firm, and t_s is the payroll tax rate on the employer.[1] $Y(L^*)$ is the value of output. Since the total wage bill depends both on the number of employees and their individual wages, I assume that the company has optimally chosen its number of employees and manipulates wages in order to adjust the total wage bill.

Denote t_e to be the payroll rate on workers and t_p the personal income tax rate. A non-evading firm pays $w^R(1+t_s)$ per employee, while a worker's after-tax earnings are $(1-t_p)(1-t_e)w^R$. If the firm under-reports w^R by an amount u, the gross wage for tax purposes becomes $w^R - u$. This type of evasion generates benefits from three different sources: Contributions payable by the firm decrease by ut_sL^*, ut_eL^* is the fall in employees' contributions and finally, PIT revenue goes down by $t_p(1-t_e)uL^*$.

No bargaining mechanism is introduced between workers and employers for the redistribution of the above-mentioned gains.[2] Before a person is hired, he needs to sign an employment

[1] Allowing for an endogenous number of employees, it can be shown that due to contribution evasion, the marginal cost of labour goes down, which makes it profitable to hire more workers. Even if the firm adjusts its number of workers, the incentive for contribution evasion (income shifting) is still present as long as the necessary condition for evasion, eq. (1.2.9), holds.

[2] Using survey data for Bulgaria, Perotti (2012) studies the factors affecting workers' decision to have their earnings under-reported. She finds that the subjective probability of survival to the age of 70 as well as the perceived tax-benefit linkage influence the intertemporal trade-off between higher net income today and a higher pension in future. Until 2000, the pension system was almost "Beveridgean," characterised by a very weak linkage between paid contributions and obtained pension. The reason for this is that the amount of personal pension for length of service and old age was calculated on the average monthly gross remuneration or income, on which insurance contributions were paid for a period of *three* consecutive years, which the person could *choose* from the last 15 years of service until January 1st, 1997 (emphasis mine). For a person retiring after January 1997,

contract stipulating his exact gross remuneration to be $w^R - u$, with the mutual understanding that he will actually receive w^R with u given under the table. The worker's net wage increases by $t_p u + t_e u(1 - t_p)$, i.e., it is assumed that the savings realised due to evaded employee's contributions go back to the employee in the form of higher compensation. In other words, if the total payroll rate is 30% divided into a 80:20 ratio between an employer and a worker, under-reporting the wage by \$1 results in a 24¢ gain for the employer and a 6¢ gain for the worker, ignoring the PIT benefit.

As the firm cannot report its true wage bill, the profit that it declares to the authorities is $\pi^{reported} = Y(L^*) - (w^R - u)L^* - (w^R - u)L^* t_s$. The real profit as a result of contribution evasion increases to

$$\pi^{real,evasion} = Y(L^*) - w^R L^* - (w^R - u)L^* t_s > \pi^{real} \tag{1.2.1}$$

The difference $\pi^{reported} - \pi^{real} = (1 + t_s)uL^*$ constitutes an evasion-driven increase in profit that can be taxed at the corporate tax rate t_c. It is at this point that social security evasion creates incentives for further manipulation of taxable income in the corporate income tax base.

Without contribution evasion, reported taxable income is such that the marginal benefit of reporting one more dollar equals the marginal cost. The under-reporting of wages artificially increases TI above its optimal level and the firm has an incentive to bring profit down. This is not a costless procedure, however, since manipulation of invoices, or whatever other method the firm chooses to hide the rise in profits, involves the risk of being caught. Moreover, an audit based on suspicions that a firm under-reports wages can also uncover manipulation of profits, whether or not triggered by contribution evasion. In any case, contribution evasion increases the probability of audit in general, and hence the marginal cost of profit manipulation goes up, inducing profit over-reporting.

Knowing by how much its profit rises on paper, a firm can choose to hide part of its sales or choose another strategy in order not to pay corporate income tax in excess of its true liability. Suppose that the firm subtracts a fraction $\phi uL^*(1 + t_s)$ from its taxable income. Thus, if $\phi = 0$, there is no attempt to bring profit down to its true level and part of the losses in social security revenue are mitigated by more collections in the corporate tax base. If $\phi > 0$ ($\phi = 1$), the cost of contribution evasion is partially (entirely) eliminated. The case when $\phi > 1$ is not considered. In other words, the firm is restricted to not manipulate profit for its own sake but only as a consequence of wage under-reporting.[3]

As long as the firm engages in fraud in both bases, the total amount evaded is:

$$E = \underbrace{(t_s + t_e + t_p(1 - t_e))uL^*}_{\text{PIT+ total social security}} + \underbrace{t_c\phi(1 + t_s)uL^*}_{\text{corporate tax}}. \tag{1.2.2}$$

besides the three years of their choice, the length of service after 1997 was also added to the period on which the pension was calculated (Tafradjiyski et al., 2005). It is clear that, by design, the system until 2000 contained an in-built incentive to promote insurance on a minimum wage and full insurance for only three years. The pension reform in 2000 strengthened the tax-benefit link to a certain extent.

[3]If a firm reports zero taxable income, then it completely removes the cost of payroll evasion and the corporate income tax, although it faces a higher probability of audit.

The firm's behaviour is constrained by the probability of detection and penalties that make evasion costly. Let the probability of detection be $\bar{p} = p_1(\phi(1+t_s)uL^*) + p_2(\frac{u}{w^R})$, where $p_1(.)$ is a function of the amount by which the firm adjusts its TI, in order to bring profit closer to its actual level. $p_1(.)$ is the probability of being caught for cheating at the corporate tax base, while $p_2(.)$ is the probability that the mechanism of contribution evasion is exposed. I follow Slemrod and Gordon (2000) and assume an endogenous detection probability that is an increasing function of evaded income in the corporate tax base, so that $p_1'(\phi(1+t_s)uL^*) > 0$. $p_2(.)$ is a function of the ratio of the amount of wage under-reported to the total wage and is also assumed to be increasing in the amount of wage under-reported, $p_2'(\frac{u}{w^R}) > 0$. A firm that is paying contributions on minimum wages is more likely to attract attention than a firm paying the average wage for the economy. If $u = 0$, then $p_1 = p_2 = 0$, which captures the previous assumption that there will be no corporate income adjustment without contribution evasion. The firm is risk neutral. Its after-tax profit if not detected is:

$$\begin{aligned} \pi^{nd} &= Y(L^*) - w^R L^* - (w^R - u)t_s L^* \\ &- t_c[Y(L^*) - (w^R - u)L^*(1+t_s) - \phi u L^*(1+t_s)] \end{aligned} \tag{1.2.3}$$

For the determination of a penalty scheme, it is assumed that an audit performed for corporate tax evasion uncovers wage under-statement and vice versa. An important question in this context is whether the firm will be reimbursed for its overpayment of profit (if any), not reimbursed, or penalised for engaging in evasion in general (Yaniv, 1988). In the first two cases – full or partial reimbursement and no reimbursement at all – the firm faces no penalty for manipulating profits provided that it is triggered by contribution evasion. Therefore, it pays off to set $\phi = 1$. If not detected, the firm will have eliminated the cost of its contribution fraud partially or fully. If detected, it will be punished for payroll and personal income tax evasion, but not corporate profit under-statement. Thus, even though the profit tax is overpaid, it makes sense not to reimburse the firm, but to punish it with a fraction of the tax "evaded". In a sense this would be a punishment for not overpaying CIT completely because, if this were the case, then no CIT "evasion" would have taken place. The penalty under these conditions becomes:

$$P = \lambda_1(t_s + t_e + t_p(1-t_e))uL^* + \lambda_2 t_c \phi(1+t_s)uL^* \tag{1.2.4}$$

where $\lambda_1 > 1$ and $\lambda_2 < 1$.[4] In the event of detection, the firm's profit changes to:

$$\begin{aligned} \pi^d &= Y(L^*) - w^R L^* - (w^R - u)t_s L^* \\ &- t_c[Y(L^*) - (w^R - u)L^*(1+t_s)] - \lambda_1(t_s + t_e + t_p(1-t_e))uL^* \\ &- \lambda_2 t_c \phi(1+t_s)uL^* \\ &= \pi^{nd} - P \end{aligned} \tag{1.2.5}$$

[4] An additional assumption behind this penalty structure is that the firm bears full responsibility for evaded employees' contributions. This possibility is not accounted for by the law, so the fact that workers cooperate willingly is ignored.

An employer then chooses ϕ^*, and u^* to maximise expected profit:

$$E[\pi] = (1-\bar{p})\pi^{nd} + \bar{p}\pi^{d}. \tag{1.2.6}$$

The first-order conditions for this problem are:

$$\begin{aligned} \frac{\partial E[\pi]}{\partial \phi} &= t_c - p_1' P - (p_1+p_2)\lambda_2 t_c = 0 && (1.2.7)\\ \frac{\partial E[\pi]}{\partial u} &= t_s - t_c(1+t_s) - (p_1+p_2)A - p_2' \frac{1}{w^R}\frac{P}{L^*} = 0, && (1.2.8) \end{aligned}$$

where $A = \lambda_1(t_s + t_e + t_p(1-t_e))$.

As discussed above, the marginal cost of under-reporting one dollar of profit, $\frac{p_1' P}{1-(p_1+p_2)\lambda_2}$ is a function of both the probability of detection for profit manipulation p_1 as well as the probability of detection for contribution evasion p_2, and is equal to the marginal benefit, t_c. The second-order condition of (1.2.7) also imposes a restriction on $p_1''(\phi(1+t_s)uL^*)$.[5]

It can be seen from (1.2.8) that the marginal benefit of under-reporting wage by one dollar, t_s, equals the marginal cost of over-reporting profit at the corporate tax base plus the expected penalty. The necessary condition for contribution evasion is thus

$$\frac{t_s}{(1+t_s)} > t_c, \tag{1.2.9}$$

which requires that the CIT is below the payroll rate.

Denote $E[\pi] = f$. Let f_ϕ and $f_{\phi\phi}$ be the first and second derivatives of f with respect to ϕ. Rewriting the FOC, totally differentiating them and dividing by dt_c, yields:

$$\begin{aligned} f_{\phi\phi}\frac{d\phi}{dt_c} + f_{\phi u}\frac{du}{dt_c} &= -f_{\phi t_c}\\ f_{u\phi}\frac{d\phi}{dt_c} + f_{uu}\frac{du}{dt_c} &= -f_{ut_c}, \end{aligned} \tag{1.2.10}$$

where $dt_s = dt_p = dt_p = d\lambda_1 = d\lambda_2 = dw^R = 0$, since I would like to consider only the effects of a change in t_c.

Cramer's rule is used to determine the sign of

$$\frac{du}{dt_c} = \frac{\det|B|}{\det|A|}, \tag{1.2.11}$$

where

$$\det|A| = \det\begin{bmatrix} f_{\phi\phi} & f_{\phi u} \\ f_{u\phi} & f_{uu} \end{bmatrix} = f_{\phi\phi}f_{uu} - {f_{\phi u}}^2 > 0^6$$

[5] The second-order condition is $-(1+t_s)uL^*(p_1'' + 2p_1'\lambda_2 t_c) < 0$ and holds if $p_1'' > 0$, i.e. if p_1 is convex. The second-order condition of (1.2.8) imposes the same restriction on p_2, $p_2'' > 0$

[6] $f_{\phi\phi}f_{uu} - {f_{\phi u}}^2 > 0$ is a sufficient condition for a relative maximum.

and

$$B = \begin{bmatrix} f_{\phi\phi} & -f_{\phi t_c} \\ f_{u\phi} & -f_{ut_c} \end{bmatrix}.$$

It can be shown that $\det|B| < 0$, so that $\frac{du}{dt_c} < 0$ (see Appendix 1.1 for derivations).

This negative relationship is not unexpected. A decrease in t_c stimulates contribution evasion by decreasing both the marginal cost of reporting more profit and the expected penalty so that $\frac{d(w^R-u)}{dt_c} > 0$. Thus, cutting the CIT rate can raise taxable income in the economy through two separate channels: First, a smaller rate translates into less corporate tax evasion; second, a lower rate triggers more social security evasion through the under-reporting of wages with at least some firms over-reporting corporate profits. Therefore, the policy of lowering the corporate tax burden may backfire through more evasion in another base.

Studying the effect of a change in t_s on $w^R - u$, $w^R - u$ is decreasing in the payroll rate, again pointing to the fact that increasing the contribution burden may cause more wage under-reporting. This is due to the positive sign of $\frac{du}{dt_s} > 0$ (Appendix 1.1).

The relationships between the tax rates and ϕ are $\frac{d\phi}{dt_c} < 0$ and $\frac{d\phi}{dt_s} > 0$ and are derived with Cramer's rule in the same fashion as the relationship between u, t_c and t_s above. A decrease in t_c leads to higher ϕ since, all else being equal, the firm has a stronger incentive to under-report wages, and therefore needs to manipulate profit more. A fall in t_s lowers ϕ for precisely the opposite reason.

Lastly, the effect of tax rates on taxable income is explored. The TI that is going to be taxed at the corporate base is:

$$TI = Y(L^*) - (w^R - u)L^*(1 + t_s) - \phi u L^*(1 + t_s) \tag{1.2.12}$$

Proceeds to the government from fines are ignored, so the focus is only on changes in revenue stemming from changes in taxable income.

$$\frac{dTI}{dt_c} = \underbrace{\frac{\partial TI}{\partial \phi}}_{-}\underbrace{\frac{d\phi}{dt_c}}_{-} + \underbrace{\frac{\partial TI}{\partial u}}_{+}\underbrace{\frac{du}{dt_c}}_{-} \tag{1.2.13}$$

On the one hand, a lower CIT rate decreases TI because ϕ goes up. On the other hand, lower t_c increases TI because u increases, so the overall effect is ambiguous. Note that there will be a further effect – bigger incentive for honest reporting of profits unrelated to payroll tax evasion – which is not captured by the above formulation, and which will most likely lead to $\frac{dTI}{dt_c} > 0$ The sign of $\frac{dTI}{dt_s}$ is also ambiguous. Decreasing t_s raises taxable income because less payroll tax expense is deducted and because ϕ decreases, but u goes down, shifting TI downwards.

$$\frac{dTI}{dt_s} = \underbrace{\frac{\partial TI}{\partial t_s}}_{-} + \underbrace{\frac{\partial TI}{\partial \phi}}_{-}\underbrace{\frac{d\phi}{dt_s}}_{+} + \underbrace{\frac{\partial TI}{\partial u}}_{+}\underbrace{\frac{du}{dt_s}}_{+} \tag{1.2.14}$$

I therefore turn to the data to determine these relationships. Before that, the next section briefly

describes the reforms in the two tax bases, which form the foundation of the empirical analysis.

1.3 Institutional Background

1.3.1 Social security system: Reform and characteristics

Until 1997 the social security system in Bulgaria was typical of any centrally planned economy: It was a standard pay-as-you-go (PAYGO) DB plan characterised by a loose linkage between benefits and contributions, too liberal conditions for access to the pension system, and an insurance burden borne solely by employers. By 1997 it became clear that a reform could no longer be postponed if the financial sustainability of the system was to be preserved (Shopov et. al., 2005).

The changes led to the establishment of a three-pillar pension system known as the World Bank scheme, with the first pillar being the obligatory PAYGO. Some of the mandatory insurance contributions were redirected towards private occupational and eventually universal pension funds as well, which formed the basis of the second pillar, capital-based, with individual insurance accounts. The third pillar is a voluntary insurance system with employees paying voluntary contributions into individual accounts. For a couple of years after its establishment the second pillar was restricted to workers from the so-called first and second labour categories who paid contributions to occupational funds for supplementary pension and early retirement. People in these two categories are employed in hazardous conditions, such as miners, underground geologists, hydrologists and others.[7]

Despite the second pillar's fully funded structure, contributions are made only by employers. Note that the empirical section of this chapter does not take into account the part of the payroll rate that employers pay to 2nd Pillar Universal or Occupational funds, which is reported in Table 1.1 for the sake of completeness.

Workers in the three different labour categories face different payroll rates, with the first labour category having the highest rate due to the amount of risk involved in the category's professions. In 1999, for example, an employer had to pay 51.7% in payroll contributions for a first labour category worker, 46.7% and 36.7% for second and third labour category employees, respectively (Table 1.1). Over the years, these rates have decreased for employers as some of the contribution burden was gradually shifted to workers.

Prior to 2000, the system did not distinguish between separate insurance risks. From 2000 onward differentiated amounts of insurance contributions for pension, sickness and maternity,

[7]Firms are assigned to labour categories in accordance with the Decree for the Categorisation of Labour upon Retirement enacted at the end of 1997. The Decree stipulates the types of labour in the first, second and third labour categories, which pay different payroll contributions as described in Table 1.1. The following type of labour falls within the first labour category: Casting of metals, metallurgy, manufacture of petroleum products and nuclear fuel, mining, and quarrying. The following type of labour falls within the second labour category: Air, coastal, railway transport, construction of ships, motorways, airfields, water projects, civil engineering works, collection and treatment of sewage, industrial dyeing (furs), manufacture of pigments, manufacture of glassware, plastics, rubber, ceramics, cement, explosives, weapons, fertilisers, and glass fibre. The type of labour not specified under the first and second categories falls within the third labour category.

Table 1.1: SOCIAL INSURANCE FINANCING AND CHARACTERISTICS

	1997		1998		1999		2000		2001		2002	
	Employer	Worker	Employer	Worker	Employer	Worker	Employer	Worker	Employer	Worker	Employer	Worker
Third Labour Category												
Pension	37	2	37	2	35.85	1.5	25.6	6.4	23.2	5.8	20.25	6.75
Sickness							2.4	0.6	2.4	0.6	2.25	0.75
Work Injury							0.7	0	0.7	0	0.7	0
Unemployment	5	0	3.8	0.95	3.55	0.7	3.2	0.8	3.2	0.8	3	1
Health Insurance					3	3	4.8	1.2	4.8	1.2	4.5	1.5
2nd Pillar Universal											1.5	0.5
Total	42	2	40.8	2.95	42.4	5.2	36.7	9	34.3	8.4	32.2	10.5
Second Labour Category												
Pension	47	2	47	2	45.85	1.5	28.6	6.4	26.2	5.8	23.25	6.75
Sickness							2.4	0.6	2.4	0.6	2.25	0.75
Work Injury							0.7	0	0.7	0	0.7	0
Unemployment	5	0	3.8	0.95	3.55	0.7	3.2	0.8	3.2	0.8	3	1
Health Insurance					3	3	4.8	1.2	4.8	1.2	4.5	1.5
2nd Pillar Universal											1.5	0.5
2nd Pillar Occupational							7	0	7	0	7	0
Total	52	2	50.8	2.95	52.4	5.2	46.7	9	44.3	8.4	42.2	10.5
First Labour Category												
Pension	52	2	52	2	50.85	1.5	28.6	6.4	26.2	5.8	23.25	6.75
Sickness							2.4	0.6	2.4	0.6	2.25	0.75
Work Injury							0.7	0	0.7	0	0.7	0
Unemployment	5	0	3.8	0.95	3.55	0.7	3.2	0.8	3.2	0.8	3	1
Health Insurance					3	3	4.8	1.2	4.8	1.2	4.5	1.5
2nd Pillar Universal											1.5	0.5
2nd Pillar Occupational							12	0	12	0	12	0
Total	57	2	55.8	2.95	57.4	5.2	51.7	9	49.3	8.4	47.2	10.5

Note: Figures are percentage of payroll.
Source: Law for Social Security for various years; Annual Bulletins of the National Social Security Institute.

Table 1.2: SURVEYS' ASSESSMENT OF THE DEGREE OF WAGE UNDER-REPORTING

	2002	2003	2004	2005	2007	2008	2009	2010
Managers' perspective on the share of workers with under-declared incomes								
Up to 10%	14.4		23.6	25.6	26.6		22.9	22
10% - 25%	12.6		24.6	18.7	11.7		14.2	10.1
25% - 50%	27.3		16.5	18.4	15.5		19.3	24.1
50% - 75%	15.2		8.1	7.8	6.6		3.6	4.4
Above 75%	12.3		6.8	7.5	4.8		7.3	8.3
None	18.2		20.4	21.9	34.8		32.7	30.3
Survey's base	374		309	347	290		248	228
Employees' answers on the true level of their remuneration, %								
On the minimal social security threshold, though the total amount of my salary is larger		12.1	13.4			13.5	12.9	10.3
On the minimal social security threshold, which is the real salary I get		10.3	14.3			9.5	12.6	5.9
On the sum set in my contract, though the total amount of my salary is larger		6.7	8.3			15	15.5	8.4
On the sum set in my contract, which is the real salary I get		68.3	63.4			61.8	56.2	67
Other		2.6	0.6			0.3	2.8	1.5
Survey's base		348	314			378	395	466

Note: The survey question asked to managers was: "In your opinion, what share of the employed in your branch work under contracts with "hidden clauses," i.e. receive payments larger than the ones stated in the contract?" The question to workers was: "What is the sum on which you are socially insured?" Before 2003, the policy of minimal social security thresholds, whose goal is to mitigate the impact of the pervasive practice to report the minimum wage as the income on which payroll taxes are paid, was not in force.
Source: (CSD, 2011).

and work injury were introduced, with the employer and the employee sharing the contributions in a given ratio. The payroll contributions payable by employers in 1997 amounted to 42% of gross salary for workers in the third labour category. Four years later, in 2002, this percentage was 32.2%. The combined employer-employee contribution rate decreased by only 1.3 percentage point for five years, from 44% in 1997 to 42.7% in 2002.

The nature of the reform in the pension system was such that within a given year the difference between the payroll rates of the third and second labour categories remained fixed at 10 percentage point, while that between the second and first category was 5 percentage point. Table 1.1 further shows that the payroll rates for the different labour categories changed by the same percentage point from year $t-1$ to year t. This means that the cross-sectional and time series variation in the payroll rates in absolute levels is the same for all three labour categories. Nevertheless, the percentage changes vary by labour category and over time, which allows the identification of the effect of the payroll rate on reported wages and taxable income using various econometric specifications.

Data on the extent of payroll tax evasion before 2002 is scarce. A 2003 survey showed that envelope wages constituted 21.1% of salaries in firms employing 2 to 10 people, 18.8% in companies with 11-50 employees, and 6.7% in the biggest firms with more than 500 workers (CSD, 2004). However, 2003 was also the year when minimum social security thresholds were introduced in Bulgaria, suggesting that the practice of wage under-declaration was likely more severe in the earlier years.

The minimum obligatory social security thresholds legally stipulate the minimum wage level on which contributions are payable for every type of profession in a given industry. They are higher than the minimum wage, and generally reflect the government's perceptions of what the true wages in the economy are (Slavova et al., 2007).

Table 1.2 summarises survey evidence on payroll tax evasion based on the views of both managers and employees, which are generally quite divergent. For example, in 2004, 79.6% of managers believed that workers' earnings are under-declared, whereas only 21.7% of employees admitted that they are insured on a lower income than their true one. Even though a greater number of managers believe that the practice was uprooted in 2010 as compared to 2002, the number of surveyed workers reporting payroll tax evasion decreased by only 0.1 percentage point from 2003 to 2010.

1.3.2 Corporate income tax

Unlike the persistently high payroll tax rates, the corporate tax rate in Bulgaria has been lowered substantially over the years (Table 1.3, Figure 1.1). For the whole period 1997-2002 firms paid a tax on profits for the central budget and a tax on profit for municipalities – the municipality tax. The tax base for the municipality tax was taxable income, while the tax base for the tax on profit was the taxable income reduced by the amount of the municipality tax.

The standard CIT rate varied from 42.2% in 1997 to 23.5% in 2002, a change of 18.7 percentage point. Firms with taxable income below a legally stipulated threshold were subject to a lower preferential rate, which was less volatile compared to the standard rate and declined by about 10 percentage point. It is important to point out that the system was not progressive: firms taxed at the standard rate did not pay the lower rate for profits up to the threshold. Starting in 2002, a single rate was imposed irrespective of firms' TI. Table 1.3 summarises the standard and preferential tax rates and calculates the effective rate taking into account the local CIT surcharge.

The fall in the CIT rates, however, was not accompanied by an extensive expansion of the tax base to make the reform revenue-neutral. Depreciation rates and loss carry-forwards in particular remained unchanged. Most importantly, while the definition of taxable income was altered, its core elements were preserved. Taxable income is formed based on the transformation of the accounting financial result. The accounting financial result is the accounting value of the difference between revenues and expenses. Once this amount is determined, it is adjusted upwards or downwards by certain provisions specified in the Corporate Income Tax Law for tax purposes in order to obtain TI. Therefore, any amendment to these provisions affects the

Table 1.3: CORPORATE INCOME TAX FINANCING AND CHARACTERISTICS

	1997	1998	1999	2000	2001	2002
CIT rate central budget						
$TI < Threshold$ (Preferential)	26	20	20	20	15	
$TI > Threshold$ (Standard)	36	30	27	25	20	15
CIT rate municipalities	6.5	10	10	10	10	10
Total CIT rate (Preferential)	33.4	28	28	28	23.5	
Total CIT rate (Standard)	42.4	37	34.3	32.5	28	23.5
			Depreciation rates			
Buildings	4	4	4	4	4	4
Machines	20	20	20	20	20	20
Vehicles	8	8	8	8	8	8
All other assets	15	15	15	15	15	15
Loss carry-forward (years)	5	5	5	5	5	5

Note: The threshold changed from \$1,000 in 1997 to \$25,000 in 1998 and remained the same from 1998 onward. In 2002 a single CIT rate was introduced irrespective of the level of taxable income.
Source: Law for Corporate Income Tax for various years.

definition of TI.

Table 1.4: CHANGES IN THE DEFINITION OF TAXABLE INCOME

	1997	1998	1999	2000	2001	2002
No. of provisions in the CIT Law						
Increasing the financial result	22	23	23	24	23	24
Decreasing the financial result	11	10	15	13	14	17
No. of abolished provisions						
Increasing the financial result		3	0	0	1	0
Decreasing the financial result		2	0	4	0	2
No. of newly stipulated provisions						
Increasing the financial result		4	0	1	0	1
Decreasing the financial result		2	5	2	1	5

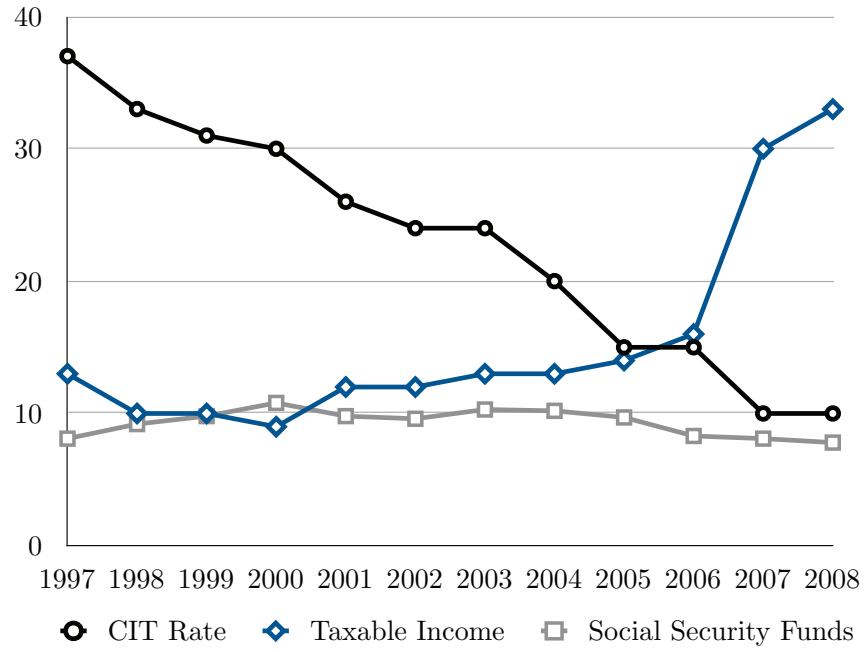
Source: Law for Corporate Income Tax for various years.

Table 1.4 shows how the number of provisions varied over the period of interest. In particular it lists how many provisions were abolished, how many new ones were introduced, and whether they increased or decreased TI. It is clear that the main change in the definition occurred between 1997 and 1998 and since then it has mostly been modified with respect to the provisions that reduce TI. This means that an increase in reported taxable income, given falling CIT rates, will not be driven by expansions of the tax base.

Estimates of the Bulgarian tax authorities, SG group and the World Bank indicate that only 55% of corporate income taxes were collected in 2002 (CSD, 2004). Figure 1.1 depicts aggregate taxable income as a percent of GDP as well as the CIT rates time series (National Revenue Agency; Ministry of Finance). TI ranged between 13 and 16% of GDP until 2007, when the CIT rate was cut to 10% and TI jumped to 30% of GDP, a 14 percentage point increase in one year.

No major fluctuations are observed for social security contributions as a percent of GDP. In fact, they begin to decline in 2005, despite a growing minimum wage and social security thresholds.

Figure 1.1: CIT RATES, AGGREGATE TAXABLE INCOME, AND SOCIAL SECURITY FUNDS, %GDP



1.4 Empirical Analysis

1.4.1 Data description

I use firm-level data for Bulgaria from the AMADEUS dataset provided by Bureau Van Dijk, which is a European electronic publishing firm. The data is an unbalanced panel consisting of firms' main financial statement variables. The time frame under consideration is restricted to 1997-2002 due to the introduction of the minimum social security thresholds in 2003.

The main dependent variables of interest are the firm's total cost of employment (*staf*), which is the yearly amount paid in salaries and contributions, and corporate taxes paid (*taxa*), according to which I will assign each firm its respective tax rate and calculate TI (Table 1.5). The explanatory variables are firm size, measured by the amount of sales (*turn*); the number of employees, fixed assets and total assets, and the degree of indebtedness, captured by the amount of current liabilities (*culi*). Changes in current assets, *cuas*, are additionally controlled for.

Only firms that file a report at the end of the year are included in the panel. Firms in liquidation, dissolution, or bankruptcy are excluded from the analysis. Since sole traders are subject to special taxation, which is not part of the Corporate Law, they are not considered either. Further, partnerships, cooperatives and other unincorporated entities are excluded, thus restricting the dataset to private and public limited liability companies (61%) and one-person private and public limited liability companies (38%). The remaining 1% of the firms in the data

Table 1.5: DESCRIPTIVE STATISTICS

	1997 Mean	1998 Mean	1999 Mean	2000 Mean	2001 Mean	2002 Mean
lnWage	-4.11	-3.96	-4.25	-4.20	-4.21	-4.05
	(1.17)	(.975)	(.807)	(.787)	(.755)	(.849)
TI_t-TI_{t-1}		-1.05	-.424	-.055	.071	.087
		(7.91)	(5.22)	(2.20)	(2.02)	(2.85)
ln(1-t_s)	-.576	-.552	-.572	- .462	-.424	-.370
	(.074)	(.070)	(.061)	(.014)	(.013)	(.012)
ln(1-t_c)	-.444	-.273	-.157	-.148	-.121	-.135
	(.203)	(.179)	(.173)	(.169)	(.139)	(.133)
ln(t_s-t_c)	-1.69	-1.96	-1.35	-1.66	-1.59	-1.89
	(.749)	(.866)	(.593)	(.779)	(.627)	(.716)
ln(1-t_s/1-t_c)	-.132	-.279	-.415	-.314	-.303	-.234
	(.213)	(.193)	(.181)	(.169)	(.139)	(.133)
ln(Fias/Toas)	-.977	-1.03	-1.30	-1.38	-1.38	-1.47
	(1.04)	(1.04)	(1.13)	(1.18)	(1.16)	(1.23)
ln(Turn/Toas)	.283	.303	.453	.377	.341	.337
	(1.15)	(1.09)	(1.22)	(1.24)	(1.18)	(1.22)
ln(Culi/Toas)	-1.25	-1.22	-1.03	-.971	-.986	-.944
	(1.02)	(1.08)	(1.12)	(1.11)	(1.12)	(1.14)
ln(Cuas/Toas)	-.995	-.896	-.689	-.636	-.632	-.618
	(.872)	(.796)	(.822)	(.785)	(.782)	(.785)
N	3,035	3,257	20,524	25,421	30,730	15,708

Note: lnWage is the natural logarithm of reported wage per worker. The reported wage is obtained by dividing the total annual wage bill *staf* (wages + contributions) by (1+t_s)**empl*, where t_s is the payroll tax rate and *empl* is the number of employees. TI_t-TI_{t-1} is the first difference of taxable income and is in hundred thousands of Bulgarian levs; ln(1-t_s) is the natural log of the net-of-tax-share of the payroll tax rate; ln(1-t_c) is the natural log of the net-of-tax-share of the corporate tax rate; ln(t_s-t_c) is the natural log of the difference between the payroll and the corporate tax rates, while ln(1-t_s/1-t_c) is the natural log of the ratio of the net-of-tax-shares of these two rates; ln(Fias/Toas) is the natural log of the ratio between fixed assets (tangible fixed assets + intangible fixed assets + other fixed assets, including financial fixed assets) and total assets; ln(Turn/Toas) is the natural log of the ratio between sales and total assets; ln(Culi/Toas) is the natural log of the ratio between current liabilities (loans + accounts payable + other current liabilities) and total assets; ln(Cuas/Toas) is the natural log of the ratio between current assets (stocks + accounts receivable+other current assets) and total assets.

are branches of foreign companies and state companies.

If a firm has submitted both consolidated and unconsolidated financial statements, only the unconsolidated one is considered. Firms with missing values for both taxes paid and cost of employees for all years they appear in the panel are dropped. I have further dropped observations with missing values of taxes paid, cost of employees, number of employees, total assets and fixed assets only at the beginning and the end of each panel.

Firms need to be differentiated based on their taxable income and the type of industry they operate in. For that purpose, TI should first be recovered from the data. I multiply the taxable income threshold stipulated by law with the lower CIT rate for a given year and assign firms that pay less than that amount in tax the low CIT rate, while those paying more are assigned the standard rate. This means that firms can switch between rates based on their annual income. Lastly, a zero corporate tax rate is assigned to those firms that have paid zero or have reported

negative profit tax. Given the differentiation between the corporate rates, there is some cross-sectional variation within a year and due to the continuous tax rate cuts, good overall time-series variation.

Once companies calculate their book profit, they have to add and deduct all items specified by law in order to obtain their taxable income. As a consequence, the data contains many firms that have zero or negative book profit but have paid positive tax. The converse is also true – some firms with positive profits for a given year pay no tax. Therefore, book profit cannot be used in place of TI, nor is it a good indicator of it. For this reason, TI is obtained by dividing the tax liability by the respective tax rate.

In view of the fact that the data does not provide information on losses carried forward, taxable income is likely adjusted downwards or becomes zero for some firms that have sustained losses in previous years. Another factor contributing to deviations of TI from the true tax liability is deferred taxes. Hanlon (2003) provides a simple example of deferred taxes that arise as a result of tax differences, which in turn are due to, for example, different methods of depreciation used for book (straight line depreciation) and tax purposes (accelerated depreciation). Moreover, some firms may have made pre-payments on current profits, and taxes paid in previous years have an impact on the current liability as well.

Intertemporal shifting of income within a base and between bases through avoidance and evasion mechanisms in anticipation of lower rates in the future can also affect the amount of reported taxable income in the current period. It is likely, therefore, that the measure of TI I use constitutes a rough approximation of real TI and hence there is measurement error in the explained variable. Despite the high probability of such an error, the estimated coefficients will not be biased, and the standard errors, while valid, will be larger due to the fact that the population variances of the coefficients are larger (Wooldridge, 2002).

Social security rates are assigned to each firm depending on its type of industry. The payroll tax rate, therefore, varies between industries within a year and over time. Footnote 6 lists the industries that fall within the first and second labour category and are, as a consequence, liable to pay higher payroll contributions. On average within a given year, the share of firms in the first labour category is 1% of the sample, and that of the second labour category – 10% of the sample. These numbers are somewhat higher than the aggregate data – for the period 2002-2007, on average 0.51% and 4.60% of the working population was within the first and second labour categories, respectively (Slavova et al., 2007). The AMADEUS database provides firms' total cost of employment $staf$, which is the sum of wages and payroll taxes. $Staf$ is divided by $1+t_s$ and the number of employees in order to obtain the average reported annual wage bill per employee, w^R.

1.4.2 Empirical specification

In order to test if there is shifting of income out of social security into the corporate tax base as a result of a faster decreasing corporate tax rate than payroll rates, the following basic

specifications are employed:

$$ln(w_{it}^R) = \alpha_0 + \alpha_1 ln(1-(t_s)_{it}) + \alpha_2 ln(1-(t_c)_{it}) + \epsilon_{it} \quad (1.4.1)$$

$$D.TI_{it} = \beta_0 + \beta_1 D.ln(1-(t_s)_{it}) + \beta_2 D.ln(1-(t_c)_{it}) + \delta, \quad (1.4.2)$$

where $ln(1-(t_s)_{it})$ and $ln(1-(t_c)_{it})$ are the natural logarithms of the net-of-tax-shares of the payroll and corporate tax rates, respectively, in firm i at time t. $ln(w_{it}^R)$ is the natural logarithm of the reported wage bill, while $D.TI_{it}$ is the first-difference of taxable income TI_{it}-TI_{it-1} in absolute levels. Equations (1.4.1) and (1.4.2), where the two tax rates are entered separately into the wage and taxable income equations, most closely follow the model developed in Section 1.2. The model predicts that an $\alpha_1 > 0$ and $\alpha_2 < 0$ would be indicative of shifting out of the payroll base, while I expect that $\beta_2 > 0$ in the TI equation. The level-log specification of eq. (1.4.2) means that a 1% change in the net-of-tax shares leads to a response of 1% of the value of the slopes β_1 and β_2.

It is important to bear in mind that there are a number of short-cuts taken between the theoretical model and the empirical specification employed in this section. First, the theoretical framework predicts the effect of t_c and t_s on the amount of wage under-reported, u, which is not known. What is observable in the data is the reported wage, $w^R - u$, so that the change in u as a result of changing tax rates can only be inferred through the behaviour of reported wages. Second, the assumption of a convex probability of detection that is increasing in u and the amount of corporate income manipulation is key to the determination of the signs of $\frac{du}{dt_c}$ and $\frac{du}{dt_s}$. Yet, given the data, I am unable to control for this probability in the regressions that follow.

Note that due to the very large number of firms reporting zero TI, it would not be reasonable to log transform taxable income. Approximately 50% of firms bunch at the corner solution of zero TI. For example, 20% report TI=0 in 1997, and this percent grows to 60% in 2001. A logarithmic transformation of taxable income will automatically drop observations with zero taxable income, as $log(0)$ is not defined. In effect such transformation would be selecting on the dependent variable and use only those firms which have reported positive taxable income in the estimation. By dropping the zeros, the dependent variable would no longer be taxable income, but TI conditional on the firm realising any profit to be taxed $E(ln(y)|x, y > 0)$.

As an alternative to eqs. (1.4.1) and (1.4.2), I consider the effect of the tax wedge $ln(t_s - t_c)$ on the two explained variables. When entered separately, t_s and t_c capture not only shifting, but also real behavioural responses. Further, a positive coefficient on $1 - t_s$ may be an indication of both shifting between tax bases and shifting of payroll taxes onto wages. The tax wedge focuses solely on the shifting incentives between the payroll and corporate tax bases.

$$ln(w_{it}^{R}) = \gamma_0 + \gamma_1 ln((t_s)_{it} - (t_c)_{it}) + \epsilon_{it}^{*} \quad (1.4.3)$$

$$D.TI_{it} = \sigma_0 + \sigma_1 D.ln((t_s)_{it} - (t_c)_{it}) + \delta^{*}. \quad (1.4.4)$$

The tax wedge, which Gordon and Slemrod (2000) refer to as a "tax incentive term," is a measure of the incentives to engage in income shifting, given the difference between the rates in the two bases. Provided that there is shifting of income between the two bases, the reported wage should decrease as the difference between the payroll rate and CIT increases, which translates into γ_1 having a negative sign. If the increase in TI that stems from payroll tax evasion is completely overpaid in the corporate income tax base, then σ_1 should be positive and similar in absolute value to γ_1. The model allows firms to cook the books and choose not to overpay CIT, which is very likely to be happening in reality. Therefore, I expect that $ln(t_s - t_c)$ will have a smaller effect on TI than on wages.

1.4.3 Estimation issues

There are several estimation problems with the specifications as presented thus far. First, $ln(1 - (t_c)_{it})$ is endogenous in the TI equations. While the CIT rate influences the amount of TI reported, it is TI that determines which corporate tax rate the firm is subject to. The solution of reverse causality in similar specifications has been the introduction of an instrument (IV), which is correlated with the endogenous variable, but exogenous to the error term (Gruber and Rauh, 2007; Gruber and Saez, 2002). I follow the literature and construct such an IV by keeping a firm's TI in year t the same as in year $t-1$ and using only the changes in the tax law between the two years for identification. TI in year t is also adjusted by growth rates, which are exogenous to the firm's behaviour and therefore show how TI would have grown in the absence of any interference by the company.

The growth rates are calculated in the following way: Apart from Bulgaria, I use data for the Czech Republic, Hungary, Poland, and Romania taken from the AMADEUS dataset for the period 1997-2002. Firms within each NACE2 industry are separated into taxable income deciles. TI for the Czech Republic, Hungary, Poland and Romania is calculated in the same way as that for Bulgaria – by dividing taxes paid by the statutory tax rate. Statutory tax rates for the four additional countries are taken from Ernst & Young Worldwide Corporate Tax Guides.

The growth rates of TI from year $t-1$ to year t for each income decile within a given NACE2 industry is calculated for Poland, the Czech Republic, Hungary and Romania and averaged out. I then multiply the TI of Bulgarian firms in year $t-1$ by one plus the specific NACE2-TI income decile growth rate and apply the year t tax rules to this adjusted TI. It is possible that the four countries may have had shocks affecting their industries differently; however, they were still in transition in the period under consideration and coming out of a similar political and to some extent economic background as Bulgaria, albeit the Czech Republic and Hungary being stronger and larger economies.

The instrument for $ln(1-t_c)$ is thus $ln(1-t_p)$, which is the log of the predicted net-of-tax-share. The same logic applies for $ln(t_s-t_c)$, which is instrumented with $ln((t_s-t_p)$ in the incentive-term specifications.

Second, the instruments above are constructed as a function of income in the previous period $t-1$. Thus, if TI_{it-1} is correlated with $\delta(\delta^*)$, running the regression with the IVs will still produce biased results. The two sources of endogeneity in this framework, as described by Gruber and Saez (2002), are mean reversion and changes in the income distribution. Mean reversion occurs when there are fluctuations in taxable income, which are transitory. For example, a firm that is exceptionally successful in year $t-1$ is likely to revert to its normal performance in year t. External shocks, which make some firms more profitable than others for reasons unrelated to changes in the tax rates, change the income distribution, which, if uncontrolled for, will bias estimation. To account for the possibility of different growth rates at different points in the income distribution, the TI equations allow for lagged taxable income as an explanatory variable.

Further, I follow Gruber and Saez (2002) and include an even richer specification of lagged taxable income to account for the possibility of a non-linear interaction between mean reversion and changes in the income distribution. In particular, a 10-piece spline of lagged taxable income, defined at the level of the entire sample, is added in the TI regressions. Nevertheless, I am still imposing the assumption that the yearly changes in mean reversion and the taxable income distribution are not correlated with the annual changes in tax policy.

Even with these controls, however, lagged taxable income can still be endogenous to the CIT rate change from year $t-1$ to year t in the presence of income shifting. If firms expect a lower corporate tax rate in year t, then they have an incentive to report less TI in $t-1$ and more TI in t. Thus, falling CIT rates, or equivalently, increasing net-of-tax-shares from $t-1$ to t, can be accompanied by increasing taxable incomes due to income shifting. This, in return, can lead to an upward bias in the estimates of the elasticity of TI w.r.t. the net-of-tax-share of the CIT rate.

Taxable income and wages of a firm can rise or fall from year to year for many different reasons apart from the corporate tax rate or income shifting. The firm, for example, can become more profitable because of increased management quality, local characteristics, or overall business strategy, and can consequently reward its employees better. Or it can change its financial policy, relying on more debt. Broadening of the tax base that offsets cuts in the statutory tax rate can be yet another reason.

Table 1.3 shows that while the definition of taxable income has been changing over the years, as a whole the adjustments have narrowed the tax base, given the rising number of provisions decreasing the financial result. The depreciation rates for the different classes of assets have not changed and neither has the rule that firms can carry losses forward for 5 years. To control for unobserved firm-specific time-invariant heterogeneity, the wage regressions contain firm fixed effects, while differencing purges firm unobservable heterogeneity from the TI specifications. The assumption behind the within estimator is that the fixed effects α_i are correlated with the

regressors x_{it}. Accounting for firm fixed effects means that the effect of the two tax rates on taxable income and wages is identified only by the within-firm time-series variation in the tax rates.

Additionally, fixed assets and sales as a fraction of total assets are included in order to control for changes in profitability not related to changes in the tax rates. I further incorporate current liabilities divided by total assets to capture any adjustments in firms' short-term debt policy. Current assets are also controlled for.

Next, time fixed effects are added. In 1997 Bulgaria came out of an inflationary recession, and there was a change in government in 1998. It is therefore important to account for these elements in the variation, which are spuriously correlated with taxable income and wages by the inclusion of year dummies. Furthermore, since the minimum wage in the country was increasing on a yearly basis in the period under consideration, it affected the reported wage for these workers who truly earned the minimum wage or whose employers under-reported their true wage to pay contributions on minimum wages. Thus, reported wages will increase due to legal provisions not related to the changes in the CIT or the payroll rates. This is yet another reason to include year fixed effects χ_t.

By adding year dummies, the taxable income and wage response will be identified using only the cross-sectional variation in the tax rates. In fact, this framework is equivalent to the diff-in-diff estimator. To see this, note that first-differencing the data across time, $y_{it} - y_{it-1}$, eliminates the time-invariant firm fixed effects, but leaves the time-fixed effects. The time-fixed effects are dropped out if we difference again, this time across groups, i.e. transforming the data into $(y_{it} - y_{it-1}) - (y_{jt} - y_{jt-1})$, which yields the difference-in-difference estimator.

Finally, industry-year fixed effects, ρ_{jt}, are included to control for changes over time in factors common to all firms in a given industry such as regulation, industrial norms, etc.

Both regression frameworks are transformed to incorporate the changes discussed above. For example, equations (1.4.1) and (1.4.2) become:

$$ln(w_{it}^R) = \alpha_i + \chi_t + \rho_{jt} + \alpha_1 ln(1 - (t_s)_{it}) + \alpha_2 ln(1 - (t_c)_{it}) + X'\Delta + \epsilon_{it} \quad (1.4.5)$$

$$\begin{aligned} D.TI_{it} &= \chi_t + \rho_{jt} + \beta_1 D.ln(1 - (t_s)_{it}) + \beta_2 D.ln(1 - (t_c)_{it}) \\ &+ \sum_{m=1}^{10} \theta_{3m} SPLINE_m(TI_{it-1}) + D.X'\Delta + \delta, \end{aligned} \quad (1.4.6)$$

where α_i, χ_t and ρ_{jt} are firm-, year-, and industry-year fixed effects, respectively. X includes the natural logarithm of the ratios of sales/total assets (toas), current liabilities/toas, fixed assets/toas and current assets/toas.

1.5 Results

1.5.1 Effect of tax rates on reported wages

The basic estimates of the wage equation are presented in Table 1.6. All regressions are estimated with firm-fixed effects. Because I always cluster at firm level, standard errors are robust to the disturbances being heteroscedastic and autocorrelated.

Column (1) in Table 1.6 presents a regression of the log of wage on the log of the net-of-tax-shares of the corporate and payroll tax rates, without any other controls, apart from firm-fixed effects. The elasticity of reported wage with respect to the net-of-tax-share of the corporate tax rate is estimated to be -0.122, while the elasticity w.r.t. the net-of-tax-share of the payroll rate is 1.2. The signs of the two coefficients are in line with the predictions of the model: a negative and significant effect of the CIT rate net-of-tax-share on wages represents compelling evidence for income shifting, as it is difficult to explain otherwise why this tax rate has an effect on employees' compensation as reported by employers.

Column (2) allows for year dummies, χ_t, and controls for firm-level factors, including the log of fixed assets, sales, current liabilities and current assets, all as a ratio of total assets. While still positive, the effect of the payroll rate is reduced to .016 and imprecisely estimated once year dummies are included in the regression. This is not surprising, as identification of the wage response in Column (2) comes solely from the cross-sectional variation in the tax rates. Section 1.3.1 explained that due to the nature of the pension reform, the payroll rate has limited cross-sectional variation. The coefficient of the CIT rate almost doubles to -0.238 and remains significant.

To purge the regressions from shocks common to all firms from the same industry in a given year, Column (3) includes industry-year fixed effects. The elasticity of wage with respect to the net-of-tax-share of the CIT rate remains very similar to that in Column (2), but the coefficient on the payroll rate increases to .354 and becomes significant at the 5% level.

Using a rich dummy structure of both year- and industry-year fixed effects in Column (4), which is my preferred specification, yields nearly identical estimates to the ones obtained by industry-year dummies only, with the coefficients of $1 - t_c$ and $1 - t_s$ significant at 1 and 5 percent, respectively.

To show robustness, Columns (5)-(8) repeat the analysis of Columns (1)-(4) in first-differences (FD). The assumption behind the FD specifications is that the percentage change in the average wage per employee is a linear function of the percentage changes in the CIT and the payroll net-of-tax-shares. Column (5) repeats the simple specification in Column (1) in first-differences, producing very similar results.

Generally, the FD estimation yields less negative elasticity of wages w.r.t. the net-of-tax-share of the CIT rate as compared to the specifications in levels. One possible explanation is that there is a delayed response of wages to changes in the CIT rate. The FD estimator uses

Table 1.6: RESPONSE OF REPORTED WAGES

	Levels				First-Difference				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	$t-2$ (9)
ln(1-t$_c$)	-.122***	-.238***	-.208***	-.217***	-.141***	-.147***	-.130***	-.132***	-.213***
	(.019)	(.020)	(.020)	(.020)	(.017)	(.018)	(.018)	(.018)	(.024)
ln(1-t$_s$)	1.21***	.016	.354**	.287**	1.08***	.156*	.458***	.438***	.323**
	(.029)	(.089)	(.112)	(.124)	(.029)	(.089)	(.110)	(.123)	(.128)
ln(Fias/Toas)		.012**	.012**	.012**		.007	.007	.007	.015**
		(.005)	(.005)	(.005)		(.005)	(.005)	(.005)	(.006)
ln(Turn/Toas)		.097***	.088***	.088***		.096***	.086***	.086***	.082***
		(.003)	(.005)	(.005)		(.005)	(.005)	(.005)	(.007)
ln(Culi/Toas)		.010**	.011**	.011**		.016***	.016***	.016***	.005
		(.003)	(.004)	(.004)		(.004)	(.004)	(.004)	(.005)
ln(Cuas/Toas)		-.006	-.005	-.006		-.004	-.004	-.004	.0007
		(.007)	(.007)	(.007)		(.007)	(.007)	(.007)	(.009)
χ_t	No	Yes	No	Yes	No	Yes	No	Yes	Yes
ρ_{jt}	No	No	Yes	Yes	No	No	Yes	Yes	Yes
Observ.	98,403	83,036	83,015	83,015	59,815	49,873	49,860	49,860	29,559
Firms	36,555	30,983	30,977	30,977	27,103	22,277	22,271	22,271	17,356

Note: The sample in each regression pertains to 1997-2002. The dependent variable is either the log of reported wage (Levels), the first-difference of log wage, or the second-difference in the last Column (9). All columns include firm-fixed effects. In Columns (1)-(4), firm-fixed effects are controlled for by demeaning, while in Columns (5)-(9) firm-fixed effects are eliminated by first/second-differencing. ln(Fias/Toas), ln(Turn/Toas), ln(Culi/Toas) and ln(Cuas/Toas) are first-differenced in Columns (5)-(8) and second-differenced in Column (9). χ_t are year dummies and ρ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

the correlation between wages and CIT from year $t-1$ to t only, while the fixed-effects estimator relates deviations from average wages to deviations from average net-of tax-share of CIT for all years. It is therefore likely that the fixed-effects estimator is more robust to delayed responsiveness. Conversely, the payroll rate has a greater effect on wages in the FD estimation, suggesting a quicker adjustment of wages to changes in the contribution rates.

Column (9) checks how the FD results change when the differencing window is expanded to $t-2$, thus focusing on longer-run responses. If firms' adjustment to changes in the tax rates is slow, as seems to be the case with the corporate tax rate, then there is a reason to expect that the $t-2$ estimates will be higher than the first-differenced ones. A quicker reaction to changes in rates or expectations that the rates will change in future will result in a weaker long-run response. In Column (9) the corporate rate effect is stronger for a longer difference window. In fact, the estimate is almost identical to that in Column (3). The coefficient on the payroll rate becomes 0.323, which is closer to the specification in levels.

Table 1.7 repeats the regressions from Table 1.6, but instead of estimating the effect of the tax rates separately, it considers the tax wedge. The effect of $\ln(t_s - t_c)$ on wages is -0.050 in the specification with year dummies only, and -0.046 when industry-year fixed effects are included. Similarly to Table 1.6, the first-difference estimation leads to lower estimates of the tax wedge in magnitude, driven by the slower responsiveness of wages to changes in the CIT rate. Once a longer difference window is taken in Column (4), the estimates in FD are approximately the same as the estimates in levels.

Table 1.8 splits the sample into three groups based on taxable income. The first group is composed of firms that have consistently reported TI greater than the threshold, so that they are taxed at the standard CIT rate for all years they appear in the panel. The next group are firms who have always been subject to the lower rate, but may have reported zero taxable income for some of the years they are in the panel. Switchers between the high, low and zero CIT rates are included in the third group. The coefficients in each regression are comparable to those using the full sample in Table 1.6. Since the group with TI>T has no cross-sectional variation in the CIT, Table 1.8 does not include year-fixed effects.

Interestingly, the effect of the tax wedge is higher for firms subject to the standard rate, albeit insignificant, and for switchers than it is for firms who were eligible for the lower CIT rate. Since the tax wedge is bigger for the low-CIT rate firms, one would expect them to be more responsive to variations in the tax rates. However, it is possible that these businesses already pay wages close to the minimum wage and find it hard, therefore, to adjust the wage downward in response to changes in the tax wedge. An inspection of the data confirmed that the average wage per employee in the group taxed at the standard CIT rate is at least three times as high as that for the low-CIT rate group.

The wages reported by the switching firms seem to be most responsive to both tax rates, given the estimated coefficients. This high responsiveness is expected due to the fluctuations in the CIT rate that stem from variations in reported TI, confirming the hypothesis that firms adjust reported wages as the tax wedge changes. In the case of switchers, a 1% increase in the

Table 1.7: RESPONSE OF REPORTED WAGES TO TAX WEDGE

	Levels		FD	FD $t-2$
	(1)	(2)	(3)	(4)
$\ln(t_s - t_c)$	-.050***	-.046***	-.031***	-.049***
	(.005)	(.004)	(.004)	(.005)
χ_t	Yes	Yes	Yes	Yes
ρ_{jt}	No	Yes	Yes	Yes
Observ.	81,208	81,188	48,462	27,829
Firms	30,959	30,953	22,212	17,285

Note: The sample in each regression refers to 1997-2002. The dependent variable is either the log of reported wage (Levels), the first-difference of the log wage (FD), or the second-difference. All columns include firm-fixed effects. The regression additionally controls for ln(Fias/Toas), ln(Turn/Toas), ln(Culi/Toas) and ln(Cuas/Toas), which are not reported here and are first-differenced in Column (3), and second-differenced in Column (4). Standard errors are clustered by firm in all specifications. χ_t are year dummies and ρ_{jt} are industry-year dummies at the NACE2 level. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Table 1.8: RESPONSE OF REPORTED WAGES BY TAXABLE INCOME GROUPS

	TI>T		TI<T or TI=0		TI<T or TI>T or $TI = 0$	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(1-t$_c$)	-.269		-.109***		-.329***	
	(.831)		(.024)		(.040)	
ln(1-t$_s$)	.879**		.216		.457**	
	(.395)		(.141)		(.208)	
$\ln(t_s - t_c)$		-.083		-.029***		-.066***
		(.119)		(.005)		(.008)
Observ.	3,643	3,392	61,235	61,235	18,137	16,561
Firms	1,065	1,042	25,602	25,602	4,310	4,309

Note: The sample in each regression pertains to 1997-2002. The dependent variable is the log of reported wage. All columns include firm fixed effects and year-industry dummies, not reported. The regression additionally controls for ln(Fias/Toas), ln(Turn/Toas), ln(Culi/Toas) and ln(Cuas/Toas), which are also not reported. Columns (1)-(2) refer to firms that were subject to the standard tax rate (have taxable income above the legally stipulated threshold) for all years they appear in the panel. Columns (3)-(4) show results for firms who were subject to the lower corporate tax rate (have TI below the threshold) or reported zero taxable income for some of the years they appear in the panel. Columns (5)-(6) refer to firms, which switched between high and low corporate tax rates or reported zero TI for some of the years they appear in the panel. Standard errors are clustered at firm level in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

CIT's net-of tax-share reduces reported wages by 0.32%, while an equivalent increase in the payroll's net-of-tax-share raises wages by 0.45%.

1.5.2 Effect of tax rates on reported taxable income

If there is shifting of income out of the social security base due to payroll evasion, then to some extent part of this income should reappear as an increased corporate taxable profit. Bear in mind that the shifting of tax liability between tax bases, be it payroll to corporate or personal to corporate (and vice versa) is only one of the numerous aspects of the relationship between corporate tax rate and corporate tax base. Others include the impact of the CIT on investment decisions, choice of corporate financing (e.g. use of debt), choice of incorporation and corporate form, evasion and avoidance, and other behavioural responses. Table 1.9 explores what happens in the corporate tax base and to TI as a result of changes in the tax rates. The regressions present 2SLS estimation. All subsequent 2SLS regressions have very strong first stages with F-statistics for the coefficients of the IVs almost always around 1000 and above.

Since taxable income is not log transformed, the results are sensitive to outliers. The first-difference of TI is restricted in the range (-300, 300), where TI is in hundred thousands of Bulgarian levs (BGN).[8] This restriction drops 12 firms from the estimation, which have experienced great fluctuations in TI, mostly due to reporting huge TI in one year and zero TI the next year.[9]

Column (1) contains no controls for lagged income, and hence does not account for mean reversion and changes in the income distribution. The results have the opposite sign for the CIT rate than expected. The estimates change dramatically, however, once lagged income is added in Column (2), which demonstrates the sensitivity of the results to controlling for first-period income. Lagged taxable income is significant with a coefficient -.281. Considering the tax change from 1997 to 1998 for a firm in the second labour category subject to the standard CIT rate, the coefficients in Column (2) imply that the 9 percent increase in the net-of-tax-share of the CIT rate in 1998 increased TI by 7,800 BGN ($3,900). The payroll net-of-tax-share is positive but is not significantly different from zero.

The estimate of the corporate net-of-tax-share increases considerably once the assumption that changes in the TI distribution are functions in log of lagged income is weakened. I do that by adding a 10-piece linear spline of lagged income in Column (3) with knots at the percentiles of the data. The first five splines drop out of the estimation because of the very big number of zeros of lagTI. The coefficient on the corporate rate goes up to 4.00 and remains significant. The payroll effect increases as well, but is again imprecisely estimated. The spline is very negative at the low end of the lagTI distribution, followed by several positive coefficients, increasing

[8] All financial variables are in hundreds of thousands. The average exchange rate for the period 1997-2002 was 0.5 $ for 1 lev. I prefer to keep the variables in the original currency in order to avoid introducing error due to fluctuations in the exchange rate. The estimates for the CIT net-of-tax-share and the other explanatory variables are robust to different intervals, which remove the major outliers.

[9] Among these twelve companies are the Bulgarian Telecommunication Company, Lukoil Burgas, and five other major oil and energy producers, two copper extraction companies, a major shipping corporation, a chemical concern, and a sea resort joint stock company.

Table 1.9: RESPONSE OF REPORTED TAXABLE INCOME

	(1)	(2)	(3)	(4)	(5)	$t-2$ (6)	Full (7)
ln(1-t_c)	-2.30***	.863*	4.00**	2.14*	2.31**	4.91**	4.57
	(.375)	(.468)	(1.48)	(1.13)	(1.16)	(1.60)	(3.07)
ln(1-t_s)	1.43**	.417	1.20	.151	-.256	-.867	-1.13
	(.689)	(.586)	(1.02)	(1.15)	(1.42)	(1.66)	(2.51)
ln(Fias/Toas)	-.014	-.034*	-.039*	-.047**	-.048**	-.113**	-.165*
	(.023)	(.020)	(.021)	(.020)	(.020)	(.037)	(.092)
ln(Turn/Toas)	.211***	.231***	.293***	.257***	.260***	.412***	.381***
	(.037)	(.032)	(.044)	(.038)	(.038)	(.054)	(.090)
ln(Culi/Toas)	-.012	-.061**	-.078***	-.049**	-.050**	-.223***	-.142**
	(.023)	(.020)	(.024)	(.021)	(.021)	(.038)	(.051)
ln(Cuas/Toas)	.168***	.125**	.163***	.144**	.145***	.059	.191**
	(.045)	(.041)	(.043)	(.043)	(.043)	(.061)	(.075)
lagTI		-.281***					
		(.044)					
Spline 5						-39.1***	
						(11.79)	
Spline 6			-21.58**	-11.89**	-12.74**	7.58**	-25.15*
			(7.52)	(5.80)	(5.95)	(2.43)	(14.78)
Spline 7			4.96***	3.09**	3.28**	1.66*	4.14
			(1.53)	(1.20)	(1.23)	(.993)	(3.16)
Spline 8			.089	-.327	-.297	-.237	2.66
			(.558)	(.501)	(.503)	(.573)	(2.02)
Spline 9			.877	1.01**	1.01**	1.16**	-2.24
			(.593)	(.508)	(.509)	(.555)	(2.15)
Spline 10			-.284***	-.280***	-.280***	-.529***	-.076
			(.046)	(.043)	(.043)	(.058)	(.139)
χ_t	No	No	Yes	No	Yes	Yes	Yes
ρ_{jt}	No	No	No	Yes	Yes	Yes	Yes
Observ.	51,577	51,577	51,577	51,577	51,577	30,153	51,628
Firms	22,434	22,434	22,434	22,434	22,434	17,354	22,446

Note: The sample in each regression refers to 1997-2002. The dependent variable is the first-difference of taxable income in absolute levels; all ln(.) explanatory variables are also first-differenced. Column (6) uses a longer differencing window and the spline is of $TI_t - 2$. Estimates in Column (7) are based on the full sample, which includes the 12 outliers. χ_t are year dummies and ρ_{jt} are industry-year dummies at the NACE2 level. In all specifications, standard errors are clustered by firm. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Table 1.10: RESPONSE OF REPORTED TAXABLE INCOME TO TAX WEDGE

	(1)	(2)	(3)	$t-2$ (4)
$\ln(t_s - t_c)$	.265**	.316*	.303*	.279
	(.120)	(.180)	(.172)	(.320)
lagTI	-.280***			
	(.054)			
χ_t	No	Yes	Yes	Yes
ρ_{jt}	No	No	Yes	Yes
Observ.	50,295	50,295	50,295	28,666
Firms	22,564	22,564	22,564	17,425

Note: The sample in each regression pertains to 1997-2002. The dependent variable is either the first-difference of TI in absolute levels, or the second-difference in Column (4). Columns (2)-(4) include splines of lagged TI, not reported here. The regression additionally controls for D.ln(Fias/Toas), D.ln(Turn/Toas), D.ln(Culi/Toas) and D.ln(Cuas/Toas), which are also not reported. Standard errors are clustered by firm in all specifications. χ_t are year dummies and ρ_{jt} are industry-year dummies at the NACE2 level. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

non-linearly as income rises, suggesting mean reversion.

Estimating the regression with year-industry fixed effects instead of year dummies yields a lower effect of $\ln(1 - t_c)$ on D.TI (2.14) in Column (4). My preferred specification in Column (5) combines year- and industry-year fixed effects leading to a very similar result to the one obtained with industry-year dummies only: a 1% increase in $D.(1 - t_c)$ translates into 0.0231% change in $D.TI$, given the level-log specification. Evaluating the tax change from 1997 to 1998 again, the coefficients in (5) imply a 20,800 BGN ($10,400) increase in TI in 1998 on average as a result of the 9% increase in CIT rate net-of-tax-share. To put this number into perspective, note that the average TI of the firms in the sample, excluding the 12 companies described above, is 95,600 BGN ($47,800).

The regression in Column (6) is identical to the one in Column (5), but the data is second-differenced in order to check if TI adjusts immediately, or if its responsiveness is delayed. The estimate of the corporate net-of-tax-share more than doubles, rising to 4.91, and so do the coefficients of fixed assets, sales and current liabilities, suggesting that it takes time before firms adapt to changes in the tax policy. The effect of current assets, which is always positive and significant in the first-differenced specifications, becomes insignificant in second-differences.

Apart from Column (1), the payroll net-of-tax-share is found to have no significant effect on the first-difference of taxable income and is not robust to the dummy variables structure, being positive in Columns (1)-(4), and switching its sign in the remaining columns. Like the model, the data analysis yields an ambiguous relationship between TI and t_s.

Lastly, Column (7) shows results for the unrestricted sample, which includes the 12 outliers dropped before. While the corporate net-of-tax-share remains positive and similar in magnitude to the previous estimates, its standard error is much higher, resulting in imprecise estimation. The 12 outliers have a significant impact on the spline coefficients as well.

Table 1.10 focuses on the response of taxable income to the tax wedge. Without lagged income control, the effect of the tax wedge has the wrong sign and is not reported. Once first period income is taken into account in Column (1), the estimate of the wedge becomes .265 and is statistically significant. Given the specification controlling for industry-year fixed effects, a 39% increase in the wedge in 1998 leads to 11,800 BGN ($5,900) increase in reported TI. Overall, the coefficients suggest that TI is more responsive to the corporate net-of-tax-share than the wedge, which makes sense, given that the wedge measures the incentives for income shifting out of the payroll base.

1.6 Overall Effect on the Tax Base

The firms in the sample paid $8.81 billion in wages for the period 1997-2002, and $3.48 billion in social security contributions. Using the coefficients of the long-run estimates in Table 1.6, Column (9) and Table 1.9, Column (6), the changes in the net-of-tax-shares of the CIT and payroll rates for firms in a given labour category, given year, and standard, low or zero CIT rate, I estimate that if there were no cuts in the payroll rate for employers, reported wages would have decreased by $922.4 million and contributions – by $314 million. Conversely, had there been no cuts in the corporate income tax, reported wages could have risen by $575.9 million and $225.3 million more contributions could have been collected.

Taxable income declared for 1997-2002 was $6.9 billion, of which $2.03 billion was paid in corporate tax. This taxable income would have been $133.2 million lower if the corporate tax rate was not cut, resulting in $41.6 million less in corporate taxes.

All in all, the increase in the net-of-tax-share of the corporate tax rate had a negative impact on the total tax base of wages and taxable income, increasing TI by $133.2 million, but decreasing wages by $575.9 million. The net-of-tax-share of the payroll rate increases the total tax base by $922.4 million through its impact on wages. Its effect on TI is ambiguous both in the theoretical derivations, and in the empirical results.

Another way to see the overall response is to estimate a regression for the total tax base, i.e. estimate the responsiveness of the sum of wages and taxable income to the net-of-tax-shares of the tax rates. This enables the log transformation of the dependent variable, as TI=0 is no longer an issue. $\ln(1-t_c)$ is instrumented for in the usual way. I include the lagged $\ln(\text{Wage}+\text{TI})_{t-2}$ in a log differenced 2SLS specification containing year-fixed effects and industry-year dummies. $\ln(\text{Wage}+\text{TI})_{t-2}$ is preferred to a spline of $\ln(\text{Wage}+\text{TI})_{t-2}$, since the wage regressions in Table 1.6, which the manual estimates above are based on, do not include a spline.

The results of a full base regression are reported in Column (3) of Table 1.11 and support the previous calculations in the case of the CIT rate. The coefficient on $1-t_s$ is again insignificant. The estimated elasticity of the CIT rate net-of-tax-share is negative and significant at 1% and so is the $t-2$ lag of ln(Wage+TI). This is due to the strong negative effect of the corporate tax on wages and its mildly positive impact on taxable income, which leads to an overall negative response of the total tax base to changes in $1-t_c$.

Table 1.11: RESPONSE OF THE TOTAL TAX BASE (WAGES+TAXABLE INCOME)

	D2.lnWage (1)	D2.TI (2)	D2.ln(Wage+TI) (3)
D2.ln(1-t_c)	-.213***	4.91**	-.470***
	(.024)	(1.60)	(.160)
D2.ln(1-t_s)	.323**	-.867	-.159
	(.128)	(1.66)	(.317)
ln(Wage+TI)$_{t-2}$			-.390***
			(.010)
Observ.	29,559	30,153	29,559
Firms	17,356	17,354	17,357

Note: The sample in each regression pertains to 1997-2002. Columns (1)-(2) repeat the estimates for the social security tax base from Table 1.6 and for the taxable income base from Table 1.9, respectively. Column (3) shows the results for the total tax base (wages + taxable income), estimated by log differenced 2SLS regression. All regressions contain year- and industry-year fixed effects. Standard errors are clustered at firm level in all specifications. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

1.7 Conclusion

In order to attract foreign direct investment and stimulate domestic business, many developing economies have cut their corporate income tax rates. Developed countries have pursued similar policies in an attempt to prevent major outflows of capital resulting from intensified competition. While such policy clearly generates incentives towards more honest disclosure of corporate profits, it would be hasty to consider its effects in isolation from other tax bases within the economy. The main goal of this chapter is to point out the risk that a too-low CIT can exacerbate payroll tax evasion if the contribution burden on employers is significant and payroll tax evasion is prevalent.

With the collaboration of employees, such fraudulent behaviour becomes virtually undetectable and as a consequence it may be more beneficial for a firm to overpay profit tax than to pay its full contribution expense. Thus, unless the government is able to somehow balance the corporate and social security burden, such a possibility certainly exists and should not be neglected. On the one hand, given Europe's rapidly ageing population and significant reliance on defined benefit pension schemes, it is unlikely that we will witness a decrease of the social security burden on employers. On the other hand, there is a very clear shift towards indirect taxation and away from direct taxation, suggesting even lower CIT rates in future. It is therefore important to carefully consider not only the advantages of a low CIT rate, but also its potential side effects through its interaction with other tax bases.

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Appendix 1.1: Comparative statics derivations

The two sufficient conditions for a relative maximum at a critical point are that $f_{\phi\phi} < 0$ and $f_{\phi\phi}f_{uu} - {f_{\phi u}}^2 > 0$. It follows from here that $f_{uu} < 0$.
$f_{\phi u} = f_{u\phi} = -p_1''(1+t_s)\phi L^* P - p_1'(\frac{P}{u} + (1+t_s)\phi L^* \lambda_2 t_c) - p_2' \frac{1}{w^R}\lambda 2 t_c < 0$ due to $p_1'' > 0$ and $p_2'' > 0$. Similarly,
$f_{ut_c} = -(1+t_s) - p_2' \frac{1}{w^R}\lambda 2 \phi u (1+t_s) < 0$ and
$f_{\phi t_s} = -p_1''\phi u L^* P - p_1' u L^* (\lambda_1 + 2\lambda_2 t_c \phi) < 0.$

$$\begin{aligned} f_{\phi t_c} &= 1 - p_1'\lambda_2 \phi u L^*(1+t_s) - (p_1+p_2)\lambda_2 \\ &= 1 - p_1'(\frac{P}{t_c} - \frac{\lambda_1(t_s + t_e + t_p(1-t_e))uL^*}{t_c}) - (p_1+p_2)\lambda_2 \\ &= \frac{\lambda_1(t_s + t_e + t_p(1-t_e))uL^*}{t_c} > 0 \end{aligned}$$

$f_{ut_s} = 1 - t_c - p_1'\phi u L^* A - (p_1+p_2)\lambda_1 - p_2' \frac{1}{w^R}(\lambda_1 u + \lambda_2 t_c \phi u)$. Dividing (8) by t_s, I get $1 - t_c = \frac{t_c}{t_s} + (p_1+p_2)\frac{A}{t_s} - p'2\frac{1}{w^R t_s} P/L^*$. I plug the expression for $1 - t_c$ into f_{ut_s} to obtain:

$$\begin{aligned} f_{ut_s} &= \frac{t_c}{t_s} + (p_1+p_2)\lambda_1 + (p_1+p_2)\lambda_1 \frac{t_e + t_p(1-t_e)}{t_s} + p'2\frac{1}{w^R}\lambda_1 u \\ &+ p'2\frac{1}{w^R}\frac{t_e + t_p(1-t_e)}{t_s} + p'2\frac{1}{w^R}\frac{\lambda_2 t_c \phi u}{t_s} + p'2\frac{1}{w^R}\lambda_2 t_c \phi u \\ &- (p_1+p_2)\lambda_1 - p'2\frac{1}{w^R}\lambda_1 u - p'2\frac{1}{w^R}\lambda_2 t_c \phi u - p_1'\phi u L^* A \\ &= \frac{t_c}{t_s} + \underbrace{(p_1+p_2)\lambda_1 \frac{t_e + t_p(1-t_e)}{t_s} + p'2\frac{1}{w^R}\frac{t_e + t_p(1-t_e)}{t_s} + p'2\frac{1}{w^R}\frac{\lambda_2 t_c \phi u}{t_s}}_{h>0} \\ &- p_1'\phi(P - \lambda_2 t_c \phi u L^*(1+t_s)) \\ &= \frac{t_c}{t_s} + h + p_1'\phi\lambda_2 t_c \phi u L^*(1+t_s) - \phi(t_c - (p_1+p_2)\lambda_2 t_c) \\ &= h + p_1'\phi\lambda_2 t_c \phi u L^*(1+t_s) + \phi(p_1+p_2)\lambda_2 t_c + t_c(1/t_s - \phi) > 0 \end{aligned}$$

since $t_s < 1$ and $\phi \leq 1$.

The main relationships are $\frac{du}{dt_c} = \frac{\det|B|}{\det|A|} < 0$, $\frac{du}{dt_s} = \frac{\det|C|}{\det|A|} > 0$, $\frac{d\phi}{dt_c} = \frac{\det|D|}{\det|A|} < 0$ and $\frac{d\phi}{dt_s} = \frac{\det|E|}{\det|A|} > 0$ and follow from:

$$\det|A| = \det \begin{bmatrix} f_{\phi\phi} & f_{\phi u} \\ f_{u\phi} & f_{uu} \end{bmatrix} > 0$$

$$\det|B| = \det \begin{bmatrix} f_{\phi\phi} & -f_{\phi t_c} \\ f_{u\phi} & -f_{ut_c} \end{bmatrix} = -f_{\phi\phi}f_{ut_c} + f_{\phi t_c}f_{u\phi} < 0$$

$$\det|C| = \det \begin{bmatrix} f_{\phi\phi} & -f_{\phi t_s} \\ f_{u\phi} & -f_{ut_s} \end{bmatrix} = -f_{\phi\phi} f_{ut_s} + f_{\phi t_s} f_{u\phi} > 0$$

$$\det|D| = \det \begin{bmatrix} f_{\phi u} & -f_{\phi t_c} \\ f_{uu} & -f_{ut_c} \end{bmatrix} = -f_{\phi u} f_{ut_c} + f_{\phi t_c} f_{uu} < 0$$

$$\det|E| = \det \begin{bmatrix} f_{\phi u} & -f_{\phi t_s} \\ f_{uu} & -f_{ut_s} \end{bmatrix} = -f_{\phi u} f_{ut_s} + f_{\phi t_s} f_{uu} > 0$$

Chapter 2

Intertemporal Income Shifting in Expectation of Lower Corporate Tax Rates: The Tax Reforms in Central and Eastern Europe

This chapter examines if firms shift income out of years with high corporate tax rates into years when tax cuts are anticipated. Such intertemporal shifting can be one explanation for the stability of corporate tax revenues in Central and Eastern Europe, despite the major decline in the corporate tax rates and overall narrowing of the tax base starting in the late 90s. Using firm-level panel data for Bulgaria, the Czech Republic, Hungary, Poland, Romania and Slovakia from 1999 to 2005, the estimates indicate that the lower corporate tax rates induced a considerable increase in taxable income. Most of this increase, however, was due to short-term shifting of income to years with lower tax rates leading to non-transitory responses ranging from zero to .151, depending on the specification employed. Splitting the sample by firm size shows that income shifting is an appealing tax saving strategy to small and to a lesser extent medium-sized enterprises, but not for big firms. A further disaggregation by country reveals that the driving country behind the results is Romania.

Keywords: Corporate tax, Income shifting, Tax reforms, Central and Eastern Europe
JEL Classification: H25; H32; D32

2.1 Introduction

Over the last three decades, as part of a broader shift towards indirect taxation and due to intensified international competition, many European Union (EU) economies decreased their statutory corporate income tax (CIT) rates. In the years between 2000 to 2009, a particularly intense period of corporate tax reform, the old Member States lowered the CIT rate by 8.32 percentage point (pp) on average and collected 1.27pp lower revenue as a percent of GDP in 2009 compared to 2000. The countries joining the EU in and after 2004, i.e., the Baltic countries, the

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Czech Republic, Poland, Slovakia, Hungary, Slovenia, Cyprus, Bulgaria and Romania undertook even larger cuts of 10.12pp on average. Yet, average proceeds increased by 0.17pp.

The pattern of falling rates and rising revenues has spawned much research on whether the tax cuts generated their own revenue, or the broad reforms simply expanded the tax base. Devereux et al. (2004), for example, focus on the UK, concluding that while base-broadening can, to some degree, explain the strength of the UK's corporate tax revenues in the 1990s, the bulk of the increase was due to the rising importance and profitability of the financial sector. A more general analysis of the OECD countries is performed by Clausing (2007), who finds positive statistically significant effects of the rate of profitability and the corporate share on collected revenues.

Piotrowska and Vanborren (2008) show that the increasing rate of corporatisation is the driving factor behind growing revenues. Their finding is corroborated by Da Rin et al. (2011), who demonstrate that a lower CIT rate leads to a higher entry rate.

While many aspects of tax reforms and firm behaviour have been studied to evaluate their revenue impacts, the intertemporal shifting of income by firms within a jurisdiction in expectation of lower future CIT rates has received little attention in the economic literature. This is surprising, given that, if the presence of income shifting is not considered, the deadweight loss of the corporate tax is likely to be overestimated owing to the fact that income shifting does not reflect permanent changes in firms' behaviour with real distortionary consequences but is a short-term transfer of revenue over time (Slemrod, 1995).

I use firm-level panel data for six Central and Eastern European (CEE) countries, namely Bulgaria, the Czech Republic, Hungary, Poland, Romania and Slovakia for the period 1999-2005, to test if taxable income was shifted to years with lower expected CIT rates. Common for these countries are the dynamic tax reforms starting in the early 2000s, characterised not only by cuts in the statutory tax rates, but also by extensive changes in the tax base and investment allowances. The announcement of the reforms was usually made in advance and, as King (1974) points out, such announcements can have significant effects on investment behaviour and taxable income reports, thus being a policy tool in their own right.

Deferral of income declaration or acceleration of expense recognition in years before a main tax reduction can generate sizeable tax savings. Thus, the shifting of taxable income to years with lower corporate tax rate would manifest as higher revenue collections. However, many other factors can account for rising corporate tax revenues. Therefore, before testing the income shifting hypothesis, I examine the tax reforms in CEE in greater detail in order to better comprehend the role adjustments in the tax base, firms' profitability, and the size of the corporate sector play in explaining revenue dynamics.

Instead of widening tax bases, tax reductions in CEE were generally accompanied by more generous capital allowances and numerous tax incentives and credits, especially targeting the manufacturing sector and new investment. Moreover, although there was an increase in firm profitability in some countries (Poland, Slovakia), higher entry rate (the Czech Republic), and an increased share of the corporate sector (Romania), these trends were not so pronounced as

to entirely explain unchanging or raising tax revenue, given the major CIT cuts. This suggests that other factors, such as curtailing of the shadow economy and income shifting, could have had a major influence on revenue collections in CEE.

The empirical analysis begins with the construction of effective corporate income tax rates based on the methodology of Devereux and Griffith (2003) and explores how elastic firms' taxable income is to changes in these tax measures. The goal is to not only estimate the current effect, but also separate the long-run and the short-run firms' responses in order to detect earnings management. Specifically, in addition to contemporaneous tax terms, lagged and leading tax rates are included, which capture adjustments in TI stemming from firms' expectations about future net-of-tax shares.

In the short-run taxable income is found to be very responsive to cuts in the CIT rate. In particular, in the richest specification, a 1% increase in the log of the current net-of-tax share increases the taxable income-total assets ratio by 0.0134. To put this number into perspective, note that the average TI to total asset ratio for the firms used in the chapter from 1999 to 2005 is between 0.07 and 0.1. The results suggest, however, that a large part of the increase in TI comes from the shifting of income across years to take advantage of tax rate cuts. There are positive and significant long-term effects in most specifications, although with some particular dummy structures, this effect becomes not significantly different from zero.

Disaggregating the data by firm size reveals that the sizeable coefficients on the lagged, leading and current tax rates are almost entirely driven by small enterprises, and become modest for medium enterprises, while for big firms the contemporaneous effect is estimated to be negative. This puzzling finding may be explained by the high political costs of income shifting faced by big firms, but also with the numerous other earnings management instruments and tax incentives available to them. The intertemporal shifting of income, therefore, appears to be a more appealing tax saving strategy to smaller companies that do not possess the wide array of tax management tools a big corporation can exploit.

A further disaggregation by country shows that Romanian firms exhibit the biggest anticipatory response, followed by the Czech Republic and Poland. For Bulgaria, Hungary and Slovakia, a negative effect of the current net-of-tax share is estimated.

The rest of the chapter is structured as follows: Section 2 proceeds with a brief overview of the literature on intertemporal income shifting; Section 3 outlines the tax reforms in CEE, while Section 4 describes the data and the empirical strategy. Results are presented in Section 5, and Section 6 concludes.

2.2 Analyses of Income Shifting in the Literature

Different tax rates can arise within the same tax base over time. One explanation for the volatility of corporate tax revenue can therefore be the intertemporal shifting of income, provided that tax cuts were anticipated. Goolsbee (2000) studies intertemporal shifting for high income executives through the timing of stock options in the context of the Omnibus Budget Reconciliation Act of 1993 (OBRA). Heim (2006) estimates the elasticity of taxable income for individuals

and like Goolsbee (2000) controls for future net-of-tax shares, but also accounts for the effect of lagged taxes. Overall, Heim (2006) finds negative and significant long-term responses.

Revenue management by firms in expectation of lower corporate tax rates is examined by Guenther (1994) and Scholes at al. (1992) for the Tax Reform Act of 1986 (TRA86). In particular, Guenther (1994) looks at adjustments in current accruals (CA) as an indicator of revenue management. CA are defined as the change in the difference between a firm's current assets and current liabilities from year $t-1$ to year t. The author focuses on CA because they are discretionary accruals, enabling managers to transfer earnings between periods by accelerating expenses or deferring the recognition of revenue.[1] Since taxable income is not observable by researchers, Guenther (1994) demonstrates that deductibility of an accrued expense or deferral of revenue for tax purposes is sufficient but not a necessary condition for the accrual of the expense or the deferral of the revenue for financial statement purposes. Thus, it is likely that deferral of taxable income translates into deferral of financial statement income.

The author estimates significantly negative current accruals for large firms for the year before the tax rate reduction, which suggests that accounting earnings were managed in response to changes in the statutory tax rate. The same analysis is performed by Roubi and Richardson (1998), who find evidence of firms' management of discretionary accruals in Canada and Singapore, and to a lesser extent, in Malaysia.

Scholes at al. (1992) use the fact that, due to the phase-in character of tax rate decreases of TRA86, different fiscal year-end firms faced different future corporate tax rates to estimate their propensity to shift income between quarters. Their results show that the shifting of gross margin and selling, general and administrative expense during quarters before the tax cuts, resulted in \$459,000 in tax savings, on average, although the shift was not uniform across income and expense items.

The shifting of income can also be captured by studying the responsiveness of TI to tax rates. Few studies have estimated the elasticity of TI w.r.t. the corporate income tax and generally, without controlling for income shifting. Overall, this literature is small, primarily because the taxable income elasticity approach for individuals does not transfer entirely to the CIT.[2] Gruber and Rauh (2007) use industry-level data on publicly traded corporations in the US and find a modest elasticity of 0.2. For Germany, ETI is estimated by Dwenger and Steiner (2012) who use detailed tax return data on loss carryforwards to estimate effective tax rates for individual firms.

[1] If the tax rate is to be increased, firms have an incentive to accelerate revenue and defer expenses in order to shift taxable income in the year before the tax increase.

[2] As Jane Gravelle points out in her critique of Gruber and Rauh (2007), adjustments in firms' TI reflect a complex combination of factor and product substitution elasticities, capital intensities, depreciation and other factors, all of which are complications, which do not arise in the case of personal income taxation.

Table 2.1: CHANGES IN STATUTORY TAX RATES AND CORPORATE REVENUE

	1999	2000	2001	2002	2003	2004	2005	2006	2007	△
BG	34.3	32.5	28.0	23.5	23.5	19.5	15.0	15.0	10.0	-24.3
	28.0	28.0	23.5							
CR % GDP	3.1	2.7	3.8	3.0	2.8	2.5	1.8	2.1	4.4	1.3
CZ	35.0	31.0	31.0	31.0	31.0	28.0	26.0	24.0	24.0	-11.0
CR % GDP	3.8	3.5	4.1	4.3	4.6	4.7	4.5	4.8	5.0	1.2
HU	19.6	19.6	19.6	19.6	19.6	17.6	17.5	17.5	21.3	1.7
CR % GDP	2.3	2.2	2.3	2.3	2.2	2.1	2.1	2.3	2.8	0.5
PL	34.0	30.0	28.0	28.0	27.0	19.0	19.0	19.0	19.0	-15.0
CR % GDP	2.4	2.4	1.9	2.0	1.8	2.2	2.5	2.4	2.8	0.4
RO	38.0	25.0	25.0	25.0	25.0	25.0	16.0	16.0	16.0	-22.0
CR % GDP	3.8	3.0	2.5	2.6	2.8	3.2	2.7	2.8	3.1	-0.7
SK	40.0	29.0	29.0	25.0	25.0	19.0	19.0	19.0	19.0	-21.0
CR % GDP	3.1	2.6	2.6	2.5	2.8	2.6	2.7	2.9	3.0	-0.1
EU-17	35.5	35.5	33.8	32.6	31	30.5	29	28.6	27.7	-7.8
CR % GDP	3.3	3.4	3.3	3.3	3.0	3.0	3.1	3.3	3.6	0.3

Note: All tax rates are in %. CR % GDP shows corporate tax revenue as a percent of the respective country's GDP. The last column lists the percentage point change from 1999 to 2007. Until 2001, in addition to the standard rate, Bulgaria had a lower CIT rate for companies with TI below a legally stipulated threshold.
Source: Ernst & Young (Various Years); European Commission (Various Years).

2.3 Corporate Tax Reforms in CEE

2.3.1 Statutory tax rates

Table 2.1 shows the evolution of the statutory CIT rates for the six countries under consideration. With the exception of Hungary, these countries maintained relatively high rates in the range of 34% to 40% in 1999, but from 2000 onwards an overall decline is observed. Romania and Slovakia slashed the CIT rate in stepwise reductions ending up with rates of 16% and 19% in 2007, respectively, which is about 21pp below their level in 1999. Bulgaria, the Czech Republic, and Poland engaged in more frequent, albeit smaller annual cuts, bringing the CIT rate substantially below the EU-15 average, apart from the Czech Republic, whose rate was only about 4pp lower than the EU-15's in 2007.

A Romanian firm that deferred $1 of TI from 1999 to 2000, gained 20%, given the 13pp fall in the CIT rate. Similar tax savings could be realised in Slovakia, and over the longer-term, in Bulgaria, the Czech Republic and Poland.

Compared to other CEE countries, Hungary had a low CIT rate of 19.6% as early as 1997, which was first reduced in 2004 to 17.6%. Thus, Hungary is one of the few EU countries exhibiting little dynamics in its statutory CIT rate. The rates in Poland, Romania, and Slovakia did not change after 2005, so the bulk of the reforms took place between 1999 and 2005.

Despite the considerable fall in the statutory rates, corporate tax revenues in CEE as a proportion of GDP remained stable and even increased in some countries (Table 2.1). From 1999

to 2007, the Czech Republic lowered its CIT rate by 11pp, yet it collected 1.2pp higher revenue as a % of GDP in 2007 than it did in 1999. Overall, the Czech Republic exhibited buoyant and steadily growing corporate tax collections accompanied by gradually declining statutory rate. Revenue was more volatile in Bulgaria. An interesting trend is that revenue collections dip in the year before a tax cut only to bounce back in the year of the tax cut. This is valid for the 2000-2001 tax decrease and especially for the 2006-2007 5pp cut, which more than doubled revenue in 2007. The same tendency is observed in Poland, where collections did not change from 1999 to 2000, while the 8pp tax cut from 2003 to 2004 increased revenue. Tax cuts in Romania and Slovakia were usually followed by a slight drop in revenue, but in general, collections displayed little fluctuation, remaining especially stable in Hungary.[3]

2.3.2 Tax base

In contrast to other EU countries, which broadened the tax base and closed loopholes to make tax cuts revenue-neutral, the six CEE countries considered in this chapter narrowed their tax bases by introducing various tax incentives and more generous capital allowances, primarily after 1999.[4] Table 2.2 summarises some of the most important tax incentives, whose effect can later be accounted for in the data.[5] In general, most tax breaks applied to the manufacturing sector, but also overall to businesses operating in areas with high unemployment.

The Czech Republic, for example grants a ten year income tax holiday for companies investing certain funds in manufacturing as well as provides job-creation and retraining grants. Although few firms qualified for this policy in its starting years, currently many foreign and domestic investors take advantage of the tax breaks. Other countries chose to stimulate smaller businesses. Romania, for instance, implemented special provisions for small and medium enterprises and microenterprises, while Bulgaria offers 100% corporate income tax relief if a company operates in a high unemployment region. Besides manufacturing, Hungary also supports its hoteling industry and Slovakia has numerous incentives for foreign investors. Since 1995, Poland created seventeen special economic zones (currently fourteen), in which companies can benefit from tax exemptions provided they obtain a permit from the zoning authorities.Table 2.2 and Appendix 2.2 describe the tax incentives in greater detail.

With regard to capital allowances, all six countries maintained the yearly write-down allowances at their 1999 level (Table 2.3). Gradually, more detailed asset categories were introduced that generally benefited from higher depreciation rates, a development applying especially to the IT and communications sector. Provisions for intangible assets were also established. In

[3]It is worth mentioning that the Baltic countries, although not studied in this chapter, experienced 100% increase in revenue through modest cuts in the CIT rates. From 2000 to 2009, for example, rates in Estonia and Lithuania fell by 5 and 4pp, respectively. Collections rose from 0.9% (2000) to 1.8% (2009) in Estonia, and from 0.7% to 1.8% in Lithuania. A similar trend is observed in Latvia.

[4]In all six countries, indirect taxation is gradually becoming one of the biggest sources of government revenue and certainly of greater importance than the CIT. The shift from direct to indirect taxation is not limited to CEE, however, and is happening, to a varying degree, across all EU countries. This shift is acknowledged and in fact encouraged by the European Commission (2010). The increasing reliance on indirect taxes can be a possible explanation of why corporate tax cuts were not accompanied by a tax base expansion.

[5]Except loss carryforward.

Table 2.2: MAJOR TAX INCENTIVES

BG	2003	Manufacturing companies qualify for 100% reduction in CIT if located in municipalities, where unemployment is 50% higher than the average unemployment in the country. The tax is accounted as a reserve and should be used for the acquisition of fixed assets. A list of qualifying municipalities is published in CIT Law annually. Incentive was still in effect in 2005. Losses can be carried forward for 5 years.
CZ	1999	Corporate income tax relief for 10 years for firms that make an investment in a specified manufacturing sector, with a certain portion of the investment being covered by equity; investment in machinery must account for at least 40% of the total investment. Incentive was still valid in 2005. Losses can be carried forward for 7 years
	2004	Losses can be carried forward for 5 years.
HU	1999	Investment tax credit of 50% of the corporate income tax if product manufacturing investment of at least HUF 1 billion is made. Credit can be claimed in each of the five years following investment if in such years sales revenue increases by at least 5% of the investment value. Same conditions apply for equivalent investment in the hotel industry, but sales turnover should increase by 25% compared to the previous year but not less than HUF 600 million. Losses can be carried forward for 5 years.
PL	1999	Since 1995 Poland has created seventeen special economic zones (SEZ). One zone was since closed, and two were merged into the Pomeranian SEZ. Companies can apply for permit to operate in these zones and benefit from tax exemptions and preferences. Tax exemptions are calculated based on the amount invested and the company would not pay income tax until the income tax exemption limit has been exhausted.
RO	2000	Small and medium enterprises (SMEs) can reduce their corporate profit tax by 20% if their employment increases by 10% compared to previous year. A SME is a company with no more than 249 employees and annual turnover less than €8 million. This tax incentive was valid until 2004.
	2001	Micro-enterprises (ME) are taxed at 1.5% on sales. An ME has no more than 9 employees and annual turnover less than €100,000. Incentive was valid until 2002. Losses can be carried forward for 5 years.
SK		Losses can be carried forward for 5 years.

Note: The table lists only those tax incentives, which are accounted for, given the data. In addition, until 2002, Bulgaria offered an incentive, which reduced profit tax by 10% of the amounts contributed to establish a company or increase the capital of a company, if the amounts are used to improve fixed tangible assets and the investment is made in municipalities with 1.5 times higher unemployment than the average for the country. Besides a corporate income tax holiday, firms in the Czech Republic can also apply for job-creation grants, customs-related benefits, grants for retraining employees and property-related incentives, all of which can affect taxable income. Hungary additionally offers tax incentives for offshore companies. Romania has special provisions in place for firms in Disfavoured Economic Zones and Industrial Parks (usually VAT deferral) and like Poland, has created Free-Trade Zones benefiting from 5% profit tax rate or a general profit tax exemption. Tax holidays and tax credits as well as contributions for new jobs and training are available to firms in Slovakia, although they need to meet a long list of requirements in order to qualify. Column (2) shows the year of implementation of the tax incentive or the year in which an already existing policy was modified.
Source: Ernst & Young (Various Years), United Nations (2000), KPMG Poland (2009).

Table 2.3: CAPITAL ALLOWANCES

BG	1999-2001	Straight-line method. I. Industrial buildings and installations 4%; II. Machines, equipment and appliances, office equipment 20%; III. Vehicles and other types of transportation (excl. automobiles) 8%; IV. All other assets 15%
	2002	For assets in Group II and certain assets in Group I, accelerated depreciation of up to 30% allowed.
	2003-2005	I. Buildings, facilities, etc. 4%; II. Machines, manufacturing equipment, apparatus 30% (can be increased to up to 50% for new investments in long-term assets); III. Transportation vehicles, excl. automobiles 10%; IV. Computers and software 50%; V. Automobiles 25%; VI. Other tangible assets 15%; VII. Intangible assets – maximum rate 25%. Depends on period of use.
CZ	1999-2004	Choice of straight line or accelerated depreciation. I. Passenger cars, buses, light machinery 4 years (straight line) 14.2% first year 28.6% subsequent years, (accelerated) 4 first year, 5 subsequent; II. Airplanes, furniture, etc. 6 years 8.5% first year 18.3% subsequent years, (accelerated) 6 first year, 7 subsequent; III. Heavy machinery 12 years (straight line) 4.3% first year 8.7% subsequent years, (accelerated) 12 first year, 13 subsequent; IV. Wooden buildings, pipelines, etc. 20 years (straight line) 2.15% first year 5.15% subsequent years, (accelerated) 20 first year, 21 subsequent; V. All other buildings 30 years (straight line) 1.4% first year 3.4% subsequent years, (accelerated) 30 first year, 31 subsequent. Tangible assets valued at up to CZK 40,000 can be deduced immediately. 10% initial depreciation allowance for certain assets if company is first owner. 15% initial depreciation allowance for purification and processing of water equipment. 20% allowance for certain agricultural equipment.
	2004	VI. Specified buildings 50 years (straight line) 1.02% first year 2.02% subsequent years, (accelerated) 50 first year, 51 subsequent. Intangible assets divided into two categories depending on period of use. Intangible assets up to CZK 60,000 can be deducted immediately.
	2005	Higher depreciation rates for office machines, Busses, airplanes, tractors, lorries and furniture, and heavy machinery.
HU	1999-2005	Straight-line depreciation. I. Hotel and catering buildings 3%; II. Industrial and commercial buildings 2 to 6% III. Motor vehicles 20%; IV. 14.5% (Computers, automation equipment, etc. 33%). Various equipment valued at less than HUF 100,000 can be written off over two years.
	2004	V. Computers 50%.
	2005	VI. Intellectual property and film production equipment 50%.
PL	1999-2005	Straight-line method. In certain cases declining balance can be allowed. For certain assets (machinery), depreciation rates can be doubled. Companies in high unemployment are subject to more favourable tax depreciation. I. Buildings 1.5 to 10%; II. Office equipment 14%; III. Computers 30%; IV. Motor vehicles 14 to 20%; V. Plant and machinery 5 to 20%.
	2005	30% depreciation rate for certain new fixed assets.
RO	1999-2001	Straight-line method. I. Buildings and constructions 10 to 50 years; II. Machinery and equipment 4 to 10 years; III. Furniture and fittings 5 to 10 years; Motor vehicles 5 to 9 years. Assets may be revalued annually if cumulative inflation rate for last 3 years exceeds 100%.
	2002	Accelerated depreciation can be claimed subject to certain criteria.
	2003-2005	Accelerated depreciation for technological equipment, machineries, tools, installations, computers and peripheral equipment, under which assets can be depreciated at 50% rate in the year of purchase or 20% deduction for investments in depreciable fixed assets if accelerated depreciation is not selected as an option.
SK	1999-2003	Choice of straight line or accelerated depreciation. I. Passenger cars, buses, light machinery 4 years (straight line) 14.2% first year 28.6% subsequent years, (accelerated) 4 first year, 5 subsequent; II. Airplanes, office equipment, etc. 8 years 6.2% first year 13.4% subsequent years, (accelerated) 8 first year, 9 subsequent; III. Heavy machinery and patents 15 years (straight line) 3.4% first year 6.9% subsequent years, (accelerated) 15 first year, 16 subsequent; IV. Wooden buildings, pipelines, etc. 30 years (straight line) 1.4% first year 3.4% subsequent years, (accelerated) 30 first year, 31 subsequent; V. All other buildings 40 years (straight line) 1.5% first year 2.5% subsequent years, (accelerated) 40 first year, 41 subsequent.
	2000	Intangible assets depreciated for a period of 2 but not more than 5 years.
	2004-2005	Four categories of assets but rates and years are not listed.

Source: Ernst & Young (Various Years).

2003 Bulgaria increased the depreciation rates for some assets including plant and machinery, followed by the Czech Republic in 2005. Romania allowed for an accelerated depreciation rate at 50% in the year of purchase for technological equipment and other machinery in service after 2002.

Due to the limitations of the data, a single definition of taxable income cannot be adopted in the empirical analysis that follows. It is therefore important to establish that the definition of TI has not changed in such a way that TI would have grown for reasons unrelated to tax rates or firms' profitability. While the definition of taxable income was indeed altered in all countries, it was mostly in the direction of increasing deductible expenses. In Bulgaria, the number of new provisions reducing the financial result was far greater than the ones raising it. The list of deductible expenses in Hungary, Poland and the Czech Republic remained virtually the same, with the exception of a new provision introduced in 2004 in the Czech Republic, stipulating that the purchase cost of intangible assets up to CZK60,000 can be deducted immediately (Ernst & Young, Various Years). Romania followed a balanced approach in modifying firms' taxable income. For example, up to 1.5% of total salary cost could be deducted in 2005 compared to 2% in 2004, but in 2005 permanent establishments could deduct R&D, and management and administration expenses up to 10% of taxable salaries.

Given the described policies and the falling CIT rates, the strength of corporate tax revenues cannot be explained by expansions in the tax base. It is certainly possible, however, that enhancement of tax administrations' enforcement and collection abilities could have generated additional revenue by driving more firms out of the shadow economy. According to the World Bank Worldwide Governance Indicators, regulatory quality, which incorporates the effectiveness of the tax collection system, has improved tremendously in CEE for the period 1999-2005. Nevertheless, according to the Indicators, there are mixed signals concerning the control of corruption, which has not exhibited marked advancement, and in the case of Poland, has actually worsened with time.

2.3.3 Rate of incorporation and profitability

Even if the tax base became narrower, lower CIT rates could have promoted a higher rate of incorporation and the growth of already established businesses. Further, firms may have become more profitable due to non-tax reasons. To examine if this is the case, I study changes in the profit rate of corporations, the share of the corporate sector in GDP and the number of firms per capita. I follow Clausing (2007) and construct a rate of profitability measure by dividing corporations' aggregate net operating surplus by corporate value added. Corporate value added scaled by GDP serves as a measure of the share of the corporate sector. Finally, the number of firms by industry as well as population statistics are taken from OECD's Structural Business Statistics and Eurostat.

Figure 2.1 shows the number of enterprises per capita in the non-financial sector from 1999 to 2005. The number of firms relative to the population increased in Romania and remained virtually unchanged in Hungary, Slovakia, and Bulgaria. There was a substantial jump in the

Figure 2.1: NUMBER OF ENTERPRISES PER CAPITA

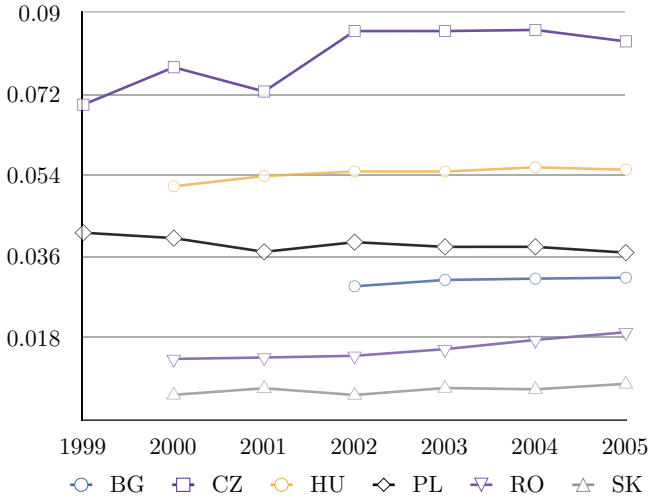
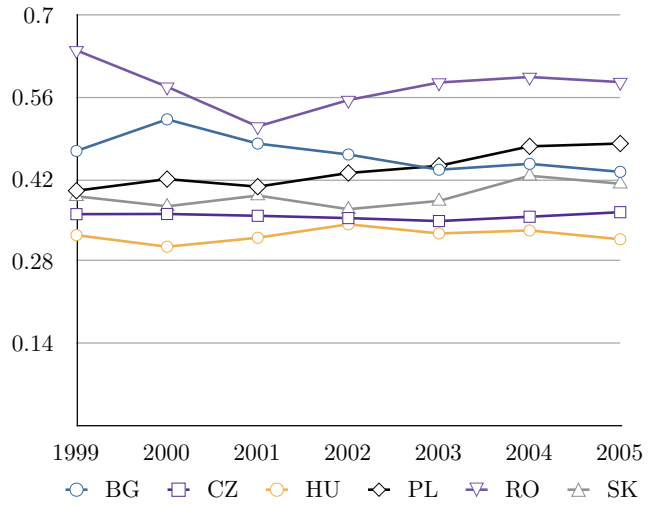


Figure 2.2: RATE OF PROFITABILITY



entry of firms in the Czech Republic between 2001 and 2002, with the time series stabilising at the higher level post 2002.[6] In general, the Czech Republic has markedly higher businesses-to-population ratio than the remaining five countries. In contrast, Poland experienced an overall decline in businesses both in absolute and per capita level.

Trends in profitability are depicted in Figure 2.2. Looking in more detail at the sectoral differences, the mining and quarrying as well as the electricity, gas, and water supply industries expanded in all countries, although their profitability was volatile – from negative in Poland, Slovakia and Hungary to steadily growing in the Czech Republic (Appendix 2.1: Tables 2.13 and 2.14).[7] The number of firms operating in the Real Estate and Business Services sector grew

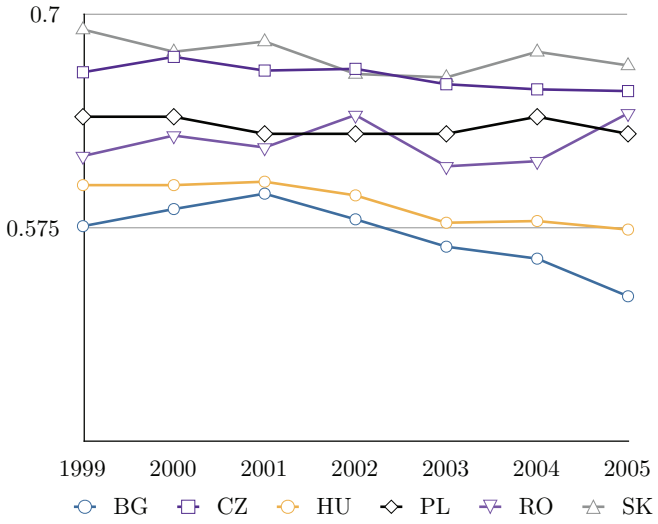
[6]The entry rate could have been even higher as the change of the number of firms from one year to the next is a combination of both the birth and death rates of firms.

[7]For Romania, the data is only for the total number of firms.

in all countries and its profitability remained stable.

Apart from the sectors mentioned above, the number of enterprises in Poland declined in all other industries, yet their profitability increased considerably. Piotrowska and Vanborren (2008) also find an increasing entry rate and corporate profit share for the Czech Republic and Poland, respectively. Overall, only Poland and Slovakia exhibit an upward tendency in the rate of profitability.[8] Last but not least, the share of the corporate sector in GDP declined in Bulgaria, Hungary, and Slovakia, remained the same in Poland and the Czech Republic, and increased in Romania, as depicted in Figure 2.3.

Figure 2.3: SHARE OF CORPORATE SECTOR IN GDP



2.4 Empirical Analysis

2.4.1 Data

I use firm-level panel data from the comprehensive AMADEUS dataset for European companies compiled by Bureau van Dijk. The data consists of financial statements' variables as reported by firms. I consider data for the 6 CEE countries discussed above, namely Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia for the period 1999-2005. Earlier years are not included because AMADEUS's data coverage for CEE was limited before and even in 1999 and also because most tax reforms took place after 1999.

Sole proprietors, partnerships, societies, associations and non-profit organisations are excluded from the analysis, since some are non-corporate entities and others are subject to special tax provisions. For each country I keep public and private limited companies, branches of foreign corporations, as well as municipal and state companies, resulting in a dataset of 3,248,643 firm-year observations. If a firm has submitted both consolidated and unconsolidated statements,

[8] Figure 2 excludes the financial sector, but the trends do not change if this sector is considered.

only the unconsolidated statement is considered in order to avoid repetitive firm observations (3,795 firm-year observations dropped). The sample is further restricted to include firms whose status is active, i.e., not in bankruptcy, dissolution, or liquidation, and that file a report at the end of the year (11,399 firm-year observations dropped).

I follow Klapper et al. (2006) and Da Rin et al. (2011) and exclude certain industries that are unlikely to manage taxable income or are subject to stricter regulations. In particular, financial services (NACE2 65-66; 2,551 firm-year observations), public administration, education, and other social and personal services industries (NACE2 75, 80, 90, 91, 92, 95, 97, 99; 40,328 firm-year observations) as well as firms missing an industry classification (36,471 firm-year observations) are removed. Overall, there remain 51 different industries based on a NACE2 classification. I additionally drop observations with spells of missing values of taxes paid, cost of employees, profit/loss for the period and depreciation in the beginning and the end of each panel (1,112,893 firm-year observations), all of which are variables used later on in the calculation of effective tax rates.

All financial amounts are transformed into thousands of USD using AMADEUS's exchange rate from the local currency to USD at the fiscal year end of companies. By and large, the exchange rates exhibit little volatility, which will not affect the subsequent empirical estimation as all balance-sheet variables are scaled by total assets.

The statutory tax rates for each country are described in Table 2.1, but before proceeding with computing taxable income, I need to identify firms that have utilised tax breaks, and therefore face lower or zero corporate tax rates. In the data, such firms usually appear as paying zero taxes due to tax incentives, yet it would be wrong to infer their taxable incomes to be zero.

Appendix 2.2 describes in detail what types of firms qualify for tax incentives and how they are identified. All in all, approximately 600 major manufacturing firms from Bulgaria, the Czech Republic, Hungary and Poland qualify for some tax incentive. The number is much more substantial for Romania, since the incentives cover SMEs and microenterprises. About 9,000 companies per year (2000-2004) in Romania fulfil the SMEs incentive criteria and more than 70,000 firms in 2001 could use the microenterprises tax rate. Earnings before interest and tax (*ebit*) are used as a measure of taxable income in the case of a tax incentive, which enables the firm to pay no tax. If the incentive reduces the tax rate, then I simply assign the lower rate to the eligible firm.

2.4.2 Computing firm-level effective tax rates

The methodology of Devereux and Griffith (2003) is followed to compute effective average corporate tax rates (EATR). An attractive feature of this effective tax rate, as pointed out by Devereux and Griffith (2003), is that it constitutes a weighted average of the marginal effective tax rate for marginal investments, and the statutory tax rate for very profitable investments. One of the main reasons for using EATR in this chapter is to create variation in the tax rates, since the formula for EATR includes a firm-specific component as will be shown below. Even though EATR is more suited to studying the firm's decision to invest, while income shifting,

especially if achieved through accounting manipulation, would be better captured by the statutory rate, it is worth noting that in the long-run, the decision to invest (or not) inevitably affects taxable income. Regressions using the statutory tax rates instead of EATR are also reported later on.

The EATR is based on the net-present value (NPV) of a hypothetical investment project, calculated in the presence and absence of a tax. In particular,

$$EATR = \frac{R^* - R}{R^*}, \tag{2.4.1}$$

with R^* being the NPV of the project without tax and R – the NPV with tax. R is derived in the following way: If V_t is the market value of a firm's shares, then following King (1974), the net-of-tax yield from investing V_t at the market rate of interest must equal the net-of-tax dividends, D_t, plus the capital gain in order to achieve equilibrium in the capital market

$$i_t(1 - m_t^i)V_t = \frac{1 - m_t^d}{1 - c_t}D_t + (1 - z_t)(V_{t+1} - V_t - N_t), \tag{2.4.2}$$

where i_t is the market rate of interest at time t, m_t^i is the personal tax rate on interest income, m_t^d is the tax rate on dividend income, z_t is the capital gains' tax rate, c_t is the rate of tax credit on dividends, and N_t is the new equity issued.

Solving this difference equation and assuming a one unit increase in the capital stock in period t $dK_t = 1$, which is reduced in the next period so that $dK_k = 0 \; \forall \; k \neq t$, yields a change in the value of the firm $R = dV_t = \sum_{k=0}^{\infty} \left[\frac{\theta dD_{t+k} - dN_{t+k}}{(1+\rho)^k} \right]$, where $\theta = (1 - m_t^d)/(1 - c_t)(1 - z_t)$ and $\rho = (1 - m_t^i)i_t/(1 - z_t)$.

From the equation for the appropriation of income, one obtains D_t as $D_t = Y(K_{t-1})(1 - \tau_t^s) - I_t + B_t - (1 + i_t(1 - \tau_t^s))B_{t-1} + \tau_t^s \phi_t (I + K_{t-1}^T) + N_t$. Output Y in period t is a function of the beginning of year capital stock K_{t-1}, τ_t^s is the statutory corporate tax rate, I_t is investment, B_t is debt, with interest payments assumed to be tax-deductible, ϕ_t is the depreciation rate of capital, and K_{t-1}^T is defined as tax-written-down value of capital stock at the beginning of t (Devereux and Griffith, 2003). Deriving the change in dD_{t+k} from the equation for D_t and plugging into the equation for dV_t, Devereux and Griffith (2003) obtain R and subsequently the EATR for different sources of financing.

Throughout the chapter I assume that $\theta = 1$, i.e., $m_t^d = c_t = z_t = 0$. Additionally, I assume that $m_t^i = 0$, which leads to the nominal discount rate of shareholders $\rho = i$. θ was first defined by King (1974) as a measure of the degree of discrimination between retaining profits and distributing profits as dividends. In other words, if paying dividends generates more tax liability as compared to retaining earnings, then $\theta < 1$. Therefore, assuming that $\theta = 1$, or equivalently not considering personal income taxes, implies that financing projects either by retained earnings, or the issue of new shares yields the same EATR.

Based on the assumptions above,

$$R = \frac{1}{1+i}[(p+\delta)(1+\pi)(1-\tau^s) - ((1+i) - (1-\delta)(1+\pi))(1-A)] + F, \tag{2.4.3}$$

where the first term in brackets is the net-of-tax change in output caused by a one unit increase in the capital stock, with p being the real financial return, δ one period cost of depreciation and π the inflation rate, which is the same for capital and output. The second term in brackets is the required decrease in investment to keep capital stock unchanged in period $t+1$. A is the NPV of tax allowances per unit of investment and F is the cost of raising external finance.[9]

Provided that the investment is financed by debt, because of deductible interest payments, taxable income will be lower, and hence the EATR is smaller. To see this, note that if the firm borrows $1-\phi\tau$ in period t, then R incorporates the amount of deductible interest payments $F = i\tau^s \frac{1-\phi\tau^s}{1+i}$, which leads to a lower EATR as compared to the case when $F = 0$, which is equivalent to financing by retained earnings or equity.[10]

Correspondingly, R^* is simply R without the taxes, or

$$R^* = -1 + \frac{1}{1+i}[(p+\delta)(1+\pi) + (1-\delta)(1+\pi)] = \frac{p-r}{1+r} \tag{2.4.4}$$

using the relationship between the real r and nominal i interest rates $(1+r)(1+\pi) = (1+i)$. The difference $R^* - R$ is then scaled by the NPV of the pre-tax total income stream net of depreciation $p/(1+r)$ in order to obtain a measure of the EATR (See Appendix 2.3).

Similarly to Da Rin et al. (2011), I measure the nominal interest rate i with the rate of short-term government bonds. In particular, two-year government bond rates are used for Bulgaria, Poland and Slovakia, and one-year government bond and one year treasury bill rates for the Czech Republic and Hungary, respectively. No such rate is available for Romania, so it is approximated with the money market interested rate, taken from Eurostat. The Harmonised Indices of Consumer Prices from Eurostat are a measure of the inflation rate π.

The maximum depreciation rates for plant and machinery in the cases of Poland and Hungary, heavy machinery for the Czech Republic and Slovakia, and machines and manufacturing equipment for Bulgaria and Romania are used as the rates at which capital expenditure is offset against tax ϕ. The results presented below are robust to using other asset categories' depreciation rates and the average of these.

The financial rate of return p is obtained by subtracting expenditures on employees ($staf$) from the added value (av), and dividing this difference by the added value: $(av - staf)/av$, where in AMADEUS av is defined as the sum of taxes paid ($taxa$), profit/loss for the period (pl), depreciation ($depre$), interest paid ($inte$), and labour expenses ($staf$). Da Rin et al. (2011) employ an identical measure but on an industry level.

A major problem is that about 90% of the AMADEUS firms have missing values for interest

[9] For $\theta = 1$ and $\rho = i$, $A = \phi\tau^s \frac{(1+i)}{i}\left(1 - \frac{1}{(1+i)^{T+1}}\right)$, where $T = 1/\phi$ for straight-line depreciation, and $A = \phi\tau^s \frac{(1+i)}{(i+\phi)}$ for declining balance. See also Da Rin et al. (2011).

[10] The assumption is that the firm is eligible for an immediate tax allowance of $\phi\tau^s$, hence $1 - \phi\tau^s$.

paid. For this reason, p is calculated without including this variable. However, estimates are presented for the small sample of firms who have reported interest payments, with p calculated accordingly, with the results confirming income shifting, although the non-transitory responses tend to be lower (close to zero) than the long-term responses estimated without *inte*.

All remaining variables, namely r, A, R and R^* are calculated using the formulas described above. The one-period cost of depreciation δ is assumed to take a value of 12.5%, taken from Da Rin et al. (2011). A step-by-step explanation of the variables and formulas used to calculate the EATR is provided in Appendix 2.3.

2.4.3 Taxable income

In general, the measure of firms' taxable income, which is taxes paid divided by the statutory tax rate, is only an approximation of the true taxable income, given the limitations of the data. In particular, there is no information on incurred losses, which can be carried forward for 5 consecutive years in all countries and are in effect a deferred tax, since they appear as deductions in future periods (Hanlon, 2003). This means that a lot of firms will report zero TI in year t, because of previous year losses, even if they are profitable at time t.

Table 2.4 provides descriptive statistics for all variables of interest. TI is between 5% and 10% of total assets, with the notable exception of 2001, when the ratio is 0.5. This high ratio is due to the large number of Romanian microenterprises subject to 1.5% tax in 2001, which lowers the mean of the tax rates in that year substantially, while raising the ratio of TI to Toas considerably as microenterprises' tax base is turnover. If the data is weighted by turnover, the weighted mean of $\frac{TI}{Toas}$ for 2001 is .079. The same occurs with inflation whose mean is well above the weighted mean due to the very large number of Romanian firms relative to the remaining sample.

Table 2.4 further shows the three corporate tax rates of interest: the statutory, and the effective tax rates assuming the project is financed by equity (τ^{ee}), and debt (τ^{ed}), respectively. τ^{ee} closely follows the statutory tax rate and is very similar in value, while τ^{ed} is much lower. Figures 2.4 and 2.5 show the distributions of τ^{ee} and τ^{ed}, respectively, in the range (0,1) for the period 1999-2005. Compared to τ^{ee}, τ^{ed}'s distribution is more compressed, with a lower mean and less rate variability.

Both tax rates, however, are lower than they should be, since interest payments were not included in the calculation of the rate of return, which resulted in smaller p, and hence lower effective tax rates. In Table 2.4, the tax rates' means are for firms that have realised some profit, i.e., the rates are in the range (0,1). In the subsequent estimation I use tax rates in the range $(-0.01, 1)$ in order to reduce the influence of very negative values of the effective tax rates.[11]

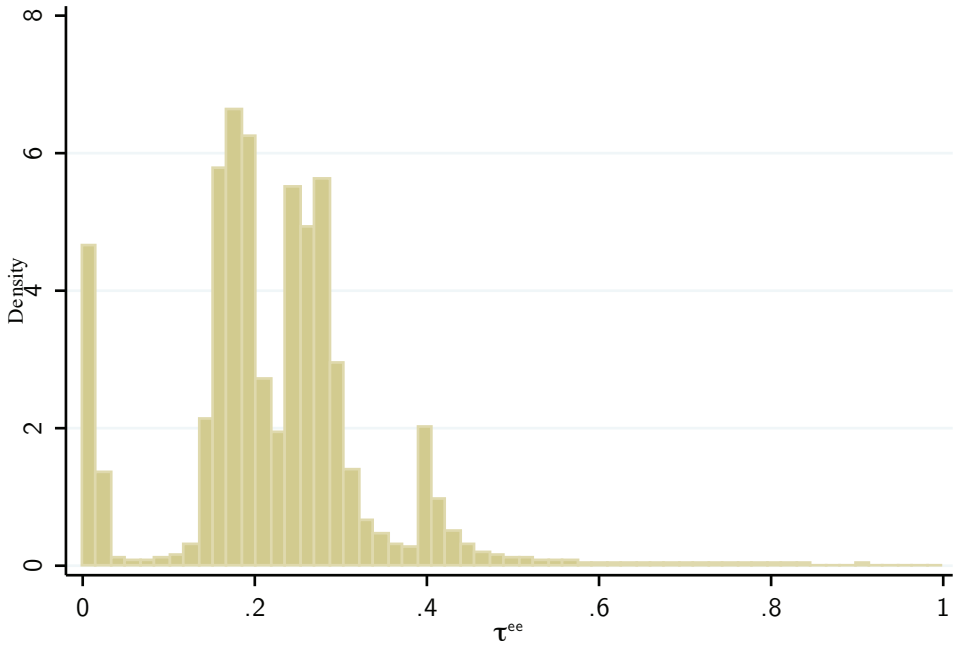
[11] Given the formulas for the effective tax rates, I obtain a number of firms which face tax rates greater than 100% and some facing negative tax rates (subsidy). The firm-year observations with tax greater than 100% are 1,930 for τ^{ee} (3,337 for τ^{ed}), all of which drop out from the subsequent estimation as $ln(1-\tau)$ becomes negative, and therefore not defined. 75.8% (70.5%) of these are Romanian enterprises that experienced very high inflation in the period 1999-2003. Inflation in Romania began to normalise in 2005, declining to 9%. The firm-year observations with a negative tax rate are 25,640 (115,440 for τ^{ed}); the estimation includes businesses facing tax rates in the negative range (-0.01, 0), or 20,805 (29,014) firm-year observations, leaving out 4,835

Table 2.4: DESCRIPTIVE STATISTICS

	1999 Mean	2000 Mean	2001 Mean	2002 Mean	2003 Mean	2004 Mean	2005 Mean
$\frac{TI_t}{Toas_t}$	.093	.110	.493	.065	.053	.057	.076
	(.175)	(.201)	(.792)	(.232)	(.136)	(.155)	(.186)
τ^s	.328	.238	.136	.232	.251	.218	.171
	(.077)	(.032)	(.116)	(.064)	(.035)	(.040)	(.030)
τ^{ee}	.342	.280	.150	.242	.245	.197	.172
	(.125)	(.085)	(.136)	(.087)	(.064)	(.073)	(.044)
τ^{ed}	.147	.163	.102	.171	.191	.151	.148
	(.094)	(.070)	(.103)	(.083)	(.078)	(.077)	(.044)
ln(Cuas/Toas)	-.637	-.588	-.589	-.554	-.553	-.575	-.575
	(.726)	(.715)	(.715)	(.719)	(.743)	(.774)	(.779)
ln(Culi/Toas)	-.685	-.681	-.525	-.507	-.579	-.765	-.780
	(1.02)	(.1.06)	(1.01)	(1.06)	(1.13)	(1.22)	(1.25)
ln(Depre/Toas)	-3.41	-3.38	-3.53	-3.54	-3.57	-3.46	-3.42
	(1.27)	(1.26)	(1.28)	(1.34)	(1.4)	(1.4)	(1.41)
ln(Fias/Toas)	-1.37	-1.46	-1.48	-1.56	-1.60	-1.59	-1.58
	(1.15)	(1.21)	(1.25)	(1.31)	(1.35)	(1.39)	(1.4)
ln(Opre/Toas)	.834	.745	.688	.717	.624	.488	.414
	(1.13)	(1.16)	(1.08)	(1.10)	(1.09)	(1.16)	(1.17)
ln(Toas)	3.36	3.35	3.59	3.65	3.86	4.20	4.14
	(2.41)	(2.39)	(2.53)	(2.55)	(2.48)	(2.30)	(2.23)
i	.485	.289	.299	.185	.141	.140	.059
	(.269)	(.156)	(.132)	(.075)	(.061)	(.060)	(.011)
ϕ	.147	.148	.149	.146	.150	.148	.149
	(.019)	(.019)	(.022)	(.019)	(.037)	(.031)	(.030)
π	.322	.313	.271	.170	.114	.091	.067
	(.185)	(.176)	(.122)	(.086)	(.062)	(.033)	(.029)
p	.438	.468	.463	.498	.530	.518	.514
	(.262)	(.269)	(.271)	(.276)	(.290)	(.281)	(.279)
N	166,411	201,182	183,122	196,703	260,943	391,654	414,909
TI>0	100,039	125,625	146,546	78,059	109,583	173,950	199,553

Note: $\frac{TI_t}{Toas_t}$ is taxable income scaled by total assets; τ^s is the statutory tax rate; τ^{ee} is the effective tax rate assuming new investment is financed by equity (retained earnings); τ^{ed} is the effective tax rate assuming new investment is financed by debt only. The means of the tax rates are in the range (0,1), i.e., they reflect the mean rates for firms with positive TI. See Footnote 11 in the text. ln(Cuas/Toas) is the natural log of the ratio between current assets (stocks + accounts receivable+other current assets) and total assets; ln(Culi/Toas) is the natural log of the ratio between current liabilities (loans + accounts payable + other current liabilities) and total assets; ln(Depre/Toas) is the natural log of the ratio of depreciation to total assets; ln(Fias/Toas) is the natural log of the ratio between fixed assets (tangible fixed assets + intangible fixed assets + other fixed assets, including financial fixed assets) and total assets; ln(Opre/Toas) is the natural log of the ratio between operating revenue and total assets; ln(Toas) is the natural log of total assets. i is the nominal interest rate, ϕ is the rate of depreciation for plant and machinery, π is inflation, and p is the rate of return. See also Appendix 2.3.

Figure 2.4: EFFECTIVE AVERAGE CORPORATE TAX RATES, EQUITY: 1999-2005



Unlike Western European countries, where the average inflation for the period 1999-2005 was about 3%, CEE had high rates of inflation, especially in the period 1999-2002, which normalised to about 7%, on average, in 2005. The nominal interest rates reflect the high inflation rates and also decrease over time.

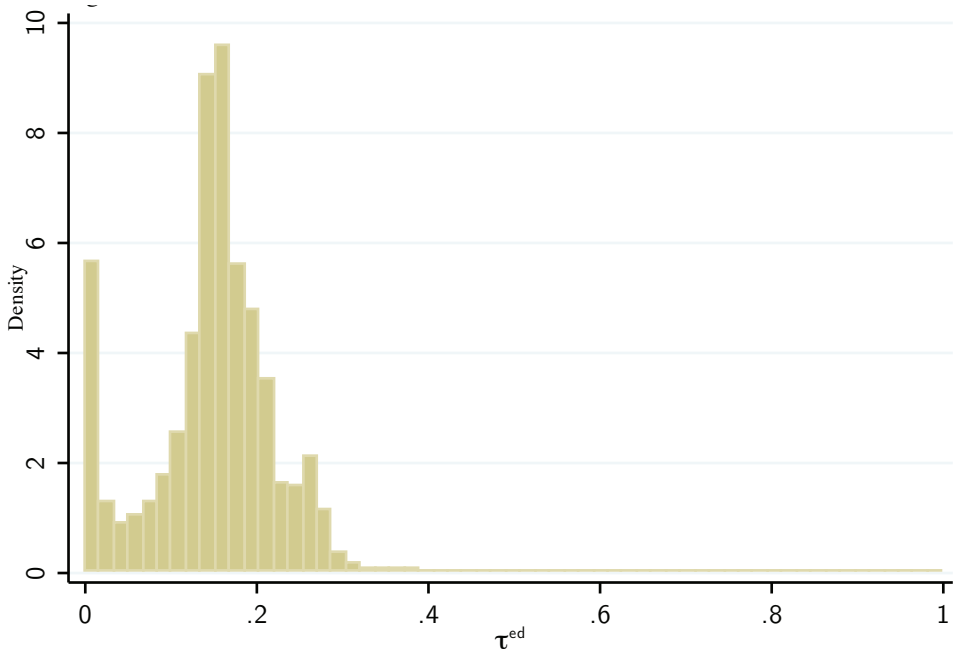
2.4.4 Methodology

The goal is to separate the long-run and short-run responses of taxable income to changes in the tax rates and this involves taking account of income shifting by firms in anticipation of lower future rates. To separate the responses, the following specification is employed:

$$\begin{aligned} \frac{TI_{it}}{Toas_{it}} &= \alpha_i + \beta_1[ln(1-\tau^e_{it}) - ln(1-\tau^e_{it-1})] + \beta_2 ln(1-\tau^e_{it}) \\ &+ \beta_3[ln(1-\tau^e_{it+1}) - ln(1-\tau^e_{it})] + \epsilon_{it} \\ &= \alpha_i + (\beta_1+\beta_2-\beta_3)ln(1-\tau^e_{it}) - \beta_1 ln(1-\tau_{it-1}) + \beta_3 ln(1-\tau_{it+1}) + \epsilon_{it} \end{aligned} \tag{2.4.5}$$

(86,426) firm-year observations with tax rates smaller than -1%. It is worth pointing out that more than 60% of all firms with negative tax rates belong to a narrow category of firms, which are also the most difficult to tax, namely: General construction and plumbing; restaurants and bars; sale, maintenance and repair of motor vehicles; sales agents; and retail trade with food, beverages and tobacco predominant. Last but not least, the firm-year observations facing a zero effective tax rate are 862,694 for both τ^{ee} and τ^{ed}, or approximately 47% of the whole sample. Again, more than 63% of the firms with zero effective tax rates belong to NACE2: 45, 50, 51, 52, and 55, i.e., construction, wholesale and retail trade and hotels and restaurants, and to NACE2 74, which is accounting and tax consulting services.

Figure 2.5: EFFECTIVE AVERAGE CORPORATE TAX RATES, DEBT: 1999-2005



which is similar to the one used by Heim (2006) and Goolsbee (2000). TI_{it} is the taxable income of firm i in year t scaled by total assets $Toas$. $ln(1-\tau^e_{it-1})$, $ln(1-\tau^e_{it})$, and $ln(1-\tau^e_{it+1})$ are the natural logarithms of the lagged, the contemporaneous, and the leading net-of-EATR shares, respectively, and α_i are firm fixed effects. α_i capture unobserved heterogeneity for firm i, assuming that firms differ randomly in a way that is not completely controlled for by the observed covariates (Cameron and Trivedi, 2009a). In this specification, $\frac{TI}{Toas}$ in period t is affected not only by the current tax rate, but also by the difference between the current and lagged and current and leading rates.

If $\tau^e_{t-1} > \tau^e_t > \tau^e_{t+1}$, I expect firms to shift income out of year $t-1$ into the current year t, and again, out of year t into $t+1$. Let $\tau^e_{t-1} - \tau^e_t = \triangle\tau^e$. Then deferring \$1 of TI to year t translates into gaining $\frac{\triangle\tau^e}{1-\tau^e_{t-1}}$. Thus, the effect of $ln(1-\tau^e_{it-1})$ on taxable income in the current year, TI_t, is likely to be positive ($\beta_1 > 0$), and that of $ln(1-\tau^e_{it+1})$ – negative ($\beta_3 < 0$). The coefficient of the current net-of-tax share is a combination of the current effect and two shifting coefficients, which entails the explicit control for the lagged and leading shares, if $\beta_2 = (\beta_1+\beta_2-\beta_3)-\beta_1+\beta_3$, the long-run effect, is to be estimated consistently.

In the linear-log specification, the coefficients measure the absolute change in $\frac{TI_{it}}{Toas_{it}}$ for a relative change in the net-of-tax shares, so that a 1% increase in $\ln(1-\tau_{it+1})$, increases the ratio of TI to total assets by $\beta_3/100$, where the division comes from the switch from relative to percentage change. The reason why I cannot log transform the dependent variable is that such transformation turns observations with zero taxable income into missing values, thus creating gaps in the individual firm-panels as $log(0)$ is not defined.

If I log transform, the estimation will be based solely on firms that have reported positive

taxable incomes. Therefore, the dependent variable is no longer $E[ln(TI)]$ but $E[ln(TI)|x, TI > 0]$. Without the log transformation, there is a mass point of TI at zero, but not a problem with observability of the dependent variable. In other words, the zeros in the case of firms' taxable income are not due to self-selection but are an actual outcome value. For this reason self-selection models are not appropriate for the data, while if Tobit is used, random effects have to be assumed, and even then, differencing the data to eliminate the firm-effects can lead to complications.[12]

There are several problems with the specification as presented above. First, $ln(1-\tau^e_{it})$ is endogenous in (2.4.5) not only due to spurious correlation stemming from the fact that common factors, such as taxes paid $taxa$ and the statutory tax rate τ^s, determine both TI_{it} and the effective tax rate τ^e_{it}, but also due to reverse causality. For example, in the case of firms that sustain losses, it is TI that determines the tax rate. Similarly, smaller firms can be taxed at preferential rates, provided that their TI do not exceed a certain limit.

Second, even if a suitable instrumental variable (IV) for $ln(1-\tau^e_{it})$ is available, an additional problem arises due to the dynamic nature of the specification and the assumption that the fixed-effects α_i are correlated with the observed regressors x_{it}, which necessitates α_i's elimination through the transformation of the data. In particular, note that a fixed-effects, two-stage least square estimation of (2.4.5) will lead to an inconsistent first stage. The first stage is an OLS of the demeaned data:

$$\begin{aligned} ln(1-\tau^e_{it}) - \overline{ln(1-\tau^e_i)}. &= \gamma_0 + \gamma_1(IV_{it} - \overline{IV_i}.) + \gamma_2[ln(1-\tau^e_{it-1}) - \overline{ln(1-\tau^e_i)_{-1}}] \\ &+ \gamma_3[ln(1-\tau^e_{it+1}) - \overline{ln(1-\tau^e_i)_{+1}}] + \varepsilon_{it} - \bar{\varepsilon_i}., \end{aligned} \tag{2.4.6}$$

where $\overline{ln(1-\tau^e_i)}. = T_i^{-1}\sum_{t=1}^{t=T_i} ln(1-\tau_{it})$, $\overline{ln(1-\tau^e_i)_{-1}} = T_i^{-1}\sum_{t=0}^{t=T_i-1} ln(1-\tau_{it})$, and $\overline{ln(1-\tau^e_i)_{+1}} = T_i^{-1}\sum_{t=2}^{t=T_i+1} ln(1-\tau_{it})$. This regression would lead to inconsistent parameter estimates, because $ln(1-\tau^e_{it-1})$ and $-T_i^{-1}ln(1-\tau^e_{it})$ are correlated with $-T_i^{-1}\varepsilon_{it-1}$ and ε_{it}, respectively. Similar negative correlations occur for the leading net-of-tax share, yielding an inconsistent within estimator (Bond, 2002). For a single lagged dependent variable, Nickell (1981) demonstrates that the leading negative correlations outweigh the positive correlations between terms such as $-T_i^{-1}\varepsilon_{it-1}$ and $-T_i^{-1}ln(1-\tau_{it-1})$, resulting in downward bias in γ_2. Eq.(2.4.6), however, contains a second endogenous variable, making it unclear if the bias formulas hold in this case. In fact, an IV estimation in the presence of any lagged or leading terms in levels will produce an inconsistent within-estimator (Cameron and Trivedi, 2009b). Therefore, in order to remove α_i and estimate eq.(2.4.6), and therefore eq.(2.4.5) consistently, I turn to the first-difference estimator.

An important advantage of the first-differencing transformation is that, unlike demeaning, it does not introduce all realisations of the disturbances $(\varepsilon_{i1}, \varepsilon_{i2}, ...\varepsilon_{iT})$ into the transformed error term. Nevertheless, adjacent time periods are still problematic. Note that in the first-differenced

[12] See Kalwij (2003) for more details on Tobit in first-differences with individual effects. Since taxable income is zero when a loss is realised, it is in fact a censored variable, so that: $TI_{it} = TI^*_{it}$ if $TI^*_{it} > 0$ (taxable profit is realised) and $TI_{it} = 0$ if $TI^*_{it} \leq 0$ (taxable loss or the firm breaks even).

first stage of (2.4.5)

$$ln\left(\frac{1-\tau^e_{it+1}}{1-\tau^e_{it}}\right) = \theta_0 + \theta_1 \triangle IV_{it+1} + \theta_2 ln\left(\frac{1-\tau^e_{it}}{1-\tau^e_{it-1}}\right) + \theta_3 ln\left(\frac{1-\tau^e_{it+2}}{1-\tau^e_{it+1}}\right) + \triangle\varepsilon_{it+1}, \quad (2.4.7)$$

$\triangle\varepsilon_{it+1}$ is correlated with $ln\left(\frac{1-\tau^e_{it}}{1-\tau^e_{it-1}}\right)$ and $\left(\frac{1-\tau^e_{it+2}}{1-\tau^e_{it+1}}\right)$, since $ln(1-\tau^e_{it})$ and $-ln(1-\tau^e_{it+1})$ are correlated with $-\varepsilon_{it}$ and ε_{it+1}, respectively, leading to a downward bias. It is uncertain how the bias in the case of first differencing will compare to demeaning considering the second endogenous regressor. $ln(1-\tau^e_{it-k})$, for $k \geq 2$, however, is not correlated with the error term, which opens up the possibility for consistent estimation using a longer difference window. Specifically a two year window is considered, so that (2.4.5) becomes

$$\begin{aligned} \frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}} &= \lambda_t + \lambda_{jt} + \lambda_{ct} + \sigma_1 ln\left(\frac{1-\tau^e_{it+2}}{1-\tau^e_{it}}\right) - \sigma_2 ln\left(\frac{1-\tau^e_{it+1}}{1-\tau^e_{it-1}}\right) \\ &+ \sigma_3 ln\left(\frac{1-\tau^e_{it+3}}{1-\tau^e_{it+1}}\right) + \triangle X'\Gamma + \epsilon_{it+2} - \epsilon_{it}, \end{aligned} \quad (2.4.8)$$

which will result in a consistent first stage of the 2SLS, provided that two key assumptions are met: ε_{it} are independent across firms and ε_{it} are serially uncorrelated.

λ_t, λ_{jt}, λ_{ct} are year, industry-year (NACE2 level) and country-year dummies, respectively; X includes the natural logarithm of the ratios of current assets, current liabilities, depreciation, fixed assets, and operating revenue to total assets as well as the natural log of total assets.

As explained above, eq.(2.4.8) requires an IV for the contemporaneous change in the net-of-tax shares $ln\left(\frac{1-\tau^e_{it+2}}{1-\tau^e_{it}}\right)$. Using Gruber and Rauh (2007)'s methodology, such an instrument is constructed by calculating the EATR in year $t+2$ with the firm characteristics from year t. Specifically, I keep the added value av at its year t level and inflate it by the producer price index, but allow the macroeconomic variables, such as the statutory tax rate, depreciation rules, etc., to change. The idea is to make the change in the net-of-tax shares between year t and $t+2$ exogenous to firm behaviour by removing that component of the change, which can be driven by tax planning considerations. The instrument for $ln\left(\frac{1-\tau^e_{it+2}}{1-\tau^e_{it}}\right)$ is therefore $ln\left(\frac{1-\tau^p_{it+2}}{1-\tau^e_{it}}\right)$, where $1-\tau^p_{it+2}$ is the predicted net-of-tax share. All subsequent 2SLS regressions have strong first stages with F-statistics for the coefficient of the IV always above 1000.

One major disadvantage of using a two-year difference window is the possible underestimation of the short-term response, especially if firms are able to react to tax changes swiftly from year to year. Company size and the level of indebtedness may capture some of this flexibility in the model, but time is certainly a factor. In contrast, it is also probable that the highest responsiveness occurs a few years after a tax reform, in which case the specification in (2.4.8) is appropriate.

An indisputable drawback of the two-year window, however, is the big loss of firm-year observations. In addition, the inclusion of the lagged and leading terms require that a firm be

present in the panel for at least 5 years, which deprives the estimation of valuable information from firms, appearing for fewer years. Moreover, the estimates should be taken as representing the shifting behaviour of already well-established firms rather than new entrants. It is for these reasons that I additionally present regressions in first-differences, despite the endogeneity discussed above, and compare the obtained results to the estimates using eq.(2.4.8).

It is worth noting that even if second-differencing removes part of the endogeneity in the estimation, it is still an imperfect method. In particular, the lack of data on loss carryforwards, which can be offset against future taxable income, means that past disturbances, usually over a five year period, will be correlated with the current net-of-tax shares. In fact, firms' behaviour with respect to the use of taxable losses to shelter other forms of taxable income is unaccounted for. As observed by Mintz (1988), the difference in firms' ability to use write-offs leads to substantial variation in the effective tax rates, unrelated to changes in tax law or the statutory tax rates. Neither τ^{ee}, or τ^{ed} incorporate this variation. It is also clear that a large number of firms may have utilised tax incentives not covered by the ones explicitly controlled for in this chapter.

2.5 Results

2.5.1 Effect of anticipated CIT rates on taxable income

The main results are presented in Table 2.5. Firm fixed effects are eliminated through second-differencing in all specifications. The effective tax rate is calculated based on a rate of return, which does not include interest payments for reasons described above, and the assumption that the project is financed by equity. Column (1) shows the basic regression of the change in the ratio of taxable income to total assets on the change in the log of the current net-of-tax share, without other controls except a constant, which acts as a time trend and accounts for income-to-assets growth. The contemporaneous effect is estimated to be 0.208, and given the specification, it should suffer from omitted variable bias. If the correlations between the current and lagged and the current and leading net-of-tax shares were positive, then this bias would be downward.

Column (2) allows for a lagged transitory component, which has a negative and statistically significant impact on the change of taxable income. Note the dramatic increase in the current tax effect due to mitigation of the omitted variable bias. This suggests that while the contemporaneous effect is close to one, part of it is due to a timing shift of income from previous years with higher CIT rates to the current year.

The leading net-of-tax share is added in Column (3) and shows how current TI reacts to anticipated changes in the corporate tax rate. Similarly to the lagged CIT, this term has a negative impact on reported income, indicating that firms act on expectations of lower taxes in the future by deferring the declaration of income, accelerating expenses, or by other means. Both the current and lagged tax terms grow as a consequence of the inclusion of future taxes.

The current effect in Column (3) is much higher than that of Columns (1) and (2) and is estimated for firms who have at least 5 years of data. As a consequence, compared to Column

Table 2.5: RESPONSE OF TAXABLE INCOME TO CURRENT, LAGGED, AND LEADING NET-OF-TAX SHARES, PROJECT FINANCED BY EQUITY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$	.208***	.917***	1.89***	1.36***	1.35***	1.34***	1.34***	.717***	.480***
	(.027)	(.066)	(.036)	(.035)	(.031)	(.034)	(.031)	(.037)	(.035)
$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t-1}}\right)$		-.864***	-1.13***	-.955***	-.838***	-.922***	-.815***	-.489***	-.322***
		(.083)	(.036)	(.032)	(.030)	(.031)	(.029)	(.023)	(.025)
$\ln\left(\frac{1-\tau^{ee}_{t+3}}{1-\tau^{ee}_{t+1}}\right)$			-.474***	-.406***	-.373***	-.399***	-.374***	-.132***	-.044*
			(.038)	(.030)	(.027)	(.029)	(.026)	(.023)	(.023)
$\triangle\ln\left(\frac{Cuas}{Toas}\right)$				.023	.022	.024	.022	-.008	-.009
				(.023)	(.023)	(.023)	(.023)	(.008)	(.008)
$\triangle\ln\left(\frac{Culi}{Toas}\right)$				.035***	.031***	.031***	.025***	-.006	-.006
				(.006)	(.006)	(.006)	(.006)	(.004)	(.004)
$\triangle\ln\left(\frac{Depre}{Toas}\right)$				.029***	.028***	.028***	.030***	.007**	.005*
				(.005)	(.005)	(.005)	(.005)	(.003)	(.003)
$\triangle\ln\left(\frac{Fias}{Toas}\right)$				.043***	.042***	.042***	.043***	-.010*	-.008
				(.011)	(.011)	(.011)	(.012)	(.005)	(.005)
$\triangle\ln\left(\frac{Opre}{Toas}\right)$				.234***	.230***	.231***	.228**	.099***	.099***
				(.022)	(.022)	(.021)	(.022)	(.005)	(.005)
$\triangle\ln(Toas)$				-.094***	-.078***	-.093***	-.084***	-.017***	-.018***
				(.019)	(.019)	(.019)	(.020)	(.005)	(.005)
Time	-.147***	-.233***	-.368***						
	(.007)	(.008)	(.005)						
λ_t				Yes			Yes	Yes	Yes
λ_{ct}					Yes		Yes	Yes	Yes
λ_{jt}						Yes	Yes	Yes	Yes
Observ.	706,785	436,186	257,378	252,150	252,150	252,150	252,150	52,114	52,114
Firms	289,808	181,289	122,001	120,639	120,639	120,639	120,639	27,113	27,113

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_t is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln\left(\frac{1-\tau^{ed}_{t+2}}{1-\tau^{ed}_{t}}\right)$ is instrumented with $ln\left(\frac{1-\tau^{p}_{it+2}}{1-\tau^{e}_{it}}\right)$. $\triangle\ln\left(\frac{Cuas}{Toas}\right)$, $\triangle\ln\left(\frac{Culi}{Toas}\right)$, $\triangle\ln\left(\frac{Depre}{Toas}\right)$, $\triangle\ln\left(\frac{Fias}{Toas}\right)$, $\triangle\ln\left(\frac{Opre}{Toas}\right)$, and $\triangle\ln(Toas)$ are differenced as described above. λ_t are year dummies, λ_{ct} are country-year dummies, and λ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

(1), the number of firms is more than cut in half in the specification including all three net-of-tax shares, revealing a major loss of observations due to second-differencing, but also the extent to which the panel is unbalanced. The non-transitory response, or the sum of the three coefficients, is approximately 0.28 and significant.

The inclusion of the year fixed effects in Column (4), which is equivalent to a diff-in-diff estimation, means that the response of taxable income is identified using solely the cross-sectional variation of the net-of-tax shares. Once other firm-level explanatory variables and year dummies are controlled for, both the current response and the shifting coefficients decrease, resulting in a long-term effect that is statistically not different from zero.

In particular, Column (4) accounts for the log change in current assets ($cuas$), current liabilities ($culi$), depreciation ($depre$), fixed assets ($fias$), and operating revenue ($opre$), all scaled by total assets and the change in total assets themselves. An increase in $cuas$, $opre$, $depre$, $fias$, and $culi$ raises the taxable income-total assets ratio, although the coefficient of $cuas$ is not precisely estimated. By construction, an increase in $Toas$ will decrease the $\frac{TI}{Toas}$ ratio. The positive sign of current liabilities seems counter-intuitive, but it may in fact reflect the possibility that highly indebted firms, which are close to violating debt covenants, may be unwilling to engage in aggressive tax planning. This is likely, given that debt covenants not only require the maintenance of certain financial health, but also determine how the numbers proving this financial health are calculated.

To purge the regression from country-specific shocks, Column (5) contains country-year fixed effects. In this case the coefficients of interest are identified from the different timing and different size of the tax cuts and magnitude of other tax reforms across countries, yielding lower shifting coefficients in absolute value and thus, a positive and significant long-run response of .139.

Alternatively, Column (6) controls for shocks such as regulations and industry norms that affect different sectors differently by incorporating industry-year dummies at the NACE2 level. Similarly to the estimation with year dummies only, controlling for industry-year fixed effects leads to a permanent response that is not significantly different from zero.

Finally, year-, country-year and industry-year fixed effects are all allowed for in Column (7), which is my preferred specification. This extensive dummy structure generates the largest significant non-transitory effect, .151, which nevertheless closely resembles the result in Column (5).

Utilising the richest specification, (8) repeats the regression in (7), but this time using an effective tax rate, which includes interest payments, i.e., the rate of return is comprised of all elements of added value. The number of firms falls drastically to about 27,000. Although the coefficients of all three net-of-tax shares decrease substantially using this subsample of firms, income shifting is still present as signalled by the magnitude of the transitory components, while the long-run effect is almost identical to the one estimated in Column (7).

The influence of current liabilities is no longer significant, while that of fixed assets becomes negative. In view of the number of tax incentives and deductions available to new investment in CEE, the negative effect of $fias$ is not unexpected, especially given that 66% of the 27,000

Table 2.6: FIRST STAGE COMPARISON: FIRST- VS. SECOND-DIFFERENCING

	First-difference		Second-difference
$\ln\left(\frac{1-\tau^{p}_{t+1}}{1-\tau^{ee}_{t}}\right)$	.813***	$\ln\left(\frac{1-\tau^{p}_{t+2}}{1-\tau^{ee}_{t}}\right)$	.937***
	(.014)		(.007)
$\ln\left(\frac{1-\tau^{ee}_{t}}{1-\tau^{ee}_{t-1}}\right)$	-.019***	$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t-1}}\right)$	.008***
	(.001)		(.0008)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t+1}}\right)$	-.046***	$\ln\left(\frac{1-\tau^{ee}_{t+3}}{1-\tau^{ee}_{t+1}}\right)$	.003**
	(.003)		(.001)
Observations	399,286		252,150
Firms	174,091		120,639

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $ln(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t}})$ in the first-difference estimation, and $ln(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}})$ in the second-difference estimation, with $ln(\frac{1-\tau^{p}_{t+1}}{1-\tau^{ee}_{t}})$, and $ln(\frac{1-\tau^{p}_{t+2}}{1-\tau^{ee}_{t}})$ being the respective instruments. All other balance-sheet explanatory variables from Table 2.5 are included but not reported. Country-year dummies, λ_{ct}, are also included. The relationship between the first-and second-differencing first stage coefficients remains robust to any dummy structure or lack thereof. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

firms reporting interest payments are big and medium enterprises.

To check if it is the inclusion of interest payments in the calculation of τ^{ee} that drives the lower coefficients in (8) or the particular subsample of firms used, Column (9) reports results based on the same subsample, but using the baseline EATR, i.e. ones without *inte*. On account of the results in (9), it can be concluded that the lower estimated coefficients are subsample-specific.

2.5.2 First-difference estimates

Table 2.7 re-estimates some of the regressions from Table 2.5 in first-differences. To obtain coefficients on the leading and lagged net-of-tax shares, a firm should be present in the panel for at least four years, whereas a year of data is lost due to first-differencing. Nevertheless, about 54,000 firms that dropped out of the previous estimation as a consequence of employing a two-year window are re-incorporated. The trade-off, as explained in Section 4.4, is the inconsistency of the first stage estimation which spills over to the 2SLS coefficients, although, due to not controlling for loss carryforwards, some bias is bound to remain in second-differences as well.

The interesting problem here is that due to the presence of fixed effects and lagged and leading terms of an explanatory variable that is endogenous, the first stage of the 2SLS estimation suffers from the classic endogeneity inherent in dynamic panel data models. This endogeneity stems from the leading and lagged net-of-tax shares, both of which are exogenous in the original regression but become endogenous in the first stage and hence cannot act as their own instruments as they violate the exclusion restriction.

Even so, it is useful to compare the first-difference estimates to the results in Table 2.5, bearing in mind that apart from Column (1), the coefficients in Table 2.7 are inconsistent. The

Table 2.7: RESPONSE OF TAXABLE INCOME TO CURRENT, LAGGED, AND LEADING NET-OF-TAX SHARES, FIRST-DIFFERENCE ESTIMATION

	(1)	(2)	(3)	(4)	(5)
$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ed}_{t}}\right)$	.544***	1.33***	1.20***	1.22***	1.25***
	(.049)	(.099)	(.053)	(.052)	(.053)
$\ln\left(\frac{1-\tau^{ee}_{t}}{1-\tau^{ee}_{t-1}}\right)$		-.845***	-.618***	-.634***	-.603***
		(.040)	(.034)	(.034)	(.033)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t+1}}\right)$		.615***	.253***	.144***	.231***
		(.047)	(.021)	(.020)	(.020)
λ_t			Yes		
λ_{ct}				Yes	
λ_{jt}					Yes
Observations	1,071,593	408,278	399,286	399,286	399,286
Firms	417,938	177,009	174,091	174,091	174,091

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+1}}{Toas_{it+1}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_t is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. In all columns fixed-effects are eliminated by first-differencing $(t+1)$-t, and $\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t}}\right)$ is instrumented with $\ln\left(\frac{1-\tau^{p}_{t+1}}{1-\tau^{ee}_{t}}\right)$. All other balance-sheet explanatory variables from Table 2.5 are included in Columns (3)-(5) in first-differences and not reported here. λ_t are year dummies, λ_{ct} are country-year dummies, and λ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

negative correlation of the leading and lagged net-of-tax shares with the error term in the first stage will lead to downward bias in their coefficients, although it is not clear how it will affect the coefficient of the instrument and thus the fitted value $I\hat{V}$.[13] The predicted error from the first stage, which in general should be orthogonal to the right-hand side of the second-stage regression, contains a bias term. The direction of bias of the 2SLS coefficients will therefore depend on the interaction between the conditional correlations and this bias term.[14]

Before looking at the first-difference estimates, Table 2.6 shows how the first stage changes when estimated in first- and second-differences. The results in Table 2.6 are obtained using country-year fixed effects, but no matter what the dummy structure is, the first-difference first stage estimates are always below the second-difference ones, suggesting a downward bias, as argued in the discussion of eq.(2.4.7).

In Column (1) of Table 2.7 the contemporaneous net-of-tax share is entered alone, which means that the first stage regression is consistent. Compared to the same estimate in Table 2.5, the coefficient in first-difference, .544, is almost three times as big as in second-differences, .208, suggesting that firms do not take as long as two years to respond to tax changes but react promptly. It is likely, therefore, that a two year window underestimates some of this responsiveness. Once the leading and lagged net-of-tax shares are incorporated in the subsequent

[13] See Section 2.4.4 and the discussion under eq.(2.4.6) and (2.4.7).

[14] I am thankful to Štěpán Jurajda for this comment.

Table 2.8: RESPONSE OF TAXABLE INCOME TO CURRENT, LAGGED, AND LEADING NET-OF-TAX SHARES, STATUTORY TAX RATE

	(1)	(2)	(3)	(4)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$	1.55***	1.54***	1.53***	1.51***
	(.032)	(.029)	(.031)	(.029)
$\ln\left(\frac{1-\tau^{s}_{t+1}}{1-\tau^{s}_{t-1}}\right)$	-1.73***	-1.60***	-1.66***	-1.55***
	(.022)	(.023)	(.022)	(.022)
$\ln\left(\frac{1-\tau^{s}_{t+3}}{1-\tau^{s}_{t+1}}\right)$	-.703***	-.910***	-.686***	-.906***
	(.026)	(.027)	(.025)	(.026)
λ_t	Yes			Yes
λ_{ct}		Yes		Yes
λ_{jt}			Yes	Yes
Observ.	282,212	282,212	282,212	282,212
Firms	141,400	141,400	141,400	141,400

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_t is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. τ^{s}_t is the statutory tax rate used in the shifting terms. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln\left(\frac{1-\tau^{ed}_{t+2}}{1-\tau^{ed}_{t}}\right)$ is instrumented with $ln\left(\frac{1-\tau^{p}_{it+2}}{1-\tau^{e}_{it}}\right)$. $\triangle\ln\left(\frac{Cuas}{Toas}\right)$, $\triangle\ln\left(\frac{Culi}{Toas}\right)$, $\triangle\ln\left(\frac{Depre}{Toas}\right)$, $\triangle\ln\left(\frac{Fias}{Toas}\right)$, $\triangle\ln\left(\frac{Opre}{Toas}\right)$, and $\triangle\ln(Toas)$ are differenced as described above. λ_t are year dummies, λ_{ct} are country-year dummies, and λ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

columns, the current term is substantially lower than its second-difference equivalent, whereas the shifting coefficients become less negative, and in fact, the leading term turns positive. All in all, if firms are quicker to react across adjacent years than two years, these coefficients imply that the contemporaneous effect is biased downwards as opposed to the leading and lagged terms whose bias is possibly upward.

If most of the income shifting occurs through accounting manipulation by deferring revenue and accelerating expenses, for example, then the more relevant tax rate to capture this behaviour is the statutory tax rate. Table 2.8 shows how results change if EATR is replaced with the statutory tax rate in the shifting terms $\ln\left(\frac{1-\tau^{s}_{t+1}}{1-\tau^{s}_{t-1}}\right)$ and $\ln\left(\frac{1-\tau^{s}_{t+3}}{1-\tau^{s}_{t+1}}\right)$, but keeping the effective tax rate in the current term. Apart from higher contemporaneous coefficients, the leading and lagged estimates increase significantly compared to their counterparts in Table 2.5, resulting in negative and statistically significant long-run response.

2.5.3 Who shifts income?

This section investigates in more detail what type of firms drive the non-transitory result, and in particular, whether the effect varies by firm size and ability to shift income. Large firms especially may be more sensitive to nontax costs of income deferral, but may also be more effective at shifting income as they have more sophisticated tax departments. Guenther (1994)

Table 2.9: RESPONSE OF TAXABLE INCOME BY FIRM SIZE

	Small (F)	Medium (M)	Big (T)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ed}_{t}}\right)$	1.71***	.227***	-.058***
	(.042)	(.031)	(.009)
$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t-1}}\right)$	-.879***	-.129***	-.028***
	(.040)	(.011)	(.004)
$\ln\left(\frac{1-\tau^{ee}_{t+3}}{1-\tau^{ee}_{t+1}}\right)$	-.537***	-.005	-.011**
	(.033)	(.012)	(.005)
Observations	158,672	71,375	22,103
Firms	76,541	33,418	10,680

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_{t} is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$ is instrumented. Firms were separated according to size in the following manner: Big(T): operating revenue $\geq$ €10 million, total assets $\geq$ €20 million, number of employees $\geq$ 100. Medium (M) companies: operating revenue $\geq$ €1 million, total assets $\geq$ €2 million, number of workers $\geq$ 15. All columns include all other balance sheet explanatory variables used in Table 2.5, as well as year, industry-year, and country-year fixed effects not reported here. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

and Scholes at al. (1992) describe two types of nontax costs: (1) those associated with income deferral such as costs caused by the acceleration of R&D projects or dissatisfied customers if year-end shipments are delayed, and (2) political costs pertaining to meeting debt covenant restrictions and management compensation plans. Guenther (1994) concludes that larger firms will tend to reduce financial statement income if they defer taxable income to minimise cost in case they are subjected to public scrutiny. Scholes at al. (1992) estimates that large public firms are more tax opportunistic than small public companies and are more prone to shifting gross margin and selling, general and administrative expenses in expectation of tax cuts.

In order to categorise firms into big, medium and small, I use AMADEUS's classification, based on total assets, operating revenue and number of employees. Firms with total assets greater or equal to €20 million, operating revenue of at least €10 million and no less than 100 employees belong to the Top 250,000 firms. Next are the Top 1,500,000 companies. In general, a firm should have total assets $\geq$ €2 million, operating revenue $\geq$ €1 million and at least 15 employees to qualify as a Top 1,500,000 company. Firms not belonging to the above two categories, are classified as small.

Table 2.9 splits the sample according to the size classification described above; 28% of firms belong to the Top 1,500,000 dataset, and 63% are small firms. It is clear from Table 2.9 that the big contemporaneous and transitory coefficients estimated in Table 2.5 are mostly driven by small firms, which exhibit high anticipation to future rates. In fact, the long-term response for small firms is twice bigger than the highest response estimated in Table 2.5. The results are very different for medium and big companies, however.

$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ed}_{t}}\right)$ has a modest but significant impact on taxable income of medium-sized companies in the current year, and so does the lagged net-of-tax share, indicating that medium-sized firms undertake income shifting on a small scale. The leading effect, while negative, is insignificant. After accounting for income shifting, the non-transitory effect on TI for medium firms is much closer to the one obtained with the full sample.

When it comes to big firms, the current net-of-tax share has a negative and significant effect on taxable income, a contradictory result to the previous estimates. While both the lagged and leading change in tax rates have precisely estimated negative impact on TI, these effects are rather small. Big firms, therefore, do not seem to engage in aggressive intertemporal earnings management.

Considering bigger firms' access to many other tax management instruments, such as debt shifting, earnings distribution between subsidiaries, geographic income shifting, as well as investment tax incentives, it is probable that such firms find cheaper alternatives to the intertemporal shifting of income (Tang and Jog, 2001; Smart and Hong, 2007).[15] This result is robust to splitting the sample by firms' number of managers, which can be used as a proxy for firm size.[16]

Another sample split, this time by country, is performed in Table 2.10 with the results varying greatly between countries. First, Bulgaria and Slovakia have negative estimated coefficients for the current effect, which are also statistically significant. An insignificant negative contemporaneous term is estimated for Hungary. Given that 75% of the total sample are Romanian firms, the coefficients for this county are closest to the full sample ones, as expected. Last but not least, Poland exhibits a modest current effect and small transitory coefficients, while in the case of the Czech Republic these effects are bigger, yet still well below the full sample estimates.

In a sense, however, Table 2.10 replicates the sample splits from Table 2.9, since 47,254 out of the 55,642 firm-year observations, or 84%, for Bulgaria, the Czech Republic, Hungary, Poland and Slovakia are medium and big enterprises, for whom small positive and negative current net-of-tax share coefficients are estimated, respectively. It is, therefore, hard to consider the samples for these five countries representative, as most of the smaller firms simply do not appear in the panel for five consecutive years and drop out of the estimation. In the other extreme is Romania, with 74% small and 23% medium firms.

In an attempt to address this aggregation problem, which makes the interpretation of the

[15] Since every edition of Amadeus deletes firms which exited the market prior to the edition year, it is likely that there is attrition bias in the data, as firms are removed if exiting the market, i.e. they do not drop out of the panel in a random fashion. Furthermore, the firms that exit are likely to be small and medium enterprises, so firm size can be significantly associated with attrition. It is possible that this bias affects the estimated shifting coefficients for small versus large companies. I am grateful to Peter Egger for this comment.

[16] In general I would expect that a firm's ability to shift income will increase proportionally to the number of managers it employs. Yet, this turns out not to be the case. The sample is divided into three subgroups: firms with zero to two managers, those with 2 up to 5 managers and firms employing more than 5 managers. The results are robust to using other subgroups and are almost identical to those in Table 2.9, with the most responsive firms being the ones with fewer managers, whereas companies with five or more managers have very small shifting coefficients. One possible explanation put forth by Guenther (1994) is that if management compensation is linked to firm performance, then executives may be reluctant to decrease taxable income to save taxes, even though this move would be beneficial to shareholders. Alternatively, as mentioned earlier, big firms can utilise a variety of tax instruments apart from income shifting, which are not easily procurable by smaller companies.

Table 2.10: RESPONSE OF TAXABLE INCOME BY COUNTRY

	BG	CZ	HU	PL	RO	SK
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$	-.249***	.467***	-.988	.169***	1.66***	-.108***
	(.009)	(.096)	(.641)	(.014)	(.035)	(.047)
$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t-1}}\right)$	-.020**	-.295**	-.236	-.043***	-.928***	-.022
	(.006)	(.135)	(.144)	(.009)	(.033)	(.017)
$\ln\left(\frac{1-\tau^{ee}_{t+3}}{1-\tau^{ee}_{t+1}}\right)$	-.011***	-.287***	.386	-.005	-.417**	.002
	(.003)	(.075)	(.508)	(.006)	(.028)	(.024)
Observations	15,712	10,212	13,783	13,929	196,508	2,006
Firms	7,326	6,460	7,012	7,273	91,440	1,128

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_{t} is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$ is instrumented. The sample is split by country. All columns include all other balance sheet explanatory variables used in Table 2.5, as well as year and industry-year effects, not reported here. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

average coefficients difficult, Table 2.11 weighs the data, using statistics for the whole population of firms for the six countries, namely turnover by NACE 1 industry. Thus, the data was re-weighed using $\frac{w_{ctj}}{W_j}$, where w_{ctj} is the turnover of industry j in country c at time t and W_{jt} is $\sum_{c=1}^{6} w_{cjt}$. In this way, the Czech and Polish firms received the highest weight, while Bulgaria and Romania, the lowest. Table 2.11 presents some preliminary results of the weighted regressions. Unlike Table 2.8, where the shifting coefficients were much larger than the ones estimated in Table 2.5, in Table 2.11 the shifting coefficients are smaller than the benchmark table results, leading to a positive long-run response.

As a robustness check, Table 2.12 repeats the regressions from Table 2.5, using the effective tax rate τ^{ed}, based on the assumption that the project is entirely financed by debt. The current effect is twice as high as the one estimated with τ^{ee}, but falls substantially when the lagged tax rates are added. Without controlling for any other firm-level variables, Column (3) actually yields a negative and significant non-transitory response. Once other explanatory variables and year dummies are accounted for in Column (4), the long-run effect is 0.258, which is higher than the one obtained with the same specification using τ^{ee}. The richest specification in Column (7), however, produces a non-transitory effect of 0.031, which is not significantly different from zero. Similarly to the regressions with τ^{ee}, the estimates with τ^{ed} lead to a long-run response that is either close to zero, or small, positive and significant, depending on the dummy structure.

In general, assuming a project financed by debt results in lower estimated coefficients of the net-of-tax shares in absolute value than a project financed by equity. This may be due to the fact that, unlike financing with equity (retained earnings), the cost of raising external capital through debt, F, is different from zero, which in turn yields higher net-present value R and hence smaller τ^{ed}. Compared to τ^{ee}, the distribution of τ^{ed} is thus shifted to the left, as shown

Table 2.11: RESPONSE OF TAXABLE INCOME TO CURRENT, LAGGED, AND LEADING NET-OF-TAX SHARES, WEIGHTED REGRESSION

	(1)	(2)	(3)
$\ln\left(\frac{1-\tau^{ee}_{t+2}}{1-\tau^{ee}_{t}}\right)$	1.52***	1.44***	1.31***
	(.051)	(.049)	(.046)
$\ln\left(\frac{1-\tau^{ee}_{t+1}}{1-\tau^{ee}_{t-1}}\right)$	-.610***	-.442***	-.435***
	(.027)	(.023)	(.022)
$\ln\left(\frac{1-\tau^{ee}_{t+3}}{1-\tau^{ee}_{t+1}}\right)$	-.603***	-.559***	-.625***
	(.037)	(.034)	(.038)
λ_t	Yes		Yes
λ_{ct}			Yes
λ_{jt}		Yes	Yes
Observ.	276,038	276,038	276,038
Firms	124,706	124,706	124,706

Note: The sample in each regression pertains to 1999-2005. The data was re-weighed using $\frac{w_{ctj}}{W_j}$, where w_{ctj} is the turnover of industry j in country c at time t and W_{jt} is $\sum_{c=1}^{6} w_{cjt}$. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ee}_t is the effective tax rate, calculated under the assumption that new investment is financed by equity (retained earnings) only. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln\left(\frac{1-\tau^{ed}_{t+2}}{1-\tau^{ed}_{t}}\right)$ is instrumented with $ln\left(\frac{1-\tau^{p}_{it+2}}{1-\tau^{e}_{it}}\right)$. $\triangle\ln\left(\frac{Cuas}{Toas}\right)$, $\triangle\ln\left(\frac{Culi}{Toas}\right)$, $\triangle\ln\left(\frac{Depre}{Toas}\right)$, $\triangle\ln\left(\frac{Fias}{Toas}\right)$, $\triangle\ln\left(\frac{Opre}{Toas}\right)$, and $\triangle\ \ln(Toas)$ are differenced as described above. λ_t are year dummies, λ_{ct} are country-year dummies, and λ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

in Figures 2.4 and 2.5. With more values of τ^{ed} closer to zero, it is not surprising that a flatter line is estimated with this tax rate than with τ^{ee}.

Table 2.12: RESPONSE OF TAXABLE INCOME TO CURRENT, LAGGED, AND LEADING NET-OF-TAX SHARES, PROJECT FINANCED BY DEBT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln\left(\frac{1-\tau^{ed}_{t+2}}{1-\tau^{ed}_{t}}\right)$	.479***	.102*	.808***	1.07***	.665***	1.10***	.696***	.296***
	(.047)	(.056)	(.061)	(.077)	(.079)	(.074)	(.076)	(.066)
$\ln\left(\frac{1-\tau^{ed}_{t+1}}{1-\tau^{ed}_{t-1}}\right)$		-.497***	-.787***	-.549***	-.472***	-.529***	-.459***	-.314***
		(.040)	(.028)	(.040)	(.026)	(.027)	(.026)	(.044)
$\ln\left(\frac{1-\tau^{ed}_{t+3}}{1-\tau^{ed}_{t+1}}\right)$			-.468***	-.263***	-.199***	-.262***	-.206***	-.076**
			(.038)	(.033)	(.026)	(.032)	(.026)	(.034)
$\triangle\ln\left(\frac{Cuas}{Toas}\right)$				.028	.027	.028	.027	-.006
				(.037)	(.037)	(.036)	(.037)	(.010)
$\triangle\ln\left(\frac{Culi}{Toas}\right)$				.071***	.065***	.065***	.058***	-.001
				(.012)	(.012)	(.012)	(.012)	(.006)
$\triangle\ln\left(\frac{Depre}{Toas}\right)$				.003	.0009	.002	.0009	-.001
				(.014)	(.015)	(.014)	(.014)	(.003)
$\triangle\ln\left(\frac{Fias}{Toas}\right)$				.005	.011	.006	.013	-.030***
				(.017)	(.017)	(.017)	(.017)	(.007)
$\triangle\ln\left(\frac{Opre}{Toas}\right)$				.328***	.326***	.326***	.323***	.107***
				(.054)	(.054)	(.054)	(.054)	(.007)
$\triangle\ln(Toas)$				-.102***	-.100***	-.101***	-.100***	-.027***
				(.020)	(.021)	(.020)	(.022)	(.006)
Time trend	-.086***	-.252***	-.407***					
	(.007)	(.011)	(.004)					
λ_t				Yes			Yes	Yes
λ_{ct}					Yes		Yes	Yes
λ_{jt}						Yes	Yes	Yes
Observations	671,257	410,098	243,473	238,549	238,549	238,549	238,549	51,085
Firms	280,633	175,090	118,509	117,112	117,112	117,112	117,112	26,645

Note: The sample in each regression pertains to 1999-2005. The dependent variable is $\frac{TI_{it+2}}{Toas_{it+2}} - \frac{TI_{it}}{Toas_{it}}$. τ^{ed}_t is the effective tax rate, calculated under the assumption that new investment is financed by debt only. In all columns fixed-effects are eliminated by differencing $(t+2)$-t and $\ln(\frac{1-\tau^{ed}_{t+2}}{1-\tau^{ed}_{t}})$ is instrumented. $\triangle\ln\left(\frac{Cuas}{Toas}\right)$, $\triangle\ln\left(\frac{Culi}{Toas}\right)$, $\triangle\ln\left(\frac{Depre}{Toas}\right)$, $\triangle\ln\left(\frac{Fias}{Toas}\right)$, $\triangle\ln\left(\frac{Opre}{Toas}\right)$, and $\triangle\ \ln(Toas)$ are differenced as described above. λ_t are year dummies, λ_{ct} are country-year dummies, and λ_{jt} are industry-year dummies at the NACE2 level. Standard errors are clustered at the firm level in all specifications and are shown in parentheses. Estimation is performed with ivreg2 (Baum et al., 2010). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

2.6 Conclusion

In the last two decades most CEE countries undertook radical tax cuts as part of a package of tax reforms speeding up their transition from controlled to competitive market economies. The considerable decline in the CIT rates contributed to a reduction in illicit economic activities, encouraged new entrepreneurs and stimulated already existing firms to expand, thus leading to a remarkable stability of revenue collections.

This chapter explores whether firms resort to income shifting across years in anticipation of lower tax rates as an additional mechanism that can explain the increase of corporate revenue in the years taxes were cut. A substantial rise in revenue in a tax cut year occurs at the expense of previous year collections if income shifting is present. Further, if tax declines are expected in the future, taxable income can be shifted further.

The shifting of income, however, is simply a timing response that does not distort real economic behaviour, and, if unaccounted for, would wrongfully inflate the deadweight loss of the CIT. Thus, the estimates of the current effect of the net-of-tax shares yield large coefficients, implying a 0.01 increase in the difference of the taxable income-total assets ratio as a result of a 1% increase in the two year difference between the net-of-tax rates. Given an average $\frac{TI}{Toas}$ ratio of 0.08, a 0.01 increase is substantial. When the possibility of income shifting is explicitly modelled by the inclusion of leading and lagged terms, the sum of the three coefficients is in the range between zero and .15 (.20 if τ^{ed} estimates are considered). Nevertheless, even the positive estimated non-transitory responses have a negligible effect on $\frac{TI}{Toas}$ as compared to the current response only.

The results suggest that small firms are most responsive to anticipated tax cuts, exhibiting the largest shifting coefficients as well as the largest long-term response, followed by medium enterprises. In contrast, the estimated current effect for big firms is negative, leading to negative and significant permanent responses. This finding is to some extent mimicked by country sample splits, since the subsamples for five of the CEE countries, Romania being excluded, are composed largely of medium and Top 250,000 firms, mainly due to the requirement that a firm appears in the panel for at least five years. For this reason, outside of the sample results, it cannot be conclusively stated that the estimates for the Czech Republic and Poland are smaller than for Romania because firms there are less responsive to tax changes, or that firms in Bulgaria, Hungary, and Slovakia behave differently given the negatively estimated current effects.

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Appendix 2.1: Change in the number of enterprises and profitability by sector

Table 2.13: CHANGE IN THE NUMBER OF ENTERPRISES BY SECTOR

	1999	2000	2001	2002	2003	2004	2005
BG							
Mining & quarry				187	207	228	250
Electricity, gas, water supply				181	214	247	279
Hotels & restaurants				22,833	23,258	23,135	22,655
Transport, communications				24,203	24,196	22,853	22,206
Manufacturing				25,689	27,603	28,730	28,740
Construction				16,986	16,824	14,250	12,823
W/sale & retail				119,501	124,051	125,500	123,740
Real estate, business				21,379	23,728	25,465	29,622
CZ							
Mining & quarry	301	241	244	317	285	427	324
Electricity, gas, water supply	668	862	707	942	883	1,066	1,083
Hotels & restaurants	38,408	41,721	42,580	47,777	48,800	50,254	50,233
Transport, communications	39,531	62,002	40,828	46,739	46,362	46,851	45,739
Manufacturing	136,206	144,099	131,582	153,788	153,131	151,252	149,581
Construction	110,813	126,040	119,764	144,038	147,790	150,474	144,177
W/sale & retail	215,456	234,686	205,514	237,088	233,560	227,419	218,839
Real estate, business	174,684	190,727	200,543	245,801	245,824	251,906	246,008
HU							
Mining & quarry			418	412	457	455	456
Electricity, gas, water supply			514	515	593	630	651
Hotels & restaurants			32,121	32,966	35,320	33,568	32,815
Transport, communications			40,644	40,207	38,947	38,160	36,882
Manufacturing			75,219	73,005	69,711	68,042	64,956
Construction			63,982	65,857	69,667	71,951	71,431
W/sale & retail			173,955	170,135	169,109	161,054	156,100
Real estate, business			161,606	174,446	171,562	189,900	193,928
PL							
Mining & quarry	1,058	1,272	1,373	1,505	1,123	1,176	1,243
Electricity, gas, water supply	1,791	1,929	1,839	2,086	1,758	1,931	2,078
Hotels & restaurants	58,461	57,664	51,645	55,685	57,142	56,614	57,146
Transport, communications	169,878	158,296	147,533	152,201	144,974	142,119	136,385
Manufacturing	243,347	219,313	199,993	210,200	197,397	207,197	191,561
Construction	214,264	205,047	174,843	183,372	170,295	159,958	160,227
W/sale & retail	677,616	653,712	589,115	626,219	614,700	610,977	591,137
Real estate, business	213,644	236,731	250,801	267,049	270,098	277,099	267,572
RO							
See Figure 1 for trend in total enterprises							
SK							
Mining & quarry		69	70	68	78	81	81
Electricity, gas, water supply		120	130	166	153	182	207
Hotels & restaurants		740	1,161	792	1,141	1,260	1,424
Transport, communications		1,184	1,531	1,179	1,399	1,530	1,951
Manufacturing		5,614	6,368	5,609	6,764	6,389	6,848
Construction		2,911	3,691	2,738	3,590	3,254	3,724
W/sale & retail		12,473	15,465	11,828	14,730	13,872	16,899
Real estate, business		6,089	8,494	6,527	9,372	9,111	11,089

Source: OECD SDBS Structural Business Statistics: All Businesses (SSIS) for the Czech Republic, Hungary, Poland, and Slovakia; Bulgarian National Statistical Institute, Structural Business Statistics for Bulgaria; Eurostat Business Demography Statistics for Romania and Hungary.

Table 2.14: CHANGE IN PROFITABILITY BY SECTOR

	1999	2000	2001	2002	2003	2004	2005
BG							
Mining & quarry	0.383	0.163	-0.222	-0.323	0.034	0.169	0.288
Electricity, gas, water supply	0.400	0.523	0.402	0.314	0.201	0.235	0.137
Hotels & restaurants	0.575	0.548	0.504	0.457	0.407	0.453	0.388
Transport, communications	0.347	0.554	0.450	0.465	0.476	0.480	0.431
Manufacturing	0.167	0.283	0.300	0.280	0.283	0.281	0.286
Construction	0.501	0.520	0.508	0.484	0.446	0.509	0.517
W/sale & retail	0.495	0.474	0.472	0.414	0.270	0.303	0.356
Real estate, business	0.817	0.805	0.780	0.779	0.76	0.745	0.722
CZ							
Mining & quarry	0.372	0.212	0.232	0.209	0.194	0.326	0.393
Electricity, gas, water supply	0.136	-0.024	0.102	0.149	0.207	0.281	0.327
Hotels & restaurants	0.487	0.426	0.379	0.361	0.420	0.448	0.392
Transport, communications	0.273	0.256	0.288	0.325	0.336	0.303	0.270
Manufacturing	0.342	0.345	0.325	0.230	0.287	0.342	0.331
Construction	0.408	0.402	0.417	0.407	0.421	0.440	0.429
W/sale & retail	0.440	0.478	0.464	0.479	0.445	0.380	0.439
Real estate, business	0.414	0.431	0.426	0.404	0.388	0.377	0.399
HU							
Mining & quarry	-0.271	-0.220	-0.349	-0.104	-0.068	-0.030	0.034
Electricity, gas, water supply	0.205	0.155	0.104	0.111	0.120	0.188	0.137
Hotels & restaurants	0.361	0.278	0.246	0.280	0.200	0.182	0.160
Transport, communications	0.069	0.034	0.053	0.113	0.125	0.147	0.128
Manufacturing	0.311	0.287	0.288	0.303	0.326	0.351	0.346
Construction	0.449	0.464	0.461	0.481	0.418	0.417	0.371
W/sale & retail	0.335	0.271	0.355	0.373	0.312	0.292	0.276
Real estate, business	0.478	0.474	0.479	0.487	0.459	0.443	0.425
PL							
Mining & quarry	-0.187	-0.008	-0.038	-0.075	-0.045	0.201	0.225
Electricity, gas, water supply	-0.266	-0.296	-0.176	-0.082	-0.005	-0.015	-0.014
Hotels & restaurants	0.424	0.419	0.396	0.457	0.458	0.441	0.457
Transport, communications	0.165	0.200	0.241	0.296	0.303	0.334	0.350
Manufacturing	0.169	0.191	0.160	0.188	0.260	0.340	0.328
Construction	0.518	0.531	0.475	0.505	0.552	0.554	0.574
W/sale & retail	0.695	0.700	0.675	0.681	0.651	0.683	0.676
Real estate, business	0.615	0.620	0.595	0.608	0.619	0.613	0.627
RO							
Mining & quarry	0.304	0.357	0.161	0.184	0.209	0.191	0.143
Electricity, gas, water supply	0.505	0.449	0.275	0.471	0.510	0.496	0.442
Hotels & restaurants	0.854	0.747	0.502	0.576	0.592	0.578	0.605
Transport, communications	0.725	0.564	0.550	0.581	0.620	0.654	0.626
Manufacturing	0.517	0.489	0.439	0.479	0.477	0.505	0.478
Construction	0.574	0.541	0.422	0.477	0.574	0.569	0.582
W/sale & retail	0.664	0.529	0.505	0.507	0.574	0.588	0.592
Real estate, business	0.869	0.869	0.802	0.828	0.849	0.825	0.828
SK							
Mining & quarry	0.205	0.318	0.274	0.125	0.219	0.177	0.224
Electricity, gas, water supply	0.103	-0.290	-1.03	-0.542	-0.059	0.127	0.021
Hotels & restaurants	0.451	0.442	0.425	0.385	0.416	0.445	0.462
Transport, communications	0.417	0.415	0.475	0.398	0.375	0.368	0.350
Manufacturing	0.321	0.347	0.37	0.315	0.329	0.393	0.394
Construction	0.457	0.607	0.575	0.645	0.559	0.568	0.601
W/sale & retail	0.493	0.355	0.469	0.394	0.508	0.553	0.529
Real estate, business	0.455	0.458	0.458	0.485	0.440	0.454	0.407

Profitability is measured as corporate net operating surplus divided by corporate value added. Source Eurostat.

Appendix 2.2: Identifying firms eligible for tax incentives

The Ernst & Young Worldwide corporate tax guides provide a comprehensive list of the tax incentives introduced over the period 1999-2005. Due to the nature of the qualifying conditions and data availability, only a subset of these incentives are accounted for, which are summarised in Table 2.2. For convenience, I repeat the reforms and eligibility criteria below and explain how I have identified firms in the AMADEUS dataset that are eligible or have used a tax break. The main assumption is that if a firm met the conditions for a tax incentive, it took advantage of it. Nevertheless, this assumption is always double checked by looking at what happens to eligible firms' tax payments.

Bulgaria

Production companies qualify for a 100% reduction of the corporate tax on income for five consecutive years if the following conditions are met: a) The company and its assets are located in municipalities with unemployment rate for the preceding year 50% higher than the average unemployment rate for the country; b) the tax is accounted for as a reserve and (part of it) is used for the acquisition of long-term fixed assets; c) 80% of workers reside in the above-mentioned municipalities; d) the company does not have outstanding liabilities for tax and social insurance contributions. The tax incentive was introduced at the beginning of 2003 and is still in force.

A list of the municipalities that satisfy the unemployment rate condition is published every year as an annex of the Bulgarian Corporate Income Tax Law. I matched the cities in which manufacturing companies operate to these municipalities as a first step to identifying firms eligible for the tax incentive. I then chose only firms whose fixed assets grew compared to the previous year. Unfortunately, I cannot account for conditions c) and d), but given that a firm satisfies a) and b), and has reported zero (negative) tax and positive accounting profit, I assume that it took advantage of the tax opportunity. Thus, if a firm qualifies in 2003, its effective tax rate is zero for the remaining years it appears in the panel. Approximately 60 firms (254 firm-year observations) meet the above conditions. Since their taxable income cannot be imputed, earnings before interest and tax are used instead (*ebit*).

The Czech Republic

Investors in manufacturing can apply for corporate income tax holiday for up to 10 years subject to conditions which change annually. For a detailed account of these requirements, see Ernst & Young (Various Years). A list of the qualifying firms for the period 1999-2005 is published at http://www.czechinvest.org/en/investment-incentives-for-manufacturing-industry. As the AMADEUS dataset includes the names of the companies, it is straightforward to identify the Czech and Czech-based foreign firms that have been granted the tax holiday. This tax incentive is in force for the whole time period considered in the chapter.

From the Czechinvest list, 167 firms altogether appear in the AMADEUS dataset, or equivalently 781 firm-year observations. Out of these, 426 firm-year observations face a zero statutory tax rate. This is because some firms appear in the data a few years before they qualified for the tax holiday. Similarly to Bulgarian firms, *ebit* is used as a measure of these firms' TI for the relevant years. In 1999 and 2000, only firms belonging to the Top 250,000 firms took advantage

of the tax holiday. From 2002 onwards, smaller companies also joined in utilising the incentive. All of them are part of Dataset M (Top 1.5 million firms). AMADEUS's criteria for Top 250,000 and Top 1.5m firms are described under Table 2.9 and in the main text.

Over 20% of all firms granted the tax holiday specialise in the manufacture of parts and accessories for motor vehicles and their engines (NACE4 3430) and the manufacture of electrical equipment for engines and vehicles (NACE4 3161).

Hungary

Hungary offers an investment tax credit of 50% of the corporate tax for two sectors: manufacturing and the hotel industry. To qualify for the credit, a manufacturing firm should make an investment of HUF 1 billion ($3.33 million). The credit can be claimed in each of the next consecutive five years if sales revenue increases by an annual average of 5% of the investment value (Ernst & Young, Various Years). Given the conditions, I identify manufacturing firms (52 firms, 167 firm-year observations), whose fixed assets grew by at least the minimum amount required and assigned 50% lower statutory tax rate for the subsequent years these firms show in the panel, provided that their sales increased by at least 5% of the minimum investment required.

With respect to hotels, the same amount of investment is necessary – HUF 1 billion. However, in order to claim the credit in the next 5 years, sales should grow by 25% compared to previous year sales but not less than HUF 600 million. Approximately 5-6 hotels meet the investment requirement per year in the AMADEUS database, but none of them meets the sales growth requirement.

Poland

Poland has fourteen special economic zones, namely Kamienna Góra, Katowice, Kostrzyn-Słubice, Kraków, Legnica, Łódź, Mielec, Pomeranian, Słupsk, Starachowice, Suwałki, Tarnobrzeg, Wałbrzych, and Warmia-Mazury. They are described in detail in KPMG Poland (2009). I obtained a list of the investors for each zone from the zone's respective website and matched it to the data.

The AMADEUS dataset contains 272 companies (717 firm-year observations) with a license to operate in one or more of the above zones. Together, these firms employ approximately 110,000 people and have $38 million of total assets, on average. Given the investment a company makes, it qualifies for a tax exemption based on the following formula: $I = R(€50 \text{ million} + 0.5B + 0.34C)$, where R is the aid intensity in a given economic zone, B is the amount of investment above €50 million ($B \leq €50\text{million}$), while C is the amount of investment exceeding €100 million. Thus, a firm investing €120 million in Slaskie voivodship is eligible for $I = 40\%(€50 \text{ million} + 0.5€50 \text{ million} + 0.34€20 \text{ million}) = €32.7$ million exemption and the firm will not pay corporate tax until this exemption has been exhausted (KPMG Poland, 2009). I use *ebit* as a measure of what these companies' TI is, even in the years they pay some tax because information on the amount of the credits is unavailable.

Romania

From 2000 to 2004 inclusive, Romania provided incentives for small and medium enterprises.

SMEs CIT was reduced by 20% if their number of employees increased by 10% as compared to the preceding year. A SME is defined as a firm that has an annual turnover of less than €8 million and employs no more than 250 employees. Another condition is that the capital of a SME is 100% privately owned. I isolated firms meeting the employment, turnover and ownership conditions and lowered their statutory tax rates by 20% if their number of employees grew with the required percent. Tax incentives for SMEs were still available in 2005 but depended on profits reinvested in equipment, and therefore, I am not able to account for them.

About 9,000 firms (42,909 firm-year observations) per year qualified for this incentive, with turnover of $1 million and 38 employees, on average. Close to 40% of the eligible companies were from the retail and wholesale industry. A statutory tax rate of 20% is assigned on a year-to-year basis to the SMEs, which fulfilled the incentive criteria.

Romania also introduced temporary provisions for microenterprises from 2001 to 2002, inclusive. A microenterprise is a firm that has no more than 9 employees, annual turnover at most €100,000, and 100% privately owned capital. It is taxed at a rate of 1.5% on all income and in addition, can benefit from the same tax incentive as the one for SMEs. In the initial year, 2001, 78,442 firms qualify in the AMADEUS dataset, more than 50% of which operate in the retail and wholesale sectors. Interestingly, most of these firms reported zero taxable incomes in 2002, thus reducing the number of companies that could use the incentive to 5,042. A typical microenterprise in 2001 had an annual turnover of $26,000 and 3 employees.

Slovakia

For the period under consideration, Slovakia offered numerous tax incentives, such as 100% corporate tax credit, especially for companies with a given percent of foreign ownership of paid-up registered capital. Due to the large number of qualifying conditions, however, I am not able to pinpoint these firms in the AMADEUS data (Ernst & Young, Various Years).

Appendix 2.3: Description of variables used in the computation of EATR

Table 2.15: VARIABLES DEFINITION, FORMULAS AND SOURCES

p	Financial rate of return, firm-level variable, equal to [Added Value – Labour Expenses]/Added Value. Added Value equals taxes paid $taxa$+profit/loss for the period pl+ depreciation $depre$+ interest paid $inte$ + labour expenses $staf$. For reasons explained in Section 2.4.2, $inte$ is not included in the calculation of p. Source AMADEUS.
i	Nominal interest rate, country-level variable. For Bulgaria, Poland and Slovakia it equals the two-year government bond rate, one year government bond rate for the Czech Republic, one year treasury bill for Hungary and the money market interest rate for Romania. Source: Central Banks of Bulgaria, the Czech Republic, Hungary, Poland; European Central Bank and Eurostat.
π	Inflation rate, country-level variable. Measured with the Harmonised Indices of Consumer Prices. Source Eurostat.
r	Real interest rate. $r = \frac{i-\pi}{1+\pi}$, country-level variable. Author's calculation.
τ^s	Statutory corporate tax rate, country-level variable for firms with positive taxable income, although it becomes zero for firms with losses (carryforward), zero profit, or tax incentives, so it is also firm-specific. For a few years, τ^s in Bulgaria also varied based on a given threshold of taxable income. Source Ernst & Young (Various Years) and European Commission (Various Years).
m^i	Tax rate on interest income, for example interest earned on deposits in savings accounts, or income from rental property, etc. I assume $m^i = 0$.
m^d	Tax rate on dividend income. I assume $m^d = 0$.
z	Tax rate on capital gains, on an accrual basis. I assume $z = 0$.
c	Rate of tax credit on dividends. The tax credit reduces the tax liability of the person receiving the dividends in order to avoid double taxation of the dividends. I assume $c = 0$.
θ	$\theta = (1 - m^d)/(1 - c)(1 - z)$. King (1974) defines θ as the opportunity cost of retained earnings in terms of net dividends foregone, or the amount which shareholders would gain if one unit of retained earnings were distributed. θ is derived from the capital market equilibrium condition eq.(2). As I assume that $m^d = c = z = 0$, then $\theta = 1$, i.e. cash held by the company or by the shareholders can be interchanged without incurring additional tax liability.
ρ	$\rho = (1 - m^i) * i/(1 - z)$ is the discount factor of the dividend stream. See Section 2.4.2. Given the assumption that $m^i = z = 0$, the discount factor is equal to the nominal interest rate i.
ϕ	Depreciation rate of capital, country-level variable. I use the maximum depreciation rate for plant and machinery in the case of Poland and Hungary, heavy machinery for the Czech Republic and Slovakia, machines and manufacturing equipment for Bulgaria and Romania. See Table 2.3 for detailed account of the various asset categories and their depreciation rates. Source Ernst & Young (Various Years).
δ	One period cost of depreciation, assumed to be 12.5%. See Da Rin et al. (2011).
R^*	Net present value of the investment project without tax. $R^* = -1 + \frac{1}{1+i}[(p+\delta)(1+\pi) + (1-\delta)(1+\pi)] = \frac{p-r}{1+r}$, where the second equality comes from the fact that $r = \frac{i-\pi}{1+\pi}$ and the assumption that $m^d = c = z = m^i = 0$. Author's calculation.
R	Net present value of the project with tax. The general formula for R is $R = \frac{\theta}{1+\rho}[(p+\delta)(1+\pi)(1-\tau^s) - ((1+\rho) - (1-\delta)(1+\pi))(1-A)] + F$, which simplifies to $R = \frac{1}{1+i}[(p+\delta)(1+\pi)(1-\tau^s) - ((1+i) - (1-\delta)(1+\pi))(1-A)] + F$, given that $\rho = i$ and $\theta = 1$. A is the NPV of tax allowances per unit of investment and $A = \phi\tau^s \frac{(1+i)}{i}\left(1 - \frac{1}{(1+i)^{T+1}}\right)$, based on $\rho = i$, for straight-line depreciation and $T = 1/\phi$. Although some countries allow for accelerated depreciation, the straight-line method is always the baseline and is the method used in the chapter. F is the cost of raising external capital. Thus $F = 0$ in case of retained earnings, and $F = \frac{-\rho(1-\theta)}{1+\rho}(1 - \phi\tau^s) = 0$ for equity as $\theta = 1$. $F = 0$ for both equity and retained earnings reflects the discussion on θ above. If capital is raised by debt, then $F = \frac{\theta(1-\phi\tau^s)}{1+\rho}(\rho - i(1-\tau^s)) = i\tau^s\frac{1-\phi\tau^s}{1+i}$, which is exactly the amount of deductible interest payments, if the firm has borrowed $1 - \phi\tau^s$. Author's calculation.
$EATR$	Effective average tax rate, firm-level variable. $EATR_{debt} = \frac{(R^*-R)(1+r)}{p} \equiv \tau^{ed}$ for debt and $EATR_{equity} = \frac{(R^*-R)(1+r)}{p}\Big\vert_{F=0} \equiv \tau^{ee}$ for equity (retained earnings). Bearing in mind that $F = 0$ for equity, $EATR_{equity} > EATR_{debt}$. Author's calculation.

Chapter 3

The Impact of Cash and Card Transactions on VAT Collection Efficiency

Using EU country-level data, this chapter investigates if any correlation exists between transactions' payment method and tax compliance in the context of the value-added tax. Intuitively, the visibility of card payments by third-party institutions can serve as a deterrent to sales under-reporting and other evasion strategies. Countries like the US and Turkey have already implemented policies directly utilising electronic payments as a tax control instrument. Estimates based on European data do not find a statistically significant effect of cards on VAT performance, but do show that cash usage has a negative impact, a result that remains robust to a wide range of controls and specifications. It is further demonstrated that the relationship between cards, cash and the VAT revenue ratio is best modelled via a second-order Taylor approximation. The role of standard and reduced VAT rates, turnover thresholds and exposure to trade is also explored.

Keywords: Value added tax, VAT revenue ratio, card payments, cash, tax evasion, European Union
JEL Classification: H21; H25; H26; K34

3.1 Introduction

Due to technological progress and the introduction of new methods of payment, tax administrations face new possibilities of improving tax enforcement, while firms devise creative opportunities for tax evasion. Nowhere is this trend more pronounced than in the case of the value-added tax (VAT). Ainsworth (2011) points out that the supply of goods and services, the movement of the supply and funding in the context of carousel VAT fraud are already entirely digitised. Given the enormous estimated losses of VAT revenue, radical proposals for fraud prevention are not infrequent. Examples range from VAT withholding, which would split the VAT amount from the taxable amount in real time and thus eliminate both firms' access to VAT and voluntary compliance, to data mirroring of companies' hard disks for tax control purposes as advanced in

I wish to thank Libor Dušek for helpful comments and suggestions. Any remaining errors are mine.

a bill by the Danish Ministry of Taxation (PriceWaterhouseCoopers, 2010; Skatteministeriet J. 2010-711-0044, 2010).

A common factor among these proposals, and recent developments in tax enforcement policies in general, is the move to discourage business/customer cash transactions in favour of electronic payments that are more easily monitored, and hence constitute a strong incentive for compliance. The deterrent effect of card transactions on tax evasion, however, is yet to be established in the economic literature. Recently, Hasan et al. (2012) provided some preliminary evidence that retail electronic transactions, and especially retail card payments, are positively correlated with GDP per capita growth, consumption, and trade. Whether a similar effect exists between electronic payments and tax compliance remains a largely unexplored question.

The empirical literature on VAT thus far has primarily studied the effect of standard and reduced rates (Bogetić and Hassan, 1993, Agha and Haughton, 1996, Engel et al., 2001), and the quality of tax administrations (de Mello, 2008) on VAT's performance, predominantly using a large cross-section of countries. A more recent panel data analysis performed by Aizenman and Jinjarak (2008) focuses on levels of urbanisation, trade openness and some political variables as determinants of VAT's collection efficiency.

While controlling for most of the variables used in the above studies, this chapter further investigates if there is any association between method of payment and VAT's revenue outcomes. Using country-level panel data for 26 EU countries in the period 2000-2010, I find that the relationship between both cash and cards and the chosen VAT performance ratio is non-linear, even after controlling for the number of ATMs and point of sale terminals (POS) per million inhabitants, the VAT rate, and other explanatory variables. In particular, this relationship is convex in the case of cash, measured as the share of ATM cash withdrawals in GDP, vis-à-vis VAT revenue as a proportion of net consumption, and concave for card transactions (share of total card transactions in GDP).

The empirical analysis does not demonstrate a statistically significant relationship between VAT revenue and card usage, but shows the consistently negative impact of cash, whose effect can turn positive in countries with high preference for cash transactions. While it is possible that there is simply no connection between cards and VAT performance, this lack of correlation can also be attributed to the fact that electronic payments are not an explicit tax control instrument in the EU, as is the case in the US and Turkey, for example. Despite the insignificant results for cards, POS terminals are shown to affect the VAT-to-consumption ratio positively in almost all regressions.

These findings are robust for both low- and high-income Member States, and hold for alternative dependent variables. They are also unaffected by the inclusion of additional control variables. Although a different specification strategy, in which the VAT rate is considered endogenous and is hence instrumented for, yields higher coefficients in absolute value, the results remain qualitatively the same. Nevertheless, since the study is limited to 26 EU members, its findings are likely specific.

The chapter is organised as follows. The next section discusses the specific role electronic

payments play in tax policies targeting compliance. Section 3 describes the data, the estimation strategy, and examines the results. Concluding comments are presented in Section 4.

3.2 Role of Electronic Payments in Tax Policy and Enforcement

The retail sales of a firm can generally be split into two categories based on the method of payment chosen by the consumer: electronic payments via credit/debit cards or mobile devices (m-payments), and cash payments. The former have an almost 100% probability of detection if an audit is instigated, since a record of the transaction exists and can be cross-checked through third-party reporting, while the latter are easily manipulated and evaded. In fact, for resourceful retailers the probability that the tax authorities would uncover cash sales evasion has decreased substantially with the invention of Zappers – add-on programs in electronic cash registers (ECR) or point of sales systems which skim sales and simultaneously re-number and re-calculate the records of the remaining invoices, thus creating consistent financial statements (Ainsworth, 2010). Even if a retailer is unaware of the evasion opportunities arising from Zappers, Ainsworth (2012) notes that an operation conducted by the US Department of Taxation and Finances, in which false restaurants were opened with the goal of soliciting tenders for ECR, showed that 70% to 80% of the sales representatives actively marketed sales deletion software.

With regard to electronic payments, the firm's knowledge that transactions are recorded by banks, credit card companies, mobile operators or others can serve as a major deterrent to evasion and as a tool to diminish the tax gap.[1] This was the objective of adding Section 6050W to Title 26 of the US Code in 2008 (in force from January 2011), which requires banks, third-party settlement organisations, and other organisations with contractual obligations in the settlement of payment cards to send annual reports to the IRS containing information on payments made to merchants via debit/credit cards or certain electronic means. The IRS can use this data to match merchants' sales with the ones reported on their tax returns (Treasury Inspector General for Tax Administration, 2011).

A similar policy is in place in Turkey. According to Dogan (2011), since 2008 Turkish businesses can check their monthly credit card sales online when preparing their VAT returns. If there is a discrepancy between the company's records and the online statement, the firm can ignore the discrepancy provided it can furnish an explanation; otherwise it will be subject to an audit. Before the implementation of the system, 140,000 taxpayers did not report any credit card sales in their VAT returns and 60,000 had deviations in more than 20% of their transactions. One year later, fewer than 20,000 had a discrepancy rate of over 20% (Dogan, 2011). It is unclear, however, how issues of data protection and privacy, as well as compliance costs incurred by merchants are to be addressed by the US and Turkish policies.

Effective taxation hinges crucially on the availability and processing of information. The rise

[1] In a randomised enforcement experiment studying evasion responses of individuals, Kleven et al. (2011) show that in Denmark evasion is modest for personal income subject to third-party reporting, and considerable for self-reported income. The advantages of third-party collection – withholding employees' PIT and collecting it from employers – versus self-declaration are, for example, explored in Dušek (2003).

in cashless retail sales means that complete information exists for the fraction of firms' retail transactions executed electronically. Thus, while businesses act as collectors of VAT for the tax authorities, at the retail stage of VAT collection, customers increasingly become the enforcers. Clearly, the substantial wedge between the probabilities of detection of suppressed cash and electronic transactions can induce firms to hide more of their cash receipts to compensate for their inability to cheat elsewhere. In a laboratory experiment conducted by Johnson et al. (2009), for example, tax revenues declined by 15% when participants were told that part of their income would be perfectly monitored by the tax administration but that they had the opportunity to transfer income from the monitored to the unmonitored source at a cost. Even if transfers were not allowed, reporting rates remained similar to the baseline case without perfect monitoring, suggesting that taxpayers would find a way to adjust to tax policy changes in order to maintain their preferred level of tax compliance (Johnson et al., 2009).

In general, a firm cannot switch easily between monitored and unmonitored sales as it faces exogenously given demand for the methods of payment, which is determined by consumers' preferences for anonymity and convenience, the amount of transaction fees, and other factors. Nevertheless, if the firm is a monopolist it can use cash discounts as a means of price discrimination, a possibility explored by Gordon (1990). Alternatively, provided that the customer initiates bargaining for a price reduction, as modelled by Fedeli (2003), then the chosen method of payment will depend on the customer's intention to evade VAT.

To prevent collusion between retailers and customers, tax administrations resort to various policies. In Italy, for example, upon leaving a restaurant, hotel, or bar, a consumer may be required by the police to produce a fiscal receipt showing the VAT paid. Failure to do so results in a fine (Tait, 1988). Gordon (1990), however, demonstrates that shifting part of the liability for unpaid taxes onto consumers can increase tax evasion, since the firm has to cut its cash price to keep cash sales demand constant.

A superior strategy is to align the incentives of the final consumer and the tax authorities, especially in areas that are notoriously hard to tax – the businesses of plumbers, builders, electricians, etc. Instead of establishing a reduced VAT rate for renovation and restoration of private dwellings, Denmark allows 15,000 DKK (≈ €2000) per person per year, which is spent on renovation, to be deducted from the personal income tax (PIT). In order to qualify for the deduction, a household must have paid for the services via a card or a bank (cash or check payments are not eligible) and present detailed documentation about the supplier and the services performed.[2]

Although the scope of this policy is relatively limited, in a nutshell it contains several essential elements which can be useful for broader tax purposes: 1) It demonstrates that the effect of reduced VAT rates can be successfully achieved through the interaction of tax bases, in this case through deductions in the PIT, while avoiding further complexity in VAT; 2) Despite the loss of tax revenue as a result of the deductions, the tax administration can obtain a very clear picture of the amount of VAT and income evasion in this predominantly cash-based sector. It

[2]Details on the conditions, requirements, and services covered are available on the website of the Danish Tax Authorities (in Danish): http://www.skat.dk/SKAT.aspx?oId=1947018&vId=0#os

can do so by comparing revenue before and after the introduction of the policy, taking into account the possibility that the tax policy itself could have increased the demand for home renovations; 3) Last, and possibly most importantly, the policy, even if of a temporary nature, roots out the use of cash in an industry where cash payments are practically entrenched. It is worth pointing out that while such measures can be effective in countries with high PIT rates relative to VAT, which makes deductions worthwhile for the consumer, most Central and Eastern European (CEE) countries, for instance, have flat PIT schemes below the standard VAT rate, so that VAT evasion remains the more profitable option.

Overall, the final consumer's choice of payment instrument can be a powerful enforcement measure if card payments on the retail level become the norm, as they already are in several EU countries. While a large part of the public will continue to adopt convenient, secure, and innovative cashless payment methods as they become more and more widespread, tax policy clearly has the means to considerably reinforce this trend through monetary or other incentives.

3.3 Data

To check if the method of payment matters for tax compliance, I use a small unbalanced panel dataset for 26 EU countries, namely Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the UK for the period 2000-2010.

The main dependent variable is the VAT Revenue Ratio (VRR), which is a measure of the performance of countries' VAT regimes. The VRR is the ratio of actual collected VAT revenue to net consumption, divided by the standard VAT rate ($SVAT$). Net consumption is item P3 in the National Accounts minus VAT revenue. In the literature, VAT performance ratios differ given the economic base they assume for VAT. The Efficiency ratio, used for example by Engel et al. (2001) and Bogetić and Hassan (1993), scales the consumption-type VAT revenue by GDP, which would have been the tax base if VAT were a gross-product based tax, under which firms cannot deduct expenditure on capital goods from sales when computing their value-added (Department of the Treasury, 1984).

If the goal is to estimate the extent to which exemptions, reduced and zero rates, and avoidance/evasion activities erode VAT revenue collection, a more appropriate indicator would be the C-efficiency ratio, $\frac{\text{VAT Revenue}}{\text{Final consumption*SVAT}}$, whose denominator captures the potential tax base given a single VAT rate, no exemptions, and full compliance. This was the chosen performance variable in Ebrill et al. (2001), Aizenman and Jinjarak (2008), and de Mello (2008). The C-efficiency ratio, however, under-states VAT's collection capacity since the National Accounts compute consumption inclusive of VAT, at market prices. Therefore, VAT revenue should be subtracted from final consumption in the ratio's denominator, resulting in an improved measure, VRR. Chapter 4 of the 2010 edition of OECD (Various Years) discusses the VRR in detail and proposes steps towards its further refinement.

The VRR is a combination of two efficiency ratios, the Policy efficiency ratio, which demon-

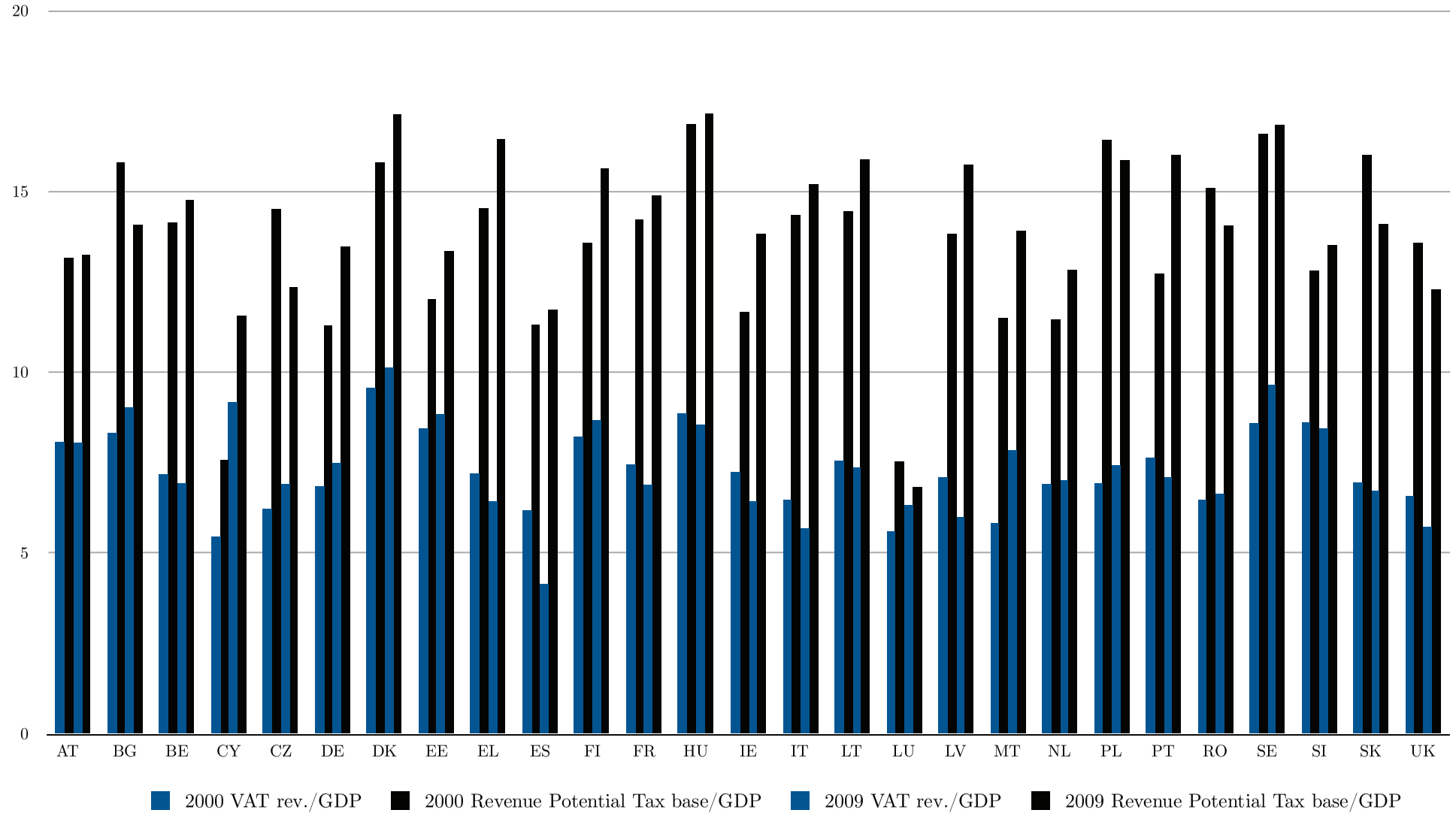
strates the degree to which current VAT legislation deviates from a uniform tax on consumption, and the Compliance efficiency ratio – measuring compliance (OECD, Various Years). For the purposes of my estimation, ideally I would use the Compliance ratio. It, however, entails the calculation of the theoretical tax revenue from actual tax law or VAT revenue under full compliance, which is a daunting task, inevitably prone to error, and thus far attempted only by Reckon LLP and by some individual countries' tax administrations.

To better understand fluctuations in VRR, one needs to take a closer look at the specific legislative changes affecting the actual tax base in a given country. In terms of rates coverage and exemptions over the 2000-2009 period, very few changes with a likely minimal impact on revenue occurred in the tax bases of Austria, Belgium, Germany, Denmark, the Netherlands, Finland, Italy, Luxembourg, Ireland, Sweden, and the UK, while in Spain there were no changes at all as shown in Table 3.5. Out of these countries, Germany, the Netherlands, Finland, Ireland and the UK increased the standard VAT rate modestly.

The CEE countries were the major VAT reformers, mostly due to their accession to the EU. The Czech Republic, and especially Hungary, expanded and changed VAT's coverage considerably in order to comply with the list of goods and services which can be subject to reduced rates as listed in Annex H to the Sixth VAT Directive. Nevertheless, the new Member States negotiated various derogations, most of which expired in 2010. Given its aggressive base expansion, and despite having a 5 percentage point (pp) lower standard rate in 2006-2008 compared to previous years, Hungary raised $SVAT$ back to 25% in 2009. Narrowing of the VAT tax base is observed in France, Portugal, and especially Greece. $SVAT$ in Greece and Portugal grew by 1pp and 3pp from 2000 to 2009 and then by further 4pp and 1pp in 2010, respectively. Registration thresholds are generally higher in 2009-2010 in Western Europe, and especially in Ireland and the UK, whereas in CEE they decrease, albeit from a very high level.

In Figure 3.1, the dynamics of actual VAT revenue (VRR's numerator) as a % of GDP in 2000 and 2009 is compared to revenue from the potential tax base under a single VAT rate, no exemptions and full compliance (VRR's denominator), again as a % of GDP. Five countries stand out due to large falls in $\frac{\text{VAT Revenue}}{\text{GDP}}\%$ and simultaneous increases in the potential tax base receipts driven by jumps in $SVAT$ and/or stronger final consumption – Spain, Ireland, Latvia, Greece, and Portugal. While the reduced revenue in Greece, Portugal and Ireland may be due to the possibility that the base narrowing effect of VAT reforms outweighed the increase in rates, the 2.03 pp drop in collected VAT to GDP in Spain in 2009 is hard to explain, given that there were virtually no alterations in VAT's legislation since 2000 and no major fluctuations in consumption. Revenues stabilised at 5.5% of GDP in 2010, after Spain raised $SVAT$ by 2 pp. One possible factor behind the revenue decline may be the 15% decrease in the number of VAT registered traders and the overall effect of the financial crisis. In Hungary, however, in spite of a significant base expansion accompanied by higher $SVAT$ and reduced rates, revenue fell by

Figure 3.1: COMPARISON OF ACTUAL VAT REVENUE WITH REVENUE FROM A POTENTIAL TAX BASE AS A % OF GDP: 2000 VS 2009



Note: Revenues from a potential tax base equal (Final consumption - VAT rev.)*Standard VAT rate.

Figure 3.2: GROWTH RATE OF VALUE OF CARD PAYMENTS AS A % OF GDP

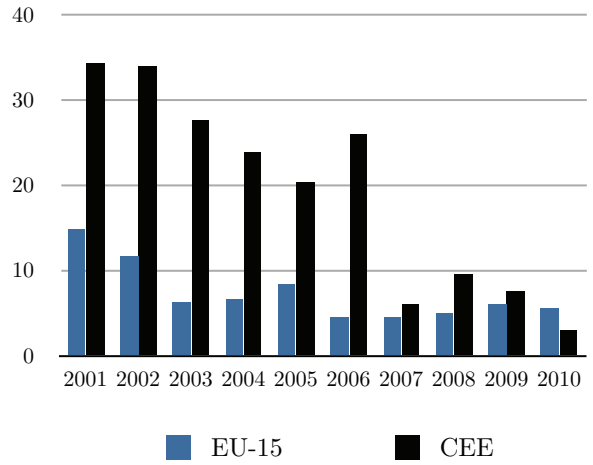


Figure 3.3: GROWTH RATE OF VALUE OF ATM CASH WITHDRAWALS AS A % OF GDP

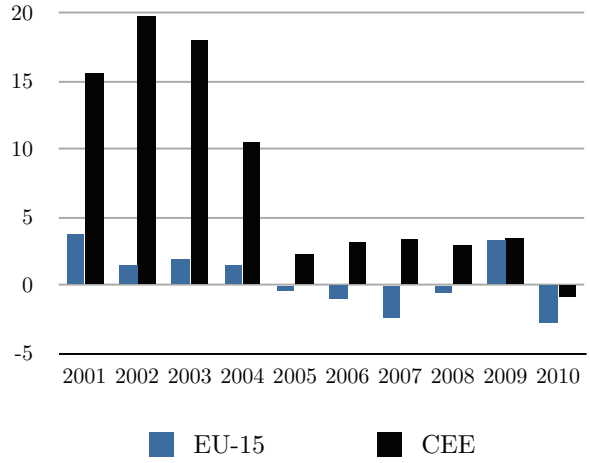
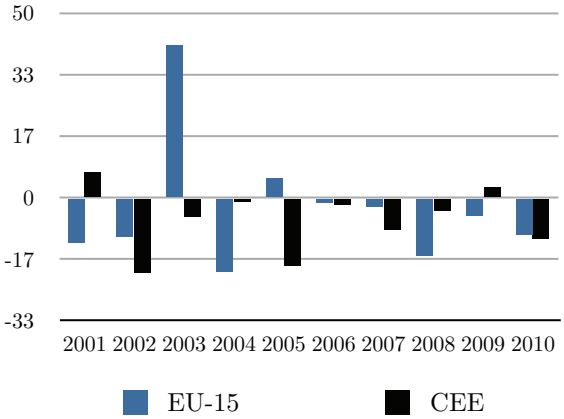


Figure 3.4: GROWTH RATE OF VALUE OF OTC CASH WITHDRAWALS AS A % OF GDP



Data for OTC withdrawals covers only the Czech Republic, Germany, Spain, Finland, the UK, Hungary, Italy, Latvia, Netherlands, Romania and Slovakia. Source: ECB.

Table 3.1: DESCRIPTIVE STATISTICS

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	N
$VRRM$	10.6	10.4	10.4	10.5	10.7	11.3	11.4	11.6	11.1	10.4	10.8	286
	(1.94)	(1.87)	(1.86)	(1.86)	(1.99)	(1.99)	(2.08)	(2.02)	(2.18)	(2.4)	(2.06)	
$CeffM$	9.58	9.41	9.42	9.47	9.7	10.1	10.3	10.4	10.0	9.38	9.78	286
	(1.57)	(1.51)	(1.51)	(1.51)	(1.61)	(1.6)	(1.66)	(1.61)	(1.76)	(1.97)	(1.67)	
$EffR$	7.34	7.24	7.26	7.32	7.44	7.74	7.78	7.74	7.59	7.32	7.56	286
	(1.00)	(0.95)	(0.95)	(1.00)	(1.07)	(1.10)	(1.19)	(1.17)	(1.24)	(1.34)	(1.12)	
$\frac{Cards}{GDP}$	6.8	6.66	7.49	8.10	8.79	9.73	10.36	10.93	11.60	12.29	12.96	281
	(5.91)	(6.10)	(5.54)	(5.58)	(5.76)	(5.73)	(5.91)	(5.97)	(6.18)	(6.22)	(6.11)	
$\frac{Cash}{GDP}$	9.58	10.02	10.74	11.55	12.12	12.27	12.82	12.94	13.21	13.66	13.42	273
	(5.71)	(5.98)	(5.44)	(5.51)	(5.72)	(5.75)	(5.99)	(6.09)	(6.29)	(6.31)	(6.19)	
CIT	31.83	30.94	29.39	28.45	27.5	26.16	25.85	25.56	24.46	24.43	24.08	286
	(6.8)	(6.07)	(6.79)	(6.85)	(7.64)	(7.93)	(7.49)	(7.95)	(7.15)	(6.94)	(7.07)	
$GovExp$	43.85	43.88	44.36	44.54	43.99	43.8	43.38	43.03	44.55	48.74	48.45	286
	(6.2)	(6.06)	(6.31)	(6.95)	(6.71)	(6.63)	(6.33)	(5.73)	(5.24)	(5.19)	(6.70)	
$Deficit$	-.942	-1.6	-2.4	-2.5	-1.96	-1.49	-.926	-.4	-2.21	-6.56	-6.53	286
	(4.09)	(3.30)	(2.96)	(2.88)	(2.71)	(3.02)	(3.27)	(2.84)	(3.32)	(3.90)	(5.89)	
$\frac{ATM}{POPM}$	483	503	532	568	601	625	657	711	738	750	736	285
	(296)	(308)	(311)	(317)	(328)	(330)	(335)	(345)	(342)	(338)	(333)	
$\frac{POS}{POPM}$	8,907	10,229	11,030	11,451	12,196	12,697	13,731	15,187	16,474	17,181	17,661	280
	(5,549)	(6,959)	(7,663)	(7,393)	(7,848)	(7,569)	(7,880)	(8,104)	(8,766)	(9,006)	(9,351)	
$Open$	109	108	104	102	107	109	117	119	120	105	116	286
	(54.6)	(52.5)	(49.1)	(46.7)	(50.6)	(51.7)	(55.9)	(57.4)	(56.3)	(52.2)	(56.3)	
$Urban$	70.59	70.7	70.8	70.9	71.05	71.17	71.33	71.49	71.64	71.8	71.9	286
	(12.45)	(12.44)	(12.44)	(12.45)	(12.45)	(12.46)	(12.46)	(2.46)	(12.47)	(12.47)	(12.48)	
$Unempl$	8.84	8.77	8.76	8.69	8.79	8.30	7.42	6.49	6.39	9.07	10.48	285
	(4.66)	(5.13)	(4.68)	(3.94)	(3.69)	(3.18)	(2.49)	(1.97)	(1.88)	(3.68)	(4.41)	
$Corrupt$	6.23	6.23	6.25	6.32	6.4	6.46	6.52	6.56	6.47	6.34	6.3	282
	(2.18)	(2.09)	(2.15)	(2.16)	(2.09)	(2.04)	(1.93)	(1.79)	(1.74)	(1.83)	(1.91)	
$ThreshGDP$	417	334	343	238	241	236	247	190	186	213	201	249
	(669)	(517)	(585)	(394)	(355)	(355)	(345)	(235)	(224)	(216)	(230)	
$SVAT$	19.57	19.61	19.73	19.65	19.61	19.73	19.54	19.65	19.61	19.96	20.65	286
	(2.92)	(2.89)	(2.87)	(2.78)	(2.60)	(2.59)	(2.36)	(2.25)	(2.24)	(2.56)	(2.44)	
$Range$	10.53	10.47	10.95	10.66	10.82	10.9	10.70	11.86	11.66	11.45	12.16	286
	(5.32)	(5.31)	(5.79)	(4.93)	(4.53)	(4.54)	(4.47)	(3.23)	(3.21)	(3.14)	(3.28)	
$\frac{GDP}{POP}$	18,880	19,215	19,569	19,830	20,396	20,919	21,661	22,403	22,350	21,083	21,357	286
	(13,621)	(13,745)	(13,967)	(13,965)	(14,271)	(14,612)	(14,948)	(15,429)	(15,142)	(14,194)	(14,376)	

Note: All means are expressed in % , except $\frac{GDP}{POP}$, which is in €, *Range* in percentage point, while $\frac{ATM}{POPM}$ and $\frac{POS}{POPM}$ are pure numbers.

Table 3.2: DESCRIPTION OF VARIABLES AND SOURCES

VRR	VAT Revenue Ratio = $\frac{\text{VAT Revenue}}{(\text{Final consumption}-\text{VAT Revenue})*SVAT}$, where VAT Revenue is the actual VAT revenue, and Final consumption is item P3 of the national accounts consisting of 1) private final consumption expenditure of households and non-profit organisations serving households and 2) individual and collective consumption expenditure of general government. $VRRM = \frac{\text{VAT Revenue}}{(\text{Final consumption}-\text{VAT Revenue})*SVAT}$ is used in estimation, since $SVAT$ is used as a control variable. Source: OECD, Eurostat.
$Ceff$	C-efficiency = $\frac{\text{Vat Revenue}}{\text{Final consumption*SVAT}}$. $CeffM = \frac{\text{Vat Revenue}}{\text{Final consumption}}$ is used in estimation, since $SVAT$ is used as a control variable. Source: OECD, Eurostat.
$EffR$	Efficiency Ratio = $\frac{\text{Vat Revenue}}{GDP}$
$\frac{Cards}{GDP}$	Value of transactions for all cards issued in the reporting country, except e-money function scaled by the Gross Domestic Product. Source: Payments and Settlement Systems Statistics, ECB Data Warehouse.
$\frac{Cash}{GDP}$	Value of cash withdrawals for all cards issued in the reporting country via customer terminals scaled by the Gross Domestic Product. Source: Payments and Settlement System Statistics, ECB Data Warehouse; Eurostat.
CIT	Statutory corporate tax rate. Source: Eurostat.
$GovExp$	Total general government expenditure as a % of GDP. Source: Eurostat.
$Deficit$	General government deficit (-) surplus (+) as a % of GDP. Source: Eurostat.
$\frac{ATM}{POPM}$	Number of ATMs per million inhabitants. Source: Payments and Settlement Systems Statistics, ECB Data Warehouse.
$\frac{POS}{POPM}$	Number of Point of Sale Terminals per million inhabitants. Source: Payments and Settlement Systems Statistics, ECB Data Warehouse.
$Open$	Imports + Exports as a percent of GDP. Source: World Development Indicators, World Bank.
$Urban$	Urban population as a percent of total population. Source: World Development Indicators, World Bank.
$Unempl$	Rate of unemployment. Source: Eurostat.
$Corrupt$	Corruption Perception Index ranging from 0 (highly corrupt) to 10 (very clean). Source: Transparency International.
$ThreshGDP$	A minimum turnover threshold, below which small traders are exempt from registering for VAT. % of $\frac{GDP}{POP}$. Source: European Commission, Taxation and Customs Union, OECD (Various Years), Ernst & Young Worldwide VAT, GST and Sales Tax Guides for 2003 and 2010, Various tax administration websites.
$SVAT$	Standard VAT rate. A single standard VAT rate is used even in countries with several standard rates applied in specific regions, as is the case in Austria, Greece, France, Portugal and Spain. For example, standard rates are different on mainland Greece and Lesbos, Chios, Samos, and the other Greek islands. The same holds for mainland Portugal and the Azores and Madeira. Source: OECD (Various Years), Eurostat.
$Range$	The difference between the standard VAT rate, $SVAT$ and the reduced rate. In countries with more than one reduced rate, the average is taken. If there is no reduced rate, $Range$ is set to zero. Source: Eurostat.
$Prefill$	A dummy variable equal to 1 if a country uses fully/ partially pre-populated personal income tax returns. Source: OECD (2008).
$\frac{GDP}{POP}$	Real gross domestic product per capita in Euro. Source: Eurostat.

Figure 3.5: MARGINAL RELATIONSHIP: VRR VS. ATM CASH WITHDRAWALS

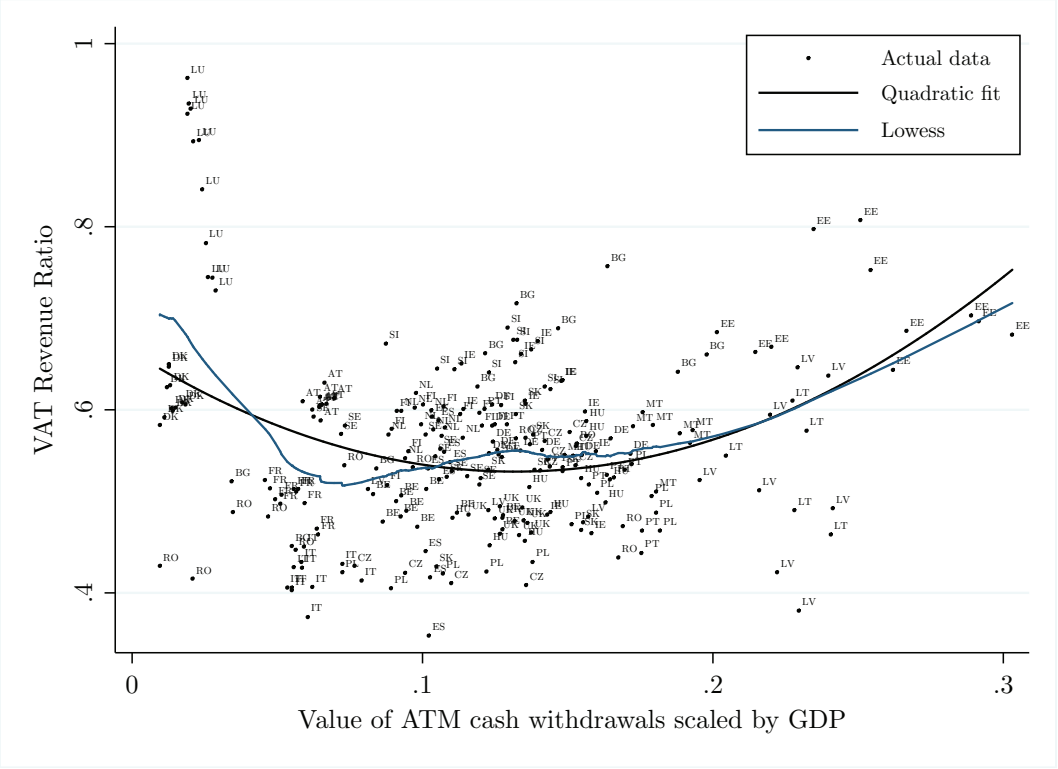
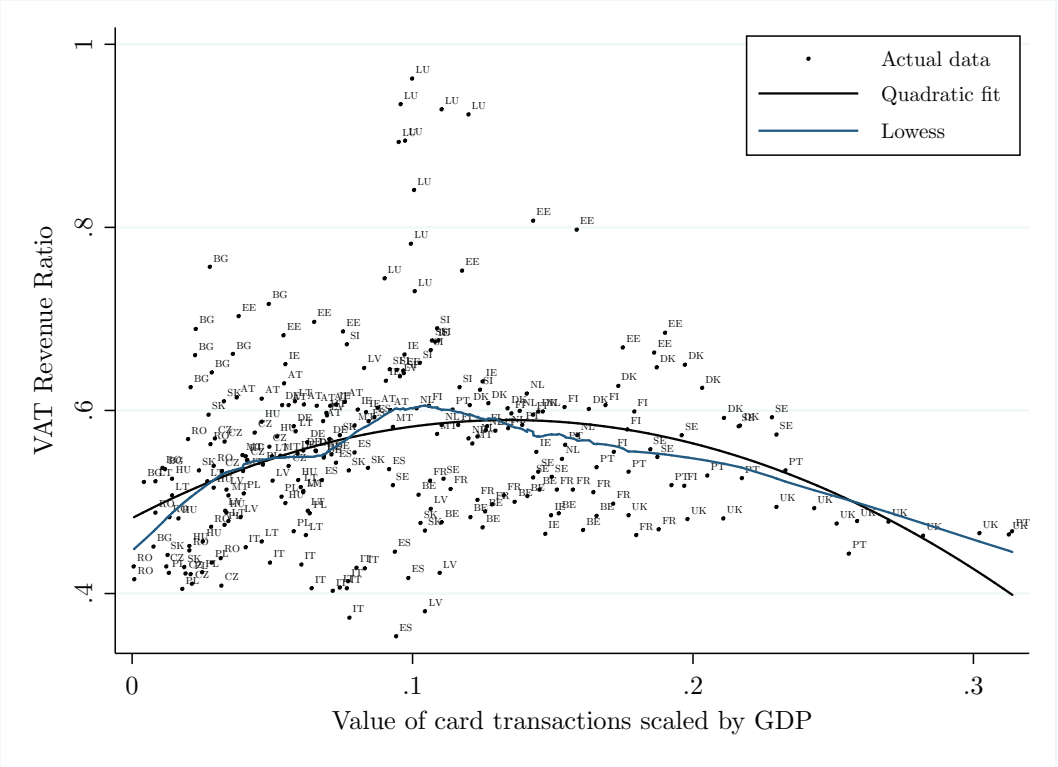


Figure 3.6: MARGINAL RELATIONSHIP: VRR VS. CARD TRANSACTIONS



0.30pp, suggesting that compliance issues may be at play.

To distinguish between methods of payment, the main explanatory variables used are the value of card transactions by all cards issued in the reporting country and the value of ATM cash withdrawals (again pertaining to cards issued in the reporting country), both sourced from the ECB's Data Warehouse. ATM cash withdrawals are an imperfect measure of cash transactions, but they are by no means an insignificant one. ATM cash ranges from 30% of GDP in Estonia in 2001 and similar high values in other Baltic countries to less than 2% in Denmark. In fact, ATM cash withdrawals nearly perfectly coincide with Denmark's currency in circulation, once I exclude the value of the largest banknote – 1000 DKK, which is rarely used for retail payments.

Figures 3.2 and 3.3 show the growth rates of $\frac{Cash}{GDP}$ and $\frac{Cards}{GDP}$ separately for CEE and the so-called 'old' Member States (EU-15) covering Austria, Belgium, Germany, Denmark, Luxembourg, Finland, the UK, France, Italy, Sweden, Malta, the Netherlands, Ireland, Portugal, and Spain. After 2004, a convergence in the growth rates of cash and cards occurred for the two regions of Europe, with card transactions growing by more than 30% per annum in CEE before 2005 and less than 10% after 2006. Cash growth was negligible and negative for the EU-15, and turned negative in CEE only in 2010. Cash withdrawals, however, remain a very stable share of GDP in most EU economies as is clear from Table 3.1. Additionally, the mean value of the number of ATMs ($\frac{ATM}{POPM}$) has increased steadily, while point of sale terminals ($\frac{POS}{POPM}$) per million inhabitants have more than doubled from 2000 to 2010. The majority of the POS terminals are EFTPOS (electronic fund transfer at point of sale) terminals for debit and credit cards.

In principle, it would have been optimal to additionally include over-the-counter (OTC) cash withdrawals in the measure of cash, but this variable is available for a very limited set of countries (the Czech Republic, Greece,Germany, Spain, Finland, the UK, Hungary, Italy, Latvia, the Netherlands, Romania, and Slovakia) and only for some years between 2000 and 2010. OTC transactions and ATMs are the two major sources of cash to the public, and hence the main indicators of retail payments done in cash. OTC withdrawals in Greece are several times higher than GDP, suggesting that they include additional payments which are not mentioned in the description of the variable. For this reason, Greek data is not considered in Figure 3.4. Such high values apply to the CEE region in general, with OTC withdrawals being 52% of GDP on average compared to only 12% in the EU-15 countries for which information is available. Even though the data should be viewed with caution, it is useful to see how OTC withdrawals change, especially in light of the fact that both ATM cash withdrawals and card payments grow as a percent of GDP, at least in CEE.

Figure 3.4, which depicts the growth rate of OTC cash withdrawals as a % of GDP, demonstrates that the biggest decline in the use of cash stems from vastly diminishing over-the-counter withdrawals, with Finland and the Netherlands having the largest negative rates. Apart from a single substantial positive spike in 2003 driven by Hungarian and Latvian data, the growth rates are negative for both the EU-15 and CEE. If looking only at ATM cash withdrawals in CEE, one can misleadingly conclude that cash usage is growing, while in fact OTC cash is substituted with

ATM withdrawals, with overall cash usage likely not trending upward, and strongly declining in the EU-15. Takala and Viren (2012), who construct a measure of cash usage in the Euro area based on both ATM and imputed OTC cash, note that bank branches' withdrawals usually involve higher denomination banknotes and large single amounts, which can be used not only as payments, but also as a store-of-value.[3]

Simple scatter plots of VRR versus $\frac{Cash}{GDP}$ and $\frac{Cards}{GDP}$ depicted in Figures 4.4 and 4.5 respectively, suggest that the marginal relationships between the dependent and the main explanatory variables of interest may not be linear. In fact, a quadratic prediction plot fits the non-parametric lowess smoothing well. Nevertheless, other predictors are ignored in these plots, and since typically control variables are correlated, there can be a substantial difference between the marginal and partial effects, which I will explore below.

3.3.1 Empirical specification and results

To find out if the method of payment has any effect on VAT's collection performance, I start out with the following basic specification:

$$\begin{aligned} lnVRRM_{it} &= \alpha_i + \gamma_t + \alpha_1 ln\frac{Cards_{it}}{GDP_{it}} + \alpha_2 ln\frac{Cash_{it}}{GDP_{it}} + \beta_1 ln\frac{GDP_{it}}{POP_{it}} + \beta_2 lnSVAT \\ &+ \beta_3 ln\frac{ATM_{it}}{POPM_{it}} + \beta_4 ln\frac{POS_{it}}{POPM_{it}} + \beta_5 Range + \epsilon_{it}, \end{aligned} \tag{3.3.1}$$

where $\ln VRRM_{it} = \frac{\text{VAT Revenue}_{it}}{(\text{Final consumption}_{it} - \text{VAT Revenue}_{it})}$ in country i at time t. As pointed out by Ebrill et al. (2001), since $SVAT$ is explicitly controlled for on the right-hand side of the regression, the specification effectively models VRR. $\ln\frac{GDP}{POP}$ is the log of GDP per capita, and $Range$ is the difference between the standard VAT rate, $SVAT$, and the reduced rate(s), if any. For countries without a reduced rate, $Range$ is set to zero. For this reason, it is not log transformed. 1pp increase in $Range$ will lead to a $\beta_4 * 100\%$ change in $VRRM$. α_i are country fixed effects, with no assumption being made about $cov(\alpha_i, x_{it})$ for now, while γ_t are year dummies. If the expectation that an audit would uncover any undeclared electronic sales drives firms to report these sales in full, then the effect of card transactions on $VRRM$ should be positive ($\alpha_1 > 0$). Conversely, if cash transactions are associated with greater evasion opportunities, then $\alpha_2 < 0$.

Estimates based on the baseline specification are presented in Table 3.3. When the relationship between $VRRM$, cash, and cards is assumed to be linear, as is the case in Column (1), neither the coefficient on $\ln\frac{Cards}{GDP}$, nor that on $\ln\frac{Cash}{GDP}$ are statistically significant, implying virtually no impact of the method of payment on VAT's collection efficiency.

Given the non-linearity suggested by the simple scatterplots in Figures 4.4 and 4.5, I check if

[3] Takala and Viren (2012) impute OTC withdrawals by using the value of new and fit banknotes withdrawn by third parties at NCB counters (a), and assuming the value of two recycling rates: cash-in-transit (b) and credit institutions' (c) recycling rates in the following formula: $a(1+b)(1+c)$. Since a is sourced from the Currency Information System 2, I do not have access to this variable at this point.

the relationship between $VRRM$ and $\frac{Cash}{GDP}/\frac{Cards}{GDP}$ is linear once the variables are log transformed, and additional covariates are added to the estimation. To do so, eq. (4.3.1) is estimated with all shown controls, except $\ln\frac{Cash}{GDP}$. The difference between the actual and predicted values of $\ln VRRM$, which constitutes the unexplained variation in the dependent variable, is then plotted against $\ln\frac{Cash}{GDP}$ in Figure 4.6. The same procedure is followed to obtain the plot in Figure 4.7, but this time $\ln\frac{Cards}{GDP}$ is excluded from the regression. The figures present a second-order polynomial fit as well as a non-parametric locally weighted scatterplot smoothing (lowess) with a bandwidth set to .4.

Both graphs indicate distinct non-linearity between the main explanatory variables and $\ln VRRM$, with the quadratic approximation almost matching the non-parametric plot for cash, and fairly closely following the lowess smooth for cards. VAT's collection efficiency decreases with increases in cash use, but for high values of cash withdrawals the curve bends upwards, showing a convex relationship. Cards, conversely, exhibit a concave relation with $\ln VRRM$, improving collection up to a point, after which their effect turns negative.

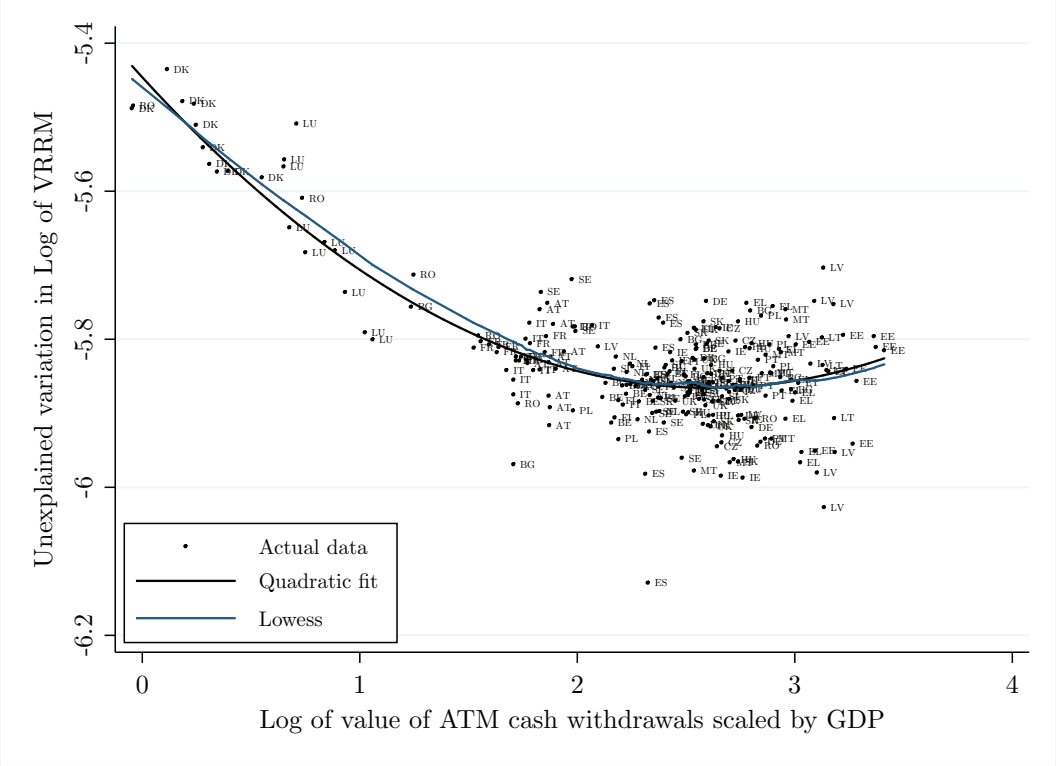
When the quadratic terms are added in Column (2) of Table 3.3, their coefficients are both significant at 5%. I assume that $cov(\alpha_i, x_{it}) \neq 0$, so that the presented estimates are obtained through a fixed effects regression, which centres the variables around their means within each cross-section. $\ln\frac{Cards}{GDP}$ remains insignificant, but cash has a strong negative effect on VAT's collection. 1% rise in GDP per capita is associated with .35% higher $VRRM$. Even though at conventional statistical levels the effect of cards on the dependent variable is nil, the number of point of sale terminals do have a positive impact on VAT's performance, a result which remains consistent across various specifications. Jumps in the VAT rate lead to a less than proportionate increase in the VAT revenue-to-consumption ratio. According to Ebrill et al. (2001), who obtain similar estimates for a cross-section of approximately 90 countries, the less than 1 elasticity can be explained with narrower tax bases, although reduced compliance is likely to be a contributing factor as well. Neither the number of ATMs per million inhabitants, nor *Range* are precisely estimated.

Note that in Column (2) the non-linear relationship is not identified by pure within variation. In fact, as argued by McIntosh and Schlenker (2006), if y is a globally quadratic function of x, deviations from group means cannot be used to identify the data generating process, since the marginal effects must depend on the un-centred values of x. Identification, therefore, stems from elements of between variation, as x is first squared, and then demeaned. In this way, the group means are re-introduced into the regression (McIntosh and Schlenker, 2006).[4,5]

[4] In the fixed effects regression, x_{it}^2 is transformed into $x_{it}^2 - \overline{x_i^2}$, which can be rewritten as $(x_{it} - \overline{x_i})^2 + 2(x_{it} - \overline{x_i})\bar{x}_i + (\overline{x_i})^2 - \overline{x_i^2}$.

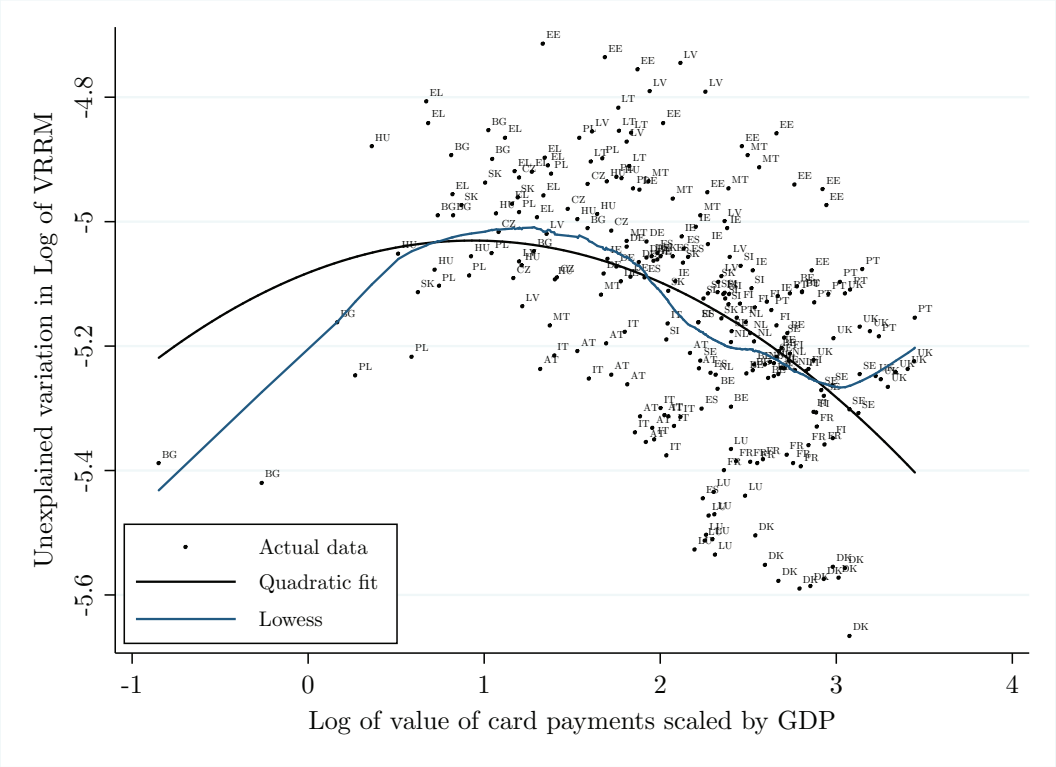
[5] I additionally performed Random-effects (RE) GLS estimation, which uses both the cross-sectional and time-series variation in the data, and imposes the restriction that $cov(\alpha_i, x_{it}) = 0$. Compared to Column (2), there are two main differences: the coefficient on $\ln\frac{Cards}{GDP}$ doubles and becomes statistically significant at 10% (.041 with s.e. .023), while the effect of GDP per capita is close to zero. A simple Hausman test for fixed effects would be inappropriate in this context, since it can only be performed with unclustered standard errors and assumes that α_i and ϵ_{it} are i.i.d., which is unlikely to hold. Indeed, standard errors are substantially underestimated when observations are not clustered by country as a consequence of considering each observation to be an independent piece of new information (Cameron and Trivedi, 2009). I use, instead the Schaffer and Stillman (2010) *xtoverid*

Figure 3.7: lnVRRM VS $\ln\frac{\text{CASH}}{\text{GDP}}$



Note: The Y-axis variable is log$VRRM$ net of the estimated effect of $\ln\frac{Cards}{GDP}$, $\ln\frac{GDP}{POP}$, $\ln\frac{ATM}{POPM}$, $\ln\frac{POS}{POPM}$, ln$SVAT$, and $Range$, but excluding $\log\frac{Cash}{GDP}$ and $\left(\ln\frac{Cash}{GDP}\right)^2$. The regression was estimated with clustered standard errors, year and country dummies.

Figure 3.8: ln$VRRM$ VS $\ln\frac{\text{CARDS}}{\text{GDP}}$



See note under Figure 4.6. This time $\ln\frac{Cash}{GDP}$ is included, and $\ln\frac{Cards}{GDP}$, $\left(\ln\frac{Cards}{GDP}\right)^2$ excluded.

Table 3.3: DETERMINANTS OF VAT COLLECTION EFFICIENCY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					2000-2007	EU-15	CEE	Cross-section
DPV	ln$VRRM$	ln$VRRM$	ln$CeffM$	ln$EffR$	ln$VRRM$	ln$VRRM$	ln$VRRM$	ln$VRRM$
$\ln(\frac{Cards}{GDP})$	-.016	.021	.020	.029	.028	.069	.004	.244*
	(.035)	(.026)	(.023)	(.024)	(.022)	(.160)	(.025)	(.122)
$\ln(\frac{Cards}{GDP})^2$		-.024**	-.022**	-.008	-.014	-.029	-.016	-.045
		(.011)	(.010)	(.006)	(.010)	(.031)	(.012)	(.033)
$\ln(\frac{Cash}{GDP})$	-.029	-.326**	-.293**	-.129*	-.266**	-.367*	-.228*	-.235
	(.062)	(.122)	(.109)	(.067)	(.115)	(.181)	(.111)	(.313)
$\ln(\frac{Cash}{GDP})^2$		.062**	.066***	.028*	.067***	.070	.065***	.059
		(.025)	(.025)	(.016)	(.022)	(.044)	(.020)	(.082)
$\ln(\frac{GDP}{POP})$	.308**	.350**	.315**	.067	.348***	1.12***	.336**	.072
	(.120)	(.130)	(.117)	(.095)	(.116)	(.236)	(.149)	(.082)
$\ln(\frac{ATM}{POPM})$	.071	.036	.031	.003	.022	.057	-.027	-.054
	(.057)	(.055)	(.050)	(.053)	(.038)	(.067)	(.111)	(.068)
$\ln(\frac{POS}{POPM})$	.045	.066**	.060**	.044	.057*	.012	.109*	-.090
	(.034)	(.032)	(.029)	(.028)	(.029)	(.040)	(.057)	(.062)
ln$SVAT$	.460**	.517***	.471***	.425**	.653***	.618***	.443*	.654**
	(.181)	(.185)	(.168)	(.162)	(.117)	(.159)	(.202)	(.295)
Range	-.003	-.005	-.005	-.003	-.004	.006	-.010***	-.010
	(.004)	(.003)	(.003)	(.003)	(.003)	(.004)	(.003)	(.011)
Observations	267	267	267	267	189	159	108	26
Countries	26	26	26	26	26	15	11	

Note: The sample in each regression pertains to 2000-2010, except in Column (6), in which 2008-2010 are excluded. The dependent variables are the logs of $VRRM$=$\frac{\text{VAT Revenue}}{\text{Finacl Consumption-VAT Revenue}}$; CeffM=$\frac{\text{VAT Revenue}}{\text{Final Consumption}}$ or EffR=$\frac{\text{VAT Revenue}}{\text{GDP}}$. All specifications include country and year fixed effects; in Column (3) results are based on GLS estimation with random effects. Standard errors are always clustered at the country level. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) level.

The C-efficiency ratio and VAT revenue to GDP, or the Efficiency ratio, replace VRRM as dependent variables in Columns (3) and (4), respectively. There is virtually no change in the estimated coefficients and their significance when $\ln CeffM$ is used instead of $\ln VRRM$. The Efficiency ratio regression, however, yields substantially lower estimates. Nevertheless, both the main and quadratic terms of cash remain significant at 10%, whereas GDP per capita is found to have no influence on the ratio.

Even though the impact of major macroeconomic shocks should be captured by the year dummies, which are present in all regressions, Column (5) removes 2008-2010 data from the estimation in order to check the extent to which the financial crisis affects the results. Apart from the finding that before the onset of the crisis a 1% increase in the VAT rate is associated with a stronger positive response of the VAT revenue to net consumption ratio, excluding the last three years of the data does not alter the estimates qualitatively or quantitatively.

The next two columns of Table 3.3 split the sample geographically into two groups: 1) the CEE region, herein the Baltic states, and 2) the EU-15. Besides geographical, the split is also along income lines, with CEE having an average of €8,140 GDP per capita, and the EU-15 – €29,898. Similarly to previous estimations, cards enter with a positive sign for the linear and negative sign for the quadratic term, both imprecisely estimated for the two subsets of countries. The coefficient of $\ln\frac{Cash}{GDP}$ is negative and significant at 10%, but only the quadratic term for CEE is statistically significant, suggesting that the positive effect of cash on VAT's performance is prevalent in countries where cash continues to be a preferred method of payment. On average, ATM cash withdrawals are 6pp higher and card payments 7pp lower in CEE than in the EU-15. Another interesting outcome of the sample split is that *Range* is negative and highly significant for CEE: 1pp widening of the range between $SVAT$ and the lowest reduced rate would lead to a 1% fall in $VRRM$.

The arguments against reduced VAT rates are many and succinctly summarised by Tait (1988). Perhaps the most compelling justification against rate differentiation is the inevitable increase in traders' compliance costs. There are also considerable administrative costs associated with the management of a complex VAT system, which functions with multiple rates, exemptions, and zero rating. It is further doubtful whether reduced rates achieve what they are aimed at, namely mitigating the impact of VAT's regressivity on low income households. In a cross-sectional analysis, Bogetić and Hassan (1993) estimate a negative relationship between *Range* and the Efficiency ratio. Likewise, Agha and Haughton (1996) demonstrate that the higher the number of VAT rates, the lower the VAT compliance. Even though *Range* is found to be statistically significant only for the CEE countries, once exposure to foreign trade is taken into account, the variable becomes significant for the whole sample, as shown in Table 3.4.

Finally, Column (8) presents results from a cross-sectional regression, where the data has been collapsed to country means. With only 26 data points, standard errors increase substantially with most of the coefficients becoming statistically insignificant. In particular, a measure of

test, which treats RE's orthogonality condition $E(x_{it} * \alpha_i) = 0$ as an over-identifying restriction and allows for clustered errors. The very large Sargan-Hansen statistic of 257.6 with p-value of zero strongly rejects the null hypothesis that RE is consistent. Thus, all subsequent regressions employ the within estimator.

cash calculated as an average over the 2000-2010 period is generally not significant in explaining VAT's performance, even though the estimates are virtually unchanged from the fixed effects coefficients. Interestingly, however, the linear term of cards is barely significant at 10%, a result which is in line with the outcome of the Random-effects regression (see footnote 4) that utilises both the time-series and cross-sectional variation in the data.

Next, Table 3.4 checks if the coefficients on cash and cards and their significance are sensitive to the incorporation of additional explanatory variables. The first departure from the benchmark specification is the inclusion of openness (*Open*), measured as exports and imports divided by GDP. Invariably, studies modelling VAT revenue as a function of trade openness find a positive association (Ebrill et al., 2001; Aizenman and Jinjarak, 2008). The intuition is that, all in all, more trade enhances VAT collection on imports, despite the existence of various fraudulent mechanisms exploiting the zero rating of exports at the border. In Table 3.4 *Open* enters with a positive sign and is always significant at 5%. The estimated elasticity of $VRRM$ to the level of trade is .24 in most regressions. Both the linear and quadratic terms of cash remain statistically significant and similar in magnitude to the estimates in Table 3.3. The quadratic term of cards is barely significant at 10%. As mentioned above, due to smaller estimated standard error, there is some indication that *Range* is negatively correlated with $VRRM$.

Column (2) adds the rate of unemployment as an explanatory variable that not only denotes the general state of the economy, but also directly affects private consumption. Not surprisingly, the coefficient of ln$Unempl$ shows that VAT's performance deteriorates as the number of unemployed rises. As long as unemployment is explicitly controlled for, GDP per capita is insignificant. Perceptions of corruption, which can influence the willingness to pay tax, also enter with a negative sign in Column (3), albeit imprecisely estimated. Previous research has shown a positive connection between the level of urbanisation and VAT revenue, but Column (3) does not corroborate this finding (Aizenman and Jinjarak, 2008; de Mello, 2008).

By exempting the smallest traders from VAT registration, the VAT turnover threshold could potentially reduce revenue, even though, given the high number of small traders, savings in administrative costs could outweigh foregone revenue. Including the threshold as a percent of GDP per capita in Column (4) shows at a 5% level of significance that if $TreshGDP$ grows by 1pp, $VRRM$ falls by 0.9%. Neither of the additional explanatory variables in Columns (2)-(4) alters the effect of cash on VRRM. Cards also remain insignificant.

One possible explanation for cards' lack of influence on $VRRM$ is that unlike Turkey, and more recently the US, where a clear signal is sent to firms that electronic sales are monitored, in Europe card transactions may not serve as a sufficiently powerful deterrent to evasion. In particular, it is unclear to what degree EU tax administrations match firms' card transactions to reported sales as a preventive mechanism before suspicions of non-compliance arise (before the fact) as opposed to a pursuant mechanism, once suspicion is already established and an audit is instigated as a consequence (after the fact).

Even if a specific tax policy utilising firms' card transactions for enforcement purposes is not in place, I test whether in general tax administrations that make extensive use of third-party

reporting are more effective in VAT revenue collection. To do so, I introduce a dummy variable $Prefill$, which equals one for countries that use pre-populated personal income tax returns; this dummy is also interacted with $\frac{Cards}{GDP}$. A high level of pre-filled returns indicates that most salaries are paid electronically, which is also conducive to a greater use of cashless transactions, provided that an adequate payment infrastructure exists. In Column (5), the coefficient of $Prefill$ is identified from countries (Estonia, France, the Netherlands, Portugal, Belgium, and Slovenia) that
switched fully or partially between taxpayer submitted returns to pre-populated returns in the period 2000-2010. Use of third-party reporting for personal income taxation was pioneered by Denmark in 1988, followed by Sweden and Finland in 1995 (OECD, 2008). In view of the results in Column (5), however, I cannot find evidence that third-party reporting for individuals, or card transactions given third-party reporting, have any effect on VAT revenue proportionate to consumption.

Lastly, Column (6) explores the possibility of the endogeneity of the VAT rate. On the one hand, higher $SVAT$ can translate into higher collected revenues. On the other hand, if revenue realisations do not meet a government target, $SVAT$ can be adjusted accordingly.[6]

Among various sets of instruments, the following three variables met the relevance and validity criteria best: the natural logs of corporate income tax rate and government expenditure, and, due to numerous negative values, the non-transformed government deficit. At least before the financial crisis, hikes in the VAT rate were generally compensated with cuts in the CIT rate and/or PIT deductions. Since raising $SVAT$ is a quick way to generate more revenue, I expect that fluctuations in the government's deficit and expenditure would closely correspond to the dynamics of the VAT rate. The results of a fixed-effects instrumental variable regression with clustered errors are reported in Column (6). The first-stage F-statistic testing for the joint significance of the excluded instruments is 6.10 with a P-value of 0.0031, indicating that the instruments are relevant. Further, given a Hansen-J statistic of 1.417 ($\chi^2(2)$ P-value=0.4923), I cannot reject the null hypothesis that the full set of orthogonality conditions are valid.

Overall, instrumenting for the VAT rate produces higher coefficients in absolute value, especially when it comes to $SVAT$, which increases four times. Both GDP per capita and the unemployment rate are significant in Column (6) as opposed to previous regressions, in which only unemployment mattered. The linear and quadratic terms of cash almost double and remain significant at 5%. A similar increase is observed for cards, but the linear effect does not change its statistical significance.[7]

[6]To detect the presence of reverse causality – revenue driving the rate rather than vice versa, one can replace the dependent variable with the VAT rate, keeping VAT revenue on the right-hand side. In such a regression, it turns out that $VRRM$ does have a statistically significant effect on $SVAT$, which poses the question of whether the results for cash and cards will change if $SVAT$ is instrumented for.

[7]Another robustness check was performed with a different measure for cash, namely net currency in circulation, taken from ECB's data warehouse and defined as the number of banknotes/coins in circulation, where for banknotes, circulation equals created notes minus destroyed notes less stock of the National Central Bank (NCB). This measure is readily available for the EU members, which are not part of the monetary union, and is not reported by the ECB for the Euro area countries. Currency in circulation for the Euro zone states was obtained from the individual countries' NCB websites, and in the case of Germany, Spain and Portugal, it was estimated. The derivation is performed by assuming that the notes put in circulation are proportional to the

Table 3.4: DETERMINANTS OF VAT COLLECTION EFFICIENCY: ROBUSTNESS CHECKS

	(1)	(2)	(3)	(4)	(5)	(6) IV
$\ln\left(\frac{Cards}{GDP}\right)$	.012	.019	.007	.017	.022	.046
	(.026)	(.026)	(.023)	(.019)	(.027)	(.051)
$\ln\left(\frac{Cards}{GDP}\right)^2$	-.020*	-.020	-.020*	-.014	-.023	-.040**
	(.011)	(.012)	(.010)	(.009)	(.013)	(.015)
$\ln\left(\frac{Cash}{GDP}\right)$	-.275**	-.293*	-.282**	-.291**	-.330**	-.446**
	(.117)	(.144)	(.130)	(.109)	(.149)	(.222)
$\ln\left(\frac{Cash}{GDP}\right)^2$	.051**	.054*	.047*	.041**	.062**	.097**
	(.022)	(.026)	(.023)	(.019)	(.026)	(.048)
$\ln\left(\frac{GDP}{POP}\right)$	.362***	.130	.179	.050	.151	.635***
	(.116)	(.152)	(.174)	(.176)	(.147)	(.234)
$\ln\left(\frac{ATM}{POPM}\right)$	.045	.051	.074	.119***	.062	-.017
	(.049)	(.050)	(.043)	(.033)	(.054)	(.093)
$\ln\left(\frac{POS}{POPM}\right)$	.070**	.077**	.076**	.065**	.072**	.077*
	(.029)	(.029)	(.032)	(.029)	(.029)	(.044)
$\ln SVAT$	.594***	.619***	.526***	.540***	.621***	2.63***
	(.167)	(.138)	(.131)	(.102)	(.137)	(.513)
$Range$	-.006*	-.006*	-.006*	-.009**	-.006*	-.024***
	(.003)	(.003)	(.003)	(.003)	(.003)	(.006)
$\ln Open$	.242**	.237**	.242**	.226**	.244**	.336*
	(.097)	(.096)	(.098)	(.100)	(.097)	(.174)
$\ln Unempl$		-.094**	-.082*	-.095**	-.092**	-.121*
		(.042)	(.042)	(.040)	(.040)	(.066)
$\ln Corrupt$			-.025	-.061		
			(.092)	(.099)		
$\ln Urban$			-.217	-.923		
			(.681)	(.633)		
$ThreshGDP$				-.009**		
				(.004)		
$Prefill$					-.103	
					(.132)	
$\ln\left(\frac{Cards}{GDP}\right) * Prefill$					.046	
					(.050)	
F-stat. of excl. instruments						6.10
P-Value						.0031
Hansen-J						1.417
P-Value						.4923
Observations	267	266	264	233	266	265

Note: The sample in each regression pertains to 2000-2010. The dependent variable is the log of $VRRM = \frac{\text{VAT Revenue}}{\text{Final Consumption-VAT Revenue}}$. All specifications include country and year fixed effects. In Column (6) $\ln SVAT$ is instrumented with $Deficit$, $\ln CIT$ and $\ln GovExp$; estimation is performed with xtivreg2 (Schaffer, 2010). In all specifications, standard errors are clustered at the country level. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

3.4 Conclusion

The exceptional amount of firm-related information tax administrations could or already have access to leads to the gradual implementation of policies whose aim is to prevent rather than pursue tax evasion. If these policies require traders to transition from cash to electronic payment systems, compliance costs are unavoidable. It is therefore important to study such practices and their expected effect on enforcement.

In itself card payments' traceability could improve compliance by increasing the perceived probability of detection, even if no explicit policy using electronic transactions data as a preventive mechanism is in force. It is this particular aspect of cards that this chapter focused on. Given the data, the visibility of electronic payments does not appear to influence VAT's collection efficacy in a significant manner. It is possible that a more proactive tax policy following the example of the US and Turkey can induce a considerable impact on compliance. Alternatively, it is equally possible that the outcome could be limited if those firms that are bent on evading, are inventive enough to find the means to do so. The picture is more clear-cut with respect to cash, whose negative effect on VAT's performance is unambiguous, at least in the countries where card payments are well-established.

countries' subscription key to the ECB's share capital minus the 8% ECB's share of total euro banknotes issued. An analogous analysis to the one performed in Figures 4.7 and 4.8 showed that a quadratic term for net currency in circulation is not justified and that the relationship between $\ln VRRM$ and currency in circulation is negative. Replacing ATM cash withdrawals with net currency in circulation in eq. (4.3.1.) yields a negative estimated coefficient of -.045, which, however, is not statistically significant (standard error is .034).

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Appendix 3.1

Table 3.5: CHANGES AFFECTING THE VAT TAX BASE

	2000	2009
AT	No zero rate; Lower rate 10%. Standard rate 20%. General registration threshold (GRT) €22,000. Aggregate administrative costs for tax functions as % of GDP (AAC): 0.22%. Number of VAT registered traders, millions (NVT): 0.69.	Lower rate [added]: water supply; refuse (waste) collection; sewage; dwelling; passenger transport; hotel accommodation; restaurant services (except drinks); medicine. GRT: €30,000. AAC: 0.19%. NVT: 0.82 No change in rates and exemptions.
BE	Zero rate; Lower rates 6%, 12%. Standard rate 21%. GRT: €5,580. AAC: -. NVT: -.	Lower rate [added]: some labour intensive services (small repair services) [2003]; construction work leading to the construction of new private housing and the sale of new private housing (subject to conditions, limitations and of temporary character)[2009 to 2010]. GRT: €5,580. AAC: 0.35%. NVT: 0.7. No change in rates and exemptions.
CZ	No zero rate; Lower rate 5%. Standard rate 22%. GRT: €85,567. AAC: -. NVT: -.	Zero rate on international passenger transport; Lower rate 9%. Standard rate 19%. Scope of lower rate reduced from covering most services in 2000 to: supply of water; disposal or waste water; accommodation; construction of private dwellings and social houses; healthcare and domestic care services; cleaning in households; funeral; sport activities. Exemptions [removed]: supplies of enterprises. GRT: €39,904. AAC: 0.20%. NVT: 0.53.
DE	No zero rate; Lower rate 7%. Standard rate 16%. GRT: €16,620. AAC: -. NVT: 4.87.	Standard rate 19%. Lower rate [added]: plants; flowers; devices for the disabled; museums; zoos; circuses; authors' rights [2003]. GRT: €17,500. AAC: 0.29%. NVT: 5.70.
DK	Zero rate; No lower rate. Standard rate 25%. GRT: €2,680. AAC: -. NVT: 0.39	First time sale of artistic work valued over DKK300,000 taxed at 5%. Exemptions [added]: sale of products of artistic work valued under DKK300,000; [removed]: supply of all land and buildings. GRT: €6,711. AAC: 0.3%. NVT: 0.43.
EL	No zero rate; Lower rate 8%. Standard rate 18%. GRT: €6,070. NVT: 1.45.	Lower rate 9%. Standard rate 19%. Exemptions [added]: legal and artists' services; authors' rights; public radio and TV; supply of water by public bodies [2003]; supply of new buildings [2005]; welfare and social security works; supply of goods used exclusively in an exempt activity, services included in the taxable value of imported goods; postage and other similar stamps [2009]. [removed] supply of new buildings [2007]. Lower rate [added]: books [2003]; cultural and sporting events; collection and treatment of waste; some labour intensive services [2005]; gas; live animals; seeds; fertilisers; pharmaceutical products; charitable work; plants and flowers [2009]. GRT: €10,000. NVT: 1.10.
ES	No zero rate; Lower rate 7%. Standard rate 16%. GRT: None. AAC: -. NVT: 3.3.	No change in rates, exemptions, and lower rate coverage. GRT: None. AAC: 0.13%. NVT: 2.8.
FI	Zero rate; Lower rates 8%, 17%. Standard rate 22%. GRT: €8,500. AAC: 0.21%. NVT: 0.5.	Zero rate [removed]: international transport [2003]. Lower rate [added]: works of art supplied by their creators or imported [2003]. Exemptions [removed]: products of visual art sold by the artist [2003]. No change in rates. GRT: €8,500. AAC: 0.22%. NVT: 0.58.

CHANGES AFFECTING THE TAX BASE Contd.

	2000	2009
FR	No zero rate; Lower rates 5.5% Standard rate 19.6%. GRT: €76,300. AAC: 0.39%. NVT: -.	Lower rate [added]: most foods and drinks [2007]; gas; electricity; pharmaceutical products; farm products, gardens, plants and flowers; refuse collection; sewage [2009]; [removed]: museums. Exemptions [added]: construction, work on monuments; cemeteries and graves of war victims; commodity futures transactions, services rendered by resource consortia to their members that are VAT exempt [2003]. No change in rates. GRT: €80,000. AAC: 0.23%. NVT: 4.20.
HU	Zero rate; Lower rate 12%. Standard rate 25%. GRT: $7,544. AAC: 0.57%. NVT: 0.55.	No zero rate; Lower rates 5%, 18%. Lower rate [removed]: food, electricity, live animals, water, pharmaceutical products, transportation, veterinary, movie, art, library and bath services, etc. [added] musical notes. Exemptions [removed]: mass sports events; services rendered by intermediaries; lending of buildings for education, sport, or cultural purposes; transfer of creditors and ownership rights, compulsory social security insurance, public administration. GRT: €17,921. AAC: 0.39%. NVT: 0.52.
IE	Zero rate; Lower rate 12.5%. Standard rate 21%. GRT: €51,000/$26,050. AAC: 0.26%. NVT: 0.22.	Lower rate 13.5%. Zero rate [added]: certain aircraft and sea-going vessels [2005]; Lower rate [added]: gas; recreational and sports services; certain nursery and garden centre stock [2009]. Exemptions: [added] child care [2003] and [removed] [2005]. GRT: €75,000. AAC: 0.28%. NVT: 0.28.
IT	Zero rate (scrap iron); Lower rate 10%. Standard rate 20%. GRT: €2,400. AAC: - . NVT: -.	No zero rate; Lower rate [added]: accommodation let by building enterprises [2003]; Exemptions [added] taxi; [removed] municipal passenger transport [2009]. GRT: €30,000. AAC: 0.20%. NVT: 5.26.
LU	No zero rate; Lower rates 5%, 12%. Standard rate 15%. GRT: €10,000. AAC: -. NVT: 0.076.	Lower rate [added]: accommodation; cultural, sporting events; certain labour intensive services; children's' clothing; electricity; construction of dwellings; gas, passenger transport, pharmaceutical products etc. Rates and exemptions unchanged. GRT: €10,000. AAC: 0.24%. NVT: 0.06.
NL	No zero rate; Lower rates 6%. Standard rate 17.5%. GRT: €1,345. AAC: 0.69%. NVT: 1.	Standard rate 19%. Lower rate [added]: cut flowers and plants; hotel and holiday accommodation; lending of books [2005]; cleaning of dwellings and hairdressing [2009]; [removed] lending of books [2009]. Exemptions unchanged. GRT: €1,345. AAC: 0.36%. NVT: 1.45.

CHANGES AFFECTING THE TAX BASE Contd.

	2000	2009
PL	Zero rate; Lower rate 7%. Standard rate 22%. Exemptions: agriculture, taxi, R&D, cremation and cemetery, and attorney services; funeral. GRT: €20,833. AAC: 0.18%. NVT: 1.3.	Zero rate [removed]: new dwelling immovable property; agricultural means of production. Lower rate [added]: basic agricultural means of production; restaurant, cemetery, certain construction, and reception of broadcasting services; certain foodstuffs and beverages; passenger transport, etc. All goods/services subject to lower rate in 2000 removed. Exemptions: students' accommodation; public radio and TV. GRT: €24.390. AAC: 0.36%. NVT: 2.14.
PT	Zero rate; Lower rates 5%, 12%. Standard rate 17%. GRT: €10,000. AAC: 0.36%. NVT: -.	Standard rate 20%. Lower rate [added]: devices for the disabled, medical services, natural gas, hotels, social housing; some goods used in agriculture; restaurant services; tools, machines or other equipment used for collecting and using alternative energy sources, etc. GRT: €12,000. AAC: 0.23%. NVT: 1.50.
SE	Zero rate; Lower rates 6%, 12%. Standard rate 25%. GRT: None. AAC: 0.27%. NVT: 0.84.	Standard rate 15%. Lower rate [added]: books; newspapers; magazines; zoos [2003]. Exemptions [added]: creative artists; investment gold [2007]; [removed]: certain memberships, publications [2003], authors' rights [2005], investment gold [2009]. Rates unchanged. GRT: None. AAC: 0.18%. NVT: 1.
UK	Zero rate; Lower rate 5%. Standard rate 17.5%. GRT: €82,258. AAC: 0.33%. NVT: 1.73.	Standard rate 15%. Lower rate [added]: certain grant-funded installations of heating equipment; children car seats; certain pharmaceutical products. Exemptions [added]: works of art. GRT: €80,000. AAC: 0.28%. NVT: 1.9.

Sources: OECD (Various Years), OECD (2004, 2009), Eurostat. Used abbreviations: AAC Aggregate administrative costs for tax functions as % of GDP; GRT General registration threshold; NVT Number of VAT registered traders (millions). In the 2000 column, the value of NVT is for 2003, as this data is not available for previous years. 2000 is the benchmark year. For coverage of lower rates and exemptions in 2000, refer to the 2001 edition of OECD (Various Years). The 2009 column lists only the low rate goods and services/ exemptions, which have been added/removed as compared to 2000.

Chapter 4

Real-time Collection of the Value-added Tax: Some Business and Legal Implications

(with Richard Thompson Ainsworth, Boston University – School of Law)

Recent estimates of the level of VAT fraud in the EU are commensurate with the EU budget. With the Green paper on the future of VAT, the European Commission stressed the urgency and necessity of comprehensive VAT reforms. This chapter analyses the business and legal implications of the recently proposed split-payment mechanism, which, if implemented, would move VAT's method of collection to real-time. The discussion is positioned in the context of two increasingly visible trends in the EU – the general shift towards greater reliance on indirect taxation and the growing popularity of electronic payment instruments. The potential implementation of VAT withholding would be a radical reform, given its shift of the taxation system from voluntary to forced compliance. We argue that, on the one hand, real-time VAT collection would constitute a potent preventive measure against VAT fraud, which could generate synergetic effects within SEPA, and further deepen integration through the harmonisation of VAT policies. On the other hand, real-time audit/refund would require tax authorities' access to confidential business information that may be incompatible with EU privacy rules. The trade-off between efficient tax collection and privacy concerns mirrors the general debate on data protection in a cashless economy.

Keywords: Value added tax, Fraud, Real-time collection, Tax design, European Union
JEL Classification: H25; H26; K34; K42

4.1 Introduction

The consequences of value-added tax (VAT) fraud within the European Union (EU) have assumed gargantuan proportions, not only in terms of syphoned off liability, but also with the crippling compliance burden imposed on honest businesses. The general sense of practitioners is that "...tax authorities in the European Union are increasingly losing control of the VAT system and that honest businesses pay the price for it..." (Zubeldia, 2011). An economic evaluation

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ordered by the European Commission (EC) estimates that compliance costs for businesses range between 2% and 8% of collected VAT (European Commission, 2011a).

Unlike personal income tax (PIT) and corporate income tax (CIT) evasion, whose effects, if socially unacceptable are normally limited to the fraudster and his relationship with the fiscal authorities, VAT fraud is very different. VAT fraud rolls through the supply chain increasing compliance cost and exposing innocent businesses to crippling penalties. With estimates varying from 1% in Luxembourg to 30% in Greece, the VAT gap is only one measure of VAT fraud. Another, and equally important measure, is the uncertainty it injects into the business environment. For example, a 2006 decision by the European Court of Justice in relation to missing-trader fraud (MT) states that if the tax administration can prove that traders "knew or should have known" that they engage in purchase transactions connected with VAT evasion, the traders do not have the right to deduct the tax on these purchases (Terra and Kajus, 2011).[1]

While it is important that courts unequivocally signal that neither fraud, nor inaction given awareness of fraud will be tolerated, the possibility that an honest business may become liable for VAT stolen by others in the VAT chain is not a normal business risk (Amand and Boucquez, 2011). In effect, the theft of VAT by fraudulent firm A transforms into a tax on production for bona fide firm B. Thus, in addition to distorting competition, VAT fraud leads to heavy compliance costs for honest traders, who, inter alia, are compelled to research their suppliers, cover possible litigation costs, and even face bankruptcy as a result of fraudulent actions committed by others.

Final consumers, who effectively bear the incidence of VAT, are not insulated from the effects of fraud either. VAT scams exacerbate already strained public finances and may lead to jumps in VAT rates to compensate for lost revenue, which the Reckon Report estimated at €106.7 billion in 2006 (Reckon LLP, 2009). To put this number into perspective, the EU budget in 2006 was €106.6 billion.

The fact that VAT is collected by firms, and thus inevitably passes through private bank accounts, makes the tax especially susceptible to fraud. Various proposals for reform targeting the source of the fraud incentive were put forth as early as 2000. Bulgaria, for example, experimented with VAT accounts in 2003, effectively eliminating traders' access to the tax (Pashev, 2007). The viability of real-time VAT collection was also discussed in the UK, where the problem of carousel fraud is severe (House of Lords, 2007).

The debate intensified recently with PriceWaterhouseCoopers' (PWC) report on the usefulness of technology and financial intermediaries regarding VAT's method of collection. In 2010, the EC launched a public debate on the problematic aspects of VAT's current design via the Green paper on the future of VAT, with VAT collection being one of the most contentious points (European Commission, 2010). In particular, PWC examined a split-payment mechanism, which would break up the value of each transaction into a taxable amount and a VAT amount in real-

[1]The specific ECJ decision concerns the joined cases C-354/03 (*Optigen*), C-355/03 (*Fulcrum*) and C-484/03 (*Bond House*), as well as joined cases C-439/04 (*Axel Kittel*), and C-440/04 (*Recolta Recycling*). According to the Court of Justice decision, the EU law cannot be relied upon for fraudulent ends, which also includes the case where a trader is aware of VAT fraud, but stands aloof without gaining any advantage (Terra and Kajus, 2011).

time, transferring the tax to a blocked VAT account. The idea of a blocked VAT account was first developed by the Ifo Institute in 2003, and was called a "VAT trust account"(Sinn et al., 2004).

According to the EC's follow-up on the public debate, the reaction of businesses and tax specialists to VAT withholding was predominantly negative, with concerns about its effects on cash flow and compliance costs. Nevertheless, the Commission's intention is to "...further analyse the feasibility of the split payment and its design in order to allay the concerns expressed." (European Commission, 2011a).

This chapter analyses the split payment mechanism in the context of two specific proposals for VAT reform: PWC's proposition for the introduction of blocked VAT accounts and Chris William's real-time VAT (RTvat). In particular, we examine compliance and cash flow effects of VAT withholding as well as the implications of the likely expansion of firm data reporting under real-time audit. The discussion is further positioned at the background of two increasingly visible trends, namely the greater reliance on indirect taxation in the EU, which makes VAT reform all the more pressing, and the gradual movement to payment digitisation, given the rising popularity of cashless transactions and targeted initiatives such as the Single European Payment Area (SEPA).

The RTvat proposal claims that technology used in the credit card industry and inter-bank payment systems makes VAT withholding a feasible alternative to the current method of collection. While undisputedly such a step would serve as a powerful preventive measure against VAT scams, it raises numerous points of concern. First and foremost, it would eliminate voluntary compliance for the firms it would affect. Second, if VAT is to be refunded in real-time as well, which would necessitate real-time audits, what is the scope of the business information that would have to be shared in real time with the tax authorities to enable an efficient audit function built-in within the split-payment system?

On the one hand, given VAT's increasing importance as a source of revenue and the steadfast move of the economy towards digitisation, a major VAT re-design seems inevitable. On the other hand, a technical solution to VAT fraud would likely entail a greater intrusion into (confidential) business data, as well as the imposition of costly compliance procedures on mostly compliant traders, although one may argue that the current enforcement measures are equally costly. In a sense, the trade-off between maximising tax revenue through efficient use of technology and privacy concerns mirrors the broader debate on data protection in an economy with quickly growing electronic payments.

The chapter is structured as follows: Section 2 briefly documents the marked shift towards indirect taxation and away from direct taxation, especially during the financial crisis of 2008-2010. Pros and cons of blocked accounts and RTvat, and the required steps toward an efficient split-payment system are studied in Section 3, while Section 4 concludes.

4.2 The Shift from Direct to Indirect Taxation

There is a gradual shift from direct to indirect taxation in the European Union economies, which became particularly evident in the nature of the fiscal packages implemented during the 2008-2010 economic downturn. It is worth noting that a major decline in the corporate tax rates is observed long before the start of the recession. In the Green paper on the future of VAT, European Commission (2010) observes that consumption is "... a broader and more stable [tax] base than income and profits," and that "the financing of the welfare state may have to rely less on labour taxes and tax revenues from capital income (savings), thereby further arguing in favour of a shift to indirect taxation." Similarly, a meeting of the OECD Ministers in 2009 singled out the shift of revenue from corporate and personal income taxation, or social security contributions onto consumption and property taxes as an important growth-oriented tax reform (OECD, 2009).

In general, receipts from VAT can be used to reduce other more distortionary taxes, such as PIT, and especially CIT. Given that, besides other distortions, CIT favours debt over equity financing, consumption over saving, labour over capital, while PIT may discourage saving and work effort, lower reliance on direct taxation would be economically advantageous (Department of the Treasury, 1984).[2] It is precisely this type of policy that was pursued by the majority of EU countries during the financial crisis.

Table 4.1 shows the tax rates and VAT revenue as a percent of GDP and total taxation in 2000 and 2009. The Member States exhibit a varying degree of reliance on VAT. In 2009, for example, proceeds ranged from 4.1% of GDP in Spain to more than 10% in Denmark. VAT revenue accounted for 13.2% of total taxation in Italy and reached 31.2% in Bulgaria.

From 2000 to 2008 inclusive, seven countries raised the standard VAT rate. Cuts occurred in the Czech Republic, Slovakia, and Hungary, although usually accompanied by increases in the reduced rates. Latvia, Romania, and Bulgaria, which initially had a single VAT rate, introduced reduced ones. Overall, this period was not characterised by a clear-cut VAT dynamics, apart from sporadic country-specific reforms.

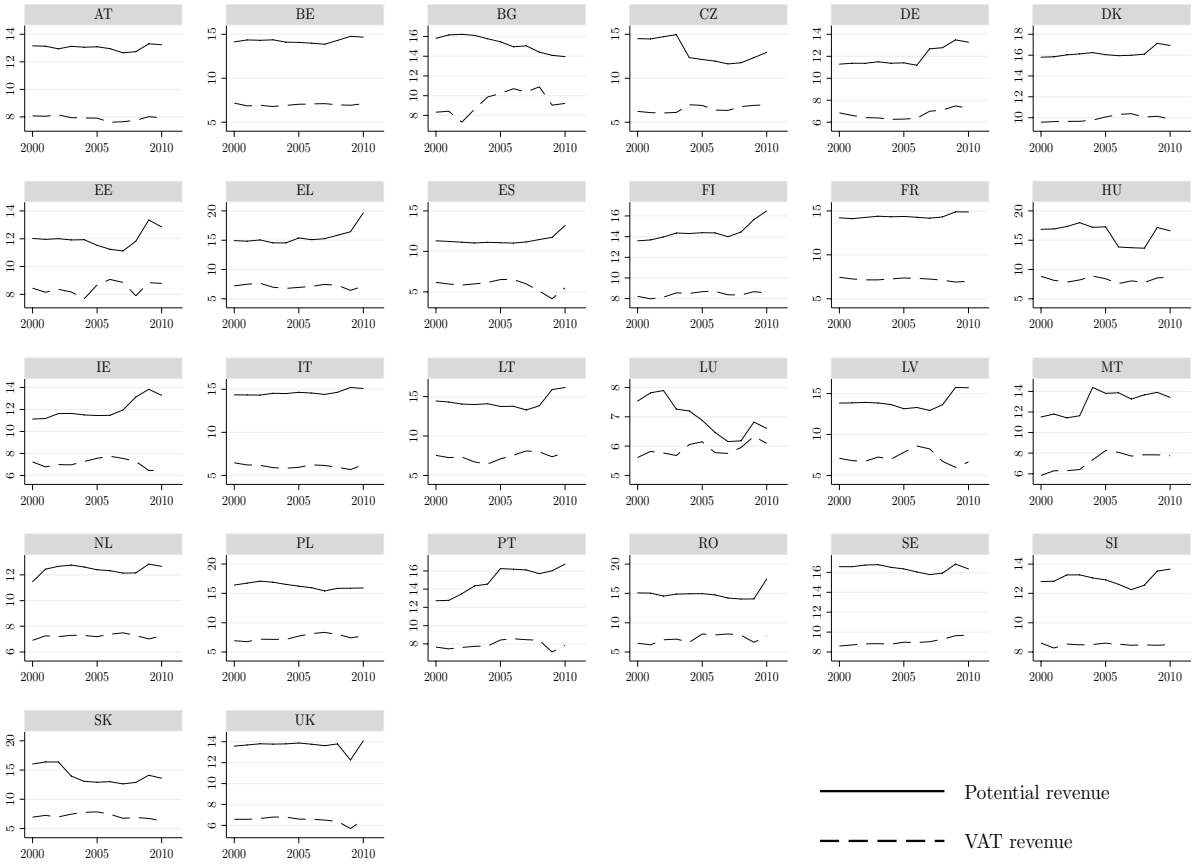
After 2008, however, VAT has consistently been utilised as a flexible fiscal policy tool, primarily with the goal of financing cuts in direct taxes and ensuring the stability of public finances during the crisis. In particular, the standard rate was raised by 2.12pp on average in fourteen Member States in the space of four years, whereas the average growth in reduced rates was 2.2pp in seven countries.[3] At the same time, a large number of base narrowing measures were introduced, mostly for equity reasons, but the positive budgetary impact of the rate increases far outweighed the effects of the base narrowing (Ferrario, 2011). Compared to their 2009 level,

[2]Some proposals even suggest replacing the income tax altogether. In the late 1990s, Professor Michael J. Graetz suggested a progressive broad-based VAT for all US households. People earning more than a stipulated threshold would be subject to an income tax on the income exceeding the threshold in addition to paying VAT (Schenk and Oldman, 2007).

[3]The upward trend in VAT was not uninterrupted for all countries. For example, the UK lowered its standard rate to 15% in 2009, and increased it to 20% in 2011. A reduction (0.5pp) followed by an increase (2pp) happened also in Ireland.

standard rates in the UK, Romania, and Greece are 5pp higher in 2012, which is not a painless jump in consumer prices. Hungary has the highest VAT in the EU as of 2012, 27%, which is 2pp greater than the rates in traditionally high-tax Denmark and Sweden. The policy of rising VAT rates in conjunction with base narrowing contradicts OECD's general recommendation on enhancing the efficiency of VAT through base expansion at a single rate, and minimal exemptions and reduced rates as prerequisites for economic growth and revenue maximisation (OECD, 2010).

Figure 4.1: POTENTIAL VS. ACTUAL COLLECTED VAT REVENUE, % GDP



Note: Potential revenue equals (Final consumption - VAT revenue)*Standard VAT rate.

Figure 4.1 compares actual VAT receipts to revenue from a potential tax base with full compliance, a single VAT rate, no exemptions, and no zero rating. The country, whose actual tax base is closest to its potential one is Luxembourg. The jumps in the standard VAT rates after 2007 are clearly reflected in the upward trend of potential revenue collections for almost all countries. In Greece, Spain, Ireland, Latvia and Portugal rising potential receipts are accompanied by collapsing actual revenues.

In contrast to VAT, the importance of the corporate income tax decreased markedly judging by its share in GDP in 2009 (Table 4.2). With the exception of Malta and Hungary, CIT rates

Table 4.1: VAT: TRENDS IN RATES AND REVENUE

		Value added tax rates			% GDP		% Total taxation	
		2000	2009	2012	2000	2009	2000	2009
Sweden	Standard	25	25	25	8.6	9.7	16.7	20.7
	Reduced	6/12	6/12	6/12				
Denmark	Standard	25	25	25	9.6	10.1	19.4	21
	Reduced							
Finland	Standard	22	22	23	8.2	8.8	17.4	20.3
	Reduced	8/17	8/17	9/13				
United Kingdom	Standard	17.5	15	20	6.6	5.8	17.9	16.6
	Reduced	5	5	5				
Netherlands	Standard	17.5	19	19	6.9	7	17.3	18.4
	Reduced	6	6	6				
Luxembourg	Standard	15	15	15	5.6	6.2	14.3	16.7
	Reduced	6/12	6/12	6/12				
Estonia	Standard	18	20	20	8.4	9.1	27.2	25.2
	Reduced	5	9	9				
France	Standard	19.6	19.6	19.6	7.3	6.8	16.6	16.3
	Reduced	5.5	5.5	5.5/7				
Portugal	Standard	17	20	23	7.7	7.1	24.6	23
	Reduced	5/12	5/12	6/13				
Belgium	Standard	21	21	21	7.2	7	15.9	16
	Reduced	6/12	6/12	6/12				
Ireland	Standard	21	21.5	23	7.3	6.4	23.1	22.7
	Reduced	12.5	13.5	9/13.5				
Slovenia	Standard	19	20	20	8.7	8.4	23.1	22.4
	Reduced	8	8.5	8.5				
Austria	Standard	20	20	20	8.1	8.1	18.8	18.9
	Reduced	10	10	10				
Spain	Standard	16	16	18	6.1	4.1	18	13.5
	Reduced	7	7	8				
Latvia	Standard	18	21	22	7	6	23.9	22.5
	Reduced		10	12				
Cyprus	Standard	10	15	15	5.8	9.1	19.3	26
	Reduced	5	5/8	5/8				
Germany	Standard	16	19	19	6.8	7.4	16.2	18.7
	Reduced	7	7	7				
Malta	Standard	15	18	18	6	7.8	21.4	22.9
	Reduced	5	5	5/7				
Lithuania	Standard	18	19	21	7.6	7.4	25.2	25.2
	Reduced	5	5/9	5/9				
Italy	Standard	20	20	21	6.5	5.7	15.6	13.2
	Reduced	10	10	10				
Slovakia	Standard	23	19	20	7	6.7	20.4	23.3
	Reduced	10	10	10				
Poland	Standard	22	22	23	6.9	7.4	21.3	23.4
	Reduced	7	7	5/8				
Hungary	Standard	25	25	27	8.7	8.4	22.3	21.3
	Reduced	12	5/18	5/18				
Czech Republic	Standard	22	19	20	6.5	7.1	19.1	20.7
	Reduced	5	9	14				
Greece	Standard	18	19	23	7.2	6.4	20.8	21.1
	Reduced	8	9	6.5/13				
Romania	Standard	19	19	24	6.5	6.7	21.4	24.8
	Reduced		5/9	5/9				
Bulgaria	Standard	20	20	20	8.3	9	26.4	31.2
	Reduced		7	9				

Source: European Commission (2011c); Taxation and Customs Union (2012). Super-reduced rates, i.e. rates below 5%, are not reported.

Table 4.2: PIT & CIT: TRENDS IN RATES AND REVENUE

	Top personal tax rates			Revenue %GDP		Corporate tax rates			Revenue %GDP	
	2000	2009	2011	2000	2009	2000	2009	2011	2000	2009
Sweden	51.5	56.4	56.4	18.1	16.4	28	26.3	26.3	3.8	3
Denmark	59.7	59	51.5	25.6	26.5	32	25	25	3.3	2.5
Finland	54	49.1	49.2	14.5	13.4	29	26	26	5.9	2
United Kingdom	40	40	50	10.8	10.4	30	28	27	3.5	2.8
Netherlands	60	52	52	6	8.6	35	25.5	25	4.3	2.1
Luxembourg	47.2	39	42.1	7.2	7.7	37.5	28.6	28.8	7	5.5
Estonia	26	21	21	6.8	5.7	26	21	21	0.9	1.8
France	59	45.8	46.7	8.4	7.5	37.8	34.4	34.4	2.8	1.3
Portugal	40	42	46.5	5.3	5.7	35.2	26.5	29	3.7	2.9
Belgium	60.6	53.7	53.7	13.3	12.2	40.2	34	34	3.2	2.5
Ireland	44	41	41	9.2	7.9	24	12.5	12.5	3.8	2.5
Slovenia	50	41	41	5.6	5.9	25	21	20	1.2	1.8
Austria	50	50	50	10.1	10	34	25	25	2.2	1.9
Spain	48	43	45	6.6	7	35	30	30	3.1	2.3
Latvia	25	23	25	5.6	5.4	25	15	15	1.6	1.6
Cyprus	40	30	30	3.6	3.9	29	10	10	6.2	6.5
Germany	53.8	47.5	47.5	10.2	9.7	51.6	29.8	29.8	1.7	0.7
Malta	35	35	35	5.6	6.3	35	35	35	2.9	6.7
Lithuania	33	15	15	7.7	4.1	24	20	15	0.7	1.8
Italy	45.9	44.9	45.6	11.5	11.7	41.3	31.4	31.4	2.4	2.4
Slovakia	42	19	19	3.4	2.4	29	19	19	2.6	2.5
Poland	40	32	32	4.4	4.6	30	19	19	2.4	2.3
Hungary	44	40	23	7.2	7.3	19.6	21.3	20.6	2.2	2.1
Czech Republic	32	15	15	4.6	3.6	31	20	19	3.5	3.6
Greece	45	40	45	5	5.1	40	25	20	4.1	2.4
Romania	40	16	16	3.5	3.5	25	16	16	3	2.6
Bulgaria	40	10	10	4	2.9	32.5	10	10	2.7	2.5

Source: European Commission (2011c). Currently Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, and Slovakia have a flat tax PIT.

have fallen substantially in the remaining EU countries, and so has revenue in the older Member States. The countries, which joined the EU in and after 2004, however, display a distinctly different pattern of CIT revenue, namely falling rates yield either stable, or rising CIT proceeds. With the exception of Portugal and Luxembourg, some Member States continued lowering the CIT throughout the 2009-2011 period. Narrowing changes in the tax base and new deductions were also implemented (Ferrario, 2011). Already six Member States collect CIT revenue below 2% of GDP, and in Germany, proceeds were 0.7% in 2009. These figures raise questions about the future of corporate taxation in the EU.

PIT reforms included mainly revisions in the tax scale, widening of the tax brackets, and an increase in new and current allowances, especially for lower-income households, who were most vulnerable to the effects of the crisis. Top rate hikes occurred in several countries with the aim of increasing the progressivity of the tax as shown in Table 4.2. The table also demonstrates

that PIT remained a stable source of revenue until 2009, with some sharp declines mainly in Central and Eastern European (CEE) countries that implemented a flat PIT and enacted major PIT rate cuts. Currently eight CEE and Baltic countries use a flat tax system, five of which have set the flat PIT rate equal to the CIT rate. The effect of the PIT reforms on revenue after 2009 remains to be seen.

Overall, increased VAT revenue during the crisis enhanced governments' fiscal manoeuvrability with respect to direct taxes. Reforms in direct taxation were in turn used to stimulate labour and business. Rises in VAT rates, however, which continue in 2012, may contribute to a further spread of fraudulent schemes, if more effective measures are not taken to combat VAT fraud that already is a major drain on the public purse. The trend of increasing rates makes the tax more conspicuous, and therefore evasion more valuable to traders and the public alike (Tait, 1988). VAT is likely to remain one of the most important sources of revenue in future, both in a stable and a turbulent economy. It is, therefore, imperative to limit VAT's exposure to organised fraud and fraud/evasion on a small scale, whose cumulative effect on receipts can be substantial.

4.3 Changing the Way VAT is Collected: Real-time Solutions

Several features of VAT's design, labelled the ABCs of VAT fraud by Richard Baldwin, make the tax susceptible to abuse by fraudsters, namely: a) Companies collect VAT on behalf of tax authorities, hence VAT passes through private hands; b) VAT is remitted through periodic returns, which means that there is a delay between the collection and the payment of the tax to the government; c) due to the destination principle, importers collect the full-value added of the imported goods.[4]

VAT fraud is predominantly technology-intensive, especially with regard to digital products such as CO_2 permits, VoIP services and all of the rapid funds transfers among fraudsters (Ainsworth, 2011a). Fraud in fictitious goods are a perfect fit with laptop technology. Compared to technology's speed of development and its use in the commitment of fraud, the EU VAT system has been slow to react and resistant to change, a fact acknowledged by the European Commission (2010) and especially emphasised by Williams (2009). There is a growing awareness that in order to fight VAT fraud effectively, technologically, tax administrations should be on a par with fraudsters. Given the technological means of perpetrating fraud, it would be difficult for initial policies addressing VAT's weak links to ignore the utilisation of technology or lag behind its advances. As an important side-effect, modernising VAT would reinforce its flexibility to two increasingly visible trends: the general shift towards indirect taxation and the move away from cash in favour of electronic payments.

Reforming VAT towards greater reliance on technology in general, and cashless payments in particular, is also in line with the objectives of SEPA as outlined in the Fourth Progress Report. Specifically, SEPA aims toward standardised common payment instruments, infrastructure, pro-

[4]Richard Baldwin, EU VAT fraud. Available at http://www.voxeu.org/index.php?q=node/256.

cedures and standards, which do not distinguish between national and cross-border payments within the Euro zone (European Central Bank, 2006). Such development would likely promote substantial economies of scale and is a logical next step in strengthening the Single Market. The introduction of the Euro in 2002 produced a single Euro payment area in cash. SEPA's goal is to extend this process to electronic payments.

Many of the schemes, systems, and products evolving under SEPA could facilitate, support and assist the transition of the VAT system, resulting in enhanced fraud prevention in both B2B and B2C transactions. Likewise, the timing of VAT reform within the roll out of SEPA is propitious and synergetic, as it may encourage public administrations to migrate faster towards the SEPA instruments. The ECB has repeatedly stressed the importance of public administrations' involvement for the success of SEPA (European Central Bank, 2006, 2010).

Not surprisingly, a growing number of proposals for combatting VAT fraud are based mainly on the role of financial intermediaries and technology, and generally target the very source of the incentive for VAT fraud – the method of collection. The rest of the chapter focuses on the PWC's proposed blocked VAT accounts and RTvat.[5] At the heart of these proposals lies the principle of split-payment also known as VAT withholding, which splits each (electronic) payment into a taxable amount that goes to the seller, and a VAT amount, transferred into blocked VAT accounts (PWC) or directly to the Treasury (RTvat). Since blocked VAT accounts can be seen as a subset of the RTvat proposal, they are analysed first.

4.3.1 Blocked VAT accounts

A blocked VAT account can be used for no other purpose but incoming and outgoing VAT payments as well as settlement of net VAT liabilities at the end of the reporting period. If the balance in the account is not enough to cover an outgoing payment, the payment should be processed through the firm's regular bank account. The mechanism is described in Figure 4.2. The blocked VAT account targets points a) and b) outlined above. First, VAT, at least on electronic transactions, is no longer remitted by firms, i.e. the tax never ends up in private bank accounts. Instead, the role of a VAT collector is delegated to the banking system/card companies, with their services being purely intermediary. There will of course be a fee for these intermediary services and it is not specified in any proposals which party will bear the cost of intermediation. Second, the tax is collected in real-time, although a delay in refunds remains under the PWC's proposal. Note that split-payment preserves the system of fractionated payments, but shifts the collection of the tax from the seller to the buyer, who effectively transfers the tax through a financial institution.

Any B2B bank/card transaction is already highly visible and easily subjected to scrutiny by the tax administration, which raises the question about the usefulness of VAT accounts. The

[5]Other technology-based proposals such as VAT locator number, digital VAT, and Mittler Model, reviewed in Ainsworth, (2011a,b) are outside the scope of the chapter. In addition to VAT accounts at various bank or automated clearing house levels, PWC envisage the creation of central VAT monitoring database, the certification of service providers, software or taxable persons as well as provide a cost-benefit analysis of the proposed alternatives.

fact that VAT is in a private bank account facilitates the establishment of an audit trail if fraud is suspected, but does not preclude missing trader and other types of frauds from happening. By taking away firms' access to VAT, a blocked account would prevent such fraud, simultaneously reducing the number of audits. VAT accounts will only be effective if they bring into the system companies that wish to remain outside the system. Thus, if VAT accounts are optional, they are likely to be inconsequential.[6] Yet, provided that blocked accounts have a mandatory character, issues emerge on what firms should be covered: only exporters, firms in risky sectors, or all VAT-registered traders.

An additional consequence of a blocked VAT account is that a record of each transaction will be available by a third party, in this case a bank. The higher the number of transactions executed through the financial intermediaries, the lower the reporting requirements of a firm, who will basically receive a pre-filled VAT return, amend it if necessary, and return it to the tax authorities.[7,8]

The importance of third-party reporting was studied by Kleven et al. (2011) for individual taxation in Denmark, where the Danish tax authorities receive most information reports regarding but not limited to personal income from third parties, and not from the taxpayer himself. In fact, almost 100% of salary and wage payments are accomplished via credit transfers. The taxpayer, however, has the option to adjust the pre-populated return. This type of return-free tax system is called tax agency reconciliation system (Denmark, Sweden) as opposed to an exact withholding system (the UK). The low levels of tax evasion in Denmark are explained accordingly with the efficient checks of third-party reporting. In other words, even if taxpayers are willing to cheat, they are unable to do so (Kleven et al., 2011). Besides the Scandinavian countries, currently Belgium, Estonia, France, the Netherlands, Portugal and Slovenia have partially or fully adopted pre-filled PIT returns.

The involvement of financial intermediaries is an attempt to move VAT closer to a return-free system through the increased use of electronic payment instruments and in fact, the elimination of voluntary compliance by firms subject to VAT withholding. Borselli (2011) notes that the Italian tax administration already has information transmitted by banks and financial intermediaries on a regular basis concerning the transactions of taxpayers who are under tax assessment.

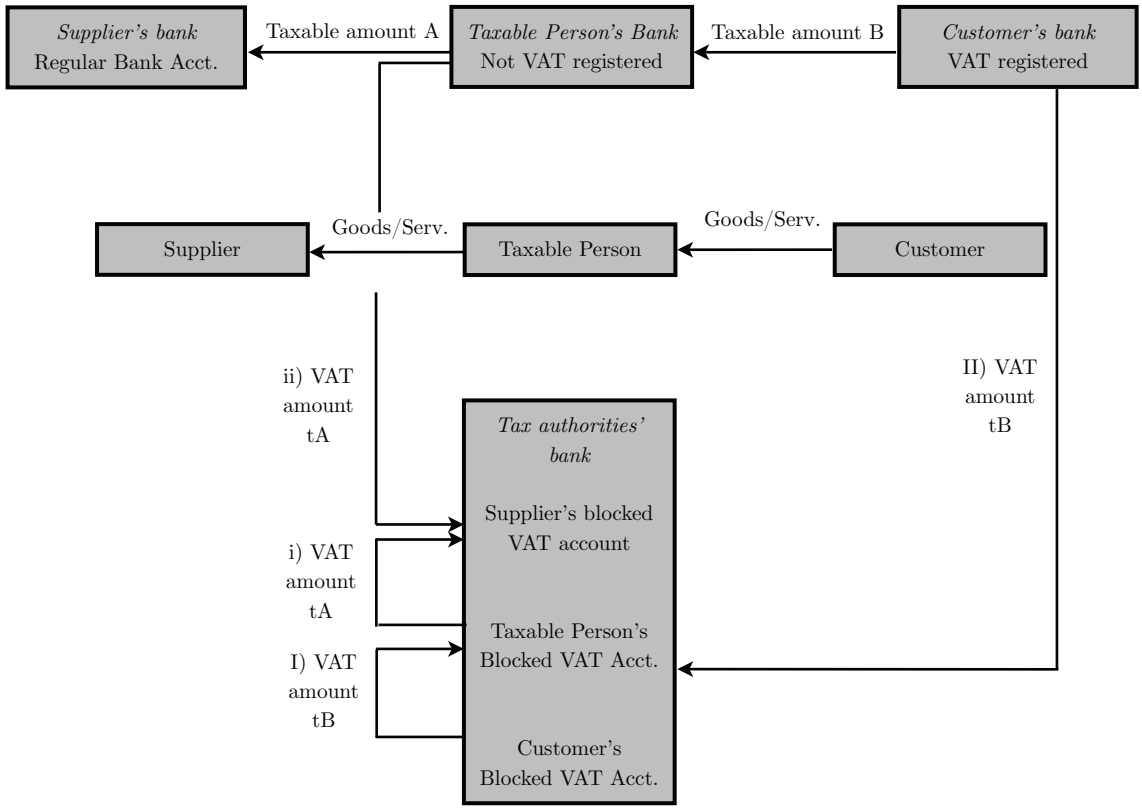
Ainsworth (2011b) points to the Latin American countries as the pioneers in VAT withholding. Currently Argentina, Brazil, Ecuador, Chile, Peru, Uruguay and Mexico have implemented

[6]VAT accounts will be most effective against MT fraud, but do not address evasion through under-reporting, non-registration, fictitious invoices, etc. VAT accounts are also not the only way to induce, and even force, traders to pass transactions through banks. Harrison and Krelove (2005) point out that many countries, including France, Hungary, Turkey, and Denmark, require that transactions above a stipulated amount should go through the banking system. In more extreme cases, Azerbaijan refuses VAT credit if purchases were done in cash.

[7]This is an oversimplification of the procedure, as the tax point, or equivalently the time of supply, can vary between the date the invoice is issued, the day of payment, or the day of the physical supply of goods. Gradual incorporation of B2C transactions into the split-payment system could make such pre-filled returns more likely.

[8]From January 2011, Section 6050W to Title 26 of the US Code requires that banks, third-party settlement organisations, and other organisations with contractual obligations in the settlement of payment cards send annual reports to the IRS regarding data on payments made to merchants via debit/credit cards and other electronic means. IRS can match this information with the sales reported on merchants' tax returns. A similar policy was enacted in Turkey in 2008 – VAT registered traders can check their monthly credit card sales online when preparing their VAT returns.

Figure 4.2: PRICEWATERHOUSECOOPERS PROPOSED SPLIT-PAYMENT MECHANISM WITH BLOCKED VAT ACCOUNTS



Supplier (S) sells goods/services to Taxable person (TP). TP's bank transfers the taxable amount A to S's regular bank account. The VAT amount, tA, is paid from TP's blocked VAT account into S's blocked VAT account (Scenario i) if enough funds are available, or from TP's regular bank account if there are insuffiicient funds in TP's blocked VAT account (Scenario ii). TP sells goods/ services to Customer (C). C's bank transfers the taxable amount B to TP's regular bank account. The VAT amount, tB, is paid from C's blocked VAT account into TP's blocked VAT account (Scenario I) if enough funds are available, or from C's regular bank account if there are insuffiicient funds in C's blocked VAT account (Scenario II). t is the VAT rate. For simplicity, steps involving the automated clearinghouse are omitted. Source: PriceWaterhouseCoopers (2010).

VAT withholding regimes, under which, if the buyer (business or final customer) chooses to pay via a bank or by card, the payment is automatically split into the taxable amount and the VAT component. The rate of VAT withholding is not always 100% and in Ecuador it varies between 30% to 100%, mainly to tackle cash flow issues.

In Europe, Bulgaria introduced obligatory VAT accounts in 2003 for VAT-registered traders. The motivation was the country's high estimated VAT gap ranging from 22% according to the World Bank (2003) to 45% of VAT revenue in a report of the 39th National Assembly referenced in Pashev (2007). Any VAT amount greater than €500 had to be paid to a supplier's VAT account. Before the introduction of the accounts, VAT credit had to be carried forward for the next three reporting periods and any refund was subject to an audit. Once the accounts were launched, however, a firm that paid at least 80% of the VAT on its transactions through the VAT accounts could obtain a refund within 45 days, irrespective of whether or not it was undergoing an audit (Pashev, 2007). Bulgaria abandoned the scheme in 2007. Given the revival of the discussion on VAT accounts in PriceWaterhouseCoopers (2010) and the EC's intention to further investigate the split-payment mechanism, it is important to understand why VAT accounts can under-perform as an anti-fraud device. Several points are worth elaborating on:

- As long as there are cash buyers at the end of a VAT chain, a blocked VAT account mitigates, but cannot eradicate the missing trader fraud.
- Businesses are unable to use the funds in the blocked accounts as working capital. Severe cash flow problems can arise for firms with thin profit margins, in times of economic crisis, etc.
- Compliance costs can be disproportionately greater for small and medium enterprises, and especially for micro enterprises.

The analysis that follows is equally valid for any general split-payment mechanism.

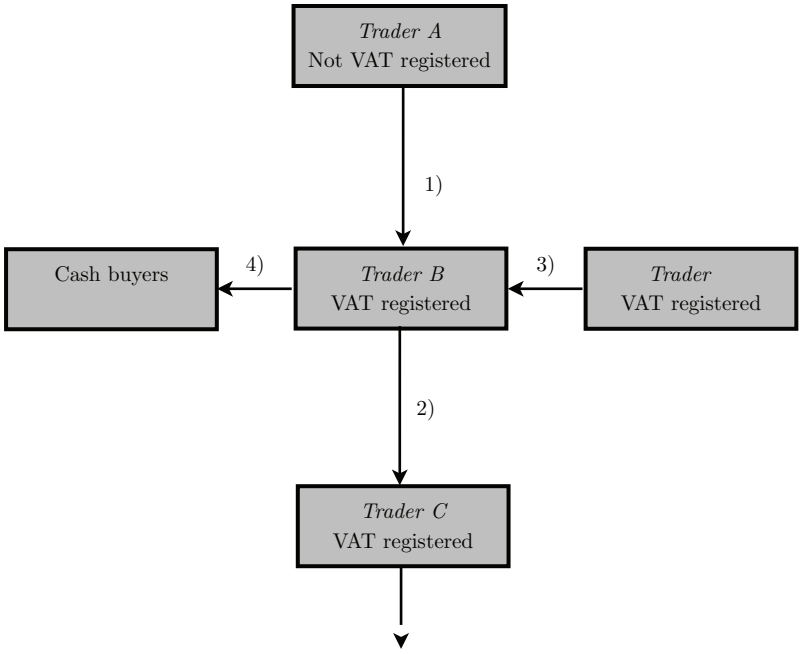
4.3.2 The problem with cash

Figure 4.3 shows a simple example borrowed from Pashev (2007) on how the VAT account system was manipulated in Bulgaria to syphon off VAT. Trader B will go missing, but before he does, he needs to acquire credit into his VAT account. First, he purchases goods from a non-VAT registered trader, in order to prevent outflow of VAT from his regular bank account. He adds value, and resells the goods to Trader C who transfers VAT into B's account. Using this credit, B can now purchase goods from D, which B will then sell to cash buyers, and disappear with the tax, having zero credit into his blocked VAT account. As Pashev (2007) points out, if Traders C and D are compliant, the evasion will be limited to the value added of B. Nevertheless, different variations are possible, with multiple colluding traders, which can result in significant losses to the treasury.

It is apparent, therefore, that as long as cash markets are easily accessible, VAT fraud cannot be precluded even if VAT accounts are introduced. According to Pashev (2007), numerous

compliant taxpayers filed legal cases against the tax administration for refund denial despite the taxpayers' diligent use of the VAT accounts. The speeding up of refunds and the weakening of the audit requirement, which were the intended benefits of VAT accounts to honest traders, backfired by accelerating the gains from fraud. The Bulgarian experience shows that audit and monitoring remain of prime importance even if firms' access to VAT is removed. Thus, unless a sophisticated fraud-analysing function is implemented, the efficacy of a split-payment arrangement would be undermined. A concerted effort to discourage the use of cash in the economy is also called for.

Figure 4.3: EXAMPLE OF CHEATING WITH BLOCKED VAT ACCOUNTS



1) Trader B purchases goods X worth €10,000 from non-registered trader A. Trader B adds value of €1,000.

2) Trader B sells goods X to VAT-registered trader C for €11,000, charging additionally €2,200 in VAT, assuming a VAT rate of 20%. Trader C deposits €2,200 into trader B's VAT account. Trader C can subsequently sell goods X, collecting €2,200 in VAT, which he keeps as he is entitled to an equivalent refund.

3) Trader B purchases goods Y worth €11,000 from trader C. Trader B deposits €2,200 of VAT into trader C's VAT account.

4) Trader B sells goods Y for €12,000 to cash buyers, collects €2,400 in VAT, and disappears.

Source: Pashev (2007)

4.3.3 The problem with cash flow

In the current system VAT payment is based on invoices issued instead of actual cash received for businesses reporting on an accrual basis. This means that if a customer does not pay a supplier before the day the VAT return is due, the supplier is stranded with a VAT bill, although he has not been paid yet (if at all) for the transaction in question. In other words, the business is experiencing negative float. To alleviate this problem, the UK, for example, offers a Cash Accounting Scheme, under which eligible companies pay VAT only on cash received and vice versa – VAT can be claimed only if the firm has paid its suppliers. Despite the availability of alternative payment methods, Blackburn et al. (2005) report that in the UK 82.9% of businesses adhere to the conventional quarterly invoice-based VAT payment. This figure is sourced from a

business survey of more than 750 enterprises performed by HM Revenue & Customs (HMRC) in 2005. The UK VAT rate in 2005 was 17.5% and for 17.8% of the surveyed companies the timing of VAT payment presented a "critical" or "major" cash flow issue, primarily due to unpredicted fluctuations in sales, late payment by customers, and the general performance of the business (Blackburn et al., 2005).

The growing reliance on indirect taxation, which generally translates into higher VAT rates, will likely exacerbate cash flow problems. A survey of 295 SMEs by the British bank Aldermore found that the 2.5pp increase in the UK VAT rate in 2011 put a heavy strain on the cash flow of 35% of the surveyed firms.[9] When faced with cash flow difficulties, the majority of firms (59.1%) resort to bank overdraft, while 39.2% can delay payment to suppliers as documented by Blackburn et al. (2005). Bank funding during a recession, however, is hard to procure, and a long hold up of payments can worsen an already unstable cash flow.

The mechanism of split-payment, with or without a VAT account, introduces an additional problem to the ones described above. In particular, 100% VAT withholding will effectively freeze VAT on sales in suppliers' VAT accounts, which can be problematic for firms realising a cash benefit. The credit can still be used for paying VAT on purchases, but cannot be used as a working capital. Ainsworth (2011b), for instance, notes that VAT withholding generated critical cash flow problems in Cameroon, which resulted in the abolishment of the regime in 2010. PriceWaterhouseCoopers (2010) do point out that a company with long days' sales outstanding (DSO), who collect VAT on sales *after* they have passed it to the tax authorities, would be indifferent between the current VAT system and VAT accounts. While this is true for industries like construction, media and manufacturing, with an average DSO of about 70 days, for retail, logistics, and real estate with a DSO of 15 days on average, the loss of working capital can be palpable (Rebel and Kester, 2011). A non-trivial 38% of SMEs in the EU are concentrated within the distributive trades, real estate and transportation and storage, employing about 30 million people (Eurostat, 2011).

4.3.4 Compliance costs

A VAT account, or any other split-payment mechanism, unavoidably yields additional transaction costs in the form of payment orders, account-keeping fees, transaction fees, etc. Compliance costs could be of small significance to big companies, who already conduct business through electronic banking and have sophisticated computerised accounting systems. Provided that refunds are sped up through a VAT account, big companies are unlikely to oppose such an arrangement. Administrative costs can be disproportionately burdensome for SMEs, however, imposing major re-adjustments in their payment practices. Harrison and Krelove (2005) single out the cost on SMEs as one of VAT accounts' main disadvantages. The overwhelming majority of enterprises in the EU are SMEs (99.8%) responsible for two out of every three jobs, and 58.6% of value-added in the non-financial sector (Eurostat, 2011). A split-payment system therefore, runs the risk of

[9]Summary of the findings of the survey is available at http://www.aldermore.co.uk/about/news-press-releases/2011/01/vat-rise/.

collecting more revenue at the expense of small business.

If transactions generating VAT amounts below a stipulated threshold are excluded from the VAT account scheme, an incentive arises to break up transactions into smaller ones in order to avoid both administrative costs and the blocking of capital in the account. Conversely, presuming that costs cannot easily be passed down to the consumer, they can be minimised by the consolidation of transactions. Such consolidation could lead to distortions in competition as big purchases would be more convenient from a single supplier, instead of several (Conrad, 2006).

4.3.5 Steps towards an optimal split-payment system

In the context of the obstacles to changing VAT's collection method, several policy recommendations emerge. First, for the viability of a split-payment system to be maintained, the general trend towards cashless transactions should be promoted. By design, cash transactions remain beyond the reach of any split-payment mechanism. Humphrey et. al. (2004) observe that with legal demand for cash falling, government provision of cash will increasingly be utilised for the payment of illegal activities such as tax evasion, money laundering, and drugs. Simultaneously, the use of cashless payment systems is growing, clearly demonstrated by the quick pace with which debit cards replace cash in the majority of Member States, and especially in the Scandinavian countries. Nevertheless, according to Amromin and Chakravorti (2007), the aggregate demand for cash has not decreased substantially, in spite of the growing adoption of non-cash payment instruments. In addition to being a store of value and medium of payment, cash has one prominent advantage: it is anonymous.

Figure 4.4 depicts the growth rates of the value of transactions of all cards issued in the EU countries, the value of ATM cash withdrawals as well as the Over-the-counter (OTC) withdrawals, all scaled by GDP.[10] Both cards and ATM cash grew significantly, albeit at a decreasing rate. From 2005 onwards, the growth rate of cash was modest and turned negative in 2010. Even though ATM distributions of cash were increasing, throughout the same period, OTC withdrawals declined steadily, highlighting the fact that as debit/credit cards became widespread payment instruments, bank branches were replaced by ATMs as the primary source of cash to the public, with the overall demand for cash remaining stable.

In Figure 4.5, the EU countries are plotted in order of increasing estimated VAT gaps for 2009. The graph also shows the value of card transactions as a percent of GDP for the same year. In general, the higher the penetration of electronic payments, the smaller the VAT gap. A notable exception is the UK with a large estimated VAT gap regardless of substantial card popularity. Yet, any conclusion about a correlation between the VAT gap and the prevalent types of payment would be premature, as many country-specific factors should first be accounted for, herein tax morale and the efficiency of the tax administration. Furthermore, the estimates of the VAT gap, which is defined as the difference between theoretical and actual VAT receipts,

[10]Data for OTC withdrawals is available for limited set of EU countries, namely the Czech Republic, Germany, Spain, Finland, the UK, Hungary, Italy, Latvia, the Netherlands, Romania, and Slovakia, and for some of these countries, only for a single year.

divided by theoretical revenue, should be viewed with extreme caution, given Reckon LLP's methodology and the imposed assumptions.

Complementing the rise in electronic transactions is the launch of SEPA's credit transfer and direct debit in January 2008 and November 2009, respectively. Common European card schemes compliant with SEPA are also underway, principally targeting retail payments. Development of online or internet payment (e-payment) and mobile payment (m-payment) services are on SEPA's agenda as well (European Central Bank, 2010).

Mobile payment platforms such as Barclays' Pingit and Singapore's Swiff already offer payments between individuals, merchants and banks through mobile devices such as smart phones and tablets. In fact, m-payments are one of the fastest growing markets. Juniper Research forecasts that m-payments for digital and physical goods, mobile money transfers and Near Field Communication transactions will jump from $240 billion in 2011 to $670 billion in 2015, while the number of mobile money users will double by 2013.[11]

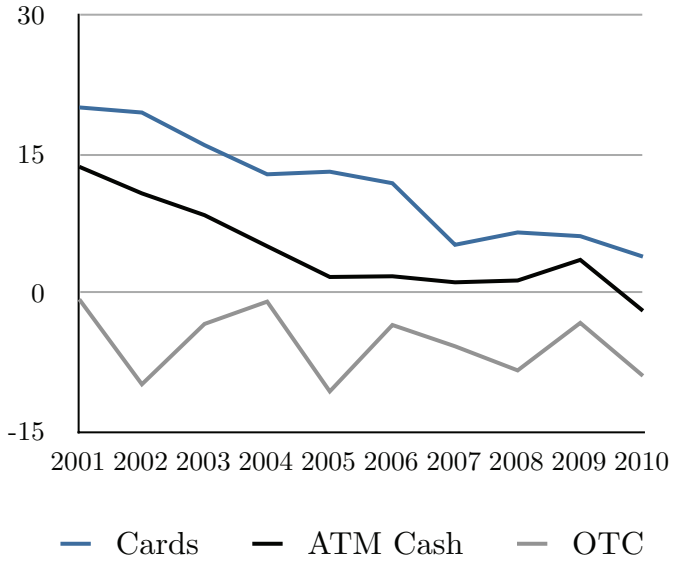
Another major development is the adoption of ISO 20022 by a growing number of institutions. ISO 20022 is a message standard, whose primary syntax is XML, used by the financial industry in the exchange of data. According to SWIFT (2010), ISO 20022 serves as an "unification tool" across the various standards currently used in the industry. Not only do part of the financial community migrate to ISO 20022, but those for whom migration costs are prohibitive, can have their message standard mapped into ISO 20022 by middleware. This enables the seamless interoperability of various standards, which is essential for cross-border transactions, among many others (SWIFT, 2010).

Second, a system whose goal is to collect VAT at real-time should strive to refund VAT in real-time as well in order to avoid the cash flow issues mentioned above. With an automated VAT collection, speedy refunds are likely, but hinge entirely on the efficiency of a central auditing function that can flag suspicious transactions, trigger audits, and most importantly, prevent fraudulent refunds. Such function is envisaged under RTvat and is discussed below. As an intermediate step, it is worthwhile considering Pakistan's categorisation of taxpayers as "gold" for refund claimants with minimal revenue risk, "silver" for claimants with moderate risk, and "others," described and recommended as a sound practice by Harrison and Krelove (2005). Gold claimants receive refunds within 3-5 days, silver–within 15 days, while regular claimants are subject to the statutory deadlines. Since split-payment can impose a considerable burden on compliant traders, expediting refunds, or equivalently minimising the interference of the VAT system on cash flow, will make the mechanism more appealing.

Third, transaction costs on electronic payments constitute a significant concern for SMEs, and especially micro-enterprises, and need to be addressed. With the launch of SEPA, domestic payment infrastructures will eventually be replaced by a single pan-European system. It is argued that the integration can culminate in significant economies of scale and scope, leading to pronounced reductions in payment costs. Bolt and Chakravorti (2010) give TARGET-2 as an example of an interbank single shared platform, which, by consolidating 15 national gross

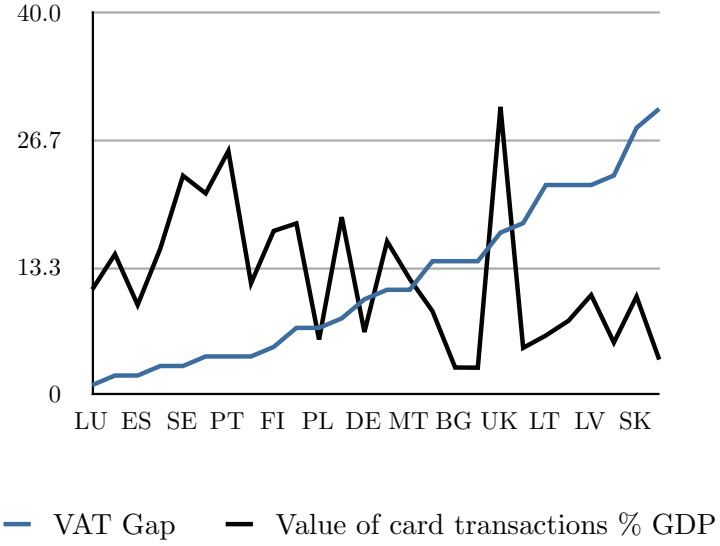
[11] http://juniperresearch.com/viewpressrelease.php?pr=250

Figure 4.4: GROWTH RATES OF VALUE OF CARD TRANSACTIONS, ATM AND OTC WITHDRAWALS AS A % OF GDP



Source: ECB Statistical Data Warehouse

Figure 4.5: VAT GAP AND VALUE OF CARD TRANSACTIONS AS % GDP, 2009



Source: ECB and Reckon LLP (2009)

real-time settlement systems, generated a considerable fall in the average fee per transaction. Estimating scale economies for point of sale and bill payments in Norway, Belgium and the Netherlands, Bolt and Humphrey (2007) find that the elasticity of operating costs with respect to payment volume ranges between 0.25-0.30. This means that a 1% increase in volume increases costs by 0.25-0.30%.

The authors observe that with time, expansions in debit card volume will naturally lower the average cost of debit card use to that of cash. Alternatively and preferably, consolidation of card processing centres in the EU can achieve even larger scale benefits of about 33% lower processing costs based on the authors estimates of the cost elasticity (Bolt and Humphrey, 2007).

In the Green Paper on an integrated European market for card, internet and mobile payments, however, European Commission (2012) notes that despite the rising volume of card payments and the generated large scale effects, no considerable fall in consumer costs, interbank, or merchant fees has occurred over the last decade. The Commission criticises multilateral inter-change fees for hampering competition, leading to market fragmentation, and lacking transparency. The opaqueness of the cost of payment services results in consumer choices of payment instruments based solely on consumer fees, which may or may not be the optimal payment method for merchants, given the merchant service charges (MSC). Since merchants typically pass their transaction costs on to consumers, the lack of information on MSC means that consumers make suboptimal choices (European Commission, 2012).

Transaction fees play a central role in determining the pace with which cashless payments are adopted. Given the compliance costs they would impose on business if VAT is collected through split-payment, the amount of charges and their potential to decline with volume would be crucial when assessing the pros and cons of VAT withholding.[12]

4.3.6 RTvat

The proposal for VAT reform most consistent with the objectives outlined above is real-time VAT, or RTvat, put forward by Chris Williams, a chairman of the RTvat Executive Committee. In the literature, RTvat has been discussed by (Ainsworth, 2011a,b). RTvat is envisioned as a real-time system based on already existing card payment platforms. It will operate through a network of interconnected server farms in all 27 Member States, whose role would be to pass payments through an automated clearing house, charge an interchange fee, split the payment into taxable amount and VAT due on the transaction, and subsequently distribute the funds

[12]Learning from countries with extensive experience in the use of debit cards can also be beneficial. Denmark's Dankort, introduced in 1983 in a joint venture by the Danish banks, is widely used in Denmark and is one of the cheapest cards in the EU. Card holders pay no fees for face-to-face transactions, and neither did businesses until 2005 (Konkurrencestyrelsen, 2010). After 2005, firms paid a subscription fee to the issuer, covering 25% of the card maintenance costs. After 2009, the subscription fees, based on number of transactions, amounted to 50% of the costs. Despite a 61% increase in businesses' Dankort costs between 2009 and 2010, the card still remains cheap relative to most debit cards in Europe. There are 4.2 million cards in Denmark for 3.9 million Danes over the age of 18. 41% of all transactions in the bricks and mortar trade were done with Dankort (Konkurrencestyrelsen, 2010). Dankort transactions amounted to 14.3% of GDP, or close to 30% of private consumption in 2007. According to Amromin and Chakravorti (2007), the critical step leading to an explosive growth in debit cards use is the adoption of card terminals by merchants. The Danish case shows that charging no fees for merchants for years on end, embedded the card in the market.

to the relevant financial institutions and tax authorities (Williams, 2009). Williams further recommends the introduction of a B2B debit card connected to both the firm's VAT identity and business bank account.

Under RTvat, blocked VAT accounts are unnecessary as the VAT amount will be transferred directly to the tax authorities. All the information required to make a real-time decision regarding the validity of a refund claim should be available to the tax administrators, enabling quicker refunds, and for traders with solid compliance history, refund automation.

RTvat would be fully operational under both the origin and destination principles for cross-border transactions. Under the origin principle, a seller in country A applies country A's VAT rate for a sale to a customer in country B. Once the customer's bank authorises the payment, the RTvat servers split the payment into the value of the supply, sent to the seller's bank account, and the VAT amount, x, sent to country A's tax authorities. Country A's tax authorities are then informed of a VAT return due in the amount of x, which is remitted to the server network. At this point a fraud function becomes activated, and if no red flags are raised, x is returned to the buyer's bank account by Country B's tax authorities (Ainsworth, 2011b). Under the destination principle, the redundant step of moving the VAT amount across two countries is removed. VAT is charged at country B's rate and the refund process takes place only in country B.

In a Communication addressing the outcome of the public debate on VAT, the EC stated that "...the Commission has come to the conclusion that there are no longer any valid reasons for this objective [the origin system], and will propose that it should be abandoned" (European Commission, 2011a). This statement strongly suggests that intra-EU transactions will continue to be conducted under the destination principle.

4.3.7 IT-audits and privacy implications

A central feature of RTvat is the Tax Authority Settlement System (TASS), that would settle VAT liabilities, and would also provide state-of-the-art real-time fraud analysis. According to Williams (2011), in a two-tier process, the fraud tool would compare the financial performance of the parties involved in a transaction, as well as compare the companies to a similar pool of firms based on size, type of business, location and other characteristics. TASS would be built on technology used by credit card companies.[13]

[13]Fraud analysis systems are already being put in place in countries with serious VAT compliance issues. An example is China, which launched a Golden Tax Project at the time it adopted the VAT system. The objective of the Project is to "...construct a centralised invoice clearing system that will permit the ... tax authorities to detect and reject fake invoices in real time, and to quickly and accurately identify the culprits issuing them" (Winn and Zhang, 2010). The Chinese system is not based on real-time collection, but e-invoicing and massive cross-checking. Whenever an electronic invoice is issued, a numerical cipher is generated, based on the information in the invoice, issue date, etc. When traders submit their invoices for the periodic VAT return, the information in the cipher is decrypted, and matched to the unencrypted data. To claim credit, general VAT traders must go through this certification process for every VAT special invoice they have paid (Winn and Zhang, 2010). VAT special invoices show the purchase price and the VAT amount separately, and can be used to claim VAT. In contrast, General VAT invoices, listing the full amount, price plus VAT, cannot be used for refund purposes. Although the authors describe the procedure as "draconian", the number of phoney invoices has decreased. However, Harrison and Krelove (2005) observe that neither the cost of administering this large-scale cross-checking of invoices, nor the

TASS was criticised by Ainsworth (2011a) on the grounds of the security of the firm-level confidential data it contains, specifically how this information would be protected against hacking attacks, but also how its authenticity would be verified once it is submitted to the system. This is valid criticism. In fact, if the EU decides to adopt a split-payment mechanism as a part of a real-time VAT collection, such a move would require massive interdisciplinary collaborative effort, shifting the debate towards the security and stability of the VAT server network, its fault-tolerance and non-availability fall back.

There are also the questions of the acceptable degree of invasiveness of the tax administration's access to business information, the optimal amount of interchange fees, and crucially, the financing of the system. In particular, it is unclear what type of information would be required for TASS to perform effectively. Likewise, under PWC's blocked VAT accounts, "enriched" data regarding the VAT treatment of the transaction is needed for payment requests. RTvat's method of accessing company information, which would be used for real-time auditing, is not specified.

On the whole, it would be difficult, if not impossible to separate audit-relevant data from sensitive personal information like personnel data or private correspondence. In this respect, TASS may be inconsistent with Article 8 of the European Convention on Human Rights as well as Article 6 of Directive 95/46/EC on the protection of individuals with regard to the processing of personal data. Such was the case, for example, with the Danish Ministry of Taxation's (DMT) proposal for the amendment of the Danish Tax Control Act in 2010 regarding the tax administration's access to firm data for purposes of tax control. A further discussion of the Danish bill is worthwhile, given its parallels with TASS.

As part of a move towards the digitisation of communication between the public and the private sector, DMT proposed that the Danish tax authorities should have the possibility to undertake data mirroring of firms' electronic devices in order to retrieve audit-relevant data without a court order (Skatteministeriet J. 2010-711-0044, 2010).[14] By electronic devices it is understood not only hard disks, CD-ROM, and USB keys, but also electronic programs and programme systems. According to the proposal, data mirroring can alleviate administrative burdens in terms of printing costs of the required accounting documentation as well as limit the duration of inspections on the premises of audited companies, and is therefore, a "logical" and "natural" response of the tax authorities to the developments in companies' use of information technology. The trade-off between infringement of privacy and efficient tax collection is clearly demonstrated in the DMT's assessment that "...restricting the scope of Article 6 of the Data Protection Directive would be necessary and proportionate relative to the potential loss of tax revenue and the crucial significance of accounting data for an effective tax control (authors' translation)" (Skatteministeriet J. 2010-711-0044, 2010).[15] The extent to which tax administrations have the discretionary power to determine whether a piece of information is audit-relevant or not is also uncertain.

compliance burden on taxpayers is known.

[14] Data mirroring is the creation of identical electronic copies of digital content in real-time.

[15] "Det er dog Skatteministeriets vurdering, at en begrænsning af rækkevidden i persondatadirektivets artikel 6 vil være nødvendig og forholdsmæssig i betragtning af det potentielle tab af skatteindtægter og regnskabsoplysningernes afgørende betydning for en effectiv skattekontrol."

The controversial issue of the acceptable degree of data provision aside, it is uncertain how confidential firm information would be safeguarded, whether in storage or while being transmitted across networks. Enterprises typically have a data security policy in place as well as data loss prevention solutions for confidential information such as customers, transactions, partners, etc. If such type of data is collected by the TASS, then the level of protection provided by the tax authorities should be at least commensurate with that of the enterprise-specific security policies, which can be a tough requirement to fulfil.

Another problem is how RTvat is going to handle electronic payments, which are not executed through a card or a bank. According to a survey on the future of money conducted by Pew Internet and Elon University, 65 out of the 100 technology experts participating in the survey agreed with the statement that "By 2020, most people would have embraced and fully adopted the use of smart-device swiping for purchases they make, nearly eliminating the need for cash or credit cards" (Smith et al., 2012). Yet, according to European Commission (2012), mobile phone manufacturers, payment service providers, and mobile network operators have still not developed interoperable payment solutions. Will RTvat be able to cover the whole spectrum of payment methods or be adaptable to emerging innovations? If not, VAT fraud can easily migrate to systems, which do not split payments.

Generally, all challenges arising out of the economy's progression towards cashless payment systems apply equally to RTvat, namely issues of data privacy and protection, as well as anonymity. These are topics of very serious concern to the majority of EU citizens as demonstrated by a large Eurobarometer survey in 2012 of the attitudes on data protection and electronic identity (European Commission, 2011b). Table 4.3 presents a selection of the questions covered by the survey. On average, 70% of the interviewees considered financial information such as salary, bank details and credit record to be personal. 54% were concerned that their payment card behaviour was recorded, while for mobile phones this percentage is slightly lower – 49%. Every third respondent out of ten resorts to transactions in cash as a strategy not to disclose his or her identity. 44% of all interviewed in Poland, 40% in Austria, and 39% in Hungary prefer the anonymity of cash to reported transactions, whereas in the Netherlands, Finland, and Denmark this method of identity protection is used only by 15%, 17% and 18%, respectively.

While cash would likely remain the preferred method of payment for illegal transactions, the survey unambiguously shows that cash is also used by some consumers as an alternative to a system they consider unsafe, either due to privacy concerns, or as a way to overcome risks inherent in cashless payments such as susceptibility to fraud.

Even though the RTvat's proposal for VAT is a logical outcome of the digitalisation of payments as well as the level of VAT fraud in the EU, it is unlikely that it is going to be compatible with EU privacy laws, especially in light of the 2012 proposal for reform of the EU's legal framework for the protection of personal data. Yet, the alternative is a patchwork of enforcement measures, mainly on a national level, leading to divergence instead of harmonisation of the VAT systems within the EU.

One of the risks of an uncoordinated anti-fraud strategy, especially in regard to external

Table 4.3: EUROBAROMETER SURVEY OF ATTITUDES ON DATA PROTECTION AND ELECTRONIC IDENTITY 2012, %

	Financial Information[a]	Concerned about payment card behaviour recorded[b]	Concerned about mobile phone behaviour recorded[c]	Use cash instead of recorded transactions[d]	Victim of fraud[e,f]
Sweden	82	37	28	21	42
Denmark	91	36	40	18	37
Finland	88	35	31	17	39
United Kingdom	87	54	48	29	49
Netherlands	90	43	44	15	26
Luxembourg	90	51	56	29	33
Estonia	79	35	36	29	45
France	81	64	55	18	47
Portugal	64	51	47	28	56
Belgium	81	56	51	23	28
Ireland	89	63	56	34	36
Slovenia	88	51	42	34	44
Austria	73	49	44	40	30
Spain	75	53	50	32	52
Latvia	79	49	41	38	48
Cyprus	70	45	49	35	38
Germany	87	62	55	37	41
Malta	83	35	39	27	33
Lithuania	70	34	37	33	45
Italy	70	58	53	26	26
Slovakia	82	54	46	34	29
Poland	44	42	45	44	53
Hungary	65	51	47	39	32
Czech Republic	82	64	63	34	40
Greece	64	67	65	34	42
Romania	46	30	31	28	25
Bulgaria	55	32	38	33	39
EU-27	75	54	49	30	41

Source: European Commission (2011b). The base of Eurobarometer 359 survey is 26,574 EU citizens.
[a] Which of the following types of information and data that are related to you do you consider as personal?
[b] Nowadays, cameras, cards, and websites record your behaviour, for a range of reasons. Are you very concerned, fairly concerned, not very concerned, or not at all concerned about your behaviour being recorded? Via payment cards (location and spending)
[c] Nowadays, cameras, cards, and websites record your behaviour, for a range of reasons. Are you very concerned, fairly concerned, not very concerned, or not at all concerned about your behaviour being recorded? Via mobile phone/ mobile Internet (call content, geo-location)
[d] In your daily life what do you do to protect your identity?
[e] I will read out a risk of potential risks. According to you, what are the most important risks connected with disclosure?
[f] The base is 40% of the whole sample

EU trade, is that dishonest importers will "shop" for the countries with least efficient tax administrations and anti-fraud policies. A case in point is Italy, whose imports of clothes from China decreased when the country's Customs Agency was empowered to adjust suspiciously low import value on the basis of market prices, transportation costs, and other general information (Borselli, 2011). As a result, Borselli (2011) reports, the average import prices for goods from China more than doubled from 2005 to 2010. In contrast, China's clothing imports with the rest of the EU doubled, while prices grew at a much slower pace than that in Italy. This example illustrates that unless a common approach is adopted at EU level, there are means to circumvent any anti-under-invoicing policy by simply redirecting trade, thus sabotaging genuine effort to combat fraud.

4.4 Conclusion

Over the last decade, major developments in technology have enabled VAT fraud on an unprecedented scale. Technology-oriented reforms of the VAT system are not only appealing due to their efficiency and revenue-maximising potential, but also because of the natural progression of the economy towards cashless transactions. Generally, there are two broad ways to approach the reform: Keeping voluntary compliance as a corner stone of the tax system with stringent and modern enforcement measures in place, or eliminating voluntary compliance in a return-free system, in which traders do not have a choice but to comply. As discussed above, the latter option would likely require a legally controversial disclosure of information and raises serious privacy concerns.

While it is distinctly possible that removing traders access to VAT would prevent the large majority of attempted frauds, VAT returns, and overall the main issues related to VAT, would be a matter of unilateral decision-making and processing by a single authority: tax administrations. This would render VAT less transparent for firms and would entail a great deal of trust in the tax authorities. The extent to which VAT fraud can be contained without excessive enforcement costs on compliant firms under the current method of VAT collection may be the deciding factor for the direction and scope of VAT reform.

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Appendix 4.1: VAT features in brief

VAT, as currently levied in the EU, is a general indirect tax on consumption. It is a non-cumulative multi-stage tax, with the value added calculated using the tax credit method. Under this method, liability is obtained by subtracting VAT on a firm's purchases from VAT due on its sales.[16]

Since firms can deduct VAT on investments in capital assets, even though they are the final consumers of the capital, the tax base of VAT is aggregate consumption (Department of the Treasury, 1984). If capital goods' VAT were not deductible (gross product VAT), or only the depreciation on the capital goods were deductible (income type VAT), then the tax would discriminate in favour of labour-intensive firms to the detriment of capital-intensive businesses. A consumption-type VAT, however, is neutral with respect to the factors of production. Furthermore, unlike a cascading tax, defined as a tax imposed at every stage inclusive of previously paid tax, VAT is neutral to management control. In other words, the incentive to reduce the tax incidence through horizontal or vertical integration, which in effect shorten the tax chain, is eliminated under VAT.[17]

Some of VAT's most praised features are its "self-administering" and "self-policing" qualities (Directorate General for Research, 1995). The statutory incidence of the tax lies with firms, as they are the collectors and payers of VAT to the tax authorities. Moreover, at least in theory, the tax credit method ensures that firms act as efficient collecting agents. This is so, because a firm has an incentive to report its purchases in full, its purchases are other firms' sales, and hence the self-checking aspect of VAT.[18] The economic incidence falls on final consumers, i.e. the tax is shifted to consumers through higher prices. The fractionated system of payment secures a portion of the tax due by the final consumer in stages.

VAT is an excellent source of revenue given its general character. Ideally, it would not distinguish between goods and services when these are intended for personal consumption. This is all the more necessary, since some services are close substitutes for goods. Taxation at one uniform rate, therefore, would leave the relative prices of goods and services unchanged, thus not distorting consumers' choices.

[16] Tait (1988), Terra and Kajus (2011) (Chapters 7 and 8) and Department of the Treasury (1984) (Chapters 2 and 3) among others offer a comprehensive analysis of the legal and economic aspects of VAT.

[17] Possibly the strongest impetus behind the adoption of VAT in Europe was the impossibility to guarantee the legal neutrality of a cascading tax. To ensure legal neutrality, the amount of tax payable under a turnover tax should be certain (i.e. expressed as a percent of the retail price) and equal for identical products, a condition which a cascading tax could not meet (Terra and Kajus, 2011).

[18] In practice, the self-checking mechanism is described as "illusory"' or plainly not working. See Keen and Smith (2006) and Tait (1988), page 304.

In reality, there are numerous reduced and super-reduced VAT rates in the EU, applying especially to education, medical products, housing, certain services provided by public authorities, social services, and others (Taxation and Customs Union, 2012).[19] Compared to Australia, Canada, New Zealand, Korea and Singapore that have a low single standard VAT rate levied on a broad base, the EU's VAT base is narrow with numerous zero and reduced rates (Owens et. al, 2011). Rate differentiation not only increases the administrative complexity of VAT and the scope for fraud, but also generates non-neutrality in its design. Nevertheless, reduced rates remain common in the EU, serving mainly as instruments of alleviating VAT's regressivity, as well as inducing certain consumption patterns.[20]

In the current VAT system, intra-EU and domestic transactions are not treated under the same VAT rules. In particular, exports are zero-rated in the country of origin, with the exporter receiving a refund of the VAT paid on his inputs. In this way the goods enter the country of destination free of tax, subsequently being taxed at the local rates. This "de-tax-and-re-tax" system is called a destination principle, and its purpose is to ensure that an imported good bears the same tax burden when sold to consumers in a given country as any other domestically produced good.

[19] According to the EU VAT Directive, Member States can have a standard rate not lower than 15%, and two reduced rates of at least 5%. Denmark is the only EU country that currently does not have a reduced VAT rate.

[20] VAT is a regressive tax, because the higher the personal income becomes, the lower the proportion of consumption. Reduced rates are aimed mainly at handling regressivity, although sometimes their purpose is to produce a desired consumption effect or to correct externalities by taxing environmentally friendly goods at lower rates. For example, smoking cessation products in the UK are subject to a reduced rate, and Portugal has a parking rate for solar and alternative energy equipment.